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**VOLUME II
APPENDICES
REVISED FINAL REPORT**

**Bench-Scale Testing of On-Line Control of Column Flotation
Using a Novel Analyzer
(Contract No. DE-AC22-92PC92207)**

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Submitted By:

DISCLAIMER

**Process Technology, Inc.
1122 Calumet Avenue
Calumet, MI 49913
Ph: (906) 337-0020
Fx: (906) 337-0023**

**Columbus, Ohio Office:
2767-69 E. Fourth Avenue
Columbus, Ohio 43219
Ph: (614) 252-9583
Fx: (614) 252-9652**

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APPENDIX A
MULTIVARIABLE TESTING RESULTS
(Upper Freeport Seam Coal)

Table 18.A.1: Target Test Conditions For Tests, By Feed Lot

Table 18.A.2: Actual Test Conditions For Tests, By Feed Lot

Table 18.A.3: Grinding Circuit Results For Tests, By Feed Lot

Table 18.A.4: Test Sample Results For Tests, By Feed Lot

Table 18.A.1
TARGET TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #1)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	M-150	No.2 F.O.	Poly. Acid		Laundry Water (GPM)	Froth Wash (GPM)		
CT#2	2/11	1200	300	9.8	6.0	NA	NA	0.0	1.7	3.0	3.0	C	None
CT#3	2/11	1338	300	9.8	6.0	NA	NA	0.0	1.7	3.0	3.0	C	None
CT#4	2/11	1510	300	9.8	6.0	NA	NA	0.0	1.7	3.0	3.0	C	None
CT#5	2/11	1740	300	9.8	6.0	NA	NA	0.0	1.7	3.0	3.0	C	None
CT#6	2/12	1214	300	9.8	6.0	NA	NA	0.0	2.5	3.0	3.0	C	None
CT#7	2/12	1319	300	9.8	6.0	NA	NA	0.0	2.5	3.0	3.0	C	None

NA - Not Available, reagents were not checked and actual settings were unknown.

Table 18.A.1 (cont.)
TARGET TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #2)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	M-150	No.2 F.O.	Poly. Acid		Laundry Water (GPM)	Froth Wash (GPM)		
DT#1	2/23	958	300	9.8	6.0	0.60	0.80	0.00	1.7	3.0	3.0	P	None
DT#2	2/23	1055	300	9.8	6.0	0.80	1.00	0.00	1.7	3.0	3.0	P	None
DT#4	2/23	1357	300	9.8	6.0	0.80	0.80	0.00	1.7	3.0	3.0	P	None
DT#5	2/23	1515	300	9.8	6.0	0.60	0.60	0.00	2.5	3.0	3.0	P	None
DT#6	2/23	1606	300	9.8	6.0	0.60	0.60	0.00	1.7	3.0	3.0	P	None
PT#1	2/26	851	250	6.5	7.5	0.60	0.60	0.00	1.7	2.0	0.7	P	None
PT#2	2/26	936	250	6.5	7.5	0.60	0.60	0.00	1.7	2.0	0.7	C	None
PT#3	2/26	1035	250	6.5	7.5	0.70	0.70	0.00	2.5	2.0	0.0	P	None
PT#4	2/26	1121	300	7.8	7.5	0.60	0.60	0.00	1.7	2.0	0.7	P	None
PT#5	2/26	1200	300	7.8	7.5	0.60	0.60	0.00	1.7	2.0	0.7	C	None
PT#6	2/26	1313	300	7.8	7.5	0.60*	0.60	0.00	1.7	2.5	0.7	P	None

* MIBC for this test only, all others were with M-150 frother.

Table 18.A.1 (con't.)
 TARGET TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #3)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	MBC	No.2 F.O.	Poly. Acid		Laundry Water (GPM)	Froth Wash (GPM)		
PT#7	3/02	1242	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	2.5	C	None
PT#8	3/02	1337	250	6.5	7.5	0.80	1.00	0.00	2.0	3.0	2.5	C	None
PT#9	3/02	1440	250	6.5	7.5	0.80	1.00	0.00	2.0	3.0	3.5	C	None
PT#10	3/02	1610	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	3.5	C	None
PT#11	3/02	1655	250	6.5	7.5	0.80	1.00	0.00	2.0	3.5	1.5	C	None
PT#12	3/02	1744	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	2.5	C	None
PT#13	3/02	1830	250	6.5	7.5	0.80	1.00	0.00	2.0	3.0	3.0	C	None
PT#14	3/02	1915	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	3.5	C	None
PT#15	3/03	1321	250	6.5	7.5	0.80	0.80	0.00	2.0	3.5	2.0	C	None
PT#16	3/03	1410	250	6.5	7.5	0.80	0.80	0.00	2.0	3.5	3.5	C	None
PT#17	3/03	1500	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	2.5	C	None
PT#18	3/03	1545	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	3.5	C	None
PT#19	3/03	1630	250	6.5	7.5	0.80	0.80	0.00	2.0	3.5	1.5	C	None
PT#20	3/03	1716	250	6.5	7.5	0.80	0.80	0.00	2.0	3.5	3.0	C	None
PT#21	3/03	1800	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	2.5	C	None
PT#22	3/03	1846	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	3.5	C	None
PT#23	3/04	1105	250	6.5	7.5	0.60	0.90	0.00	2.5	3.5	3.5	C	None
PT#24	3/04	1151	250	6.5	7.5	0.60	0.90	0.00	2.5	3.5	3.5	C	None
PT#25	3/04	1253	250	6.5	7.5	0.60	0.90	0.00	2.5	3.0	3.0	C	None
PT#26	3/04	1350	250	9.7	5.0	0.60	0.90	0.00	2.5	3.5	3.0	C	None
PT#27	3/04	1436	250	9.7	5.0	0.60	0.90	0.00	2.5	3.5	3.0	C	None
PT#28	3/05	930	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	3.5	C	11-3/8
PT#29	3/05	1030	250	6.5	7.5	0.80	1.00	0.00	2.0	3.5	3.5	C	11-3/8
PT#30	3/08	1010	250	6.5	7.5	0.80	1.00	0.00	3.0	3.5	2.5	C	11-3/8
PT#31	3/08	1055	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	3.5	C	11-3/8
PT#32	3/08	1140	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	2.5	C	11-3/8
PT#33	3/08	1225	250	6.5	7.5	0.80	0.80	0.00	3.0	3.5	2.5	C	11-3/8

Table 18.A.1 (con't.)
TARGET TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #4)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.			Poly. Acid	Laundry Water (GPM)		
FT#1	3/10	1052	250	6.5	7.5	0.90	1.10	0.00	1.5	3.5	3.0	C	None
FT#2	3/10	1145	250	8.1	6.0	0.95	1.15	0.00	1.5	3.5	3.0	C	None
FT#3	3/10	1250	200	6.5	6.0	1.00	1.20	0.00	1.5	3.5	3.0	C	None
FT#4	3/10	1335	200	6.5	6.0	1.00	1.20	0.00	1.5	3.5	0.8	C	None
FT#5	3/10	1425	200	7.8	5.0	1.05	1.30	0.00	1.5	3.5	3.0	C	None
FT#6	3/10	1510	200	6.5	6.0	1.00	1.20	0.00	1.5	3.5	3.0	P	None
FT#7	3/10	1555	250	6.5	7.5	0.90	1.10	0.00	1.5	3.5	3.0	P	None
FT#8	3/11	1230	250	7.5	6.5	1.00	1.80	0.00	1.2	3.5	0.8	C	None
FT#9	3/11	1310	250	7.5	6.5	1.00	1.80	0.00	1.2	3.5	0.8	C	None
FT#10	3/11	1356	250	7.5	6.5	1.00	1.80	0.00	1.7	3.5	0.8	C	None
FT#11	3/11	1430	250	7.5	6.5	1.00	1.80	0.00	1.0	3.5	0.8	C	None
FT#12	3/11	1506	250	6.5	7.5	1.00	2.00	0.00	1.5	3.5	3.5	C	None
FT#13	3/11	1540	250	6.5	7.5	1.00	2.00	0.00	2.0	3.5	4.0	C	None
FT#14	3/11	1620	250	6.5	7.5	1.00	2.00	0.00	2.0	3.5	3.5	C	None
FT#15	3/11	1642	250	6.5	7.5	1.00	2.00	0.00	1.5	3.5	3.5	C	None
FT#16	3/11	1720	200	5.2	7.5	1.00	2.00	0.00	1.5	3.5	3.0	C	None
FT#17	3/11	1753	200	5.2	7.5	1.00	2.00	0.00	1.5	3.5	3.5	C	None
FT#18	3/11	1825	200	5.2	7.5	0.70	1.40	0.00	1.5	3.5	3.5	C	None
FT#19	3/11	1855	200	7.8	5.2	0.70	1.40	0.00	1.5	3.5	0.8	C	None
FT#20	3/16	925	250	8.1	6.0	1.20	2.00	0.00	1.2	3.5	1.0	C	None
FT#21	3/16	1012	250	8.1	6.0	1.20	2.00	0.60	1.2	3.5	1.0	C	None
FT#22	3/16	1101	250	8.1	6.0	1.20	2.00	1.20	1.2	3.5	1.0	C	None
FT#23	3/16	1213	250	6.1	8.0	1.20	2.00	0.00	1.2	3.5	3.0	C	None
FT#24	3/16	1311	250	6.1	8.0	1.20	2.00	0.00	1.2	3.5	3.0	C	None
FT#25	3/16	1439	250	6.1	8.0	1.20	2.00	1.20	1.2	3.5	3.0	C	None
FT#26	3/16	1535	250	6.1	8.0	1.20	2.00	0.00	1.5	3.5	3.0	C	None
FT#27	3/16	1745	250	6.1	8.0	1.20	2.00	1.20	1.5	3.5	3.0	C	None
FT#28	3/16	1838	250	8.1	6.0	1.20	2.00	0.00	1.5	3.5	1.0	C	None
FT#29	3/16	1930	250	6.1	8.0	1.20	2.00	0.00	1.5	3.5	3.0	C	None

Note: - The solids feed rate for FT#27 through FT#29 was much lower than expected due to grinding circuit problems. Those 3 tests will need to be repeated.

Table 18.A.1 (con't.)
 TARGET TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #4)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (in.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	MIBC	No. 2 F.O.	Poly. Acid		Laundry Water (GPM)	Froth Wash (GPM)		
FT#30	3/17	1110	250	6.1	8.0	1.20	2.00	1.20	1.5	3.5	3.0	City	None
FT#31	3/17	1155	250	8.1	6.0	1.20	2.00	0.00	1.5	3.5	1.0	City	None
FT#32	3/17	1250	250	6.1	8.0	0.90	2.00	0.00	1.5	3.5	3.0	City	None
FT#33	3/17	1350	250	6.1	8.0	0.90	2.00	0.60	1.5	3.5	3.0	City	None
FT#34	3/17	1435	250	6.1	8.0	0.90	2.00	0.60	1.5	3.5	3.0	City	None
FT#35	3/17	1615	250	6.1	8.0	0.90	2.00	1.20	1.5	3.5	3.0	City	None
FT#36	3/17	1700	250	8.1	6.0	0.90	2.00	0.00	1.5	3.5	1.0	City	None
FT#37	3/17	1745	250	8.1	6.0	0.90	2.00	1.20	1.5	3.5	1.0	City	None
FT#38	3/17	1830	250	8.1	6.0	0.90	2.00	0.00	1.2	3.5	1.0	City	None
FT#39	3/17	1945	250	6.1	8.0	0.90	2.00	0.00	1.2	3.5	3.0	City	None
FT#40	3/18	1350	250	6.1	8.0	0.90	2.00	1.20	1.2	3.5	3.0	City	None
FT#41	3/18	1445	250	8.1	6.0	0.90	2.00	0.00	1.5	3.5	1.0	City	None
FT#42	3/18	1530	250	6.1	8.0	0.90	2.00	0.00	1.5	3.5	3.0	City	None
FT#43	3/18	1648	250	6.1	8.0	0.90	2.00	1.20	1.5	3.5	3.0	City	None
FT#44	3/18	1733	250	6.1	8.0	0.90	2.00	1.20	1.5	3.5	3.0	City	None
FT#45	3/18	1825	250	6.1	8.0	1.20	2.00	1.20	1.5	3.5	3.0	City	None
FT#46	3/18	1910	250	8.1	6.0	1.20	2.00	0.00	1.5	3.5	1.0	City	None

Table 18.A.1 (con't.)
TARGET TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #5)

Test	Date	Start Sampling Time	Feed Rate			Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.	Poly. Acid			Laundry Water (GPM)	Froth Wash (GPM)		
FT#47	3/22	1245	250	6.1	8.0	1.20	2.00	0.00	1.5	36	3.5	3.0	City	None
FT#48	3/22	1340	250	6.1	8.0	0.80	1.60	0.00	1.5	24	3.5	3.0	City	None
FT#49	3/22	1430	250	6.1	8.0	0.80	1.60	1.00	1.5	24	3.5	3.0	City	None
FT#50	3/22	1535	250	6.1	8.0	0.80	1.60	0.00	2.0	24	3.5	3.0	City	None
FT#51	3/22	1635	190	6.1	6.0	1.05	2.10	0.00	1.5	24	3.5	3.0	City	None
FT#52	3/22	1735	190	6.1	6.0	1.05	2.10	1.32	1.5	24	3.5	3.0	City	None
FT#53	3/22	1830	190	6.1	6.0	1.05	2.10	0.00	2.0	24	3.5	3.0	City	None
FT#54	3/22	1915	190	6.1	6.0	1.05	2.10	0.00	1.5	36	3.5	3.0	City	None
FT#55	3/23	955	190	6.1	6.0	1.05	2.10	1.32	1.5	36	3.5	3.0	City	None
FT#56	3/23	1045	190	6.1	6.0	1.05	2.10	0.00	2.0	36	3.5	3.0	City	None
FT#57	3/23	1150	250	6.1	8.0	0.80	1.60	0.00	1.5	36	3.5	3.0	City	None
FT#58	3/23	1245	250	6.1	8.0	0.80	1.60	1.00	1.5	36	3.5	3.0	City	None
FT#59	3/23	1335	250	6.1	8.0	0.80	1.60	0.00	2.0	36	3.5	3.0	City	None
FT#60	3/23	1440	250	6.1	8.0	1.20	2.00	0.00	1.5	24	3.5	3.0	City	None
FT#61	3/23	1520	250	6.1	8.0	1.20	2.00	0.00	1.5	24	3.5	3.0	City	None
FT#62	3/23	1625	250	6.1	8.0	0.90	2.00	0.00	1.5	36	3.5	3.0	Process	None
FT#63	3/23	1715	250	6.1	8.0	0.90	2.00	0.00	1.5	36	3.5	3.0	Process	None
FT#64	3/25	1200	250	6.1	8.0	1.00	2.00	0.00	1.5	24	3.5	3.0	City	11-3/8
FT#65	3/25	1305	250	6.1	8.0	1.00	2.00	1.00	1.5	24	3.5	3.0	City	11-3/8
FT#66	3/25	1400	250	6.1	8.0	1.00	2.00	0.00	2.0	24	3.5	3.0	City	11-3/8
FT#67	3/25	1450	190	6.1	6.0	1.31	2.62	0.00	1.5	24	3.5	3.0	City	11-3/8
FT#68	3/25	1550	190	6.1	6.0	1.31	2.62	1.32	1.5	24	3.5	3.0	City	11-3/8
FT#69	3/25	1655	190	6.1	6.0	1.31	2.62	0.00	2.0	24	3.5	3.0	City	11-3/8
FT#70	3/25	1750	190	6.1	6.0	1.31	2.62	0.00	1.5	36	3.5	3.0	City	11-3/8
FT#71	3/25	1835	190	6.1	6.0	1.31	2.62	0.00	1.5	36	3.5	3.0	City	11-3/8
FT#72	3/25	1925	190	6.1	6.0	1.31	2.62	1.32	1.5	36	3.5	3.0	City	11-3/8
FT#73	3/25	2010	190	6.1	6.0	1.31	2.62	0.00	2.0	36	3.5	3.0	City	11-3/8

Table 18.A.1 (con't.)
 TARGET TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #5)

Test	Date	Start Sampling Time	Feed Rate			Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Water Additions		Water Type (P/C)	Inner Sleeve (In. O.D.)
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.	Poly. Acid			Launder Water (GPM)	Froth Wash (GPM)		
FT#74	3/26	815	250	6.1	8.0	1.00	2.00	0.00	1.5	36	3.5	3.0	City	11-3/8
FT#75	3/26	905	250	6.1	8.0	1.00	2.00	1.00	1.5	36	3.5	3.0	City	11-3/8
FT#76	3/26	1000	250	6.1	8.0	1.00	2.00	0.00	2.0	36	3.5	3.0	City	11-3/8
FT#77	3/26	1040	250	6.1	8.0	1.00	2.00	0.00	2.0	36	3.5	3.0	City	11-3/8
FT#78	3/26	1135	250	6.1	8.0	1.00	2.00	0.00	1.5	24	3.5	4.0	City	11-3/8
FT#79	3/26	1245	250	6.1	8.0	1.00	2.00	1.00	1.5	36	3.5	4.0	City	11-3/8
FT#80	3/26	1335	250	6.1	8.0	1.00	2.00	0.00	1.5	24	3.5	4.0	City	11-3/8
FT#81	3/26	1435	250	6.1	8.0	1.00	2.00	1.00	1.5	36	3.5	4.0	City	11-3/8
FT#82	3/30	1035	300	8.0	7.3	1.00	2.00	0.00	1.5	24	2.0	2.5	City	11-3/4
FT#83	3/30	1130	300	6.0	9.7	1.00	2.00	0.00	1.5	24	2.0	2.5	City	11-3/4
FT#84	3/30	1245	300	4.5	12.7	1.00	2.00	0.00	1.5	24	3.5	2.5	City	11-3/4
FT#85	3/30	1355	150	8.0	3.7	1.00	2.00	0.00	1.5	24	3.5	2.5	City	11-3/4
FT#86	3/30	1445	150	6.0	4.9	1.00	2.00	0.00	1.5	24	3.5	2.5	City	11-3/4
FT#87	3/30	1605	150	4.5	6.5	1.00	2.00	0.00	1.5	24	3.5	2.5	City	11-3/4

Table 18.A.2
ACTUAL TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #1)

Test	Date	Start Sampling Time	Feed Rate			Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results				
			#/Hr.	GPM	% Solids	M-150	No.2 F.O.	Poly. Acid			Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
CT#2	2/11	1200	323	9.8	6.4	NA	NA	0.00	1.7	28	3.0	3.0	11.5	1.3	4.3
CT#3	2/11	1338	320	9.7	6.4	NA	NA	0.00	1.7	28	3.0	3.0	11.2	1.5	4.5
CT#4	2/11	1510	323	9.8	6.4	NA	NA	0.00	1.7	28	3.0	3.0	11.1	1.7	4.7
CT#5	2/11	1740	298	9.8	5.9	NA	NA	0.00	1.7	28	3.0	3.0	11.6	1.2	4.2
CT#6	2/12	1214	318	9.8	6.3	NA	NA	0.00	2.5	28	3.0	3.0	10.9	1.9	4.9
CT#7	2/12	1319	313	9.8	6.2	NA	NA	0.00	2.5	28	3.0	3.0	10.9	1.9	4.9

NA - Not Available, reagents were not checked and actual settings were unknown.

Table 18.A.2 (con't.)
ACTUAL TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #2)

Test	Date	Start Sampling Time	Feed Rate			Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results				
			#/Hr.	GPM	% Solids	M-150	No.2 F.O.	Poly. Acid			Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
DT#1	2/23	958	313	9.8	6.2	0.58	0.77	0.00	1.7	28	3.0	3.0	NA	NA	NA
DT#2	2/23	1055	313	9.8	6.2	0.76	0.98	0.00	1.7	28	3.0	3.0	NA	NA	NA
DT#4	2/23	1357	308	9.8	6.1	0.78	0.78	0.00	1.7	28	3.0	3.0	NA	NA	NA
DT#5	2/23	1515	293	9.8	5.8	0.60	0.60	0.00	2.5	28	3.0	3.0	NA	NA	NA
DT#6	2/23	1606	278	9.8	5.5	0.64	0.65	0.00	1.7	28	3.0	3.0	NA	NA	NA
PT#1	2/26	851	268	6.5	8.0	0.55	0.57	0.00	1.7	28	2.0	0.7	NA	NA	NA
PT#2	2/26	936	235	6.5	7.0	0.63	0.65	0.00	1.7	28	2.0	0.7	NA	NA	NA
PT#3	2/26	1035	201	6.5	6.0	0.90	0.91	0.00	2.5	20	2.0	0.0	NA	NA	NA
PT#4	2/26	1121	294	7.8	7.3	0.59	0.60	0.00	1.7	20	2.0	0.7	NA	NA	NA
PT#5	2/26	1200	314	7.8	7.8	0.57	0.58	0.00	1.7	20	2.0	0.7	NA	NA	NA
PT#6	2/26	1313	306	7.8	7.6	0.58*	0.60	0.00	1.7	20	2.5	0.7	NA	NA	NA

Note: * MIBC for this test only, all others were with M-150 frother.

- NA - Data logging program failed during these tests, so this data was unavailable.

Table 18.A.2 (cont.)
 ACTUAL TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #3)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (in.)	Flow Balance Results				
			#/Hr.	GPM	% Solids	MIBC	No. 2 F.O.	Poly Acid		Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
PT#7	3/02	1242	238	6.5	7.1	0.86	1.04	0.00	3.0	3.5	2.5	4.3	4.7	8.2
PT#8	3/02	1337	241	6.5	7.2	0.82	1.05	0.00	2.0	3.0	2.5	5.3	3.7	6.7
PT#9	3/02	1440	244	6.4	7.4	0.84	1.02	0.00	2.0	3.0	3.5	6.4	3.5	6.5
PT#10	3/02	1610	265	6.5	7.9	0.77	0.94	0.00	3.0	3.5	3.5	5.2	4.8	8.3
PT#11	3/02	1655	211	6.4	6.4	0.97	1.18	0.00	2.0	3.5	1.5	4.3	3.6	7.1
PT#12	3/02	1744	254	6.4	7.7	0.83	0.99	0.00	3.0	3.5	2.5	4.3	4.6	8.1
PT#13	3/02	1830	258	6.5	7.7	0.80	0.99	0.00	2.0	3.0	3.0	6.4	3.1	6.1
PT#14	3/02	1915	245	6.5	7.3	0.85	1.04	0.00	3.0	3.5	3.5	5.6	4.4	7.9
PT#15	3/03	1321	231	6.5	6.9	0.83	0.87	0.00	2.0	3.5	2.0	5.1	3.4	6.9
PT#16	3/03	1410	251	6.5	7.5	0.79	0.82	0.00	2.0	3.5	3.5	7.0	3.0	6.5
PT#17	3/03	1500	278	6.5	8.3	0.72	0.72	0.00	3.0	3.5	2.5	4.5	4.5	8.0
PT#18	3/03	1545	284	6.4	8.6	0.70	0.71	0.00	3.0	3.5	3.5	5.6	4.3	7.8
PT#19	3/03	1630	265	6.5	7.9	0.77	0.75	0.00	2.0	3.5	1.5	4.6	3.4	6.9
PT#20	3/03	1716	251	6.5	7.5	0.79	0.81	0.00	2.0	3.5	3.0	6.3	3.2	6.7
PT#21	3/03	1800	255	6.5	7.6	0.77	0.79	0.00	3.0	3.5	2.5	4.7	4.3	7.8
PT#22	3/03	1846	265	6.5	7.9	0.75	0.74	0.00	3.0	3.5	3.5	5.9	4.1	7.6
PT#23	3/04	1105	265	6.5	7.9	0.56	0.85	0.00	2.5	3.5	3.5	6.1	3.9	7.4
PT#24	3/04	1151	245	6.5	7.3	0.60	0.92	0.00	2.5	3.5	3.5	6.2	3.8	7.3
PT#25	3/04	1253	245	6.5	7.3	0.61	0.91	0.00	2.5	3.5	3.0	6.0	3.5	7.0
PT#26	3/04	1350	290	9.7	5.8	0.51	0.77	0.00	2.5	3.5	3.0	9.4	3.3	6.8
PT#27	3/04	1436	255	9.7	5.1	0.58	0.88	0.00	2.5	3.5	3.0	9.6	3.1	6.6
PT#28	3/05	930	287	6.4	8.7	0.71	0.87	0.00	3.0	3.5	3.5	5.5	4.4	7.9
PT#29	3/05	1030	257	6.4	7.8	0.80	0.97	0.00	2.0	3.5	3.5	6.9	3.0	6.5
PT#30	3/08	1010	244	6.4	7.4	0.83	1.00	0.00	3.0	3.5	2.5	4.7	4.2	7.7
PT#31	3/08	1055	244	6.4	7.4	0.83	0.82	0.00	3.0	3.5	3.5	5.6	4.3	7.8
PT#32	3/08	1140	241	6.4	7.3	0.83	0.81	0.00	3.0	3.5	2.5	4.9	4.0	7.5
PT#33	3/08	1225	268	6.5	8.0	0.75	0.74	0.00	3.0	3.5	2.5	4.9	4.1	7.6

Table 18.A.2 (cont.)
ACTUAL TEST CONDITIONS
(Upper Freeport Seam Raw Coal, Feed Lot #4)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results				
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.	Polv. Acid		Laundry Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
FT#1	3/10	1052	258	6.5	7.7	0.89	1.10	0.00	1.5	3.5	3.0	5.9	3.6	7.1
FT#2	3/10	1145	252	8.0	6.1	0.94	1.12	0.00	1.5	3.5	3.0	7.5	3.5	7.0
FT#3	3/10	1250	194	6.5	5.8	1.01	1.24	0.00	1.5	3.5	3.0	6.5	3.0	6.5
FT#4	3/10	1335	204	6.5	6.1	0.96	1.19	0.00	1.5	3.5	0.8	4.2	3.1	6.6
FT#5	3/10	1425	193	7.8	4.8	1.07	1.34	0.00	1.5	3.5	3.0	8.0	2.8	6.3
FT#6	3/10	1510	204	6.5	6.1	0.98	1.19	0.00	1.5	3.5	3.0	6.4	3.1	6.6
FT#7	3/10	1555	257	6.4	7.8	0.86	1.08	0.00	1.5	3.5	3.0	5.7	3.7	7.2
FT#8	3/11	1230	232	7.5	6.1	1.08	1.96	0.00	1.2	3.5	0.8	4.9	3.4	6.9
FT#9	3/11	1310	224	7.5	5.8	1.10	2.01	0.00	1.2	3.5	0.7	5.2	3.0	6.5
FT#10	3/11	1356	240	7.4	6.3	1.05	1.91	0.00	1.7	3.5	0.7	4.2	3.9	7.4
FT#11	3/11	1430	255	7.5	6.6	0.97	1.77	0.00	1.0	3.5	0.7	5.0	3.2	6.7
FT#12	3/11	1506	257	6.4	7.8	0.96	1.96	0.00	1.5	3.5	3.5	6.1	3.8	7.3
FT#13	3/11	1540	268	6.5	8.0	0.93	1.90	0.00	2.0	3.5	4.0	6.1	4.4	7.9
FT#14	3/11	1620	278	6.5	8.3	0.91	1.82	0.00	2.0	3.5	3.5	5.7	4.3	7.8
FT#15	3/11	1642	271	6.4	8.2	0.93	1.86	0.00	1.5	3.5	3.5	6.2	3.7	7.2
FT#16	3/11	1720	223	5.2	8.3	0.90	1.81	0.00	1.5	3.5	3.0	4.9	3.3	6.8
FT#17	3/11	1753	223	5.2	8.3	0.90	1.81	0.00	1.5	3.5	3.5	5.3	3.4	6.9
FT#18	3/11	1825	206	5.2	7.7	0.65	1.39	0.00	1.5	3.5	3.5	6.0	2.7	6.2
FT#19	3/11	1855	193	7.5	5.0	0.72	1.48	0.00	1.5	3.5	1.0	5.7	2.8	6.3
FT#20	3/16	925	297	8.1	7.1	0.99	1.72	0.00	1.2	3.5	1.0	5.7	3.4	6.9
FT#21	3/16	1012	242	8.1	5.8	1.22	2.11	0.64	1.2	3.5	1.0	5.7	3.4	6.9
FT#22	3/16	1101	272	8.1	6.5	1.08	1.88	1.14	1.2	3.5	1.0	5.6	3.5	7.0
FT#23	3/16	1213	277	6.1	8.8	1.08	1.83	0.00	1.2	3.5	3.0	5.4	3.7	7.2
FT#24	3/16	1311	274	6.1	8.7	1.09	1.88	0.00	1.2	3.5	3.0	5.5	3.6	7.1
FT#25	3/16	1439	261	6.1	8.3	1.15	1.95	1.19	1.2	3.5	3.0	5.4	3.7	7.2
FT#26	3/16	1535	252	6.1	8.0	1.20	2.00	0.00	1.5	3.5	3.0	5.1	4.0	7.5
FT#27	3/16	1745	91	6.1	2.9	3.30	5.60	3.21	1.5	3.5	3.0	6.4	2.7	6.2
FT#28	3/16	1838	138	8.1	3.3	2.19	3.75	0.00	1.5	3.5	1.0	7.1	2.0	5.5
FT#29	3/16	1930	164	6.1	5.2	1.84	3.14	0.00	1.5	3.5	3.0	7.9	1.2	4.7

Table 18.A.2 (cont.)
ACTUAL TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #4)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results				
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.	Poly. Acid		Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
FT#30	3/17	1110	289	6.1	9.2	1.04	1.74	1.00	1.5	3.5	3.0	5.2	3.9	7.4
FT#31	3/17	1155	259	8.1	6.2	1.16	1.96	0.00	1.5	3.5	1.0	5.4	3.7	7.2
FT#32	3/17	1250	246	6.2	7.7	0.91	2.07	0.00	1.5	3.5	3.0	5.3	3.9	7.4
FT#33	3/17	1350	252	6.1	8.0	0.88	2.02	0.58	1.5	3.5	3.0	5.3	3.8	7.3
FT#34	3/17	1435	278	6.2	8.7	0.81	1.83	0.52	1.5	3.5	3.0	5.3	3.9	7.4
FT#35	3/17	1615	249	6.1	7.9	0.90	2.05	1.16	1.5	3.5	3.0	5.4	3.7	7.2
FT#36	3/17	1700	246	8.1	5.9	0.89	2.05	0.00	1.5	3.5	1.0	5.1	4.0	7.5
FT#37	3/17	1745	259	8.1	6.2	0.87	1.98	1.11	1.5	3.5	1.0	5.0	4.1	7.6
FT#38	3/17	1830	280	8.1	6.7	0.80	1.82	0.00	1.2	3.5	1.0	5.5	3.6	7.1
FT#39	3/17	1945	293	6.1	9.3	0.78	1.75	0.00	1.2	3.5	3.0	5.7	3.4	6.9
FT#40	3/18	1350	245	6.1	7.8	0.91	2.05	1.17	1.2	3.5	3.0	5.7	3.4	6.9
FT#41	3/18	1445	259	8.1	6.2	0.86	1.95	0.00	1.5	3.5	1.0	5.5	3.6	7.1
FT#42	3/18	1530	261	6.1	8.3	0.85	1.91	0.00	1.5	3.5	3.0	5.1	4.0	7.5
FT#43	3/18	1648	258	6.1	8.2	0.87	1.96	1.11	1.5	3.5	3.0	4.9	4.2	7.7
FT#44	3/18	1733	245	6.1	7.8	0.93	2.06	1.19	1.5	3.5	3.0	4.7	4.4	7.9
FT#45	3/18	1825	286	6.1	9.1	1.06	1.77	1.01	1.5	3.5	3.0	4.7	4.4	7.9
FT#46	3/18	1910	272	8.1	6.5	1.19	1.85	0.00	1.5	3.5	1.0	5.2	3.9	7.4

Table 18.A.2 (cont.)
ACTUAL TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #5)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results					
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.			Poly. Acid	Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
FT#47	3/22	1245	280	6.1	8.9	1.08	1.84	0.00	1.5	36	3.5	3.0	5.1	4.0	7.5
FT#48	3/22	1340	264	6.1	8.4	0.76	1.51	0.00	1.5	24	3.5	3.0	5.5	3.6	7.1
FT#49	3/22	1430	255	6.1	8.1	0.76	1.57	0.96	1.5	24	3.5	3.0	5.9	3.2	6.7
FT#50	3/22	1535	261	6.1	8.3	0.74	1.50	0.00	2.0	24	3.5	3.0	5.3	3.8	7.3
FT#51	3/22	1635	204	6.1	6.5	0.97	1.91	0.00	1.5	24	3.5	3.0	6.2	2.9	6.4
FT#52	3/22	1735	201	6.2	6.3	0.99	1.99	1.25	1.5	24	3.5	3.0	6.2	3.0	6.5
FT#53	3/22	1830	195	6.1	6.2	1.03	2.04	0.00	2.0	24	3.5	3.0	6.0	3.1	6.6
FT#54	3/22	1915	189	6.2	5.9	1.07	2.10	0.00	1.5	36	3.5	3.0	6.5	2.7	6.2
FT#55	3/23	955	145	6.1	4.6	1.38	2.84	1.72	1.5	36	3.5	3.0	6.5	2.6	6.1
FT#56	3/23	1045	138	6.1	4.4	1.43	2.93	0.00	2.0	36	3.5	3.0	6.4	2.7	6.2
FT#57	3/23	1150	252	6.1	8.0	0.80	1.61	0.00	1.5	36	3.5	3.0	5.9	3.2	6.7
FT#58	3/23	1245	249	6.1	7.9	0.80	1.62	1.01	1.5	36	3.5	3.0	6.0	3.1	6.6
FT#59	3/23	1335	223	6.1	7.1	0.90	1.82	0.00	2.0	36	3.5	3.0	5.7	3.4	6.9
FT#60	3/23	1440	249	6.1	7.9	1.17	1.98	0.00	1.5	24	3.5	3.0	5.2	3.9	7.4
FT#61	3/23	1520	245	6.1	7.8	0.94	2.03	0.00	1.5	24	3.5	3.0	5.3	3.8	7.3
FT#62	3/23	1625	264	6.1	8.4	0.86	1.89	0.00	1.5	36	3.5	3.0	5.5	3.6	7.1
FT#63	3/23	1715	249	6.1	7.9	0.92	2.04	0.00	1.5	36	3.5	3.0	5.4	3.7	7.2
FT#64	3/25	1200	255	6.1	8.1	0.99	2.00	0.00	1.5	24	3.5	3.0	5.9	3.2	6.7
FT#65	3/25	1305	252	6.1	8.0	1.00	2.00	1.01	1.5	24	3.5	3.0	5.9	3.2	6.7
FT#66	3/25	1400	255	6.1	8.1	0.99	1.96	0.00	2.0	24	3.5	3.0	5.4	3.7	7.2
FT#67	3/25	1450	211	6.1	6.7	1.21	2.37	0.00	1.5	24	3.5	3.0	6.1	3.0	6.5
FT#68	3/25	1550	192	6.1	6.1	1.33	2.63	1.32	1.5	24	3.5	3.0	6.0	3.1	6.6
FT#69	3/25	1655	214	6.1	6.8	1.19	2.38	0.00	2.0	24	3.5	3.0	5.9	3.2	6.7
FT#70	3/25	1750	198	6.1	6.3	1.26	2.56	0.00	1.5	36	3.5	3.0	6.5	2.6	6.1
FT#71	3/25	1835	182	6.1	5.8	1.40	2.78	0.00	1.5	36	3.5	3.0	6.5	2.6	6.1
FT#72	3/25	1925	192	6.1	6.1	1.33	2.62	1.29	1.5	36	3.5	3.0	6.4	2.7	6.2
FT#73	3/25	2010	205	6.2	6.4	1.24	2.47	0.00	2.0	36	3.5	3.0	6.4	2.8	6.3

Table 18.A.2 (cont.)
 ACTUAL TEST CONDITIONS
 (Upper Freeport Seam Raw Coal, Feed Lot #5)

Test	Date	Start Sampling Time	Feed Rate		Reagents (#/T)			Air Rate 50 Psi (CFM)	Froth Height (In.)	Flow Balance Results					
			#/Hr.	GPM	% Solids	MIBC	No.2 F.O.			Poly. Acid	Launder Water (GPM)	Froth Wash (GPM)	Tails Flow (GPM)	Conc. Flow (GPM)	Diluted Conc. Flow (GPM)
FT#74	3/26	815	242	6.1	7.7	1.04	2.08	0.00	1.5	36	3.5	3.0	6.0	3.1	6.6
FT#75	3/26	905	267	6.1	8.5	0.95	1.92	0.94	1.5	36	3.5	3.0	6.1	3.0	6.5
FT#76	3/26	1000	267	6.1	8.5	0.95	1.87	0.00	2.0	36	3.5	3.0	5.8	3.3	6.8
FT#77	3/26	1040	264	6.1	8.4	0.94	1.90	0.00	2.0	36	3.5	3.0	5.6	3.5	7.0
FT#78	3/26	1135	248	5.4	8.9	1.04	1.99	0.00	1.5	24	3.5	4.0	6.2	3.2	6.7
FT#79	3/26	1245	259	5.4	9.3	0.98	1.96	0.96	1.5	36	3.5	4.0	7.3	2.1	5.6
FT#80	3/26	1335	317	5.4	9.6	0.80	1.59	0.00	1.5	24	3.5	4.0	6.3	3.1	6.6
FT#81	3/26	1435	259	5.4	9.3	0.98	1.93	0.96	1.5	36	3.5	4.0	7.3	2.1	5.6
FT#82	3/30	1035	314	8.0	7.6	0.96	1.97	0.00	1.5	24	2.0	2.5	6.2	4.3	6.3
FT#83	3/30	1130	300	6.0	9.7	1.01	2.04	0.00	1.5	24	2.0	2.5	4.5	4.0	6.0
FT#84	3/30	1245	306	4.5	13.2	0.99	2.00	0.00	1.5	24	3.5	2.5	2.8	4.2	7.7
FT#85	3/30	1355	173	8.0	4.2	0.84	1.72	0.00	1.5	24	3.5	2.5	8.4	2.1	5.6
FT#86	3/30	1445	195	6.0	6.3	0.74	1.50	0.00	1.5	24	3.5	2.5	6.5	2.0	5.5
FT#87	3/30	1605	161	4.6	6.8	0.89	1.87	0.00	1.5	24	3.5	2.5	4.8	2.3	5.8

Table 18.A.3
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot #1)

Test	Date	Start Sampling Time	Feed Rate		Feed Sump Water (GPM)	Hammer Mill Screen (In.)	Dry Screening Results			Wet Screening Results		
			#/Hr.	GPM			+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)
CT#2	2/11	1200	323	9.8	6.4							
CT#3	2/11	1338	320	9.7	6.4							
CT#4	2/11	1510	323	9.8	6.4							
CT#5	2/11	1740	258	9.8	5.9							
CT#6	2/12	1214	318	9.8	6.3							
CT#7	2/12	1319	313	9.8	6.2							

** No Data Available **

Table 18.A.3 (cont.)
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 2)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Sump Water (GPM)	Feed Sump Level (%)	Feed Rate		Dry Sample Results			Slurry Sample Results			Ash (Wt%, Dry)
						#/Hr.	GPM	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	
DT#1	2/23	958	1/16	NA	NA	313	9.8	NA	0.8	2.7	NA	NA	NA	NA
DT#2	2/23	1055	1/16	NA	NA	313	9.8	NA	0.5	4.8	NA	NA	NA	NA
DT#4	2/23	1357	1/16	NA	NA	308	9.8	NA	3.7	7.4	NA	NA	NA	NA
DT#5	2/23	1515	1/16	NA	NA	293	9.8	NA	4.0	8.8	NA	NA	NA	NA
DT#6	2/23	1606	1/16	NA	NA	278	9.8	NA	6.1	11.6	NA	NA	NA	NA
PT#1	2/26	851	3/16	NA	NA	268	6.5	NA	1.2	4.5	NA	1.1	3.3	83.8
PT#2	2/26	936	3/16	NA	NA	235	6.5	NA	1.2	5.0	NA	1.1	3.3	83.8
PT#3	2/26	1035	3/16	NA	NA	201	6.5	NA	1.7	5.1	NA	1.1	3.3	83.8
PT#4	2/26	1121	3/16	NA	NA	294	7.8	NA	1.3	4.4	NA	1.1	3.3	83.8
PT#5	2/26	1200	3/16	NA	NA	314	7.8	NA	1.7	6.1	NA	0.5	2.4	81.2
PT#6	2/26	1313	3/16	NA	NA	306	7.8	NA	1.7	6.1	NA	0.5	2.4	81.2

Note: - NA - Not Available
- Hammermill Screen broke between DT#2 and DT#4 on 2/23/93.

Table 18.A.3 (cont.)
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 3)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Rate			Feed Sump Water (GPM)	Feed Sump Level (%)	Dry Sample Results				Slurry Sample Results				
				#/Hr.	GPM	% Solids			+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	Ash (Wt% Dry)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	-325M (Wt%)	Ash (Wt% Dry)
PT#7	3/02	1242	3/16	238	6.5	7.1	4.7	52.8	NA	3.0	6.3	NA	NA	2.1	3.8	81.1	26.36
PT#8	3/02	1337	3/16	241	6.5	7.2	4.6	50.7	NA	3.0	6.3	NA	NA	2.1	3.8	81.1	26.36
PT#9	3/02	1440	3/16	244	6.4	7.4	4.7	51.3	0.9	2.6	5.9	NA	NA	2.1	3.8	81.1	26.36
PT#10	3/02	1610	3/16	265	6.5	7.9	4.5	53.5	0.9	2.6	5.9	NA	NA	2.1	3.8	81.1	25.14
PT#11	3/02	1655	3/16	211	6.4	6.4	4.5	49.8	0.9	2.6	5.9	NA	1.0	2.4	4.7	76.5	25.14
PT#12	3/02	1744	3/16	254	6.4	7.7	4.6	50.0	1.5	3.5	7.8	NA	1.0	2.4	4.7	76.5	26.57
PT#13	3/02	1830	3/16	258	6.5	7.7	4.6	54.4	1.5	3.5	7.8	NA	1.0	2.4	4.7	76.5	26.57
PT#14	3/02	1915	3/16	245	6.5	7.3	4.8	51.3	1.5	3.5	7.8	NA	1.0	2.4	4.7	76.5	26.57
PT#15	3/03	1321	3/16	231	6.5	6.9	4.7	51.3	0.2	0.8	3.7	NA	0.1	0.9	3.4	75.7	29.06
PT#16	3/03	1410	3/16	251	6.5	7.5	4.6	51.4	0.2	0.8	3.7	NA	0.1	0.9	3.4	75.7	29.06
PT#17	3/03	1500	3/16	278	6.5	8.3	4.3	50.1	0.2	0.8	3.7	NA	0.1	0.9	3.4	75.7	28.59
PT#18	3/03	1545	3/16	284	6.4	8.6	4.5	51.3	0.7	1.8	4.5	NA	0.1	0.9	3.4	75.7	28.59
PT#19	3/03	1630	3/16	265	6.5	7.9	4.6	51.2	0.7	1.8	4.5	NA	0.2	1.0	3.3	83.0	29.41
PT#20	3/03	1716	3/16	251	6.5	7.5	4.7	50.2	0.3	1.4	4.4	NA	0.2	1.0	3.3	83.0	29.41
PT#21	3/03	1800	3/16	255	6.5	7.6	4.6	52.6	0.3	1.4	4.4	NA	0.2	1.0	3.3	83.0	30.47
PT#22	3/03	1846	3/16	265	6.5	7.9	4.6	52.3	0.3	1.4	4.4	NA	0.2	1.0	3.3	83.0	30.47
PT#23	3/04	1105	1/8	265	6.5	7.9	4.6	51.4	0.2	1.1	3.6	NA	0.1	0.4	1.8	85.8	27.73
PT#24	3/04	1151	1/8	245	6.5	7.3	4.7	51.4	0.2	1.1	3.6	NA	0.1	0.4	1.8	85.8	27.73
PT#25	3/04	1253	1/8	245	6.5	7.3	4.8	51.0	0.3	1.1	3.3	NA	0.1	0.4	1.8	85.8	27.73
PT#26	3/04	1350	1/8	290	9.7	5.8	7.9	50.4	0.3	1.1	3.3	NA	0.1	0.4	1.8	85.8	27.43
PT#27	3/04	1436	1/8	255	9.7	5.1	7.8	51.1	0.2	1.1	3.2	NA	0.1	0.4	1.8	85.8	27.43
PT#28	3/05	930	1/8	287	6.4	8.7	4.7	51.6	0.8	2.5	6.7	NA	0.3	1.4	4.7	79.2	31.64
PT#29	3/05	1030	1/8	257	6.4	7.8	4.6	51.1	0.8	2.5	6.7	NA	0.3	1.4	4.7	79.2	31.64
PT#30	3/08	1010	1/8	244	6.4	7.4	4.4	51.0	0.4	1.7	5.2	NA	0.1	1.6	5.2	80.1	NA
PT#31	3/08	1055	1/8	244	6.4	7.4	4.5	51.6	0.4	1.7	5.2	NA	0.1	1.6	5.2	80.1	NA
PT#32	3/08	1140	1/8	241	6.4	7.3	4.3	52.1	0.5	1.9	7.7	NA	0.1	1.6	5.2	80.1	NA
PT#33	3/08	1225	1/8	268	6.5	8.0	4.6	51.5	0.5	1.9	7.7	NA	0.1	1.6	5.2	80.1	NA

Note: - Hammer Mill Screen had a hole in it for PT#7 through PT#14.

Table 18.A.3 (cont')
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 4)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Rate		Feed Sump Water (GPM)	Feed Sump Level (%)	Dry Sample Results				Slurry Sample Results				
				#/HL	GPM			% Solids	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	Ash (Wt% Dry)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	-325M (Wt%)
FT#1	3/10	1052	1/8	258	6.5	4.5	25.6	0.1	1.3	4.7	NA	0.1	1.0	3.7	81.6	26.31
FT#2	3/10	1145	1/8	252	8.0	6.1	25.0	0.1	1.3	4.7	NA	0.1	1.0	3.7	81.6	26.31
FT#3	3/10	1250	1/8	194	6.5	4.8	24.7	0.1	1.3	4.7	NA	0.1	1.0	3.7	81.6	35.78
FT#4	3/10	1335	1/8	204	6.5	4.8	25.0	0.4	2.2	NA	NA	0.1	1.0	3.7	81.6	35.78
FT#5	3/10	1425	1/8	193	7.8	6.0	25.4	0.4	2.2	NA	NA	0.1	1.2	4.4	82.0	36.04
FT#6	3/10	1510	1/8	204	6.5	4.7	24.9	0.4	1.6	4.6	NA	0.1	1.2	4.4	82.0	36.04
FT#7	3/10	1555	1/8	257	6.4	4.5	24.8	0.4	1.6	4.6	NA	0.1	1.2	4.4	82.0	36.04
FT#8	3/11	1230	1/8	232	7.5	5.5	24.8	0.3	1.5	5.0	NA	0.8	1.9	4.8	80.1	25.51
FT#9	3/11	1310	1/8	224	7.5	5.8	25.1	0.3	1.5	5.0	NA	0.8	1.9	4.8	80.1	25.51
FT#10	3/11	1356	1/8	240	7.4	5.4	24.9	0.2	1.5	4.8	NA	0.8	1.9	4.8	80.1	25.51
FT#11	3/11	1430	1/8	255	7.5	5.5	25.0	0.2	1.5	4.8	NA	0.4	1.8	4.8	80.7	25.28
FT#12	3/11	1506	1/8	257	6.4	4.4	24.9	0.7	2.4	5.8	NA	0.4	1.8	4.8	80.7	25.28
FT#13	3/11	1540	1/8	268	6.5	4.4	24.9	0.7	2.4	5.8	NA	0.4	1.8	4.8	80.7	24.90
FT#14	3/11	1620	1/8	278	6.5	4.5	24.9	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	28.65
FT#15	3/11	1642	1/8	271	6.4	4.4	24.9	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	28.65
FT#16	3/11	1720	1/8	223	5.2	3.5	25.1	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	28.65
FT#17	3/11	1753	1/8	223	5.2	3.6	25.0	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	34.36
FT#18	3/11	1825	1/8	206	5.2	3.6	24.9	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	34.36
FT#19	3/11	1855	1/8	193	7.5	5.8	24.9	0.6	2.3	5.9	NA	0.4	1.8	4.8	80.7	34.36
FT#20	3/16	925	1/8	297	8.1	6.0	36.0	0.4	1.7	5.2	NA	0.1	1.3	4.5	79.0	NA
FT#21	3/16	1012	1/8	242	8.1	6.2	35.7	0.4	1.7	5.2	NA	0.1	1.3	4.5	79.0	NA
FT#22	3/16	1101	1/8	272	8.1	6.4	32.9	0.4	1.7	5.2	NA	0.1	1.3	4.5	79.0	NA
FT#23	3/16	1213	1/8	277	6.1	4.5	35.5	0.4	1.7	5.2	NA	0.1	1.3	4.5	79.0	NA
FT#24	3/16	1311	1/8	274	6.1	4.1	34.2	0.5	2.2	6.5	NA	0.1	1.3	4.5	79.0	NA
FT#25	3/16	1439	1/8	261	6.1	4.2	35.9	0.5	2.2	6.5	NA	0.1	1.3	4.5	79.0	NA
FT#26	3/16	1535	1/8	252	6.1	4.1	34.6	0.5	2.2	6.5	NA	0.1	1.3	4.5	79.0	NA
FT#27	3/16	1745	1/8	91	6.1	5.3	34.5	1.3	3.8	8.3	NA	0.1	1.3	4.5	79.0	NA
FT#28	3/16	1838	1/8	138	8.1	7.0	32.8	1.3	3.8	8.3	NA	0.1	1.3	4.5	79.0	NA
FT#29	3/16	1930	1/8	164	6.1	5.3	40.3	1.3	3.8	8.3	NA	0.1	1.3	4.5	79.0	NA

Table 18.A.3 (cont.)
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 4)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Rate		Feed Water (GPM)	Feed Sump Level (%)	Dry Sample Results				Slurry Sample Results				Ash (Wt%, Dry)
				#/Hr.	GPM	% Solids		+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	Ash (Wt%, Dry)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	-325M (Wt%)	
FT#30	3/17	1110	1/16	289	6.1	9.2	4.0	0.3	1.0	3.4	NA	0.1	0.6	2.9	81.0	NA
FT#31	3/17	1155	1/16	259	8.1	6.2	6.1	0.3	1.0	3.4	NA	0.1	0.6	2.9	81.0	NA
FT#32	3/17	1250	1/16	246	6.2	7.7	4.2	0.3	1.0	3.4	NA	0.1	0.6	2.9	81.0	NA
FT#33	3/17	1350	1/16	252	6.1	8.0	4.2	0.3	1.0	3.4	NA	0.1	0.6	2.9	81.0	NA
FT#34	3/17	1435	1/16	278	6.2	8.7	4.2	0.0	0.4	2.0	NA	0.1	0.6	2.9	81.0	NA
FT#35	3/17	1615	1/16	249	6.1	7.9	4.6	0.0	0.4	2.0	NA	0.1	0.6	2.9	81.0	NA
FT#36	3/17	1700	1/16	246	8.1	5.9	6.0	0.0	0.4	2.0	NA	0.1	0.6	2.9	81.0	NA
FT#37	3/17	1745	1/16	259	8.1	6.2	5.9	0.4	1.6	5.4	NA	0.1	0.6	2.9	81.0	NA
FT#38	3/17	1830	1/16	280	8.1	6.7	5.8	0.4	1.6	5.4	NA	0.1	0.6	2.9	81.0	NA
FT#39	3/17	1945	1/16	293	6.1	9.3	4.0	0.4	1.6	5.4	NA	0.1	0.6	2.9	81.0	NA
FT#40	3/18	1350	1/16	289	6.1	7.8	4.0	0.1	0.7	2.6	NA	0.0	0.2	2.4	83.8	NA
FT#41	3/18	1445	1/16	259	8.1	6.2	6.0	0.1	0.7	2.6	NA	0.0	0.2	2.4	83.8	NA
FT#42	3/18	1530	1/16	261	6.1	8.3	3.9	0.1	0.7	2.6	NA	0.0	0.2	2.4	83.8	NA
FT#43	3/18	1648	1/16	258	6.1	8.2	3.9	0.1	0.7	2.6	NA	0.0	0.2	2.4	83.8	NA
FT#44	3/18	1733	1/16	245	6.1	7.8	3.7	0.1	0.7	2.6	NA	0.0	0.2	2.4	83.8	NA
FT#45	3/18	1825	1/16	286	6.1	9.1	4.3	0.1	1.3	5.7	NA	0.0	0.2	2.4	83.8	NA
FT#46	3/18	1910	1/16	272	8.1	6.5	5.9	0.1	1.3	5.7	NA	0.0	0.2	2.4	83.8	NA

Table 18.A.3 (cont.)
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 5)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Rate		Feed Sump Water (GPM)	Feed Sump Level (%)	Dry Sample Results				Slurry Sample Results				Ash (Wt% Dry)
				#/Hr.	GPM	% Solids		+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	Ash (Wt% Dry)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	-325M (Wt%)	
FT#47	3/22	1245	1/16	280	6.1	8.9	3.9	0.9	3.7	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#48	3/22	1340	1/16	264	6.1	8.4	3.9	0.9	3.7	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#49	3/22	1430	1/16	255	6.1	8.1	3.9	0.9	3.7	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#50	3/22	1535	1/16	261	6.1	8.3	3.9	0.9	3.0	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#51	3/22	1635	1/16	204	6.1	6.5	4.4	0.9	3.0	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#52	3/22	1735	1/16	201	6.2	6.3	4.4	0.9	3.0	8.9	NA	0.6	2.3	6.2	79.3	NA
FT#53	3/22	1830	1/16	195	6.1	6.2	4.4	0.0	1.2	4.4	NA	0.6	2.3	6.2	79.3	NA
FT#54	3/22	1915	1/16	189	6.2	5.9	4.3	0.0	1.2	4.4	NA	0.6	2.3	6.2	79.3	NA
FT#55	3/23	955	1/16	145	6.1	4.6	5.0	0.3	0.6	3.3	NA	0.7	2.1	5.1	81.5	NA
FT#56	3/23	1045	1/16	138	6.1	4.4	5.0	0.3	0.6	3.3	NA	0.7	2.1	5.1	81.5	NA
FT#57	3/23	1150	1/16	252	6.1	8.0	4.2	0.3	0.6	3.3	NA	0.7	2.1	5.1	81.5	NA
FT#58	3/23	1245	1/16	249	6.1	7.9	4.1	0.3	0.6	3.3	NA	0.7	2.1	5.1	81.5	NA
FT#59	3/23	1335	1/16	223	6.1	7.1	4.3	0.3	1.3	4.6	NA	0.7	2.1	5.1	81.5	NA
FT#60	3/23	1440	1/16	249	6.1	7.9	4.2	0.3	1.3	4.6	NA	0.7	2.1	5.1	81.5	NA
FT#61	3/23	1520	1/16	245	6.1	7.8	4.3	0.3	1.3	4.6	NA	0.7	2.1	5.1	81.5	NA
FT#62	3/23	1625	1/16	264	6.1	8.4	4.2	0.4	1.6	4.4	NA	0.7	2.1	5.1	81.5	NA
FT#63	3/23	1715	1/16	249	6.1	7.9	3.8	0.4	1.6	4.4	NA	0.7	2.1	5.1	81.5	NA
FT#64	3/25	1200	1/16	255	6.1	8.1	4.2	0.6	2.7	7.5	NA	0.6	2.4	6.2	77.4	NA
FT#65	3/25	1305	1/16	252	6.1	8.0	4.2	0.6	2.7	7.5	NA	0.6	2.4	6.2	77.4	NA
FT#66	3/25	1400	1/16	255	6.1	8.1	4.3	0.6	2.7	7.5	NA	0.6	2.4	6.2	77.4	NA
FT#67	3/25	1450	1/16	211	6.1	6.7	4.5	0.6	2.7	7.5	NA	0.6	2.4	6.2	77.4	NA
FT#68	3/25	1550	1/16	192	6.1	6.1	4.6	0.4	1.7	5.0	NA	0.6	2.4	6.2	77.4	NA
FT#69	3/25	1655	1/16	214	6.1	6.8	4.4	0.4	1.7	5.0	NA	0.6	2.4	6.2	77.4	NA
FT#70	3/25	1750	1/16	198	6.1	6.3	4.4	0.4	1.7	5.0	NA	0.6	2.4	6.2	77.4	NA
FT#71	3/25	1835	1/16	182	6.1	5.8	4.5	0.2	1.8	4.8	NA	0.6	2.4	6.2	77.4	NA
FT#72	3/25	1925	1/16	192	6.1	6.1	4.4	0.2	1.8	4.8	NA	0.6	2.4	6.2	77.4	NA
FT#73	3/25	2010	1/16	205	6.2	6.4	4.6	0.2	1.8	4.8	NA	0.6	2.4	6.2	77.4	NA

Table 18.A.3 (con't.)
GRINDING CIRCUIT RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 5)

Test	Date	Start Sampling Time	Hammer Mill Screen (In.)	Feed Rate		Feed Sump Water (GPM)	Feed Sump Level (%)	Dry Sample Results				Slurry Sample Results					
				#/Hr.	GPM			% Solids	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	Ash (Wt%, Dry)	+30M (Wt%)	+50M (Wt%)	+100M (Wt%)	-325M (Wt%)	Ash (Wt%, Dry)
FT#74	3/26	815	1/16	242	6.1	7.7	4.1	34.5	0.4	1.7	5.0	NA	0.1	1.2	3.5	85.0	NA
FT#75	3/26	905	1/16	267	6.1	8.5	4.0	35.0	0.4	1.7	5.0	NA	0.1	1.2	3.5	85.0	NA
FT#76	3/26	1000	1/16	267	6.1	8.5	4.1	35.8	0.4	1.7	5.0	NA	0.1	1.2	3.5	85.0	NA
FT#77	3/26	1040	1/16	264	6.1	8.4	4.1	34.3	0.4	1.4	3.8	NA	0.1	1.2	3.5	85.0	NA
FT#78	3/26	1135	1/16	248	5.4	8.9	3.5	35.3	0.4	1.4	3.8	NA	0.1	0.6	2.2	86.8	NA
FT#79	3/26	1245	1/16	259	5.4	9.3	3.3	35.4	0.4	1.4	3.8	NA	0.1	0.6	2.2	86.8	NA
FT#80	3/26	1335	1/16	317	5.4	9.6	3.4	34.2	0.5	1.7	4.3	NA	0.1	0.6	2.2	86.8	NA
FT#81	3/26	1435	1/16	259	5.4	9.3	3.3	36.7	0.5	1.7	4.3	NA	0.1	0.6	2.2	86.8	NA
FT#82	3/30	1035	1/16	314	8.0	7.6	5.7	34.9	0.2	1.1	3.9	NA	0.1	1.1	3.6	79.0	NA
FT#83	3/30	1130	1/16	300	6.0	9.7	3.7	34.9	0.2	1.1	3.9	NA	0.1	1.1	3.6	79.0	NA
FT#84	3/30	1245	1/16	306	4.5	13.2	2.2	35.0	0.2	1.1	3.9	NA	0.1	1.1	3.6	79.0	NA
FT#85	3/30	1355	1/16	173	8.0	4.2	6.7	34.9	0.1	0.5	2.1	NA	0.1	0.7	2.0	83.6	NA
FT#86	3/30	1445	1/16	195	6.0	6.3	4.7	35.1	0.1	0.5	2.1	NA	0.1	0.7	2.0	83.6	NA
FT#87	3/30	1605	1/16	161	4.6	6.8	3.2	35.4	0.1	0.5	2.1	NA	0.1	0.7	2.0	83.6	NA

Table 18.A.4
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot #1)

Test	Date	Start Sampling Time	Feed				Concentrate (Diluted)					Tailings	
			Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Yield (Wt%)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Solids (Wt%)	Ash (Wt%)
Lot#1	Head	—	—	25.94	2.49	1.90	—	—	—	—	—	—	—
CT#2	2/11	1200	6.45	27.01	—	—	44.6	4.28	11.76	—	—	3.41	39.28
CT#3	2/11	1338	6.45	27.01	—	—	35.5	4.36	10.92	—	—	3.73	35.85
CT#4	2/11	1510	6.44	29.90	—	—	44.3	4.24	12.82	—	—	3.63	43.48
CT#5	2/11	1740	5.90	26.57	2.51	—	42.5	4.17	13.25	2.11	1.44	3.68	37.14
CT#6	2/12	1214	6.32	25.77	—	—	56.7	3.72	11.65	—	—	3.11	44.28
CT#7	2/12	1319	6.19	25.85	—	—	53.3	5.01	11.04	—	—	2.99	42.74

Table 18.A.4 (con't.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot #2)

Test	Date	Start Sampling Time	Feed				Concentrate (Diluted)					Tailings	
			Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Yield (Wt%)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Solids (Wt%)	Ash (Wt%)
Lot#2	Head	—	—	29.23	2.68	2.04	—	—	—	—	—	—	—
DT#1	2/23	958	6.17	28.43	—	—	17.5	2.86	10.74	—	—	4.03	32.18
DT#2	2/23	1055	6.17	28.43	—	—	11.3	3.05	11.80	—	—	4.00	30.54
DT#4	2/23	1357	6.05	33.18	2.62	2.22	15.6	2.93	14.06	2.01	1.35	4.16	36.72
DT#5	2/23	1515	5.76	27.64	—	—	35.3	3.59	12.64	—	—	3.56	35.83
DT#6	2/23	1606	5.53	32.59	—	—	10.1	3.11	11.11	—	—	3.89	34.99
PT#1	2/26	851	7.97	30.00	—	—	31.2	4.86	11.71	—	—	5.83	38.31
PT#2	2/26	936	6.97	30.22	—	—	27.8	4.68	11.44	—	—	5.39	37.44
PT#3	2/26	1035	5.50	30.35	—	—	52.2	5.84	21.86	—	—	5.96	39.62
PT#4	2/26	1121	7.25	31.19	—	—	30.0	5.47	26.73	—	—	5.85	33.10
PT#5	2/26	1200	7.80	32.00	—	—	23.2	4.87	14.12	—	—	5.89	37.39
PT#6	2/26	1313	7.65	32.32	—	—	47.4	5.50	21.57	—	—	5.83	42.01

Notes: - Yields and Qualities are for -28M portion of feed, as there was a screen problem, and considerable undesirable +28M was present in the feed.

Table 18.A.4 (con't.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot #3)

<u>Test</u> Lot#3	<u>Date</u> Head	Start Sampling Time	Feed				Concentrate (Diluted)					Tailings	
			Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Yield (Wt%)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Solids (Wt%)	Ash (Wt%)
Lot#3	Head	—	—	27.21	2.57	2.03	—	—	—	—	—	—	—
PT#7	3/02	1242	7.08	27.23	—	—	74.4	4.29	16.36	—	—	2.86	58.89
PT#8	3/02	1337	7.26	26.20	2.55	2.11	59.7	4.42	12.95	2.09	1.33	3.46	45.85
PT#9	3/02	1440	7.39	25.19	2.54	—	58.6	4.12	11.72	1.98	—	2.92	44.28
PT#10	3/02	1610	7.92	24.97	—	—	67.3	4.16	15.52	—	—	2.99	44.42
PT#11	3/02	1655	6.42	26.72	—	—	56.5	4.20	15.08	—	—	4.38	41.82
PT#12	3/02	1744	7.69	25.26	—	—	70.0	3.95	15.53	—	—	3.63	47.93
PT#13	3/02	1830	7.73	25.67	—	—	47.6	3.63	11.27	—	—	3.75	38.73
PT#14	3/02	1915	7.30	25.76	—	—	60.9	3.54	14.41	—	—	3.38	43.44
PT#15	3/03	1321	6.86	28.94	—	—	53.8	3.83	14.14	—	—	4.11	46.15
PT#16	3/03	1410	7.51	29.70	—	—	45.5	3.57	11.84	—	—	3.58	44.59
PT#17	3/03	1500	8.35	27.81	—	—	67.5	4.00	16.24	—	—	3.76	51.80
PT#18	3/03	1545	8.61	28.02	—	—	60.0	3.77	14.43	—	—	3.37	48.40
PT#19	3/03	1630	7.93	29.67	—	—	52.5	4.01	14.94	—	—	4.63	45.97
PT#20	3/03	1716	7.52	30.71	—	—	44.0	3.47	12.46	—	—	4.42	45.03
PT#21	3/03	1800	7.60	30.49	—	—	62.0	4.01	16.68	—	—	3.87	53.06
PT#22	3/03	1846	7.92	30.03	—	—	57.4	3.80	14.84	—	—	3.69	50.50
PT#23	3/04	1105	7.88	28.82	2.63	2.11	53.6	3.62	13.06	2.03	1.39	3.80	47.04
PT#24	3/04	1151	7.32	28.13	2.63	2.21	56.4	3.69	12.69	2.02	1.30	3.40	48.08
PT#25	3/04	1253	7.34	27.62	—	—	54.5	3.73	13.10	—	—	3.57	44.99
PT#26	3/04	1350	5.79	27.80	—	—	43.8	3.44	12.15	—	—	2.89	39.98
PT#27	3/04	1436	5.07	28.55	—	—	39.7	3.34	11.98	—	—	3.19	39.44
PT#28	3/05	930	8.74	30.57	—	—	61.6	3.99	17.91	—	—	3.67	50.91
PT#29	3/05	1030	7.84	30.94	—	—	49.9	3.57	13.62	—	—	3.91	48.17
PT#30	3/08	1010	7.44	25.44	—	—	67.2	4.06	13.71	—	—	3.46	49.46
PT#31	3/08	1055	7.43	25.67	—	—	61.9	3.87	12.31	—	—	3.08	47.33
PT#32	3/08	1140	7.27	25.61	2.47	1.98	65.8	3.91	12.92	1.98	1.25	3.14	50.06
PT#33	3/08	1225	8.02	25.91	2.45	1.96	66.4	4.04	13.78	2.05	1.38	3.93	49.92

Note: - Yields and qualities are for 28M x 0 size fraction, for cases where pulverizer screen broke.

Table 18.A.4 (cont.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 4)

Test Lot #4	Date Head	Start Sampling Time	Balance Method	Feed				Concentrate (Diluted)				Tailings					
				Flow (GPM)	Solids (WT%)	Ash (WT%)	Sulfur (WT%)	Pyr. Sulfur (WT%)	F.B. Yield (WT%)	A.B. Yield (WT%)	Solids (WT%)	Ash (WT%)	Sulfur (WT%)	Pyr. Sulfur (WT%)	Flow (GPM)	Solids (WT%)	Ash (WT%)
FT#1	3/10	1052	ASTM	6.5	7.65	26.63	2.53	2.00	57.5	53.9	3.76	10.94	1.95	1.19	5.9	3.58	44.96
FT#2	3/10	1145	ASTM	8.0	6.09	27.42	—	—	52.0	48.3	3.50	10.92	—	—	7.5	3.12	42.83
FT#3	3/10	1250	ASTM	6.5	5.77	33.55	—	—	53.2	49.3	3.87	13.21	2.03	—	6.5	2.70	53.30
FT#4	3/10	1335	ASTM	6.5	6.05	36.28	2.71	2.27	63.2	60.2	3.91	18.47	2.44	1.87	4.2	3.45	63.22
FT#5	3/10	1425	ASTM	7.8	4.80	32.83	—	—	51.3	53.3	3.29	12.45	—	—	8.0	2.28	56.06
FT#6	3/10	1510	ASTM	6.5	6.06	30.86	—	—	63.4	63.2	3.55	14.19	2.24	—	6.4	2.25	59.44
FT#7	3/10	1555	ASTM	6.4	7.80	33.36	2.76	2.25	65.1	56.2	3.55	13.91	2.33	1.63	5.7	3.06	58.30
FT#8	3/11	1230	ASTM	7.5	6.13	28.49	—	—	69.6	59.2	4.65	14.48	—	—	4.9	2.85	60.01
FT#9	3/11	1310	ASTM	7.5	5.82	24.40	2.55	1.94	69.7	75.1	4.93	12.91	2.36	1.65	5.2	2.54	59.10
FT#10	3/11	1356	ASTM	7.4	6.32	25.05	—	—	77.8	75.7	4.67	14.51	2.08	—	4.2	2.47	57.86
FT#11	3/11	1430	ASTM	7.5	6.61	25.38	2.53	1.94	68.8	67.4	5.16	12.90	1.99	1.24	5.0	3.09	51.24
FT#12	3/11	1506	ASTM	6.4	7.83	25.87	—	—	66.5	62.7	4.25	11.58	—	—	6.1	2.75	49.91
FT#13	3/11	1540	ASTM	6.5	8.00	26.58	—	—	68.0	65.2	4.22	12.56	2.05	—	6.1	2.73	52.95
FT#14	3/11	1620	ASTM	6.5	8.30	28.82	—	—	67.1	59.7	4.25	12.67	—	—	5.7	3.11	52.76
FT#15	3/11	1642	ASTM	6.4	8.25	28.51	—	—	60.8	55.6	4.17	11.42	—	—	6.2	3.34	49.94
FT#16	3/11	1720	ASTM	5.2	8.30	28.63	2.54	1.91	69.3	64.3	4.02	12.84	2.09	1.40	4.9	2.70	57.08
FT#17	3/11	1753	ASTM	5.2	8.26	33.50	—	—	64.6	59.8	4.09	14.42	—	—	5.3	2.87	61.94
FT#18	3/11	1825	ASTM	5.2	7.72	34.77	—	—	54.7	50.5	3.65	13.02	2.27	—	6.0	3.03	56.96
FT#19	3/11	1855	ASTM	7.5	5.03	33.18	2.56	2.09	59.5	58.6	3.73	17.24	2.34	1.57	5.7	2.68	55.76
FT#20	3/16	925	ASTM	8.1	7.08	24.10	2.32	1.76	75.1	71.1	4.74	11.76	2.03	1.35	5.7	2.51	54.51
FT#21	3/16	1012	ASTM	8.1	5.77	24.56	—	—	69.4	67.7	4.71	11.87	—	—	5.7	2.51	51.18
FT#22	3/16	1101	ASTM	8.1	6.49	24.71	—	—	61.9	60.0	4.43	11.84	—	—	5.6	3.58	43.98
FT#23	3/16	1213	ASTM	6.1	8.77	26.03	2.56	1.96	65.2	62.0	4.40	11.69	1.99	1.37	5.4	3.45	49.45
FT#24	3/16	1311	ASTM	6.1	8.67	32.32	2.73	2.35	65.1	53.1	4.32	13.42	2.11	1.48	5.5	3.36	53.74
FT#25	3/16	1439	ASTM	6.1	8.32	31.76	—	—	62.0	60.5	4.08	14.69	—	—	5.4	3.57	57.91
FT#26	3/16	1535	ASTM	6.1	8.04	29.94	2.51	—	68.4	69.4	4.41	14.76	2.36	1.66	5.1	3.04	64.44
FT#27	3/16	1745	ASTM	6.1	2.86	25.75	—	—	64.0	76.7	3.98	13.35	—	—	6.4	0.98	66.55
FT#28	3/16	1838	ASTM	8.1	3.27	23.46	2.00	1.50	83.4	72.2	3.17	11.64	1.97	—	7.1	0.62	54.15
FT#29	3/16	1930	ASTM	6.1	5.17	25.29	—	—	85.0	65.9	2.30	10.28	2.01	1.36	7.9	0.60	54.33

Table 18.A.4 (cont.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 4)

Test	Date	Start Sampling Time	Balance Method	Feed			Concentrate (Diluted)						Tailings				
				Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
FT#30	3/17	1110	ASTM	6.1	9.24	27.24	—	—	56.1	52.3	4.16	10.83	1.86	1.20	5.2	4.76	45.26
FT#31	3/17	1155	ASTM	8.1	6.21	26.03	—	—	69.5	69.8	5.14	14.35	—	—	5.4	2.84	53.08
FT#32	3/17	1250	ASTM	6.2	7.72	26.02	—	—	67.8	66.9	4.17	13.64	—	—	5.3	2.91	51.09
FT#33	3/17	1350	ASTM	6.1	8.01	27.36	2.54	—	62.8	60.5	4.14	14.02	2.12	—	5.3	3.43	47.79
FT#34	3/17	1435	ASTM	6.2	8.69	28.40	2.81	—	64.7	58.6	4.02	15.16	2.13	—	5.3	3.59	47.14
FT#35	3/17	1615	ASTM	6.1	7.93	28.84	—	—	59.7	60.5	3.93	14.66	—	—	5.4	3.61	50.53
FT#36	3/17	1700	ASTM	8.1	5.88	28.55	—	—	61.9	67.5	4.78	16.37	2.19	—	5.1	3.56	53.83
FT#37	3/17	1745	ASTM	8.1	6.15	28.50	—	—	61.8	62.0	4.52	15.79	—	—	5.0	3.81	49.21
FT#38	3/17	1830	ASTM	8.1	6.70	29.28	2.49	2.05	68.7	63.7	4.75	16.02	2.20	1.61	5.5	3.09	52.50
FT#39	3/17	1945	ASTM	6.1	9.27	33.47	—	—	63.7	52.0	4.34	14.07	—	—	5.7	3.60	54.48
FT#40	3/18	1350	ASTM	6.1	7.76	31.30	—	—	60.9	62.8	4.08	14.30	—	—	5.7	3.25	59.96
FT#41	3/18	1445	ASTM	8.1	6.20	27.96	—	—	69.8	70.2	4.73	15.44	—	—	5.5	2.76	57.35
FT#42	3/18	1530	ASTM	6.1	8.33	27.50	—	—	69.3	68.0	4.35	12.44	—	—	5.1	3.06	59.44
FT#43	3/18	1648	ASTM	6.1	8.24	26.13	—	—	69.4	70.3	4.40	12.95	2.12	1.42	4.9	3.14	57.39
FT#44	3/18	1733	ASTM	6.1	7.76	24.28	2.20	1.75	71.5	74.4	4.49	12.16	2.12	1.37	4.7	2.87	59.56
FT#45	3/18	1825	ASTM	6.1	9.14	26.11	2.38	2.07	78.3	73.4	4.68	12.09	2.12	1.51	4.7	2.57	64.82
FT#46	3/18	1910	ASTM	8.1	6.48	25.93	—	—	77.2	75.5	5.29	14.28	—	—	5.2	2.30	61.80

Table 18 A 4 (cont.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 5)

Test Lot #5	Date Head	Start Sampling Time	Balance Method	Feed				Concentrate (Diluted)						Tailings			
				Flow (GPM)	Solids (WT%)	Ash (WT%)	Sulfur (WT%)	Pyr. Sulfur (WT%)	F B. Yield (WT%)	A B. Yield (WT%)	Solids (WT%)	Ash (WT%)	Sulfur (WT%)	Pyr. Sulfur (WT%)	Flow (GPM)	Solids (WT%)	Ash (WT%)
FT#47	3/22	1245	ASTM	6.1	8.89	28.15	2.75	2.39	69.2	67.7	4.65	13.52	2.21	1.68	5.1	3.28	58.76
FT#48	3/22	1340	ASTM	6.1	8.35	31.58	—	—	59.7	59.9	4.35	15.19	—	—	5.5	3.74	56.10
FT#49	3/22	1430	ASTM	6.1	8.13	30.87	—	—	52.1	51.5	4.42	14.46	—	—	5.9	4.03	47.79
FT#50	3/22	1535	ASTM	6.1	8.31	34.38	2.72	2.28	54.7	54.5	3.85	18.98	2.40	1.80	5.3	4.33	52.82
FT#51	3/22	1635	ASTM	6.1	6.49	29.39	—	—	68.5	71.8	4.37	15.44	—	—	6.2	2.01	64.84
FT#52	3/22	1735	ASTM	6.2	6.34	25.48	—	—	68.6	70.6	3.98	12.36	2.13	1.50	6.2	1.99	58.92
FT#53	3/22	1830	ASTM	6.1	6.15	25.00	—	—	68.8	69.4	3.90	12.61	—	—	6.0	1.95	53.16
FT#54	3/22	1915	ASTM	6.2	5.94	26.85	2.60	1.98	69.1	70.7	4.32	13.01	2.17	1.53	6.5	1.75	60.23
FT#55	3/23	955	ASTM	6.1	4.58	25.89	—	—	75.1	73.3	3.34	11.92	—	—	6.5	1.07	64.20
FT#56	3/23	1045	ASTM	6.1	4.41	24.86	—	—	68.8	72.2	3.45	11.80	—	—	6.4	1.31	58.86
FT#57	3/23	1150	ASTM	6.1	7.99	26.45	—	—	70.5	64.7	4.38	11.67	—	—	5.9	2.44	53.52
FT#58	3/23	1245	ASTM	6.1	7.85	26.44	—	—	56.9	56.7	4.08	11.20	—	—	6.0	3.44	46.38
FT#59	3/23	1335	ASTM	6.1	7.14	26.87	—	—	64.9	63.9	4.27	12.86	2.16	1.54	5.7	2.88	51.67
FT#60	3/23	1440	ASTM	6.1	7.94	26.03	2.43	1.98	78.1	76.9	4.88	14.66	2.27	1.60	5.2	2.04	63.78
FT#61	3/23	1520	ASTM	6.1	7.81	26.00	2.47	1.93	69.1	72.8	4.87	15.28	2.29	1.56	5.3	2.78	54.68
FT#62	3/23	1625	ASTM	6.1	8.39	28.28	—	—	64.1	62.4	4.56	16.87	2.08	—	5.5	3.34	47.25
FT#63	3/23	1715	ASTM	6.1	7.86	30.46	2.70	2.11	60.6	61.6	4.60	17.92	2.26	—	5.4	3.50	50.55
FT#64	3/25	1200	ASTM	6.1	8.07	31.35	2.65	—	60.7	62.3	4.45	15.61	2.32	—	5.9	3.28	57.35
FT#65	3/25	1305	ASTM	6.1	7.99	30.95	—	—	59.0	57.5	4.05	16.25	—	—	5.9	3.39	50.94
FT#66	3/25	1400	ASTM	6.1	8.13	27.63	—	—	63.0	64.7	4.03	16.63	—	—	5.4	3.40	47.83
FT#67	3/25	1450	ASTM	6.1	6.72	25.81	—	—	67.7	68.3	4.12	16.13	—	—	6.1	2.17	46.67
FT#68	3/25	1550	ASTM	6.1	6.06	26.10	—	—	60.2	64.4	3.69	15.44	—	—	6.0	2.45	45.37
FT#69	3/25	1655	ASTM	6.1	6.83	26.36	—	—	68.7	63.7	3.58	15.93	—	—	5.9	2.21	44.67
FT#70	3/25	1750	ASTM	6.1	6.25	25.66	2.38	1.85	64.4	64.2	3.88	14.47	2.21	1.60	6.5	2.09	45.69
FT#71	3/25	1835	ASTM	6.1	5.84	26.30	—	—	63.0	62.2	3.90	14.53	—	—	6.5	2.03	45.70
FT#72	3/25	1925	ASTM	6.1	6.13	26.86	—	—	62.7	57.5	3.62	14.09	—	—	6.4	2.18	44.13
FT#73	3/25	2010	ASTM	6.2	6.39	26.95	—	—	59.5	60.7	3.41	15.19	—	—	6.4	2.51	45.08

Table 18.A.4 (cont.)
TEST SAMPLE RESULTS
(Upper Freeport Seam Raw Coal, Feed Lot # 5)

Test	Date	Start Sampling Time	Balance Method	Feed				Concentrate (Diluted)						Tailings			
				Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Solids (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
FT#74	3/26	815	ASTM	6.1	7.72	31.95	—	—	56.7	46.8	3.84	15.85	—	—	6.0	3.40	46.12
FT#75	3/26	905	ASTM	6.1	8.47	37.53	3.40	2.86	50.8	44.1	3.62	21.31	2.60	2.18	6.1	4.17	50.33
FT#76	3/26	1000	ASTM	6.1	8.53	32.36	—	—	51.4	56.3	3.44	20.98	—	—	5.8	4.36	47.03
FT#77	3/26	1040	ASTM	6.1	8.36	27.20	—	—	50.0	62.0	3.56	18.88	—	—	5.6	4.55	40.75
FT#78	3/26	1135	ASTM	5.4	8.93	26.51	—	—	47.3	48.3	3.58	14.27	—	—	6.2	4.10	37.96
FT#79	3/26	1245	ASTM	5.4	9.30	26.40	2.49	1.98	40.1	36.5	3.08	10.62	1.94	1.33	7.3	4.12	35.47
FT#80	3/26	1335	ASTM	5.4	9.57	26.92	—	—	52.6	51.0	3.72	13.97	—	—	6.3	3.89	40.42
FT#81	3/26	1435	ASTM	5.4	9.28	27.30	—	—	36.3	32.9	2.95	11.26	—	—	7.3	4.37	35.18
FT#82	3/30	1035	ASTM	8.0	7.59	24.37	2.42	1.97	63.8	64.9	4.66	12.97	1.91	1.35	6.2	3.55	45.46
FT#83	3/30	1130	ASTM	6.0	9.68	24.93	—	—	65.1	66.7	4.98	13.67	—	—	4.5	4.51	47.46
FT#84	3/30	1245	ASTM	4.5	13.23	26.63	—	—	66.4	62.6	4.62	15.28	—	—	2.8	7.15	45.61
FT#85	3/30	1355	ASTM	8.0	4.18	26.87	2.61	—	51.3	52.2	3.23	11.62	2.16	—	8.4	1.94	43.55
FT#86	3/30	1445	ASTM	6.0	6.33	25.53	—	—	65.3	58.4	3.27	13.04	—	—	6.5	2.03	43.08
FT#87	3/30	1605	ASTM	4.6	6.83	26.51	—	—	64.1	59.4	3.49	15.01	—	—	4.8	2.35	43.34

APPENDIX B

VERTICALLY MOUNTED SKID MODULE DRAWINGS

Figure B.1 - Elevation 1116' Skid Components

Figure B.2 - Elevation 1106' Skid Module

Figure B.3 - Elevation 1096' Skid Module

Figure B.4 - Elevation 1086' Skid Module

Figure B.1
ELEVATION 1116'
SKID COMPONENTS

Figure B.2
ELEVATION 1106'
SKID MODULE

Figure B.3

**ELEVATION 1096'
SKID MODULE**

Figure B.4
ELEVATION 1086'
SKID MODULE

APPENDIX C

2" LABORATORY COLUMN TEST RESULTS

(Upper Freeport Seam Coal)

Table 18.C.1:	Set #1 Head Analysis (Old Coal and PTI Grind)
Table 18.C.2:	Batch #1 Tests with 0.50 #/T M-150 (lab) and 0.50 #/T Fuel Oil
Table 18.C.3:	Batch #2 Tests with 0.50 #/T M-150 (lab) and 1.00 #/T Fuel Oil
Table 18.C.4:	Batch #3 Tests with 0.75 #/T M-150 (lab) and 0.75 #/T Fuel Oil
Table 18.C.5:	Batch #4 Tests with 0.50 #/T M-150 (lab) and 1.50 #/T Fuel Oil
Table 18.C.6:	Set #2 Head Analysis (Old Coal and PTI Grind)
Table 18.C.7:	Batch #5 Feed Sump Mixing Tests
Table 18.C.8:	Batch #6 Tests with 0.60 #/T M-150 (lab) and 0.60 #/T Fuel Oil
Table 18.C.9:	Batch #7 Tests with 0.50 #/T M-150 (lab) and 0.80 #/T Fuel Oil
Table 18.C.10:	Batch #8 Tests with 0.75 #/T M-150 (lab) and 0.75 #/T Fuel Oil
Table 18.C.11:	Batch #9 Tests with 0.75 #/T M-150 (lab) and 0.75 #/T Fuel Oil, and 0.20 #/T Polyacrylic Acid
Table 18.C.12:	Batch #10 Tests with 0.50 #/T M-150 (lab) and 0.80 #/T Fuel Oil, and 0.30 #/T Polyacrylic Acid
Table 18.C.13:	Batch #11 Tests with 0.50 #/T M-150 (lab) and 0.80 #/T Fuel Oil, and 0.40 #/T Polyacrylic Acid
Table 18.C.14:	Batch #12 Tests with 0.50 #/T M-150 (lab) and 0.80 #/T Fuel Oil, and 0.50 #/T Polyacrylic Acid
Table 18.C.15:	Set #3 Head Analyses (Old Coal and PTI Grind)
Table 18.C.16:	Batch #1 Tests with 0.60 #/T M-150 (site) and 0.60 #/T Fuel Oil
Table 18.C.17:	Batch #2 Tests with 0.60 #/T MIBC and 0.60 #/T Fuel Oil
Table 18.C.18:	Batch #3 Tests with 0.55 #/T MIBC and 0.55 #/T Fuel Oil
Table 18.C.19:	Batch #4 Tests with 0.45 #/T MIBC and 0.60 #/T Fuel Oil
Table 18.C.20:	Batch #5 Tests with 0.60 #/T CM-670 (site) and 0.60 #/T Fuel Oil
Table 18.C.21:	Set #4 Head Analysis Lot #3 (Lot #5 Plant Coal and PTI Grind)
Table 18.C.22:	Batch #1 Tests with 0.45 #/T MIBC and 0.60 #/T Fuel Oil
Table 18.C.23:	Set #5 Head Analysis (Lot #5 Plant Coal and PETC Grind)
Table 18.C.24:	Batch #1 Tests with 0.45 #/T MIBC and 0.60 #/T Fuel Oil
Table 18.C.25:	Batch #2 Tests with 0.30 #/T MIBC and 0.50 #/T Fuel Oil
Table 18.C.26:	Batch #3 Tests with 0.30 #/T MIBC and 0.50 #/T Fuel Oil

18.C.1
2" KEN-FLOTE COLUMN TESTS
SET #1, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
Upper Freeport Seam Raw Coal
(Dried at 107 C and Pulverized)

I. Head Analysis: Set #1 Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	0.16	---
Ash (Wt%)	26.66	26.70
Sulfur (Wt%)	2.29	2.29
Pyritic Sulfur (Wt%)	1.82	1.82

II. Screen Analysis (Dry Basis): Set #1 Composite

<u>Size Fraction</u> <u>(USA Mesh)</u>	<u>Direct</u> <u>(Wt%)</u>	<u>Cum. Passing</u> <u>(Wt%)</u>
Top x 30M	0.00	100.00
30M x 50M	0.30	99.70
50M x 70M	2.93	95.77
70M x 100M	6.98	89.79
100M x 200M	17.90	71.89
200M x 400M	20.53	51.36
400M x 0	51.36	---

SET #1, BATCH #1, 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50 #/T Betz M-150 Frother

Batch Collector Dosages = 0.50 #/T No. 2 Fuel Oil

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Laundry Water		Froth Wash Water		Retention Time (min.)	
		(GPM)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
1	1	542	37.3	224	10	14	0 070	3 18	28 4	300	404	150	28	6.9	4 3
1	2	560	34.5	207	10	14	0 035	1 59	15 4	300	637	150	27	6.6	4.2
1	3	580	31.3	188	10	14	0 105	4 77	50 8	300	361	150	26	6.4	4.1
1	4	568	29.9	179	14	19	0 105	4 77	53 2	300	362	150	26	6.5	4.2
1	5	531	27.3	164	14	19	0 035	1 59	19 4	300	750	150	28	7.0	4.4

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Laundry Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
1	—	—	—	—	—	—	—	—	—	—	—	—	27.21	2.37	1.82
1	—	—	—	—	—	—	Start Feed	—	14 22	—	—	—	59.02	—	—
1	1	2	10	5	150	300	Recon. Feed	—	6 89	542	37.3	100.0	27.35	—	—
							Product	6 21	31 28	74	23.2	62.2	10.95	—	—
							Tailings	—	2 28	618	14.1	37.8	54.34	—	—
1	2	1	10	5	150	300	Recon. Feed	—	6 16	560	34.5	100.0	22.92	—	—
							Product	5.43	39.98	47	18.8	54.5	9.72	—	—
							Tailings	—	2 37	663	15.7	45.5	38.73	—	—
1	3	3	10	5	150	300	Recon. Feed	—	5 40	580.00	31.3	100.0	21.12	—	—
							Product	6 10	28 12	83	23.4	74.8	10.78	1.71	1.03
							Tailings	—	1 22	647	7.9	25.2	51.80	—	—
1	4	3	14	7	150	300	Recon. Feed	—	5 26	568	29.9	100.0	18.94	—	—
							Product	6 27	28 98	83	24.0	80.3	10.52	1.62	0.96
							Tailings	—	0 93	635	5.9	19.7	53.26	—	—
1	5	1	14	7	150	300	Recon. Feed	—	5 14	531	27.3	100.0	18.27	—	—
							Product	4 87	41 42	40	16.6	60.8	9.08	—	—
							Tailings	—	1 66	641	10.7	39.2	32.52	—	—
1	—	—	—	—	—	—	End Feed	—	4 40	—	—	—	18.43	1.45	0.90

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes laundry water addition for product samples.
- Actual solids content reflects product sample prior to laundry water addition

SET #1, BATCH #2, 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50 #/T Betz M-150 Frother

Batch Collector Dosages = 1.00 #/T No. 2 Fuel Oil

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(GPM)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
2	1	560	37.3	224	10	14	0.070	3.18	28.4	300	299	150	27	6.6	4.2
2	2	542	34.7	208	10	14	0.035	1.59	15.3	300	372	150	28	6.9	4.3
2	3	632	32.9	197	10	14	0.105	4.77	48.4	300	233	150	24	5.9	3.8
2	4	525	28.7	172	14	19	0.105	4.77	55.4	300	337	150	29	7.1	4.4
2	5	540	27.2	163	14	19	0.035	1.59	19.5	300	428	150	28	6.9	4.3

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
2	—	—	—	—	—	—	—	—	—	—	—	—	27.11	2.32	1.82
2	—	—	—	—	—	—	Start Feed	—	12.44	—	—	—	55.70	—	—
2	1	2	10	5	150	300	Recon. Feed	—	6.66	560	37.3	100.0	29.66	—	—
							Product	6.57	26.20	100	26.3	70.5	14.05	—	—
							Tailings	—	1.80	610	11.0	29.5	66.97	—	—
2	2	1	10	5	150	300	Recon. Feed	—	6.40	542	34.7	100.0	20.91	—	—
							Product	7.30	34.49	81	27.8	80.1	12.21	1.89	1.21
							Tailings	—	1.13	611	6.9	19.9	55.94	—	—
2	3	3	10	5	150	300	Recon. Feed	—	5.21	632	32.9	100.0	20.48	1.69	1.10
							Product	6.65	22.16	128	28.5	86.6	13.43	1.79	1.11
							Tailings	—	0.67	654	4.4	13.4	66.05	1.06	1.03
2	4	3	14	7	150	300	Recon. Feed	—	5.47	525	28.7	100.0	19.10	1.62	1.03
							Product	6.56	28.68	89	25.5	88.9	13.14	1.70	1.04
							Tailings	—	0.55	586	3.2	11.1	66.81	0.96	0.92
2	5	1	14	7	150	300	Recon. Feed	—	5.04	540	27.2	100.0	18.91	—	—
							Product	5.89	31.10	70	21.8	80.1	10.74	—	—
							Tailings	—	0.87	620	5.4	19.9	51.78	—	—
2	—	—	—	—	—	—	End Feed	—	4.67	—	—	—	18.71	1.54	1.01

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #1, BATCH #3, 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.75 #/T Betz M-150 Frother

Batch Collector Dosages = 0.75 #/T No. 2 Fuel Oil

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Water Water		Retention Time (min.)	
		(GPM)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
3	1	513.0	45.0	270	10	14	0.070	3.18	23.6	300	175	150	29	7.2	4.5
3	2	552	38.1	229	10	14	0.035	1.59	13.9	300	307	150	27	6.7	4.2
3	3	545	29.7	178	10	14	0.105	4.77	53.6	300	123	150	28	6.8	4.3
3	4	609	29.8	179	14	19	0.105	4.77	53.4	300	140	150	25	6.1	3.9
3	5	576	27.7	166	14	19	0.035	1.59	19.1	300	442	150	26	6.5	4.1

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (m ³ /min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
3	—	—	—	—	—	—	—	—	—	—	—	—	27.14	2.35	1.82
3	—	—	—	—	—	—	Start Feed	—	12.41	—	—	—	54.58	5.83	5.63
3	1	2	10	5	150	300	Recon. Feed	—	8.77	513	45.0	100.0	30.57	2.45	2.04
							Product	8.18	22.48	172	38.6	85.7	22.85	2.72	2.25
							Tailings	—	1.30	491	6.4	14.3	76.87	0.86	0.79
3	2	1	10	5	150	300	Recon. Feed	—	6.90	552	38.1	100.0	22.97	—	—
							Product	8.07	32.82	98	32.1	84.3	15.76	—	—
							Tailings	—	0.99	604	6.0	15.7	61.68	—	—
3	3	3	10	5	150	300	Recon. Feed	—	5.45	545	29.7	100.0	20.29	—	—
							Product	5.10	11.36	245	27.8	93.6	16.63	—	—
							Tailings	—	0.42	450	1.9	6.4	73.80	—	—
3	4	3	14	7	150	300	Recon. Feed	—	4.89	609	29.8	100.0	19.02	—	—
							Product	5.43	13.03	214	27.9	93.6	15.48	—	—
							Tailings	—	0.35	545	1.9	6.4	70.87	—	—
3	5	1	14	7	150	300	Recon. Feed	—	4.81	576	27.7	100.0	18.72	1.49	0.92
							Product	6.36	34.46	68	23.4	84.5	12.57	1.54	0.92
							Tailings	—	0.65	658	4.3	15.5	52.24	1.20	0.90
3	—	—	—	—	—	—	End Feed	—	4.52	—	—	—	18.32	1.46	0.94

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #1, BATCH #4, 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.75 #/T Betz M-150 Frother

Batch Collector Dosages = 1.50 #/T No. 2 Fuel Oil

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(GPM)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
4	1	562	39.1	235	10	14	0.070	3.18	27.1	300	142	150	27	6.6	4.2
4	2	570	35.3	212	10	14	0.035	1.59	15.0	300	302	150	26	6.5	4.1
4	3	637	35.9	215	10	14	0.105	4.77	44.3	300	81	150	24	5.8	3.8
4	4	504	28.6	172	14	19	0.105	4.77	55.6	300	100	150	30	7.4	4.5
4	5	547	29.0	174	14	19	0.035	1.59	18.3	300	377	150	27	6.8	4.3

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
4	—	—	—	—	—	—	—	—	—	—	—	—	27.02	2.28	1.82
4	—	—	—	—	—	—	Start Feed	—	12.14	—	—	—	53.73	—	—
4	1	2	10	5	150	300	Recon. Feed	—	6.96	562	39.1	100.0	25.46	—	—
							Product	7.03	17.00	212	36.0	92.1	21.48	2.19	1.64
							Tailings	—	0.62	500	3.1	7.9	71.81	—	—
4	2	1	10	5	150	300	Recon. Feed	—	6.19	570	35.3	100.0	22.71	—	—
							Product	7.74	31.09	99	30.9	87.5	17.31	—	—
							Tailings	—	0.71	621	4.4	12.5	60.51	—	—
4	3	3	10	5	150	300	Recon. Feed	—	5.64	637	35.9	100.0	20.30	—	—
							Product	5.14	9.29	371	34.5	96.1	18.09	—	—
							Tailings	—	0.34	416	1.4	3.9	74.65	—	—
4	4	3	14	7	150	300	Recon. Feed	—	5.68	504	28.6	100.0	18.48	—	—
							Product	4.62	9.24	300	27.7	96.8	16.69	—	—
							Tailings	—	0.25	354	0.9	3.2	72.67	—	—
3	5	1	14	7	150	300	Recon. Feed	—	5.30	547	29.0	100.0	18.64	—	—
							Product	6.72	32.04	80	25.5	87.9	13.94	1.59	0.98
							Tailings	—	0.57	617	3.5	12.1	52.77	—	—
3	—	—	—	—	—	—	End Feed	—	4.79	—	—	—	19.88	—	—

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

18.C.6
 2" KEN-FLOTE COLUMN TESTS
 SET #2, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
 Upper Freeport Seam Raw Coal
 (Dried at 40 C and Pulverized)

I. Head Analysis: Set #2 Feed Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	0.57	---
Ash (Wt%)	26.09	26.24
Sulfur (Wt%)	2.32	2.33
Pyritic Sulfur (Wt%)	1.81	1.82

II. Screen Analysis (Dry Basis): Set #2 Composite

Size Fraction <u>(USA Mesh)</u>	Direct <u>(Wt%)</u>	Cum. Passing <u>(Wt%)</u>
Top x 30M	0.0	100.0
30M x 50M	0.3	99.7
50M x 70M	2.7	97.0
70M x 100M	6.4	90.6
100M x 200M	19.2	71.4
200M x 400M	32.3	48.1
400M x 0	<u>48.1</u>	0.0
	100.0	

Table 18.C.7
SET #2, BATCH #5, 2" KEN-FLOTE LAB COLUMN
FEED SUMP MIXING TESTS
Upper Freeport Raw Coal

Conditions: - 6.0 Wt% Feed Solids
 - 0.50 #/Ton Betz M-150 Frother
 - 1.00 #/Ton No. 2 Fuel Oil Collector
 - Put 10 GPM Recirculator Pump on Bottom of Sump
 - Moved Feed Suction Point 10" Up Into Sump Directly Under Agitator
 - Feed At 800 ml/min. and Compared 10 Minute Feed Increments Over Entire Feed Period

Sample #	Description	Recirc. Pump (%scale)	Feed Pump (%scale)	Final Sump Level (in. down)	Feed Sample Composition			
					Slurry Weight (lbs.)	Solids Content (Wt%)	Dry Ash (Wt%)	Dry Sulfur (Wt%)
1	Time zero to 10 minutes	100	40	2.5	18.05	5.34	23.15	1.88
2	Time 10 to 20 minutes	100	40	3	18.16	5.31	21.78	1.77
3	Time 20 to 30 minutes	100	40	4	17.58	5.49	22.95	1.88
4	Time 30 to 40 minutes	100	40	4.5	18.56	5.58	24.05	1.91
5	Time 40 to 50 minutes	100	40	5.5	18.37	5.42	25.71	1.99
6	Time 50 to 60 minutes	100	40	6.5	17.93	5.39	24.91	1.98
7	Time 60 to 70 minutes	100	40	8	18.34	5.49	24.89	1.98
8	Time 70 to 80 minutes	100	40	9.5	18.55	5.59	25.95	2.04
9*	Time 80 to 90 minutes	80	20	11	18.69	5.86	28.00	2.18
10	Time 90 to 100 minutes	80	20	13	18.50	6.51	31.22	2.64
11	Time 100 to 105 minutes	80	20	16	9.93	7.22	29.78	2.56
12	Leftover in Sump	---	---	19	17.57	8.21	27.98	2.93

Notes: - * Feed was fairly consistent up to Sample #9. We have only 90 minutes (1 hour and 30 minutes) to complete all tests when we are doing batch testing.
 - We will shorten suction pipe about one inch to try and get slightly higher solids, ash, and sulfur content at the start.

SET #2, BATCH #6 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60#/T Betz M-150 Frother

Batch Collector Dosages = 0.60#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
6	1	751	43.6	262	10	14	035	1.59	12.2	400	714	200	27	5.0	3.1
6	2	826	49.4	296	10	14	070	3.18	21.5	400	280	200	24	4.5	2.9
6	3	771	43.8	263	14	19	070	3.18	24.2	400	404	200	26	4.8	3.0
6	4	823	47.4	284	14	19	035	1.59	11.2	400	952	200	24	4.5	3.9

Batch	Test	Air Rate (l/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
6	—	—	—	—	—	—	Head	—	—	—	—	—	26.24	2.27	1.82
6	—	—	—	—	—	—	Start Feed	—	5.78	—	—	—	22.39	1.88	1.30
6	1	1	10	5	200	400	Recon. Feed	—	5.81	751	43.6	100.0	21.17	—	—
							Product	6.00	48.93	56	27.4	62.8	9.28	1.75	—
							Tailings	—	1.81	895	16.2	37.2	41.24	—	—
6	2	2	10	5	200	400	Recon. Feed	—	5.98	826	49.4	100.0	23.45	1.98	1.49
							Product	6.96	26.43	143	37.8	76.5	11.77	2.03	1.44
							Tailings	—	1.31	883	11.6	23.5	61.49	1.80	1.64
6	3	2	14	7	200	400	Recon. Feed	—	5.68	771	43.8	100.0	24.09	1.97	—
							Product	6.51	32.83	99	32.5	74.2	11.04	1.96	1.35
							Tailings	—	1.30	872	11.3	25.8	61.63	1.98	—
6	4	1	14	7	200	400	Recon. Feed	—	5.76	823	47.4	100.0	25.39	—	—
							Product	5.05	53.10	42	22.3	47.0	7.60	—	—
							Tailings	—	2.56	981	25.1	53.0	41.17	—	—
6	—	—	—	—	—	—	End Feed	—	5.70	—	—	—	26.84	2.14	1.67

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #2, BATCH #7 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50#/T Betz M-150 Frother

Batch Collector Dosages = 0.80#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
7	1	788	45.0	270	10	14	.035	1.59	11.8	400	690	200	25	4.7	3.0
7	2	788	49.9	299	10	14	.070	3.18	21.3	400	377	200	25	4.7	3.0
7	3	834	46.1	277	14	19	.070	3.18	23.0	400	494	200	24	4.5	2.9
7	4	807	49.2	295	14	19	.035	1.59	10.8	400	1430	200	25	4.6	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
7	—	—	—	—	—	—	—	—	—	—	—	—	26.39	2.31	1.82
7	—	—	—	—	—	—	Start Feed	—	5.38	—	—	—	22.06	—	—
7	1	1	10	5	200	400	Recon. Feed	—	5.71	788	45.0	100.0	21.59	—	—
							Product	5.76	45.52	58	26.4	58.7	9.34	—	—
							Tailings	—	2.00	930	18.6	41.3	38.99	—	—
7	2	2	10	5	200	400	Recon. Feed	—	6.33	788	49.9	100.0	25.61	2.10	1.60
							Product	6.90	32.92	106	34.9	69.9	10.70	1.98	1.35
							Tailings	—	1.70	882	15.0	30.1	60.22	2.39	2.18
7	3	2	14	7	200	400	Recon. Feed	—	5.53	834	46.1	100.0	24.57	2.01	1.50
							Product	6.69	39.75	81	32.2	69.8	10.11	1.92	1.31
							Tailings	—	1.46	953	13.9	30.2	57.98	2.22	1.93
7	4	1	14	7	200	400	Recon. Feed	—	6.10	807	49.2	100.0	25.98	—	—
							Product	4.70	71.79	28	20.1	40.9	7.52	—	—
							Tailings	—	2.97	979	29.1	59.1	38.75	—	—
7	—	—	—	—	—	—	End Feed	—	5.99	—	—	—	26.97	—	—

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #2, BATCH #8 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.75#/T Betz M-150 Frother

Batch Collector Dosages = 0.75#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
8	1	766	44.7	268	10	14	.035	1.59	11.9	400	392	200	26	4.9	3.1
8	2	708	43.9	263	10	14	.070	3.18	24.2	400	172	200	28	5.3	3.3
8	3	848	38.9	233	14	19	.070	3.18	27.3	400	286	200	24	4.4	2.8
8	4	751	42.5	255	14	19	.035	1.59	12.5	400	656	200	27	5.0	3.1

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
8	—	—	—	—	—	—	—	—	—	—	—	—	26.39	2.28	1.82
8	—	—	—	—	—	—	Start Feed	—	5.15	—	—	—	22.71	1.82	—
8	1	1	10	5	200	400	Recon. Feed	—	5.84	766	44.7	100.0	20.91	1.84	—
							Product	7.08	34.80	102	35.5	79.4	12.93	1.94	1.33
							Tailings	—	1.06	864	9.2	20.6	51.65	1.46	—
8	2	2	10	5	200	400	Recon. Feed	—	6.20	708	43.9	100.0	21.49	—	—
							Product	6.11	16.62	233	38.7	88.2	15.54	—	—
							Tailings	—	0.77	675	5.2	11.8	66.00	—	—
8	3	2	14	7	200	400	Recon. Feed	—	4.59	848	38.9	100.0	26.43	—	—
							Product	5.72	22.07	140	30.9	79.4	15.69	—	—
							Tailings	—	0.88	908	8.0	20.6	67.82	—	—
8	4	1	14	7	200	400	Recon. Feed	—	5.66	751	42.5	100.0	26.29	2.06	1.64
							Product	6.33	47.87	61	29.2	68.7	12.18	2.11	1.57
							Tailings	—	1.49	890	13.3	31.3	57.25	1.96	1.78
8	—	—	—	—	—	—	End Feed	—	5.06	—	—	—	27.75	2.15	—

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

SET #2, BATCH #9 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.75#/T Betz M-150 Frother

Batch Collector Dosages = 0.75#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.20#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
9	1	770	48.3	290	10	14	.035	1.59	11.0	400	404	200	26	4.8	3.1
9	2	767	46.2	277	10	14	.070	3.18	23.0	400	186	200	26	4.8	3.1
9	3	796	42.1	253	14	19	.070	3.18	25.2	400	313	200	25	4.7	3.0
9	4	836	45.8	275	14	19	.035	1.59	11.6	400	678	200	24	4.4	2.9
9	5	764	53.2	319	14	19	.035	1.59	10.0	400	513	200	26	4.9	3.1

Batch	Test	Air Rate (l/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
9	—	—	—	—	—	—	—	—	—	—	—	—	26.18	2.14	1.82
9	—	—	—	—	—	—	Start Feed	—	5.31	—	—	—	22.22	1.80	1.06
9	1	1	10	5	200	400	Recon. Feed	—	6.27	770	48.3	100.0	20.81	1.89	—
							Product	7.50	37.88	99	37.5	77.6	12.43	1.99	1.46
							Tailings	—	1.24	871	10.8	22.4	49.85	1.54	—
9	2	2	10	5	200	400	Recon. Feed	—	6.02	767	46.2	100.0	21.37	—	—
							Product	6.49	18.56	215	39.9	86.4	14.56	—	—
							Tailings	—	0.83	752	6.3	13.6	64.65	—	—
9	3	2	14	7	200	400	Recon. Feed	—	5.29	796	42.1	100.0	26.29	—	—
							Product	6.34	26.17	128	33.5	79.6	15.66	—	—
							Tailings	—	0.99	868	8.6	20.4	67.77	—	—
9	4	1	14	7	200	400	Recon. Feed	—	5.48	836	45.8	100.0	26.97	2.11	1.65
							Product	6.54	50.85	59	30.0	65.5	12.12	2.16	1.59
							Tailings	—	1.62	977	15.8	34.5	55.17	2.01	1.76
9	5*	1	14	7	200	400	Recon. Feed	—	6.96	764	53.2	100.0	28.63	2.20	—
							Product	7.55	46.28	78	36.1	67.8	12.27	2.14	1.59
							Tailings	—	1.93	886	17.1	32.2	63.09	2.32	—
9	—	—	—	—	—	—	End Feed	—	6.12	—	—	—	29.51	2.27	1.90

* After Test #4, we increased Polyacrylic Acid dosage from 0.20#/T to approximately 0.60#/T and conducted Test #5 (Test #4 repeat).

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #2, BATCH #10 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50#/T Betz M-150 Frother

Batch Collector Dosages = 0.80#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.30#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Laundry Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
10	1	745	41.5	249	14	19	.070	3.18	25.6	400	323	200	27	5.0	3.1
10	2	850	48.6	262	10	14	.070	3.18	21.8	400	253	200	24	4.4	2.8
10	3	769	44.5	267	14	19	.070	3.18	23.8	400	323	200	26	4.8	3.1
10	4	804	45.0	270	10	14	.070	3.18	23.6	400	296	200	25	4.6	3.0

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Laundry Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
10	—	—	—	—	—	—	—	—	—	—	—	—	26.21	2.22	1.82
10	—	—	—	—	—	—	Start Feed	—	5.50	—	—	—	23.22	1.93	1.45
10	1	2	14	7	200	400	Recon. Feed	—	5.57	745	41.5	100.0	21.24	—	—
							Product	6.58	27.82	124	34.5	83.1	12.59	—	—
							Tailings	—	0.85	821	7.0	16.9	63.80	—	—
10	2	2	10	5	200	400	Recon. Feed	—	5.72	850	48.6	100.0	21.00	1.85	1.31
							Product	7.26	25.63	158	40.5	83.3	12.46	1.95	1.33
							Tailings	—	0.91	892	8.1	16.7	63.57	1.35	1.23
10	3*	2	14	7	200	400	Recon. Feed	—	5.79	769	44.5	100.0	23.26	—	—
							Product	6.93	29.27	124	36.3	81.6	12.64	—	—
							Tailings	—	0.97	845	8.2	18.4	70.38	—	—
10	4	2	10	5	200	400	Recon. Feed	—	5.60	804	45.0	100.0	24.60	—	—
							Product	6.60	26.15	135	35.3	78.4	12.34	—	—
							Tailings	—	1.12	869	9.7	21.6	69.12	—	—
10	—	—	—	—	—	—	End Feed	—	5.87	—	—	—	26.57	—	—

* After Test #2, we increased Polyacrylic Acid dosage from 0.30#/T to approximately 0.80#/T for Tests #3 and #4.

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes laundry water addition for product samples.

- Actual solids content reflects product sample prior to laundry water addition.

SET #2, BATCH #11 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50#/T Betz M-150 Frother

Batch Collector Dosages = 0.80#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
11	1	854	44.5	267	14	19	.070	3.18	23.8	400	305	200	23	4.4	2.8
11	2	849	47.2	283	10	14	.070	3.18	22.5	400	270	200	24	4.4	2.8
11	3	852	48.8	293	14	19	.053	2.41	16.5	400	351	200	23	4.4	2.8
11	4	871	50.9	305	10	14	.053	2.41	15.8	400	381	200	23	4.3	2.8

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
11	—	—	—	—	—	—	—	—	—	—	—	—	26.36	2.29	1.82
11	—	—	—	—	—	—	Start Feed	—	5.41	—	—	—	22.47	1.85	1.30
11	1	2	14	7	200	400	Recon. Feed	—	5.21	854	44.5	100.0	22.29	1.86	1.29
							Product	6.59	26.72	131	35.0	78.7	11.81	1.94	1.26
							Tailings	—	1.03	923	9.5	21.3	61.03	1.56	1.41
11	2	2	10	5	200	400	Recon. Feed	—	5.56	849	47.2	100.0	22.66	1.93	—
							Product	6.72	24.86	148	36.8	78.0	11.70	1.98	1.28
							Tailings	—	1.15	901	10.4	22.0	61.54	1.76	—
11	3	1.5	14	7	200	400	Recon. Feed	—	5.73	852	48.8	100.0	23.85	1.98	1.44
							Product	6.73	30.35	114	34.6	70.9	10.34	1.94	1.26
							Tailings	—	1.51	938	14.2	29.1	56.78	2.07	1.89
11	4	1.5	10	5	200	400	Recon. Feed	—	5.84	871	50.9	100.0	28.97	—	—
							Product	6.30	30.29	105	31.3	62.5	9.67	1.99	—
							Tailings	—	1.98	966	19.1	37.5	61.14	—	—
—	—	—	—	—	—	—	End Feed	—	5.60	—	—	—	29.86	2.30	1.93

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

SET #2, BATCH #12 , 2" KEN-FLOTE COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.50#/T Betz M-150 Frother

Batch Collector Dosages = 0.80#/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.50#/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Laundry Water		Froth Wash Water		Retention Time (min.)	
		(ml/min.)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
12	1	828	44.2	265	14	19	.070	3.18	24.0	400	267	200	24	4.5	2.9
12	2	820	44.9	269	10	14	.070	3.18	23.6	400	290	200	24	4.5	2.9
12	3	822	44.2	265	14	19	.053	2.41	18.2	400	396	200	24	4.5	2.9
12	4	834	46.7	280	10	14	.053	2.41	17.2	400	381	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Laundry Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Actual Flow Rate (ml/min.)	Solids Feed Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
12	—	—	—	—	—	—	—	—	—	—	—	—	26.34	2.29	1.82
12	—	—	—	—	—	—	Start Feed	—	5.37	—	—	—	22.59	1.85	1.37
12	1	2	14	7	200	400	Recon. Feed	—	5.34	828	44.2	100.0	22.02	1.90	1.31
							Product	6.42	23.53	150	35.3	80.0	12.61	2.00	1.31
							Tailings	—	1.01	878	8.9	20.0	59.65	1.49	1.31
12	2	2	10	5	200	400	Recon. Feed	—	5.48	820	44.9	100.0	23.80	1.96	—
							Product	6.54	25.51	138	35.2	78.4	13.80	2.07	1.53
							Tailings	—	1.10	882	9.7	21.6	62.72	1.58	—
12	3*	1.5	14	7	200	400	Recon. Feed	—	5.38	822	44.2	100.0	25.46	2.02	1.57
							Product	6.49	32.18	101	32.5	73.5	12.15	2.09	1.53
							Tailings	—	1.27	921	11.7	26.5	62.37	1.81	1.69
12	4	1.5	10	5	200	400	Recon. Feed	—	5.60	834	46.7	100.0	29.13	—	—
							Product	6.24	30.00	105	31.5	67.5	11.48	2.12	—
							Tailings	—	1.64	929	15.2	32.5	65.78	—	—
—	—	—	—	—	—	—	End Feed	—	6.15	—	—	—	28.65	—	—

* After Test #2, we increased Polyacrylic Acid dosage from 0.50#/T to approximately 1.0#/T for Tests #3 and #4

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes laundry water addition for product samples.

- Actual solids content reflects product sample prior to laundry water addition.

Table 18.C.15
2" KEN-FLOTE™ COLUMN TESTS
SET #3, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
Upper Freeport Seam Raw Coal
(Dried at 40° C and Pulverized)

I. Head Analysis: Set #3 Feed Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	0.77	—
Ash (Wt%)	26.30	26.50
Sulfur (Wt%)	2.33	2.35
Pyritic Sulfur (Wt%)	1.74	1.75

II. Screen Analysis (Dry Basis): Set #3 Composite

<u>Size Fraction</u> <u>(USA Mesh)</u>	<u>Direct</u> <u>(Wt%)</u>	<u>Cum. Passing</u> <u>(Wt%)</u>
Top x 30M	0.0	100.0
30M x 50M	0.2	99.8
50M x 70M	3.1	96.7
70M x 100M	6.2	90.5
100M x 200M	22.1	68.4
200M x 400M	22.9	45.5
400M x 0	<u>45.5</u>	0.0
	100.0	

SET #3, BATCH #1, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T Betz M-150 Frother (Site)

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
1	1	784	44.1	265	10	14	053	2.41	18.2	400	305	200	26	4.7	3.0
1	2	789	45.6	274	10	14	070	3.18	23.3	400	258	200	25	4.7	3.0
1	3	819	47.2	283	14	19	070	3.18	22.5	400	270	200	24	4.5	2.9
1	4	813	46.7	280	14	19	053	2.41	17.2	400	367	200	25	4.6	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
1	—	—	—	—	—	—	—	—	—	—	—	—	26.51	2.38	1.75
1	—	—	—	—	—	—	Start Feed	—	5.60	—	—	—	22.59	1.86	—
1	1	1.5	10	5	200	400	Recon. Feed	—	5.63	784	44.1	100.0	22.23	1.85	—
							Product	6.52	26.41	131	34.6	78.5	12.49	1.93	—
							Tailings	—	1.11	853	9.5	21.5	57.77	1.56	—
1	2	2.0	10	5	200	400	Recon. Feed	—	5.78	789	45.6	100.0	22.35	1.88	—
							Product	6.68	23.94	155	37.1	81.4	13.02	1.96	—
							Tailings	—	1.02	834	8.5	18.6	63.16	1.51	—
1	3	2.0	14	7	200	400	Recon. Feed	—	5.76	819	47.2	100.0	23.70	1.93	—
							Product	6.73	24.93	148	36.9	78.1	12.41	1.98	—
							Tailings	—	1.18	871	10.3	21.9	63.98	1.76	—
1	4	1.5	14	7	200	400	Recon. Feed	—	5.74	813	46.7	100.0	25.05	1.99	1.54
							Product	6.48	30.28	109	33.0	70.7	10.94	1.93	1.38
							Tailings	—	1.52	904	13.7	29.3	59.08	2.14	1.93
1	—	—	—	—	—	—	End Feed	—	5.90	—	—	—	25.91	2.08	1.49

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

SET #3, BATCH #2, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate (g/min.)	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
			g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
2	1	806	45.3	272	10	14	.053	2.41	17.7	400	290	200	25	4.6	3.0
2	2	745	43.2	259	10	14	.070	3.18	24.6	400	247	200	27	5.0	3.1
2	3	798	45.3	272	14	19	.070	3.18	23.4	400	299	200	25	4.7	3.0
2	4	754	41.8	251	14	19	.053	2.41	19.2	400	440	200	27	4.9	3.1

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
2	—	—	—	—	—	—	—	—	—	—	—	—	26.47	2.36	1.75
2	—	—	—	—	—	—	Start Feed	—	5.23	—	—	—	23.27	—	—
2	1	1.5	10	5	200	400	Recon. Feed	—	5.62	806	45.3	100.0	21.53	—	—
							Product	7.34	28.62	138	39.5	87.3	12.73	—	—
							Tailings	—	0.67	868	5.8	12.7	82.01	—	—
2	2	2.0	10	5	200	400	Recon. Feed	—	5.80	745	43.2	100.0	22.40	—	—
							Product	6.67	23.15	162	37.5	86.8	13.04	—	—
							Tailings	—	0.73	783	5.7	13.2	83.94	—	—
2	3	2.0	14	7	200	400	Recon. Feed	—	5.68	798	45.3	100.0	24.74	—	—
							Product	7.06	28.13	134	37.7	83.2	12.84	—	—
							Tailings	—	0.88	864	7.6	16.8	83.65	—	—
2	4	1.5	14	7	200	400	Recon. Feed	—	5.54	754	41.8	100.0	28.98	—	—
							Product	6.52	35.16	91	32.0	76.6	12.60	2.33	1.54
							Tailings	—	1.13	863	9.8	23.4	82.62	—	—
2	—	—	—	—	—	—	End Feed	—	5.52	—	—	—	30.51	2.33	1.71

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
 - Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
 - Diluted solids content includes launder water addition for product samples.
 - Actual solids content reflects product sample prior to launder water addition.

SET #3, BATCH #3, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.55 #/T MIBC Frother

Batch Collector Dosages = 0.55 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate (g/min.)	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
			g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
3	1	769	44.3	266	10	14	.053	2.41	18.1	400	296	200	26	4.8	3.1
3	2	760	41.9	251	10	14	.070	3.18	25.3	400	258	200	26	4.9	3.1
3	3	829	47.7	286	14	19	.070	3.18	22.3	400	315	200	24	4.5	2.9
3	4	906	48.1	289	14	19	.053	2.41	16.7	400	392	200	22	4.1	2.7

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
3	—	—	—	—	—	—	—	—	—	—	—	—	27.00	2.39	1.75
3	—	—	—	—	—	—	Start Feed	—	5.42	—	—	—	23.17	—	—
3	1	1.5	10	5	200	400	Recon. Feed	—	5.76	769	44.3	100.0	21.92	—	—
							Product	7.42	29.41	135	39.7	89.6	14.88	—	—
							Tailings	—	0.55	834	4.6	10.4	82.61	—	—
3	2	2.0	10	5	200	400	Recon. Feed	—	5.51	760	41.9	100.0	23.36	—	—
							Product	6.59	23.61	155	36.6	87.4	14.64	—	—
							Tailings	—	0.66	805	5.3	12.6	83.81	—	—
3	3	2.0	14	7	200	400	Recon. Feed	—	5.75	829	47.7	100.0	25.26	—	—
							Product	7.57	31.42	127	39.9	83.6	13.68	—	—
							Tailings	—	0.86	902	7.8	16.4	84.32	—	—
3	4	1.5	14	7	200	400	Recon. Feed	—	5.31	906	48.1	100.0	30.77	—	—
							Product	7.25	35.68	102	36.4	75.7	14.01	—	—
							Tailings	—	1.17	1004	11.7	24.3	83.00	—	—
—	—	—	—	—	—	—	End Feed	—	5.27	—	—	—	32.17	—	—

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

SET #3, BATCH #4, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate (g/min.)	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
			g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	mi/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
4	1	753	45.0	270	10	14	053	2.41	17.8	400	303	200	27	4.9	3.1
4	2	824	45.4	272	10	14	070	3.18	23.4	400	260	200	24	4.5	2.9
4	3	832	47.3	284	14	19	070	3.18	22.4	400	292	200	24	4.5	2.9
4	4	866	49.6	298	14	19	053	2.41	16.2	400	354	200	23	4.3	2.8

Batch	Test	Air Rate (U/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
4	—	—	—	—	—	—	—	—	—	—	—	—	26.38	2.30	1.75
4	—	—	—	—	—	—	Start Feed	—	5.27	—	—	—	22.26	—	—
4	1	1.5	10	5	200	400	Recon. Feed	—	5.98	753	45.0	100.0	20.45	—	—
							Product	7.46	30.08	132	39.7	88.2	12.52	—	—
							Tailings	—	0.65	821	5.3	11.8	79.70	—	—
4	2	2.0	10	5	200	400	Recon. Feed	—	5.51	824	45.4	100.0	22.32	—	—
							Product	7.04	25.32	154	39.0	85.9	12.57	—	—
							Tailings	—	0.74	870	6.4	14.1	81.69	—	—
4	3	2.0	14	7	200	400	Recon. Feed	—	5.69	832	47.3	100.0	23.78	2.02	—
							Product	7.32	28.69	137	39.3	83.1	11.92	2.12	1.34
							Tailings	—	0.89	895	8.0	16.9	82.07	1.54	—
4	4	1.5	14	7	200	400	Recon. Feed	—	5.73	866	49.6	100.0	29.54	2.35	1.83
							Product	7.37	33.45	113	37.8	76.2	12.93	2.41	1.73
							Tailings	—	1.24	953	11.8	23.8	82.70	2.18	2.17
4	—	—	—	—	—	—	End Feed	—	5.08	—	—	—	32.00	2.58	—

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

SET #3, BATCH #5, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T Betz CM-670 Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	%feed flow	rel. to feed	actual
5	1	761	45.4	272	10	14	.053	2.41	17.7	400	315	200	26	4.9	3.1
5	2	786	47.3	284	10	14	.070	3.18	22.4	400	231	200	25	4.7	3.0
5	3	848	47.3	284	14	19	.070	3.18	22.4	400	301	200	24	4.4	2.8
5	4	834	47.9	287	14	19	.053	2.41	16.8	400	435	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
5	—	—	—	—	—	—	—	—	—	—	—	—	26.24	2.29	1.75
5	—	—	—	—	—	—	Start Feed	—	5.52	—	—	—	22.28	—	—
5	1	1.5	10	5	200	400	Recon. Feed	—	5.97	761	45.4	100.0	20.82	—	—
							Product	7.46	30.94	127	39.3	86.6	13.90	—	—
							Tailings	—	0.73	834	6.1	13.4	65.52	—	—
5	2	2.0	10	5	200	400	Recon. Feed	—	6.01	786	47.3	100.0	22.21	—	—
							Product	7.10	23.53	173	40.7	86.0	14.56	—	—
							Tailings	—	0.81	813	6.6	14.0	69.21	—	—
5	3	2.0	14	7	200	400	Recon. Feed	—	5.58	848	47.3	100.0	24.46	—	—
							Product	7.22	28.95	133	38.5	81.4	14.24	—	—
							Tailings	—	0.96	915	8.8	18.6	69.16	—	—
5	4	1.5	14	7	200	400	Recon. Feed	—	5.74	834	47.9	100.0	25.84	2.12	—
							Product	7.50	40.11	92	36.9	77.0	13.44	2.25	1.40
							Tailings	—	1.17	942	11.0	23.0	67.34	1.70	—
5	—	—	—	—	—	—	End Feed	—	5.54	—	—	—	26.41	2.11	1.60

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples
- Actual solids content reflects product sample prior to launder water addition

18.C.21
2" KEN-FLOTE™ COLUMN TESTS
SET #4, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
Upper Freeport Seam Raw Coal
(Dried at 40° C and Pulverized)

I. Head Analysis: Set #4 Feed Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	0.91	—
Ash (Wt%)	26.06	26.30
Sulfur (Wt%)	2.55	2.53
Pyritic Sulfur (Wt%)	1.99	2.01

SET #4, BATCH #1, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate (g/min.)	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
			g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
1	1	760	44.0	264	10	14	053	2.41	18.3	400	345	200	26	4.9	3.1
1	2	719	43.9	263	10	14	070	3.18	24.2	400	370	200	28	5.2	3.2
1	3	787	46.1	277	14	19	070	3.18	23.0	400	381	200	25	4.7	3.0
1	4	822	44.0	264	14	19	0.053	2.41	18.3	400	506	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
1	—	—	—	—	—	—	—	—	—	—	—	—	26.30	2.58	2.01
1	—	—	—	—	—	—	Start Feed	—	5.31	—	—	—	22.69	1.95	1.38
1	1	1.5	10	5	200	400	Recon. Feed	—	5.79	760	44.0	100.0	22.02	—	—
							Product	7.31	32.50	116	37.7	85.7	12.59	—	—
							Tailings	—	0.75	844	6.3	14.3	78.55	—	—
1	2	2.0	10	5	200	400	Recon. Feed	—	6.11	719	43.9	100.0	21.37	—	—
							Product	7.42	34.91	108	37.7	85.9	11.47	—	—
							Tailings	—	0.76	811	6.2	14.1	81.65	—	—
1	3	2.0	14	7	200	400	Recon. Feed	—	5.86	787	46.1	100.0	22.92	—	—
							Product	7.64	36.76	105	38.6	83.7	11.62	—	—
							Tailings	—	0.85	882	7.5	16.3	80.94	—	—
1	4	1.5	14	7	200	400	Recon. Feed	—	5.35	822	44.0	100.0	26.20	—	—
							Product	7.29	44.18	79	34.9	79.3	12.41	—	—
							Tailings	—	0.97	943	9.1	20.7	79.05	—	—
1	—	—	—	—	—	—	End Feed	—	—	—	—	—	27.43	2.29	1.77

- Notes:
- Retention time "relative to feed" is total column volume divided by volume feed rate.
 - Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
 - Diluted solids content includes launder water addition for product samples.
 - Actual solids content reflects product sample prior to launder water addition.

18.C.23
 2" KEN-FLOTE COLUMN TESTS
 SET #5, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
 Upper Freeport Seam Raw Coal
 (Pulverized at PETC)

I. Head Analysis: Set #5 Feed Composite (PETC Grind Lot #5)

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	0.73	—
Ash (Wt%)	25.97	26.15
Sulfur (Wt%)	2.52	2.54
Pyritic Sulfur (Wt%)	1.88	1.89

II. Screen Analysis (Dry Basis): Set #5 Feed Composite

Size Fraction (<u>USA Mesh</u>)	Direct (<u>Wt%</u>)	Cum. Passing (<u>Wt%</u>)
Top x 30M	0.2	99.8
30M x 50M	1.0	98.8
50M x 70M	1.0	97.8
70M x 100M	1.4	96.4
100M x 200M	6.3	90.1
200M x 400M	13.0	77.1
400M x 0	<u>77.1</u>	0.0
	100.0	

SET #5, BATCH #1, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
1	1	795	45.4	272	10	14	.053	2.41	17.7	400	190	200	25	4.7	3.0
1	2	792	47.8	287	10	14	.070	3.18	22.2	400	163	200	25	4.7	3.0
1	3	781	48.9	293	14	19	.070	3.18	21.7	400	165	200	26	4.8	3.0
1	4	819	51.3	308	14	19	.053	2.41	15.7	400	181	200	24	4.5	2.9
1	5	836	49.2	295	10	14	.053	2.41	16.3	400	194	200	24	4.4	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
1	—	—	—	—	—	—	—	—	—	—	—	—	26.16	2.54	1.89
1	—	—	—	—	—	—	Start Feed	—	5.87	—	—	—	25.14	—	—
1	1	1.5	10	5	200	400	Recon. Feed	—	5.71	795	45.4	100.0	25.02	—	—
							Product	6.42	18.58	211	39.2	86.3	17.52	—	—
							Tailings	—	0.79	784	6.2	13.7	72.27	—	—
1	2	2.0	10	5	200	400	Recon. Feed	—	6.03	792	47.8	100.0	24.53	—	—
							Product	6.42	16.87	246	41.5	86.8	16.95	—	—
							Tailings	—	0.84	746	6.3	13.2	74.41	—	—
1	3	2.0	14	7	200	400	Recon. Feed	—	6.26	781	48.9	100.0	25.15	—	—
							Product	6.53	17.31	242	41.9	85.7	16.66	—	—
							Tailings	—	0.95	739	7.0	14.3	76.06	—	—
1	4	1.5	14	7	200	400	Recon. Feed	—	6.26	819	51.3	100.0	25.66	—	—
							Product	6.88	19.32	221	42.7	83.2	16.06	—	—
							Tailings	—	1.08	798	8.6	16.8	73.23	—	—
1	5	1.5	10	5	200	400	Recon. Feed	—	5.89	836	49.2	100.0	27.04	—	—
							Product	6.62	19.47	206	40.1	81.5	16.12	—	—
							Tailings	—	1.10	830	9.1	18.5	75.13	—	—
1	—	—	—	—	—	—	End Feed	—	5.93	—	—	—	27.63	—	—

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #5, BATCH #2, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.30 #/T MIBC Frother

Batch Collector Dosages = 0.50 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
2	1	802	60.6	364	14	19	.053	2.41	13.3	600	359	200	25	4.6	3.0
2	2	827	48.8	293	14	19	.035	1.59	10.9	600	566	200	24	4.5	2.9
2	3	825	49.9	299	14	19	.035	1.59	10.6	600	857	300	36	4.5	2.7
2	4	836	51.8	311	14	19	.053	2.41	15.5	600	355	300	36	4.4	2.6
2	5	835	53.9	323	14	19	.053	2.41	14.9	600	319	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
2	—	—	—	—	—	—	—	—	—	—	—	—	26.16	2.54	1.89
2	—	—	—	—	—	—	Start Feed	—	5.80	—	—	—	24.89	—	—
2	1	1.5	14	7	200	600	Recon. Feed	—	7.56	802	60.6	100.0	28.23	—	—
							Product	5.55	25.51	167	42.6	70.3	14.01	—	—
							Tailings	—	2.16	835	18.0	29.7	61.89	—	—
2	2	1.0	14	7	200	600	Recon. Feed	—	5.90	827	48.8	100.0	26.15	—	—
							Product	3.82	25.47	106	27.0	55.3	12.35	—	—
							Tailings	—	2.37	921	21.8	44.7	43.23	—	—
2	3	1.0	14	7	300	600	Recon. Feed	—	6.05	825	49.9	100.0	25.71	—	—
							Product	3.04	29.14	70	20.4	40.9	10.94	—	—
							Tailings	—	2.80	1055	29.5	59.1	35.93	—	—
2	4	1.5	14	7	300	600	Recon. Feed	—	6.20	836	51.8	100.0	26.04	2.42	—
							Product	4.63	21.07	169	35.6	68.7	12.08	2.21	1.60
							Tailings	—	1.68	967	16.2	31.3	56.67	2.88	—
2	5	1.5	14	7	200	600	Recon. Feed	—	6.49	835	53.9	100.0	26.48	2.50	—
							Product	4.92	20.64	188	38.8	72.0	12.90	2.27	1.69
							Tailings	—	1.78	847	15.1	28.0	61.39	3.09	—
2	—	—	—	—	—	—	End Feed	—	6.22	—	—	—	26.99	2.53	2.11

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

SET #5, BATCH #3, 2" KEN-FLOTE™ COLUMN TESTS
Upper Freeport Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.30 #/T MIBC Frother

Batch Collector Dosages = 0.50 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
3	1	765	45.3	272	14	19	.040	1.82	13.4	600	373	200	26	5.0	3.1
3	2	784	46.8	281	10	14	.040	1.82	13.0	600	331	200	26	4.7	3.0
3	3	803	48.1	289	10	14	.053	2.41	16.7	600	305	200	25	4.6	3.0
3	4	780	48.3	290	14	19	.053	2.41	16.6	600	328	200	26	4.8	3.0

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
3	—	—	—	—	—	—	—	—	—	—	—	—	26.16	2.54	1.89
3	—	—	—	—	—	—	Start Feed	—	5.66	—	—	—	24.68	2.23	1.8
3	1	1.25	14	7	200	600	Recon. Feed	—	5.92	785	45.3	100.0	24.31	—	—
							Product	4.52	21.37	161	34.4	75.9	13.69	—	—
							Tailings	—	1.36	804	10.9	24.1	57.75	—	—
3	2	1.25	10	5	200	600	Recon. Feed	—	5.97	784	46.8	100.0	24.52	—	—
							Product	4.51	19.45	181	35.2	75.2	13.77	—	—
							Tailings	—	1.44	803	11.6	24.8	57.13	—	—
3	3	1.5	10	5	200	600	Recon. Feed	—	5.99	803	48.1	100.0	24.93	2.31	—
							Product	4.62	18.68	197	36.8	76.5	13.82	2.23	1.59
							Tailings	—	1.40	806	11.3	23.5	61.02	2.57	—
3	4	1.5	14	7	200	600	Recon. Feed	—	6.19	780	48.3	100.0	24.86	2.30	1.83
							Product	4.53	19.40	183	35.5	73.5	12.88	2.15	1.53
							Tailings	—	1.61	797	12.8	26.5	58.09	2.71	2.67
3	4B	1.5	14	7	200	600	Recon. Feed	—	—	—	—	100.0	25.94	2.34	1.84
							Product	—	—	—	—	71.1	12.78	2.12	1.47
							Tailings	—	—	—	—	28.9	58.30	2.87	2.76
3	—	—	—	—	—	—	End Feed	—	5.84	—	—	—	26.00	2.43	1.91

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

APPENDIX D
2" LABORATORY COLUMN TEST RESULTS
(Pittsburgh No. 8 Seam Coal)

Table 18.D.1: Batch #1-#13 Head Analysis (Old Coal and PTI Grind)

Table 18.D.2: Batch #1 Feed Sump Mixing Tests (12" Recirculator Depth)

Table 18.D.3: Batch #2 Feed Sump Mixing Tests (9" Recirculator Depth)

Table 18.D.4: Batch #3 Tests, 0.80 #/T M-150, 0.80 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.5: Batch #4 Tests, 0.80 #/T M-150, 0.80 #/T Fuel Oil, 0.40 #/T Polyacrylic Acid

Table 18.D.6: Batch #5 Tests, 0.60 #/T M-150, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.7: Batch #6 Tests, 0.60 #/T M-150, 0.60 #/T Fuel Oil, 0.30 #/T Polyacrylic Acid

Table 18.D.8: Batch #7 Tests, 0.45 #/T MIBC, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.9: Batch #8 Tests, 0.45 #/T MIBC, 0.60 #/T Fuel Oil, 0.300 #/T Polyacrylic Acid

Table 18.D.10: Batch #9 Tests, 0.60 #/T CM-670, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.11: Batch #10 Tests, 0.60 #/T CM-670, 0.60 #/T Fuel Oil, 0.30 #/T Polyacrylic Acid

Table 18.D.12: Batch #11 Tests, 0.45 #/T M-150 (Site), 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.13: Batch #12 Tests, 0.45 #/T M-150 (Site), 0.60 #/T Fuel Oil, 0.30 #/T Polyacrylic Acid

Table 18.D.14: Batch #13 Tests, 0.45 #/T CM-670, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.15: Batch #14-#15 Head Analysis (New Coal and PETC Grind)

Table 18.D.16: Batch #14 Tests, 0.45 #/T MIBC, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.17: Batch #15 Tests, 0.45 #/T MIBC, 0.60 #/T Fuel Oil, 0.00 #/T Polyacrylic Acid

Table 18.D.1
 2" KEN-FLOTE™ COLUMN TESTS
 BATCH 1-13, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
 Pittsburgh No. 8 Seam Raw Coal
 (Dried at 40° C and Pulverized)

I. Head Analysis: Batch 1-13 Feed Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	1.26	---
Ash (Wt%)	28.75	29.12
Sulfur (Wt%)	5.20	5.27
Pyritic Sulfur (Wt%)	2.86	2.90

II. Screen Analysis (Dry Basis): Batch 1-13 Composite

<u>Size Fraction</u> <u>(USA Mesh)</u>	<u>Direct</u> <u>(Wt%)</u>	<u>Cum. Passing</u> <u>(Wt%)</u>
Top x 30M	0.0	100.0
30M x 50M	0.4	99.6
50M x 70M	4.3	95.3
70M x 100M	11.1	84.2
100M x 200M	26.6	57.6
200M x 400M	21.2	36.4
400M x 0	<u>36.4</u>	0.0
	100.0	

Table 18.D.2
2" KEN-FLOTE™ LAB COLUMN
FEED SUMP MIXING TESTS
PITTSBURGH NO. 8 SEAM RAW COAL (Batch #1)
(Recirculator Discharging 12" Down into Sump)

Conditions: - 6.0 Wt% Feed Solids
- 0.80 #/Ton Betz M-150 Frother
- 0.80 #/Ton No. 2 Fuel Oil Collector
- Put 10 GPM Recirculator Pump on Bottom of Sump
- Moved Feed Suction Point 10" Up Into Sump Directly Under Agitator
- Feed At 800 ml/min. and Compared 10 Minute Feed Increments Over Entire Feed Period
- Head Split was 28.38 Wt% Dry Ash, and 5.26 Wt% Dry Sulfur.

Sample #	Description	Recirc. Pump (%scale)	Feed Pump (%scale)	Final Sump Level (in. down)	Feed Sample Composition				Filtrate pH
					Slurry Weight (lbs.)	Solids Content (Wt%)	Dry Ash (Wt%)	Dry Sulfur (Wt%)	
1	Time zero to 10 minutes	100	19	3.00	17.91	5.62	25.45	—	—
2	Time 10 to 20 minutes	100	18	3.50	17.28	5.69	25.27	4.31	7.94
3	Time 20 to 30 minutes	100	18	4.00	17.43	5.91	24.45	—	—
4	Time 30 to 40 minutes	100	18	5.00	16.79	5.98	24.59	4.55	7.87
5	Time 40 to 50 minutes	100	18	5.50	16.64	5.99	24.44	—	—
6	Time 50 to 60 minutes	100	18	6.50	17.37	6.00	26.02	4.54	8.00
7	Time 60 to 70 minutes	100	18	7.50	18.01	5.68	28.07	—	—
8	Time 70 to 80 minutes	100	18	8.50	17.95	5.46	30.69	4.79	8.03
9*	Time 80 to 90 minutes	100	18	10.00	18.05	5.43	31.83	—	—
10	Time 90 to 100 minutes	100	18	12.00	18.18	5.53	31.33	5.11	7.91
11	Time 100 to 110 minutes	70	18	13.50	18.27	5.38	33.72	—	—
12	Time 110 to 114 minutes	70	18	16.50	7.64	5.34	32.24	5.16	8.05
13	Leftover in Sump	---	---	19.00	13.62	9.43	27.10	---	---

Notes: - * Feed was fairly consistent through Sample #9. We have only 90 minutes (1 hour and 30 minutes) to complete all tests when we are doing batch testing.

Table 18.D.3
2" KEN-FLOTE™ LAB COLUMN
FEED SUMP MIXING TESTS
PITTSBURGH NO. 8 SEAM RAW COAL (Batch #2)
(Recirculator Discharging 9" Down into Sump)

Conditions: - 6.0 Wt% Feed Solids
- 0.80 #/Ton Betz M-150 Frother
- 0.80 #/Ton No. 2 Fuel Oil Collector
- Put 10 GPM Recirculator Pump on Bottom of Sump
- Moved Feed Suction Point 10" Up Into Sump Directly Under Agitator
- Feed At 800 ml/min. and Compared 10 Minute Feed Increments Over Entire Feed Period
- Head Split was 29.74 Wt% Dry Ash, and 5.22 Wt% Dry Sulfur.

Sample #	Description	Recirc. Pump (%scale)	Feed Pump (%scale)	Final Sump Level (in. down)	Feed Sample Composition				
					Slurry Weight (lbs.)	Solids Content (Wt%)	Dry Ash (Wt%)	Dry Sulfur (Wt%)	Filtrate pH
1	Time zero to 10 minutes	100	18	3.00	17.80	5.59	25.09	—	—
2	Time 10 to 20 minutes	100	18	3.50	17.93	5.69	25.36	4.43	7.94
3	Time 20 to 30 minutes	100	19	4.00	17.66	5.92	24.40	—	—
4	Time 30 to 40 minutes	100	19	5.00	17.92	6.11	24.41	4.48	7.93
5	Time 40 to 50 minutes	100	19	5.50	18.27	6.09	24.93	—	—
6	Time 50 to 60 minutes	100	19	6.50	18.60	5.91	26.92	4.63	7.84
7	Time 60 to 70 minutes	100	19	7.50	17.89	5.39	31.33	—	—
8	Time 70 to 80 minutes	100	18	9.00	18.45	5.19	32.75	5.20	7.98
9*	Time 80 to 90 minutes	70	18	10.00	18.36	5.40	32.77	—	—
10	Time 90 to 100 minutes	70	18	12.00	18.03	5.70	32.41	5.24	8.01
11	Time 100 to 110 minutes	70	18	13.50	18.10	5.37	36.84	—	—
12	Leftover in Sump	---	---	19.00	14.34	10.49	24.78	6.33	8.00

Notes: - * Feed was fairly consistent through Sample #9. We have only 90 minutes (1 hour and 30 minutes) to complete all tests when we are doing batch testing.

BATCH #3, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.8 #/T Betz M-150 Frother

Batch Collector Dosages = 0.8 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min)	
		(g/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
3	1	799	49.2	295	10	14	053	2.41	16.3	400	203	200	25	4.7	3.0
3	2	802	49.7	298	10	14	070	3.18	21.3	400	120	200	25	4.6	3.0
3	3	819	47.5	285	14	19	070	3.18	22.3	400	151	200	24	4.5	2.9
3	4	838	48.6	292	14	19	053	2.41	16.5	400	360	200	24	4.4	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
3	—	—	—	—	—	—	—	—	—	—	—	—	29.26	5.31	2.90
3	—	—	—	—	—	—	Start Feed	—	5.81	—	—	—	24.52	4.31	2.40
3	1	1.5	10	5	200	400	Recon. Feed	—	6.16	799	49.20	100.00	23.46	4.49	2.40
							Product	6.83	20.71	197	40.80	82.90	13.16	4.75	2.37
							Tailings	—	1.05	802	8.40	17.10	73.40	3.21	2.52
3	2	2.0	10	5	200	400	Recon. Feed	—	6.20	802	49.70	100.00	24.07	—	—
							Product	5.74	12.65	332	42.00	84.50	14.62	4.80	—
							Tailings	—	1.15	670	7.70	15.50	75.60	—	—
3	3	2.0	14	7	200	400	Recon. Feed	—	5.80	819	47.50	100.00	27.77	—	—
							Product	5.59	14.04	265	37.20	78.30	15.24	—	—
							Tailings	—	1.37	754	10.30	21.70	75.10	—	—
3	4	1.5	14	7	200	400	Recon. Feed	—	5.80	838	48.60	100.00	28.35	4.84	—
							Product	6.97	32.07	111	35.60	73.20	12.12	4.96	2.42
							Tailings	—	1.40	927	13.00	26.80	72.66	4.53	—
3	—	—	—	—	—	—	End Feed	—	5.32	—	—	—	30.76	4.82	2.83

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #4, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.8 #/T Betz M-150 Frother

Batch Collector Dosages = 0.8 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.4 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
4	1	799	50.7	304	10	14	053	2.41	15.8	400	190	200	25	4.7	3.0
4	2	832	50.4	302	10	14	070	3.18	21.0	400	119	200	24	4.5	2.9
4	3	784	49.9	299	14	19	070	3.18	21.3	400	127	200	26	4.7	3.0
4	4	856	48.8	293	14	19	053	2.41	16.5	400	336	200	23	4.3	2.8

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
4	---	---	---	---	---	---	---	---	---	---	---	---	28.66	5.28	2.90
4	---	---	---	---	---	---	Start Feed	---	5.65	---	---	---	24.69	4.41	2.90
4	1	1.5	10	5	200	400	Recon. Feed	---	6.35	799	50.70	100.00	22.67	---	---
							Product	7.15	20.76	210	43.60	86.00	14.15	4.82	2.39
							Tailings	---	0.90	789	7.10	14.00	75.03	---	---
4	2	2.0	10	5	200	400	Recon. Feed	---	6.06	832	50.40	100.00	24.08	---	---
							Product	5.95	13.04	335	43.70	86.17	15.69	---	---
							Tailings	---	0.96	697	6.70	13.30	78.81	---	---
4	3	2.0	14	7	200	400	Recon. Feed	---	6.36	784	49.90	100.00	24.84	---	---
							Product	5.98	13.60	314	42.70	85.60	15.83	---	---
							Tailings	---	1.07	670	7.20	14.40	78.43	---	---
4	4	1.5	14	7	200	400	Recon. Feed	---	5.70	856	48.8	100.00	28.97	4.90	3.03
							Product	7.09	30.92	119	36.8	75.40	13.91	5.02	2.65
							Tailings	---	1.28	937	12.0	24.60	75.12	4.55	4.20
4	---	---	---	---	---	---	End Feed	---	5.53	---	---	---	30.62	4.93	---

* After Test #2, We increased polyacrylic acid dosage for 0.4 #/T to approximately 1.0 #/T for Tests #3 and #4

- Notes:
- Retention time "relative to feed" is total column volume divided by volume feed rate.
 - Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
 - Diluted solids content includes launder water addition for product samples.
 - Actual solids content reflects product sample prior to launder water addition.

BATCH #5, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.6 #/T Betz M-150 Frother

Batch Collector Dosages = 0.6 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate (g/min.)	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
			g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min	% prod. flow	ml/min	% feed flow	rel. to feed	actual
5	1	801	44.0	264	10	14	.053	2.41	18.3	400	278	200	25	4.6	3.0
5	2	834	47.8	287	10	14	.070	3.18	22.2	400	161	200	24	4.5	2.9
5	3	825	46.4	278	14	19	.070	3.18	22.9	400	231	200	24	4.5	2.9
5	4	825	48.1	289	14	19	.053	2.41	16.7	400	377	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
5	—	—	—	—	—	—	—	—	—	—	—	—	29.22	5.43	2.90
5	—	—	—	—	—	—	Start Feed	—	5.22	—	—	—	26.08	—	—
5	1	1.5	10	5	200	400	Recon. Feed	—	5.49	801	44.0	100.0	24.56	—	—
							Product	6.36	24.03	144	34.6	78.6	12.35	—	—
							Tailings	—	1.10	857	9.4	21.4	69.40	—	—
5	2	2.0	10	5	200	400	Recon. Feed	—	5.73	834	47.8	100.0	24.20	—	—
							Product	6.00	15.62	249	38.9	81.4	12.86	—	—
							Tailings	—	1.13	785	8.9	18.6	73.85	—	—
5	3	2.0	14	7	200	400	Recon. Feed	—	5.62	825	46.4	100.0	26.34	—	—
							Product	6.23	20.64	173	35.7	76.9	12.11	—	—
							Tailings	—	1.26	852	10.7	23.1	73.70	—	—
5	4	1.5	14	7	200	400	Recon. Feed	—	5.83	825	48.1	100.0	27.79	—	—
							Product	6.80	32.45	106	34.4	71.5	10.52	—	—
							Tailings	—	1.49	919	13.7	28.5	71.10	—	—
5	—	—	—	—	—	—	End Feed	—	5.56	—	—	—	26.92	—	—

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #6, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T Betz M-150 Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.30 #/T Polyacrylic Acid at Start

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
6	1	767	42.6	256	10	14	053	2.41	18.9	400	315	200	26	4.8	3.1
6	2	786	45.9	275	10	14	070	3.18	23.1	400	192	200	25	4.7	3.0
6	3	794	48.9	293	14	19	070	3.18	21.7	400	216	200	25	4.7	3.0
6	4	833	50.4	302	14	19	053	2.41	15.9	400	408	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
6	---	---	---	---	---	---	---	---	---	---	---	---	29.12	5.16	2.90
6	---	---	---	---	---	---	Start Feed	---	5.09	---	---	---	26.79	---	---
6	1	1.5	10	5	200	400	Recon Feed	---	5.55	767	42.6	100.0	25.23	---	---
							Product	6.38	26.46	127	33.6	78.9	12.83	---	---
							Tailings	---	1.07	840	9.0	21.1	71.58	---	---
6	2	2.0	10	5	200	400	Recon Feed	---	5.84	786	45.9	100.0	24.74	---	---
							Product	6.17	18.03	208	37.5	81.7	13.30	---	---
							Tailings	---	1.08	778	8.4	18.3	75.83	---	---
6	3*	2.0	14	7	200	400	Recon Feed	---	6.16	794	48.9	100.0	24.21	---	---
							Product	6.77	21.41	185	39.6	81.0	12.28	---	---
							Tailings	---	1.15	809	9.3	19.0	75.06	---	---
6	4	1.5	14	7	200	400	Recon Feed	---	6.05	833	50.4	100.0	25.78	---	---
							Product	7.63	38.76	98	38.0	75.4	10.89	---	---
							Tailings	---	1.33	935	12.4	24.6	71.40	---	---
6	---	---	---	---	---	---	End Feed	---	5.72	---	---	---	28.13	---	---

* After Test #2 we increased Polyacrylic Acid addition from 0.30 #/T to approximately 0.80 #/T for Tests #3 and #4

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate

- Diluted solids content includes launder water addition for product samples

- Actual solids content reflects product sample prior to launder water addition

BATCH #7, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
7	1	771	42.7	256	10	14	053	2.41	18.8	400	465	200	26	4.8	3.1
7	2	783	45.7	274	10	14	070	3.18	23.2	400	357	200	26	4.7	3.0
	3	800	47.6	286	14	19	070	3.18	22.3	400	455	200	25	4.6	3.0
7	4	820	45.0	270	14	19	053	2.41	17.8	400	588	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
7	---	---	---	---	---	---	---	---	---	---	---	---	28.99	5.10	2.90
7	---	---	---	---	---	---	Start Feed	---	5.12	---	---	---	26.62	4.32	2.31
7	1	1.5	10	5	200	400	Recon. Feed	---	5.54	771	42.7	100.0	25.48	---	---
							Product	7.14	40.35	86	34.7	81.3	12.63	---	---
							Tailings	---	0.90	885	8.0	18.7	81.34	---	---
7	2	2.0	10	5	200	400	Recon. Feed	---	5.84	783	45.7	100.0	24.26	---	---
							Product	7.29	33.30	112	37.3	81.6	11.69	---	---
							Tailings	---	0.96	871	8.4	18.4	79.98	---	---
7	3	2.0	14	7	200	400	Recon. Feed	---	5.95	800	47.6	100.0	25.12	4.45	2.49
							Product	7.64	42.39	88	37.3	78.4	10.92	4.57	2.24
							Tailings	---	1.13	912	10.3	21.6	76.65	4.02	3.40
7	4	1.5	14	7	200	400	Recon. Feed	---	5.49	820	45.0	100.0	28.18	4.46	---
							Product	6.94	47.79	68	32.5	72.2	10.08	4.64	2.32
							Tailings	---	131.00	952	12.5	27.8	75.20	3.99	---
7	---	---	---	---	---	---	End Feed	---	5.73	---	---	---	27.88	4.51	2.78

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #8, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.30 #/T Polyacrylic Acid at Start

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
8	1	744	43.0	258	10	14	.053	2.41	18.7	400	513	200	27	5.0	3.1
8	2	775	45.4	272	10	14	.070	3.18	23.4	400	444	200	26	4.8	3.0
8	3	793	47.6	286	14	19	.070	3.18	22.3	400	476	200	25	4.7	3.0
8	4	820	46.3	278	14	19	.053	2.41	17.3	400	678	200	24		

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
8	—	—	—	—	—	—	—	—	—	—	—	—	28.28	5.23	2.90
8	—	—	—	—	—	—	Start Feed	—	5.25	—	—	—	26.57	—	—
8	1	1.5	10	5	200	400	Recon. Feed	—	5.78	744	43.0	100.0	24.27	—	—
							Product	7.49	45.90	78	35.8	83.3	13.20	—	—
							Tailings	—	0.83	866	7.2	16.7	79.49	—	—
8	2	2.0	10	5	200	400	Recon. Feed	—	5.86	775	45.4	100.0	24.65	—	—
							Product	7.55	41.11	90	37.0	81.5	12.46	—	—
							Tailings	—	0.95	885	8.4	18.5	78.37	—	—
8	3*	2.0	14	7	200	400	Recon. Feed	—	6.00	793	47.6	100.0	25.48	4.60	2.65
							Product	7.54	43.45	84	36.5	76.7	11.39	4.67	2.33
							Tailings	—	1.22	909	11.1	23.3	71.86	4.36	3.70
8	4	1.5	14	7	200	400	Recon. Feed	—	5.65	820	46.3	100.0	28.37	—	—
							Product	7.08	55.08	59	32.5	70.2	10.64	4.76	2.33
							Tailings	—	1.44	961	13.8	29.8	70.15	—	—
8	—	—	—	—	—	—	End Feed	—	5.80	—	—	—	27.87	4.77	2.83

* After Test #2 we increased Polyacrylic Acid addition from 0.30 #/T to approximately 0.80 #/T for Tests #3 and #4.

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #9, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T CM-670 Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
9	1	768	45.6	274	10	14	.053	2.41	17.6	400	255	200	26	4.8	3.1
9	2	750	47.5	285	10	14	.070	3.18	22.3	400	119	200	27	5.0	3.1
9	3	772	47.9	287	14	19	.070	3.18	22.1	400	148	200	26	4.8	3.1
9	4	804	45.6	274	14	19	.053	2.41	17.6	400	417	200	25	4.6	3.0

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
9	—	—	—	—	—	—	—	—	—	—	—	—	28.87	5.23	2.90
9	—	—	—	—	—	—	Start Feed	—	5.28	—	—	—	26.43	—	—
9	1	1.5	10	5	200	400	Recon. Feed	—	5.94	768	45.6	100.0	24.04	—	—
							Product	6.91	24.52	157	38.5	84.4	14.66	—	—
							Tailings	—	0.88	811	7.1	15.6	74.78	—	—
9	2	2.0	10	5	200	400	Recon. Feed	—	6.33	750	47.5	100.0	23.86	—	—
							Product	5.61	12.30	335	41.2	86.7	15.66	—	—
							Tailings	—	1.02	615	6.3	13.3	77.32	—	—
9	3	2.0	14	10	200	400	Recon. Feed	—	6.20	772	47.9	100.0	25.18	—	—
							Product	5.98	14.80	271	40.1	83.7	15.01	—	—
							Tailings	—	1.11	701	7.8	16.3	77.39	—	—
9	4	1.5	14	10	200	400	Recon. Feed	—	5.67	804	45.6	100.0	28.28	—	—
							Product	6.98	36.04	96	34.6	75.9	13.37	—	—
							Tailings	—	1.21	908	11.0	24.1	75.24	—	—
9	—	—	—	—	—	—	End Feed	—	5.59	—	—	—	29.69	—	—

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

BATCH #10, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.60 #/T Betz CM-670 Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.30 #/T Polyacrylic Acid at Start

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
10	1	803	47.5	285	10	14	.053	2.41	16.9	400	227	200	25	4.6	3.0
10	2	797	50.9	305	10	14	.070	3.18	20.8	400	114	200	25	4.7	3.0
10	3	833	48.2	289	14	19	.070	3.18	22.0	400	141	200	24	4.5	2.9
10	4	824	48.8	293	14	19	.053	2.41	16.5	400	348	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
10	—	—	—	—	—	—	—	—	—	—	—	—	28.02	5.17	2.90
10	—	—	—	—	—	—	Start Feed	—	5.41	—	—	—	24.88	—	—
10	1	1.5	10	5	200	400	Recon. Feed	—	5.92	803	47.5	100.0	23.68	—	—
							Product	7.05	23.07	176	40.6	85.5	14.85	—	—
							Tailings	—	0.83	827	6.9	14.5	75.76	—	—
10	2	2.0	10	5	200	400	Recon. Feed	—	6.39	797	50.9	100.0	23.20	—	—
							Product	5.97	12.76	352	44.9	88.2	15.76	—	—
							Tailings	—	0.93	645	6.0	11.8	78.75	—	—
10	3*	2.0	14	7	200	400	Recon. Feed	—	5.79	833	48.2	100.0	25.98	—	—
							Product	5.89	14.20	283	40.2	83.4	15.66	—	—
							Tailings	—	1.07	750	8.0	16.6	77.83	—	—
10	4	1.5	14	7	200	400	Recon. Feed	—	5.92	824	48.8	100.0	26.92	—	—
							Product	7.46	33.39	115	38.4	78.7	13.73	—	—
							Tailings	—	1.14	909	10.4	21.3	75.64	—	—
10	—	—	—	—	—	—	End Feed	—	5.51	—	—	—	28.79	—	—

* After Test #2 we increased Polyacrylic Acid addition from 0.30 #/T to approximately 0.80 #/T for Tests #3 and #4.

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #11, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T Betz M-150 Frother (Site)

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
11	1	827	47.5	285	10	14	.053	2.41	16.9	400	404	200	24	4.5	2.9
11	2	835	50.3	302	10	14	.070	3.18	21.1	400	267	200	24	4.5	2.9
11	3	836	52.3	314	14	19	.070	3.18	20.3	400	331	200	24	4.5	2.9
11	4	805	50.7	304	14	19	.053	2.41	15.8	400	533	200	25	4.6	3.0

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
11	---	---	---	---	---	---	---	---	---	---	---	---	29.37	5.07	2.90
11	---	---	---	---	---	---	Start Feed	---	5.36	---	---	---	26.20	4.36	2.23
11	1	1.5	10	5	200	400	Recon. Feed	---	5.74	827	47.5	100.0	24.57	---	---
							Product	7.37	37.17	99	36.8	77.5	10.91	---	---
							Tailings	---	1.15	928	10.7	22.5	71.63	---	---
11	2	2.0	10	5	200	400	Recon. Feed	---	6.02	835	50.3	100.0	25.56	---	---
							Product	7.20	26.40	150	39.6	78.7	11.94	---	---
							Tailings	---	1.21	885	10.7	21.3	75.89	---	---
11	3	2.0	14	7	200	400	Recon. Feed	---	6.26	836	52.3	100.0	26.19	4.53	2.76
							Product	7.64	32.89	121	39.8	76.1	10.92	4.71	2.33
							Tailings	---	1.37	915	12.5	23.9	74.80	3.96	4.13
11	4	1.5	14	7	200	400	Recon. Feed	---	6.30	805	50.7	100.0	27.18	---	---
							Product	7.60	48.13	75	36.1	71.2	9.53	4.88	2.32
							Tailings	---	1.57	930	14.6	28.8	70.83	---	---
11	---	---	---	---	---	---	End Feed	---	6.03	---	---	---	28.79	4.67	2.92

- Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.
- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
- Diluted solids content includes launder water addition for product samples.
- Actual solids content reflects product sample prior to launder water addition.

BATCH #12, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T Betz M-150 Frother (Site)

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.30 #/T Polyacrylic Acid at Start

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
12	1	777	44.9	269	10	14	.053	2.41	17.9	400	526	200	26	4.8	3.0
12	2	818	48.2	289	10	14	.070	3.18	22.0	400	303	200	24	4.5	2.9
12	3	806	49.6	298	14	19	.070	3.18	21.4	400	357	200	25	4.6	3.0
12	4	819	49.1	295	14	19	.053	2.41	16.4	400	625	200	24	4.5	2.9

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
12	—	—	—	—	—	—	—	—	—	—	—	—	30.26	5.14	2.90
12	—	—	—	—	—	—	Start Feed	—	5.26	—	—	—	26.27	—	—
12	1	1.5	10	5	200	400	Recon. Feed	—	5.78	777	44.9	100.0	25.37	—	—
							Product	7.18	45.00	76	34.2	76.2	11.72	—	—
							Tailings	—	1.19	901	10.7	23.8	69.07	—	—
12	2	2.0	10	5	200	400	Recon. Feed	—	5.89	818	48.2	100.0	24.62	—	—
							Product	7.24	29.17	132	38.5	79.9	12.20	—	—
							Tailings	—	1.09	886	9.7	20.1	73.98	—	—
12	3*	2.0	14	7	200	400	Recon. Feed	—	6.15	806	49.6	100.0	24.82	4.52	2.50
							Product	7.68	35.09	112	39.3	79.2	11.66	4.75	2.31
							Tailings	—	1.15	894	10.3	20.8	74.94	3.63	3.22
12	4	1.5	14	7	200	400	Recon. Feed	—	6.00	819	49.1	100.0	27.01	4.72	—
							Product	7.76	56.25	64	36.0	73.3	10.51	4.79	2.28
							Tailings	—	1.37	955	13.1	26.7	72.31	4.52	—
12	—	—	—	—	—	—	End Feed	—	5.73	—	—	—	28.55	4.92	3.05

* After Test #2 we increased Polyacrylic Acid addition from 0.30 #/T to approximately 0.80 #/T for Tests #3 and #4.

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

BATCH #13, 2" KEN-FLOTE™ COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T CM-670 Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.0 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min.)	g/min	#/hr. ft 2	inches	% height	CFM	CFM/ft 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	%feed flow	rel. to feed	actual
13	1	781	44.8	269	10	14	.053	2.41	17.9	400	364	200	26	4.8	3.0
13	2	825	48.8	293	10	14	.070	3.18	21.7	400	159	200	24	4.5	2.9
13	3	816	49.8	299	14	19	.070	3.18	21.3	400	195	200	25	4.6	2.9
13	4	845	46.2	277	14	19	.053	2.41	17.4	400	533	200	24	4.4	2.8

Batch	Test	Air Rate (L/min.)	Froth Height (inches)	Froth Wash Depth (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
13	---	---	---	---	---	---	---	---	---	---	---	---	29.71	5.02	2.90
13	---	---	---	---	---	---	Start Feed	---	5.26	---	---	---	25.40	---	---
13	1	1.5	10	5	200	400	Recon. Feed	---	5.74	781	44.8	100.0	23.99	---	---
							Product	7.25	33.64	110	37.0	82.6	12.08	---	---
							Tailings	---	0.90	871	7.8	17.4	75.79	---	---
13	2	2.0	10	5	200	400	Recon. Feed	---	5.92	825	48.8	100.0	24.33	---	---
							Product	6.30	16.31	252	41.1	84.2	14.25	---	---
							Tailings	---	1.00	773	7.7	15.8	78.06	---	---
13	3	2.0	14	7	200	400	Recon. Feed	---	6.10	816	49.8	100.0	25.29	4.63	2.72
							Product	6.76	19.95	205	40.9	82.1	14.32	4.93	2.66
							Tailings	---	1.10	811	8.9	17.9	75.58	3.28	3.01
13	4	1.5	14	7	200	400	Recon. Feed	---	5.47	845	46.2	100.0	29.53	---	---
							Product	7.24	45.87	75	34.4	74.5	13.45	---	---
							Tailings	---	1.22	970	11.8	25.5	76.51	---	---
13	---	---	---	---	---	---	End Feed	---	5.58	---	---	---	29.72	---	---

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

18.D.15
2" KEN-FLOTE COLUMN TESTS
BATCH 14-15, FEED COMPOSITE, HEAD AND SCREEN ANALYSIS
Pittsburgh No. 8 Seam Raw Coal
(Dried at 40 C and Pulverized)

I. Head Analysis: PETC Grind Composite

	<u>As-Determined</u>	<u>Dry Basis</u>
Moisture (Wt%)	1.72	---
Ash (Wt%)	23.00	23.40
Sulfur (Wt%)	4.43	4.51
Pyritic Sulfur (Wt%)	2.64	2.69

II. Screen Analysis (Dry Basis): PETC Grind Composite

<u>Size Fraction</u> <u>(USA Mesh)</u>	<u>Direct</u> <u>(Wt%)</u>	<u>Cum. Passing</u> <u>(Wt%)</u>
Top x 30M	1.0	99.0
30M x 50M	3.4	95.6
50M x 70M	3.8	91.8
70M x 100M	5.6	86.2
100M x 200M	15.3	70.9
200M x 400M	22.6	48.3
400M x 0	<u>48.3</u>	0.0
	100.0	

BATCH #14, 2" KEN-FLOTE COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min)	g/min	#/hr. ft. 2	inches	% height	CFM	CFM/ft. 2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
14	1	788	42.8	257	10	14	0.053	2.41	18.8	400	374	200	25	4.7	3.0
14	2	762	45.4	272	10	14	0.070	3.18	23.4	400	303	200	26	4.9	3.1
14	3	847	49.6	298	10	14	0.070	3.18	21.4	400	282	200	24	4.4	2.8
14	4	818	44.5	267	10	14	0.053	2.41	18.0	400	351	200	24	4.5	2.9
14	5	844	49.4	296	10	14	0.053	2.41	16.3	400	308	200	24	4.4	2.8

Batch	Test	Air Rate (L/min.)	Number of Aspirations	Froth Height (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
14	—	—	—	—	—	—	—	—	—	—	—	—	23.44	4.51	2.69
14	—	—	—	—	—	—	Start Feed	—	5.35	—	—	—	21.99	4.02	2.25
14	1	1.5	1	10	200	400	Recon. Feed	—	5.43	788	42.8	100.0	22.12	3.80	—
							Product	6.88	32.62	107	34.9	81.5	11.30	4.14	—
							Tailings	—	0.90	881	7.9	18.5	69.76	2.30	—
14	2	2.0	2	10	200	400	Recon. Feed	—	5.96	762	45.4	100.0	21.26	—	—
							Product	7.29	29.39	132	38.8	85.4	11.43	—	—
							Tailings	—	0.80	830	6.6	14.6	78.75	—	—
14	3	2.0	1	10	200	400	Recon. Feed	—	5.86	847	49.6	100.0	22.06	3.99	2.30
							Product	7.35	28.03	142	39.8	80.3	10.33	4.25	2.27
							Tailings	—	1.08	905	9.8	19.7	69.87	2.92	2.42
14	4	1.5	2	10	200	400	Recon. Feed	—	5.44	818	44.5	100.0	23.47	3.92	2.40
							Product	6.67	30.09	114	34.3	77.0	9.54	4.13	2.23
							Tailings	—	1.13	904	10.2	23.0	70.11	3.22	2.99
14	5	1.5	1	10	200	400	Recon. Feed	—	5.85	844	49.4	100.0	22.39	—	—
							Product	7.29	29.69	130	38.6	78.2	9.60	—	—
							Tailings	—	1.18	914	10.8	21.8	68.25	—	—
14	—	—	—	—	—	—	End Feed	—	5.78	—	—	—	22.66	4.25	2.49

- Notes:
- Retention time "relative to feed" is total column volume divided by volume feed rate.
 - Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.
 - Diluted solids content includes launder water addition for product samples.
 - Actual solids content reflects product sample prior to launder water addition.

BATCH #14, 2" KEN-FLOTE COLUMN TESTS
Pittsburgh No. 8 Seam Raw Coal

Batch Feed Solids = 6.0 Wt%

Batch Frother Dosage = 0.45 #/T MIBC Frother

Batch Collector Dosages = 0.60 #/T No. 2 Fuel Oil

Batch Pyrite Depressant Dosage = 0.00 #/T Polyacrylic Acid

Batch	Test	Feed Rate	Solids Feed Rate		Froth Height		Compressed Air Use (40 PSI)			Launder Water		Froth Wash Water		Retention Time (min.)	
		(g/min)	g/min	#/hr. ft.2	inches	% height	CFM	CFM/ft.2	CFM/TPH	ml/min.	% prod. flow	ml/min.	% feed flow	rel. to feed	actual
15	1	746	42.9	257	14	19	0.035	1.59	12.4	400	430	200	27	5.0	3.1
15	2	772	44.8	269	14	19	0.070	3.18	23.7	400	348	200	26	4.8	3.0
15	3	749	45.5	273	14	19	0.070	3.18	23.3	400	348	200	27	5.0	3.1
15	4	797	44.5	267	14	19	0.035	1.59	11.9	400	426	200	25	4.7	3.0
15	5	848	45.4	272	14	19	0.035	1.59	11.7	400	449	200	24	4.4	2.8

Batch	Test	Air Rate (L/min.)	Number of Aspirations	Froth Height (inches)	Froth Wash Water (ml/min.)	Launder Water (ml/min.)	Sample Head	Diluted Solids Content (Wt%)	Actual Solids Content (Wt%)	Total Flow Rate (g/min.)	Solids Flow Rate (g/min.)	Column Performance (Dry Basis)			
												Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. Sulfur (Wt%)
15	---	---	---	---	---	---	---	---	---	---	---	---	23.44	4.51	2.69
15	---	---	---	---	---	---	Start Feed	---	5.47	---	---	---	21.81	---	---
15	1	1.0	1	14	200	400	Recon. Feed	---	5.75	746	42.9	100.0	21.86	---	---
							Product	7.13	37.74	93	35.1	81.9	10.01	---	---
							Tailings	---	0.91	853	7.8	18.1	75.48	---	---
15	2	2.0	2	14	200	400	Recon. Feed	---	5.80	772	44.8	100.0	21.85	---	---
							Product	7.23	32.43	115	37.3	83.2	10.21	---	---
							Tailings	---	0.88	857	7.5	16.8	79.48	---	---
15	3	2.0	1	14	200	400	Recon. Feed	---	6.07	749	45.5	100.0	21.83	---	---
							Product	7.15	32.09	115	36.9	81.1	9.59	---	---
							Tailings	---	1.03	834	8.6	18.9	74.35	---	---
15	4	1.0	2	14	200	400	Recon. Feed	---	5.58	797	44.5	100.0	22.79	3.91	---
							Product	6.94	36.49	94	34.3	77.1	8.38	4.06	---
							Tailings	---	1.13	903	10.2	22.9	71.30	3.41	---
15	5	1.0	1	14	200	400	Recon. Feed	---	5.35	848	45.4	100.0	24.31	---	---
							Product	6.27	34.49	89	30.7	67.6	6.46	3.62	1.65
							Tailings	---	1.53	959	14.7	32.4	61.55	---	---
15	---	---	---	---	---	---	End Feed	---	5.84	---	---	---	23.78	---	---

Notes: - Retention time "relative to feed" is total column volume divided by volume feed rate.

- Retention time "actual" is 80% of total column volume divided by volume feed rate and froth wash water rate.

- Diluted solids content includes launder water addition for product samples.

- Actual solids content reflects product sample prior to launder water addition.

APPENDIX E
FEED COAL WASHABILITIES AND RELEASE ANALYSES
(Upper Freeport Seam Coal)

Table 18.E.1 - Feed Coal Washability Analysis (PETC Grind)

Table 18.E.2 - Feed Coal Washability Analysis (PTI Grind)

Figure 18.E.3 - Release Analysis Procedure

Table 18.E.3 - Release Analysis Test Data (PETC Grind)

Table 18.E.4 - Summary Release Analysis Data (PETC Grind)

Table 18.E.5 - Release Analysis Test Data (PTI Grind)

Table 18.E.6 - Summary Release Analysis Data (PTI Grind)

Table 18.E.1
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 UPPER FREEPORT SEAM RAW COAL WASHABILITY
 Lot #3-#5 Feed Composite (PT#8, FT #1, FT #69, FT #71)
 (Dry Basis)

Top x 400M size fraction representing 24.2 Wt.% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
		Weight	Ash	Sulfur	Pyr. S.	Weight	Ash	Sulfur	Pyr. S.
<u>Sink</u>	<u>Float</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
Float	x 1.30	34.9	1.96	0.73	0.06	34.9	1.96	0.73	0.06
	1.30 x 1.40	17.0	10.64	1.07	0.45	51.9	4.80	0.84	0.19
	1.40 x 1.50	8.2	21.19	1.31	0.79	60.1	7.04	0.91	0.27
	1.50 x 1.60	4.4	42.22	2.41	2.13	64.5	9.44	1.01	0.40
	1.60 x 1.80	4.7	42.22	2.41	2.13	69.2	11.67	1.10	0.51
	1.80 x 2.20	4.6	42.22	2.41	2.13	73.8	13.57	1.18	0.62
	2.20 x Sink	26.2	84.78	9.06	9.00	100.0	32.23	3.25	2.81
Total		100.0	32.23	3.25	2.81				
Head		100.0	32.57	3.13	2.88				

Table 18.E.1 (cont.)
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 UPPER FREEPORT SEAM RAW COAL WASHABILITY
 Lot #3-#5 Feed Composite (PT#8, FT #1, FT #69, FT #71)
 (Dry Basis)

400M x 0 size fraction representing 75.8 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
		Weight	Ash	Sulfur	Pyr. S.	Weight	Ash	Sulfur	Pyr. S.
<u>Sink</u>	<u>Float</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
Float	x 1.30	46.4	1.84	0.68	0.01	46.4	1.84	0.68	0.01
1.30	x 1.40	18.3	7.71	0.77	0.15	64.7	3.50	0.71	0.05
1.40	x 1.50	6.0	16.07	0.90	0.43	70.7	4.57	0.72	0.08
1.50	x 1.60	2.9	28.59	1.58	1.23	73.6	5.51	0.76	0.13
1.60	x 1.80	2.2	28.59	1.58	1.23	75.8	6.18	0.78	0.16
1.80	x 2.20	3.9	58.54	1.72	1.44	79.7	8.75	0.83	0.22
2.20	x Sink	20.3	85.66	7.51	7.44	100.0	24.36	2.18	1.69
Total		100.0	24.36	2.18	1.69				
Head		100.0	24.21	2.21	1.75				

Table 18.E.1 (cont.)
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 UPPER FREEPORT SEAM RAW COAL WASHABILITY
 Lot #3-#5 Feed Composite (PT#8, FT #1, FT #69, FT #71)
 (Dry Basis)

Top x 0 size fraction representing 100.0 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	43.6	1.86	0.69	0.02	43.6	1.86	0.69	0.02
1.30	x 1.40	18.0	8.37	0.84	0.22	61.6	3.76	0.73	0.08
1.40	x 1.50	6.5	17.71	1.03	0.54	68.1	5.10	0.76	0.12
1.50	x 1.60	3.3	32.67	1.83	1.51	71.4	6.36	0.81	0.19
1.60	x 1.80	2.8	34.18	1.92	1.59	74.2	7.41	0.85	0.24
1.80	x 2.20	4.1	53.67	1.89	1.62	78.3	9.82	0.91	0.31
2.20	x Sink	21.7	85.51	7.97	7.91	100.0	26.26	2.44	1.96
Total		100.0	26.26	2.44	1.96				
Head		100.0	26.15	2.47	1.89				

Table 18.E.2
PTI GRIND USED FOR
UPPER FREEPORT SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

Top x 400M size fraction representing 53.3 Wt.% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	Yield	Ash	Sulfur	Pyr. S.	Yield	Ash	Sulfur	Pyr. S.
		(Wt%)	(Wt%)	(Wt%)	(Wt%)	(Wt%)	(Wt%)	(Wt%)	(Wt%)
Float	x 1.30	41.5	1.75	0.77	0.08	41.5	1.75	0.77	0.08
	1.30 x 1.40	17.3	10.19	1.19	0.65	58.8	4.23	0.89	0.25
	1.40 x 1.50	7.0	20.06	1.68	0.94	65.8	5.92	0.98	0.32
	1.50 x 1.60	3.7	27.92	2.34	1.81	69.5	7.09	1.05	0.40
	1.60 x 1.80	3.7	38.34	3.28	2.67	73.2	8.67	1.16	0.52
	1.80 x 2.20	3.5	55.74	4.34	3.70	76.7	10.82	1.31	0.66
	2.20 x Sink	23.3	84.66	8.42	8.42	100.0	28.02	2.96	2.47
Total		100.0	28.02	2.96	2.47				
Head		100.0	29.55	3.29	2.60				

Table 18.E.2 (cont.)
PTI GRIND USED FOR
UPPER FREEPORT SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

400M x 0 size fraction representing 46.7 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
		Yield	Ash	Sulfur	Pyr. S.	Yield	Ash	Sulfur	Pyr. S.
<u>Sink</u>	<u>Float</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
Float	x 1.30	37.5	2.51	0.73	0.06	37.5	2.51	0.73	0.06
1.30	x 1.40	24.6	7.91	0.79	0.27	62.1	4.65	0.75	0.14
1.40	x 1.50	9.5	15.40	0.91	0.32	71.6	6.08	0.77	0.17
1.50	x 1.60	4.3	19.87	1.10	0.60	75.9	6.86	0.79	0.19
1.60	x 1.80	2.0	30.48	2.39	1.95	77.9	7.46	0.83	0.24
1.80	x 2.20	3.5	51.16	2.62	2.09	81.4	9.34	0.91	0.32
2.20	x Sink	18.6	85.44	7.33	6.95	100.0	23.50	2.10	1.55
Total		100.0	23.50	2.10	1.55				
Head		100.0	23.81	2.09	1.53				

Table 18.E.2 (cont.)
PTI GRIND USED FOR
UPPER FREEPORT SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

Top x 0 size fraction representing 100.0 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	39.6	2.09	0.75	0.07	39.6	2.09	0.75	0.07
	1.30 x 1.40	20.7	8.93	0.97	0.44	60.3	4.43	0.83	0.20
	1.40 x 1.50	8.2	17.53	1.26	0.60	68.5	5.99	0.88	0.25
	1.50 x 1.60	4.0	23.86	1.71	1.20	72.5	6.98	0.92	0.30
	1.60 x 1.80	2.9	35.81	2.99	2.44	75.4	8.09	1.00	0.38
	1.80 x 2.20	3.5	53.60	3.54	2.95	78.9	10.11	1.12	0.49
	2.20 x Sink	21.1	84.98	7.97	7.81	100.0	25.91	2.56	2.04
Total		100.0	25.91	2.56	2.04				
Head		100.0	26.41	2.58	2.09				

Figure 18.E.3
RELEASE ANALYSIS PROCEDURAL DIAGRAM

Table 18.E.3
FLOTATION RELEASE ANALYSIS

Test No: UFF#1 Coal: Upper Freeport
Date: 8/6/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.0	3	60	1400	9
1st Cleaner	0.2	0.0	3	60	1400	8
2nd Cleaner	0.2	0.0	3	60	1400	8
C1	0.2	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	153.5	0.77	152.3	54.3	9.01	54.3	9.01
C2	59.3	0.66	58.9	21.0	13.58	75.3	10.28
C3	17.4	0.60	17.3	6.2	34.40	81.5	12.11
C4	5.4	0.59	5.4	1.9	65.88	83.4	13.33
TF	6.1	1.01	6.0	2.1	86.43	85.5	15.13
<u>T1</u>	<u>40.8</u>	<u>0.84</u>	<u>40.5</u>	<u>14.5</u>	<u>89.18</u>	<u>100.0</u>	<u>25.87</u>
Total	282.5	---	280.4	100.0	25.87	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UFF#2 Coal: Upper Freeport
Date: 8/11/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.4	3	60	1400	10
1st Cleaner	0.2	0.0	3	60	1400	8
2nd Cleaner	0.2	0.0	3	60	1400	7
C1	0.2	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	196.4	0.74	194.9	67.3	10.31	67.3	10.31
C2	38.9	0.68	38.6	13.3	19.17	80.6	11.77
C3	8.2	0.69	8.1	2.8	52.80	83.4	13.15
C4	4.4	0.68	4.4	1.5	77.12	84.9	14.28
TF	5.5	0.97	5.4	1.9	86.30	86.8	15.86
<u>T1</u>	<u>38.5</u>	<u>1.08</u>	<u>38.1</u>	<u>13.2</u>	<u>89.53</u>	<u>100.0</u>	<u>25.58</u>
Total	291.9	---	289.5	100.0	25.58	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UFF#3 Coal: Upper Freeport
Date: 8/11/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.5	0.0	3	60	1400	9
1st Cleaner	0.25	0.0	3	60	1400	8
2nd Cleaner	0.25	0.0	3	60	1400	7
C1	0.25	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	186.2	0.35	185.5	63.6	9.08	63.6	9.08
C2	44.2	0.49	44.0	15.1	18.17	78.7	10.82
C3	11.3	0.62	11.2	3.8	46.63	82.5	12.47
C4	4.4	0.62	4.4	1.5	73.33	84.0	13.56
TF	6.0	0.92	5.9	2.0	87.29	86.0	15.27
<u>T1</u>	<u>41.2</u>	<u>0.95</u>	<u>40.8</u>	<u>14.0</u>	<u>89.37</u>	<u>100.0</u>	<u>25.64</u>
Total	293.3	---	291.8	100.0	25.65	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UFF#4 Coal: Upper Freeport
Date: 8/12/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.5	0.5	3	60	1400	7
1st Cleaner	0.25	0.0	3	60	1400	7
2nd Cleaner	0.25	0.0	3	60	1400	6
C1	0.25	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	172.3	0.74	171.0	59.0	9.70	59.0	9.70
C2	62.5	0.90	61.9	21.3	17.03	80.3	11.64
C3	7.8	0.81	7.7	2.7	53.13	83.0	12.99
C4	3.4	0.90	3.4	1.2	78.47	84.2	13.92
TF	4.3	1.19	4.2	1.4	87.50	85.6	15.12
<u>T1</u>	<u>42.0</u>	<u>1.05</u>	<u>41.6</u>	<u>14.4</u>	<u>90.12</u>	<u>100.0</u>	<u>25.92</u>
Total	292.3	---	289.8	100.0	25.93	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UFF#5 Coal: Upper Freeport
Date: 8/16/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.45	0.0	3	60	1400	7
1st Cleaner	0.225	0.0	3	60	1400	7
2nd Cleaner	0.225	0.0	3	60	1400	6
C1	0.225	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	144.6	0.87	143.3	49.4	9.13	49.4	9.13
C2	72.7	0.61	72.1	24.9	12.50	74.3	10.26
C3	19.0	0.72	18.9	6.5	27.98	80.8	11.69
C4	6.6	0.67	6.6	2.3	63.55	83.1	13.13
TF	5.4	0.63	5.4	1.9	83.21	85.0	14.70
<u>T1</u>	<u>43.9</u>	<u>0.83</u>	<u>43.5</u>	<u>15.0</u>	<u>89.42</u>	<u>100.0</u>	<u>25.91</u>
Total	292.2	---	289.8	100.0	25.90	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UFF#6 Coal: Upper Freeport
Date: 8/17/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.6	0.0	3	60	1400	8
1st Cleaner	0.3	0.0	3	60	1400	8
2nd Cleaner	0.3	0.0	3	60	1400	7
C1	0.3	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	173.7	0.75	172.4	59.2	9.82	59.2	9.82
C2	54.9	0.73	54.5	18.7	14.70	77.9	10.99
C3	12.1	0.73	12.0	4.1	36.96	82.0	12.29
C4	4.5	0.76	4.5	1.6	69.56	83.6	13.39
TF	4.3	1.01	4.3	1.5	86.80	85.1	14.68
<u>T1</u>	<u>43.8</u>	<u>1.01</u>	<u>43.4</u>	<u>14.9</u>	<u>89.73</u>	<u>100.0</u>	<u>25.86</u>
Total	293.3	---	291.1	100.0	25.86	---	---
Head	---	0.54	---	100.0	26.28	---	---

Table 18.E.4
SUMMARY RELEASE ANALYSIS DATA
Upper Freeport Seam Raw Coal
(PETC Grind)

Test Number	Reagents (Rougher)		Sample	Direct Analysis (Dry Basis)				Cumulative Analysis (Dry Basis)			
	(MIBC #/T)	(F.O. #/T)		Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)
---	---	---	Head	100.0	26.28	2.57	1.83	---	---	---	---
UFF #3	0.5	0.0	Recon. Feed	100.0	25.65	2.46	1.93	---	---	---	---
	0.25	0.0	Conc. #1	63.6	9.08	1.79	1.15	63.6	9.08	1.79	1.15
	0.25	0.0	Conc. #2	15.1	18.17	3.12	2.40	78.7	10.82	2.05	1.39
	0.25	0.0	Conc. #3	3.8	46.63	6.34	5.78	82.5	12.47	2.25	1.59
	0.0	0.0	Conc. #4	1.5	73.33	7.51	7.51	84.0	13.56	2.34	1.70
	0.0	0.0	Tail Final	2.0	87.29	2.99	2.19	86.0	15.27	2.36	1.73
	0.0	0.0	Tail #1	14.0	89.37	3.15	3.15	100.0	25.64	2.47	1.93
---	---	---	Head	100.0	26.28	2.57	1.83	---	---	---	---
UFF #6	0.6	0.0	Recon. Feed	100.0	25.86	2.54	1.94	---	---	---	---
	0.3	0.0	Conc. #1	59.2	9.82	1.88	1.23	59.2	9.82	1.88	1.23
	0.3	0.0	Conc. #2	18.7	14.70	2.66	2.02	77.9	10.99	2.07	1.42
	0.3	0.0	Conc. #3	4.1	36.96	5.39	4.49	82.0	12.29	2.24	1.57
	0.0	0.0	Conc. #4	1.6	69.56	7.02	6.54	83.6	13.39	2.33	1.67
	0.0	0.0	Tail Final	1.5	86.80	3.46	3.46	85.1	14.68	2.35	1.70
	0.0	0.0	Tail #1	14.9	89.73	3.64	3.33	100.0	25.86	2.54	1.94

Table 18.E.5
FLOTATION RELEASE ANALYSIS

Test No: UF#1 Coal: Upper Freeport
Date: 7/27/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.0	2	60	1400	9
1st Cleaner	0.2	0.0	2	60	1400	7
2nd Cleaner	0.2	0.0	2	60	1400	5
C1	0.2	0.0	2	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	163.1	0.67	162.0	56.2	9.40	56.2	9.40
C2	66.1	0.62	65.7	22.8	15.03	79.0	11.02
C3	16.5	0.67	16.4	5.7	42.38	84.7	13.13
C4	4.2	0.83	4.2	1.5	75.99	86.2	14.22
TF	1.5	1.02	1.5	0.5	86.52	86.7	14.63
<u>T1</u>	<u>38.7</u>	<u>1.09</u>	<u>38.3</u>	<u>13.3</u>	<u>88.49</u>	<u>100.0</u>	<u>24.45</u>
Total	290.1	---	288.1	100.0	24.47	---	---
Head	---	0.70	---	100.0	26.41	---	---

**Table 18.E.5 (cont.)
FLOTATION RELEASE ANALYSIS**

Test No: UF#2 Coal: Upper Freeport
Date: 7/28/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.4	3	60	1400	7
1st Cleaner	0.2	0.0	3	60	1400	6
2nd Cleaner	0.2	0.0	3	60	1400	4
C1	0.2	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	168.7	0.56	167.8	57.5	9.93	57.5	9.93
C2	64.7	0.59	64.3	22.0	16.93	79.5	11.87
C3	14.2	0.62	14.1	4.8	46.09	84.3	13.82
C4	3.5	0.79	3.5	1.2	77.11	85.5	14.71
TF	2.1	1.06	2.1	0.7	87.24	86.2	15.30
<u>T1</u>	<u>40.6</u>	<u>0.92</u>	<u>40.2</u>	<u>13.8</u>	<u>88.80</u>	<u>100.0</u>	<u>25.44</u>
Total	293.8	---	292.0	100.0	25.43	---	---
Head	---	0.70	---	100.0	26.41	---	---

Table 18.E.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UF#3 Coal: Upper Freeport
Date: 7/28/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.8	3	60	1400	6
1st Cleaner	0.2	0.0	3	60	1400	6
2nd Cleaner	0.2	0.0	3	60	1400	6
C1	0.2	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	161.1	0.39	160.5	55.0	9.86	55.0	9.86
C2	77.4	0.50	77.0	26.3	16.85	81.3	12.12
C3	9.4	0.73	9.3	3.2	49.10	84.5	13.52
C4	2.9	0.88	2.9	1.0	76.48	85.5	14.26
TF	2.5	0.77	2.5	0.9	87.51	86.4	15.02
<u>T1</u>	<u>40.1</u>	<u>0.89</u>	<u>39.7</u>	<u>13.6</u>	<u>88.39</u>	<u>100.0</u>	<u>25.00</u>
Total	293.4	---	291.9	100.0	25.00	---	---
Head	---	0.70	---	100.0	26.41	---	---

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Table 18.E.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UF#4 Coal: Upper Freeport
Date: 8/2/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.5	0.0	3	60	1400	8
1st Cleaner	0.25	0.0	3	60	1400	8
2nd Cleaner	0.25	0.0	3	60	1400	7
C1	0.25	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	153.7	0.37	153.1	52.0	9.68	52.0	9.68
C2	81.6	0.33	81.3	27.6	16.34	79.6	11.99
C3	13.2	0.40	13.1	4.4	46.72	84.0	13.81
C4	3.7	0.54	3.7	1.3	77.34	85.3	14.78
TF	3.1	0.67	3.1	1.0	88.12	86.3	15.63
<u>T1</u>	<u>40.4</u>	<u>0.54</u>	<u>40.2</u>	<u>13.7</u>	<u>87.94</u>	<u>100.0</u>	<u>25.54</u>
Total	295.7	---	294.5	100.0	25.53	---	---
Head	---	0.70	---	100.0	26.41	---	---

Table 18.E.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: UF#5 Coal: Upper Freeport
Date: 8/2/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.5	0.5	3	60	1400	8
1st Cleaner	0.25	0.0	3	60	1400	7
2nd Cleaner	0.25	0.0	3	60	1400	6
C1	0.25	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	177.1	0.20	176.7	60.0	9.84	60.0	9.84
C2	66.5	0.23	66.3	22.5	19.49	82.5	12.47
C3	5.9	0.25	5.9	2.0	60.54	84.5	13.61
C4	3.0	0.30	3.0	1.0	80.21	85.5	14.39
TF	2.8	0.87	2.8	1.0	87.12	86.5	15.23
<u>T1</u>	<u>40.0</u>	<u>0.77</u>	<u>39.7</u>	<u>13.5</u>	<u>88.92</u>	<u>100.0</u>	<u>25.18</u>
Total	295.3	---	294.4	100.0	25.18	---	---
Head	---	0.70	---	100.0	26.41	---	---

**Table 18.E.5 (cont.)
FLOTATION RELEASE ANALYSIS**

Test No: UF#6 Coal: Upper Freeport
Date: 8/5/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.3	0.0	3	60	1400	7
1st Cleaner	0.15	0.0	3	60	1400	6
2nd Cleaner	0.15	0.0	3	60	1400	5
C1	0.15	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	151.9	0.57	151.0	52.8	8.68	52.8	8.68
C2	68.2	0.60	67.8	23.7	14.12	76.5	10.37
C3	16.5	0.60	16.4	5.7	35.67	82.2	12.12
C4	5.2	0.72	5.2	1.8	66.52	84.0	13.29
TF	3.3	0.99	3.3	1.2	86.76	85.2	14.32
<u>T1</u>	<u>42.7</u>	<u>0.83</u>	<u>42.3</u>	<u>14.8</u>	<u>88.90</u>	<u>100.0</u>	<u>25.36</u>
Total	287.8	---	286.0	100.0	25.36	---	---
Head	---	0.70	---	100.0	26.41	---	---

Table 18.E.6
SUMMARY RELEASE ANALYSIS DATA
Upper Freeport Seam Raw Coal
(PTI Grind)

Test Number	Reagents (Rougher)		Sample	Direct Analysis (Dry Basis)				Cumulative Analysis (Dry Basis)			
	(MIBC #/T)	(F.O. #/T)		Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)
---	---	---	Head	100.0	26.41	2.58	2.09	---	---	---	---
UF1	0.4	0.0	Recon. Feed	100.0	24.47	2.59	2.01	---	---	---	---
			Conc. #1	56.2	9.40	1.77	1.05	56.2	9.40	1.77	1.05
			Conc. #2	22.8	15.03	2.62	2.04	79.0	11.02	2.02	1.34
			Conc. #3	5.7	42.38	5.52	4.74	84.7	13.13	2.26	1.57
			Conc. #4	1.5	75.99	8.18	7.99	86.2	14.22	2.36	1.68
			Tail Final	0.5	86.52	3.75	3.75	86.7	14.63	2.37	1.69
			Tail #1	13.3	88.49	4.09	4.09	100.0	24.45	2.60	2.01
---	---	---	Head	100.0	26.41	2.58	2.09	---	---	---	---
UF6	0.3	0.0	Recon. Feed	100.0	25.36	2.58	2.00	---	---	---	---
			Conc. #1	52.8	8.68	1.76	1.05	52.8	8.68	1.76	1.05
			Conc. #2	23.7	14.12	2.55	1.85	76.5	10.37	2.00	1.30
			Conc. #3	5.7	35.67	5.13	4.57	82.2	12.12	2.22	1.53
			Conc. #4	1.8	66.52	6.74	6.74	84.0	13.29	2.32	1.64
			Tail Final	1.2	86.76	3.62	3.24	85.2	14.32	2.34	1.66
			Tail #1	14.8	88.90	3.98	3.98	100.0	25.36	2.58	2.00

APPENDIX F

FEED COAL WASHABILITIES AND RELEASE ANALYSIS

(Pittsburgh No. 8 Seam Coal)

Table 18.F.1 - Feed Coal Washability Analysis (PETC Grind)

Table 18.F.2 - Feed Coal Washability Analysis (PTI Grind)

Figure 18.F.3 - Release Analysis Procedure

Table 18.F.3 - Release Analysis Test Data (PETC Grind)

Table 18.F.4 - Summary Release Analysis Data (PETC Grind)

Table 18.F.5 - Release Analysis Test Data (PTI Grind)

Table 18.F.6 - Summary Release Analysis Data (PTI Grind)

Table 18.F.1
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
 Lot #1 Feed Composite
 (Dry Basis)

Top x 400M size fraction representing 51.7 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	56.0	2.76	2.42	0.16	56.0	2.76	2.42	0.16
1.30	x 1.40	20.2	8.69	3.12	1.03	76.2	4.33	2.61	0.39
1.40	x 1.50	5.5	18.53	4.52	2.68	81.7	5.29	2.73	0.54
1.50	x 1.60	2.5	36.58	6.70	5.22	84.2	6.22	2.85	0.68
1.60	x 1.80	2.2	36.58	6.70	5.22	86.4	6.99	2.95	0.80
1.80	x 2.20	1.8	36.58	6.70	5.22	88.2	7.59	3.03	0.89
2.20	x Sink	11.8	77.45	16.96	16.03	100.0	15.84	4.67	2.68
Total		100.0	15.84	4.67	2.68				
Head		100.0	16.91	4.94	2.98				

Table 18.F.1 (cont.)
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
 Lot #1 Feed Composite
 (Dry Basis)

400M x 0 size fraction representing 48.3 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	35.3	2.75	2.24	0.05	35.3	2.75	2.24	0.05
1.30	x 1.40	20.3	7.49	2.04	0.17	55.6	4.48	2.17	0.09
1.40	x 1.50	7.4	16.27	1.85	0.38	63.0	5.87	2.13	0.13
1.50	x 1.60	2.4	31.05	2.60	1.57	65.4	6.79	2.15	0.18
1.60	x 1.80	1.8	31.05	2.60	1.57	67.2	7.44	2.16	0.22
1.80	x 2.20	4.4	60.84	1.78	1.40	71.6	10.72	2.14	0.29
2.20	x Sink	28.4	85.64	7.41	7.18	100.0	32.00	3.63	2.25
Total		100.0	32.00	3.63	2.25				
Head		100.0	32.13	3.76	2.26				

Table 18.F.1 (cont.)
 PETC GRIND
 MULTIVARIABLE TESTING MATRIX
 PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
 Lot #1 Feed Composite
 (Dry Basis)

Top x 0 size fraction representing 100.0 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Weight</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	46.0	2.76	2.35	0.12	46.0	2.76	2.35	0.12
1.30	x 1.40	20.2	8.13	2.60	0.62	66.2	4.40	2.43	0.27
1.40	x 1.50	6.4	17.32	3.04	1.40	72.6	5.54	2.48	0.37
1.50	x 1.60	2.5	33.31	4.67	3.43	75.1	6.46	2.55	0.47
1.60	x 1.80	2.0	34.30	4.94	3.65	77.1	7.18	2.62	0.56
1.80	x 2.20	3.1	52.69	3.23	2.53	80.2	8.94	2.64	0.63
2.20	x Sink	19.8	83.19	10.36	9.91	100.0	23.64	4.17	2.47
Total		100.0	23.64	4.17	2.47				
Head		100.0	23.83	4.42	2.62				

Table 18.F.2
PTI GRIND
2" COLUMN TESTS AND RA
PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

Top x 400M size fraction representing 60.2 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
<u>Sink</u>	<u>Float</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	54.1	2.64	2.43	0.18	54.1	2.64	2.43	0.18
1.30	x 1.40	18.8	8.72	3.31	1.14	72.9	4.21	2.66	0.43
1.40	x 1.50	4.8	17.81	4.84	2.83	77.7	5.05	2.79	0.58
1.50	x 1.60	2.6	26.25	5.62	4.14	80.3	5.73	2.88	0.69
1.60	x 1.80	2.2	44.65	8.03	6.66	82.5	6.77	3.02	0.85
1.80	x 2.20	2.2	44.65	8.03	6.66	84.7	7.76	3.15	1.00
2.20	x Sink	15.3	78.33	14.72	14.72	100.0	18.55	4.92	3.10
Total		100.0	18.55	4.92	3.10				
Head		100.0	19.71	5.47	3.49				

Table 18.F.2 (cont.)
PTI GRIND
2" COLUMN TESTS AND RA
PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

400M x 0 size fraction representing 39.8 Wt% of total sample

<u>Gravity Fraction</u>		<u>Direct Analysis</u>				<u>Cumulative Analysis</u>			
<u>Sink</u>	<u>Float</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>	<u>Yield</u> <u>(Wt%)</u>	<u>Ash</u> <u>(Wt%)</u>	<u>Sulfur</u> <u>(Wt%)</u>	<u>Pyr. S.</u> <u>(Wt%)</u>
Float	x 1.30	34.0	2.04	2.27	0.05	34.0	2.04	2.27	0.05
1.30	x 1.40	19.0	5.97	2.07	0.17	53.0	3.45	2.20	0.09
1.40	x 1.50	4.8	12.95	1.92	0.53	57.8	4.24	2.18	0.13
1.50	x 1.60	2.2	19.31	2.06	0.94	60.0	4.79	2.17	0.16
1.60	x 1.80	4.4	61.66	3.26	2.43	64.4	8.68	2.25	0.31
1.80	x 2.20	2.2	61.66	3.26	2.43	66.6	10.43	2.28	0.38
2.20	x Sink	33.4	86.76	5.64	5.25	100.0	35.92	3.40	2.01
Total		100.0	35.92	3.40	2.01				
Head		100.0	36.29	3.45	2.10				

Table 18.F.2 (cont.)
PTI GRIND
2" COLUMN TESTS AND RA
PITTSBURGH NO. 8 SEAM RAW COAL WASHABILITY
Lot #1 Feed Composite
(Dry Basis)

Top x 0 size fraction representing 100.0 Wt% of total sample

Gravity Fraction		Direct Analysis				Cumulative Analysis			
		Yield	Ash	Sulfur	Pyr. S.	Yield	Ash	Sulfur	Pyr. S.
<u>Sink</u>	<u>Float</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
Float	x 1.30	46.1	2.46	2.38	0.14	46.1	2.46	2.38	0.14
1.30	x 1.40	18.9	7.62	2.81	0.75	65.0	3.96	2.51	0.32
1.40	x 1.50	4.8	15.88	3.68	1.91	69.8	4.78	2.59	0.43
1.50	x 1.60	2.4	23.76	4.34	2.99	72.2	5.41	2.64	0.51
1.60	x 1.80	3.1	54.34	5.31	4.25	75.3	7.43	2.75	0.67
1.80	x 2.20	2.2	51.42	6.13	4.98	77.5	8.67	2.85	0.79
2.20	x Sink	22.5	83.31	9.36	9.13	100.0	25.47	4.31	2.67
Total		100.0	25.46	4.32	2.67				
Head		100.0	25.95	4.58	2.90				

Figure 18.F.3
RELEASE ANALYSIS PROCEDURAL DIAGRAM

Table 18.F.3
FLOTATION RELEASE ANALYSIS

Test No: PP1 Coal: Pittsburgh No. 8 Lot #1
Date: 7/12/93 Grind: PETC Grind
Feed (g): 300g

	MIBC	F.O.	Cond.			Float
<u>Flotation</u>	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>Air</u>	<u>Agitator</u>	<u>Time</u>
			<u>(min.)</u>	<u>(%)</u>	<u>(RPM)</u>	<u>(min.)</u>
Rougher	0.5	1.0	3	22	1400	9
1st Cleaner	0.25	0.0	3	22	1400	8
2nd Cleaner	0.25	0.0	3	22	1400	7
C1	0.25	0.0	3	4	900	1
C2	0.0	0.0	0	8	1000	1
C3	0.0	0.0	0	12	1100	1
C4	0.0	0.0	0	16	1300	2

	Surface	Inh.	Final			Cum.	Cum.
<u>Sample</u>	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>Yield</u>	<u>Ash</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	118.2	0.98	117.0	40.7	6.38	40.7	6.38
C2	96.2	0.97	95.7	33.3	8.78	74.0	7.46
C3	16.1	1.09	15.9	5.5	21.11	79.5	8.40
C4	4.3	1.72	4.2	1.5	39.20	81.0	8.97
TF	6.6	1.72	6.5	2.3	60.04	83.3	10.38
<u>T1</u>	<u>48.8</u>	<u>1.51</u>	<u>48.1</u>	<u>16.7</u>	<u>83.86</u>	<u>100.0</u>	<u>22.65</u>
Total	290.6	---	287.4	100.0	22.65	---	---
Head	---	1.76	---	100.0	23.51	---	---

Table 18.F.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: PP2 Coal: Pittsburgh No. 8 Lot #1
Date: 7/13/93 Grind: PETC Grind
Feed (g): 300g

	MIBC	F.O.	Cond.			Float
<u>Flotation</u>	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>Air</u>	<u>Agitator</u>	<u>Time</u>
			<u>(min.)</u>	<u>(%)</u>	<u>(RPM)</u>	<u>(min.)</u>
Rougher	0.3	0.6	3	60	1400	9
1st Cleaner	0.15	0.0	3	60	1400	8
2nd Cleaner	0.15	0.0	3	60	1400	6
C1	0.15	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

	Surface	Inh.	Final			Cum.	Cum.
<u>Sample</u>	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>Yield</u>	<u>Ash</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	96.1	1.18	95.0	33.3	6.11	33.3	6.11
C2	86.6	1.16	85.6	30.0	7.90	63.3	6.96
C3	38.6	1.23	38.1	13.3	13.77	76.6	8.14
C4	12.4	1.41	12.2	4.3	30.08	80.9	9.31
TF	6.6	1.70	6.5	2.3	65.41	83.2	10.86
<u>T1</u>	<u>48.7</u>	<u>1.53</u>	<u>48.0</u>	<u>16.8</u>	<u>82.08</u>	<u>100.0</u>	<u>22.82</u>
Total	289.0	---	285.4	100.0	22.82	---	---
Head	---	1.76	---	100.0	23.51	---	---

Table 18.F.3 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: PP3 Coal: Pittsburgh No. 8 Lot #1
Date: 7/13/93 Grind: PETC Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.7	1.4	3	60	1400	11
1st Cleaner	0.35	0.0	3	60	1400	10
2nd Cleaner	0.35	0.0	3	60	1400	8
C1	0.35	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	152.4	1.22	150.5	52.8	6.69	52.8	6.69
C2	68.9	1.15	68.1	23.9	9.97	76.7	7.71
C3	11.6	1.21	11.5	4.0	24.09	80.7	8.52
C4	3.0	1.15	3.0	1.1	38.38	81.8	8.92
TF	5.5	1.62	5.4	1.9	62.90	83.7	10.15
<u>T1</u>	<u>47.2</u>	<u>1.62</u>	<u>46.4</u>	<u>16.3</u>	<u>84.24</u>	<u>100.0</u>	<u>22.23</u>
Total	288.6	---	284.9	100.0	22.23	---	---
Head	---	1.76	---	100.0	23.51	---	---

Table 18.F.4
SUMMARY RELEASE ANALYSIS DATA
Pittsburgh No. 8 Seam Raw Coal
(PETC Grind)

Test Number	Reagents (Rougher)		Sample	Direct Analysis (Dry Basis)				Cumulative Analysis (Dry Basis)			
	(MIBC #/T)	(F.O. #/T)		Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)
---	---	---	Head	100.0	23.51	4.54	2.59	---	---	---	---
PP1	0.5	1.0	Recon. Feed	100.0	22.65	4.25	2.48	---	---	---	---
			Conc. #1	40.7	6.38	3.34	1.17	40.7	6.38	3.34	1.17
			Conc. #2	33.3	8.78	3.97	1.85	74.0	7.46	3.62	1.48
			Conc. #3	5.5	21.11	6.40	4.37	79.5	8.40	3.81	1.68
			Conc. #4	1.5	39.20	7.54	7.54	81.0	8.97	3.88	1.79
			Tail Final	2.3	60.04	7.12	5.12	83.3	10.83	3.97	1.88
			Tail #1	16.7	83.86	5.60	5.48	100.0	22.65	4.24	2.48
---	---	---	Head	100.0	23.51	4.54	2.59	---	---	---	---
PP2	0.3	0.6	Recon. Feed	100.0	22.82	4.26	2.51	---	---	---	---
			Conc. #1	33.3	6.11	3.19	1.10	33.3	6.11	3.19	1.10
			Conc. #2	30.0	7.90	3.71	1.61	63.3	6.96	3.44	1.34
			Conc. #3	13.3	13.77	4.88	3.00	76.6	8.14	3.69	1.63
			Conc. #4	4.3	30.08	7.41	5.57	80.9	9.31	3.89	1.84
			Tail Final	2.3	65.41	8.40	7.56	83.2	10.86	4.01	2.00
			Tail #1	16.8	82.08	5.52	5.03	100.0	22.82	4.26	2.51

Table 18.F.5
FLOTATION RELEASE ANALYSIS

Test No: P1 Coal: Pittsburgh No. 8 Lot #1
Date: 7/10/93 Grind: PTI Grind
Feed (g): 300g

			Cond.			Float
<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Time</u>	<u>Air</u>	<u>Agitator</u>	<u>Time</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>(min.)</u>	<u>(%)</u>	<u>(RPM)</u>	<u>(min.)</u>
Rougher	1.0	1.5	---	22	1400	---
1st Cleaner	0.5	0.0	---	22	1400	---
2nd Cleaner	0.5	0.0	---	22	1400	---
C1	0.5	0.0	---	4	900	---
C2	0.0	0.0	---	8	1000	---
C3	0.0	0.0	---	12	1100	---
C4	0.0	0.0	---	16	1300	---

	Surface	Inh.	Final			Cum.	Cum.
	Dry Wt.	Water	Dry Wt.	Yield	Ash	Yield	Ash
<u>Sample</u>	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	182.0	1.06	180.1	62.9	6.00	62.9	6.00
C2	34.9	0.96	34.6	12.1	10.74	75.0	6.76
C3	5.1	1.15	5.0	1.8	19.15	76.8	7.05
C4	2.2	1.00	2.2	0.8	33.95	77.6	7.33
TF	3.0	0.81	3.0	1.0	54.97	78.6	7.94
<u>T1</u>	<u>62.2</u>	<u>1.23</u>	<u>61.4</u>	<u>21.4</u>	<u>76.93</u>	<u>100.0</u>	<u>22.70</u>
Total	289.4	---	286.3	100.0	22.70	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P2 Coal: Pittsburgh No. 8 Lot #1
Date: 7/02/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	1.0	2.0	3	10	1400	20
1st Cleaner	0.5	0.0	3	10	1400	15
2nd Cleaner	0.5	0.0	3	10	1400	8
C1	0.5	0.0	3	2	900	0.5
C2	0.0	0.0	—	4	1000	1
C3	0.0	0.0	—	6	1100	1
C4	0.0	0.0	—	8	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	121.4	1.49	119.6	41.3	7.03	41.3	7.03
C2	91.4	1.37	90.1	31.1	8.49	72.4	7.66
C3	17.9	1.43	17.6	6.1	13.59	78.5	8.12
C4	6.6	1.42	6.5	2.3	21.41	80.8	8.50
TF	6.4	1.29	6.3	2.2	53.71	83.0	9.70
<u>T1</u>	<u>50.1</u>	<u>1.50</u>	<u>49.3</u>	<u>17.0</u>	<u>83.41</u>	<u>100.0</u>	<u>22.23</u>
Total	293.8	—	289.4	100.0	22.23	---	---
Head	---	1.33	—	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P3 Coal: Pittsburgh No. 8 Lot #1
Date: 7/06/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	1.5	1.5	3	12	1400	15
1st Cleaner	0.75	0.0	3	12	1400	9
2nd Cleaner	0.75	0.0	3	12	1400	8
C1	0.0	0.0	3	2.5	900	0.5
C2	0.0	0.0	0	5	1000	1
C3	0.0	0.0	0	7	1100	1
C4	0.0	0.0	0	10	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	99.5	1.05	98.5	33.9	6.41	33.9	6.41
C2	91.7	1.03	90.8	31.3	7.82	65.2	7.09
C3	32.9	1.12	32.5	11.2	11.56	76.4	7.75
C4	11.9	1.08	11.8	4.1	20.55	80.5	8.40
TF	6.1	1.20	6.0	2.1	55.21	82.6	9.59
<u>T1</u>	<u>51.1</u>	<u>0.95</u>	<u>50.6</u>	<u>17.4</u>	<u>83.17</u>	<u>100.0</u>	<u>22.39</u>
Total	293.2	---	290.2	100.0	22.39	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P4 Coal: Pittsburgh No. 8 Lot #1
Date: 7/07/93 Grind: PTI Grind
Feed (g): 300g

			Cond.			Float
<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Time</u>	<u>Air</u>	<u>Agitator</u>	<u>Time</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>(min.)</u>	<u>(%)</u>	<u>(RPM)</u>	<u>(min.)</u>
Rougher	1.0	1.5	3	14	1400	16
1st Cleaner	0.5	0.0	3	12	1400	8
2nd Cleaner	0.5	0.0	3	12	1400	7
C1	0.0	0.0	3	2.5	900	0.5
C2	0.0	0.0	0	5	1000	1
C3	0.0	0.0	0	7	1100	1
C4	0.0	0.0	0	10	1250	2

	Surface	Inh.	Final			Cum.	Cum.
	Dry Wt.	Water	Dry Wt.	Yield	Ash	Yield	Ash
<u>Sample</u>	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	74.0	1.34	73.0	25.1	5.99	25.1	5.99
C2	101.2	1.23	100.0	34.4	7.18	59.5	6.68
C3	49.9	1.26	49.3	16.9	10.29	76.4	7.48
C4	13.3	1.35	13.1	4.5	21.26	80.9	8.25
TF	4.7	1.37	4.6	1.6	65.26	82.5	9.36
<u>T1</u>	<u>51.8</u>	<u>1.57</u>	<u>51.0</u>	<u>17.5</u>	<u>85.28</u>	<u>100.0</u>	<u>22.65</u>
Total	294.9	---	291.0	100.0	22.64	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P5
Date: 7/08/93
Tech: Jerry

Coal: Pittsburgh No. 8 Lot #1
Grind: PTI Grind
Feed (g): 300g

	MIBC	F.O.	Cond.	Air		Float
<u>Flotation</u>	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>@40 psi</u>	<u>gitat</u>	<u>Time</u>
			<u>(min.)</u>	<u>(%)</u>	<u>RPM</u>	<u>(min.)</u>
Rougher	0.5	1.0	3	60	1400	12
1st Cleaner	0.25	---	3	60	1400	10
2nd Cleaner	0.25	---	3	60	1400	8
C1	0.25	---	3	12	900	1
C2	---	---	---	24	1000	1
C3	---	---	---	36	1100	1
C4	---	---	---	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>				<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>Yield</u>	<u>Ash</u>	<u>Ash</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Units</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	180.8	1.07	178.0	61.6	6.61		61.6	6.61
C2	50.4	1.12	49.8	17.2	12.40		78.8	7.87
C3	7.3	1.20	7.2	2.5	29.96		81.3	8.55
C4	2.4	1.02	2.4	0.8	50.82		82.1	8.96
TF	3.9	1.29	3.8	1.3	77.08		83.4	10.02
<u>T1</u>	<u>48.4</u>	<u>1.23</u>	<u>47.8</u>	<u>16.6</u>	<u>86.90</u>		<u>100.0</u>	<u>22.78</u>
Total	293.2	---	289.0	100.0	22.79		---	---
Head	---	1.33	---	100.0	23.36		---	---

**Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS**

Test No: P6 Coal: Pittsburgh No. 8 Lot #1
Date: 7/08/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.3	0.6	3	60	1400	8
1st Cleaner	0.15	0.0	3	60	1400	7
2nd Cleaner	0.15	0.0	3	60	1400	5
C1	0.15	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>			<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>Yield</u>	<u>Ash</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
C1	92.5	1.09	91.5	31.5	5.21	31.5	5.21
C2	81.1	1.26	80.1	27.5	7.12	59.0	6.10
C3	44.6	1.42	44.0	15.1	11.44	74.1	7.19
C4	18.0	1.49	17.7	6.1	20.03	80.2	8.17
TF	6.0	1.50	5.9	2.0	54.05	82.2	9.29
<u>T1</u>	<u>52.4</u>	<u>1.38</u>	<u>51.7</u>	<u>17.8</u>	<u>84.64</u>	<u>100.0</u>	<u>22.70</u>
Total	294.6	---	290.9	100.0	22.70	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P7 Coal: Pittsburgh No. 8 Lot #1
Date: 7/08/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.7	1.4	3	60	1400	8
1st Cleaner	0.35	0.0	3	60	1400	6
2nd Cleaner	0.35	0.0	3	60	1400	5
C1	0.35	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	170.4	1.12	168.5	58.3	7.72	58.3	7.72
C2	58.6	1.07	57.8	20.0	12.44	78.3	8.93
C3	7.8	1.08	7.7	2.7	28.79	81.0	9.59
C4	1.2	0.89	1.2	0.4	52.34	81.4	9.80
TF	3.5	1.27	3.5	1.2	79.08	82.6	10.81
<u>T1</u>	<u>50.6</u>	<u>1.01</u>	<u>50.1</u>	<u>17.4</u>	<u>86.78</u>	<u>100.0</u>	<u>24.03</u>
Total	292.1	---	288.8	100.0	24.02	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.5 (cont.)
FLOTATION RELEASE ANALYSIS

Test No: P8 Coal: Pittsburgh No. 8 Lot #1
Date: 7/11/93 Grind: PTI Grind
Feed (g): 300g

<u>Flotation</u>	<u>MIBC</u>	<u>F.O.</u>	<u>Cond.</u>	<u>Air</u>	<u>Agitator</u>	<u>Float</u>
	<u>(#/T)</u>	<u>(#/T)</u>	<u>Time</u>	<u>(%)</u>	<u>(RPM)</u>	<u>Time</u>
			<u>(min.)</u>			<u>(min.)</u>
Rougher	0.4	0.8	3	60	1400	7
1st Cleaner	0.2	0.0	3	60	1400	5
2nd Cleaner	0.2	0.0	3	60	1400	4
C1	0.2	0.0	3	12	900	1
C2	0.0	0.0	0	24	1000	1
C3	0.0	0.0	0	36	1100	1
C4	0.0	0.0	0	48	1250	2

<u>Sample</u>	<u>Surface</u>	<u>Inh.</u>	<u>Final</u>	<u>Yield</u>	<u>Ash</u>	<u>Cum.</u>	<u>Cum.</u>
	<u>Dry Wt.</u>	<u>Water</u>	<u>Dry Wt.</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>Yield</u>	<u>Ash</u>
	<u>(g)</u>	<u>(%)</u>	<u>(g)</u>			<u>(Wt%)</u>	<u>(Wt%)</u>
C1	120.5	1.19	119.1	41.0	6.99	41.0	6.99
C2	102.3	1.16	101.1	34.8	10.48	75.8	8.59
C3	9.0	1.21	8.9	3.1	29.33	78.9	9.40
C4	2.4	1.09	2.4	0.8	51.33	79.7	9.82
TF	3.3	1.18	3.3	1.1	73.31	80.8	10.68
<u>T1</u>	<u>56.4</u>	<u>1.11</u>	<u>55.8</u>	<u>19.2</u>	<u>85.46</u>	<u>100.0</u>	<u>25.04</u>
Total	293.9	---	290.6	100.0	25.05	---	---
Head	---	1.33	---	100.0	23.36	---	---

Table 18.F.6
SUMMARY RELEASE ANALYSIS DATA
Pittsburgh No. 8 Seam Raw Coal
(PTI Grind)

Test Number	Reagents (Rougher)		Sample	Direct Analysis (Dry Basis)				Cumulative Analysis (Dry Basis)			
	(MIBC #/T)	(F.O. #/T)		Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)
---	---	---	Head	100.0	23.36	4.39	2.61	---	---	---	---
P5	0.5	1.0	Recon. Feed	100.0	22.79	4.36	2.65	---	---	---	---
			Conc. #1	61.6	6.61	3.61	1.44	61.6	6.61	3.61	1.44
			Conc. #2	17.2	12.40	4.58	2.64	78.8	7.87	3.82	1.70
			Conc. #3	2.5	29.96	7.22	5.94	81.3	8.55	3.92	1.83
			Conc. #4	0.8	50.82	10.48	10.40	82.1	8.96	3.98	1.91
			Tail Final	1.3	77.08	9.61	9.61	83.4	10.02	4.07	2.03
			Tail #1	16.6	86.90	5.76	5.76	100.0	22.78	4.35	2.65
---	---	---	Head	100.0	23.36	4.39	2.61	---	---	---	---
P6	0.3	0.6	Recon. Feed	100.0	22.70	4.35	2.61	---	---	---	---
			Conc. #1	31.5	5.21	3.28	0.95	31.5	5.21	3.28	0.95
			Conc. #2	27.5	7.12	3.72	1.61	59.0	6.10	3.49	1.26
			Conc. #3	15.1	11.44	4.50	2.61	74.1	7.19	3.70	1.54
			Conc. #4	6.1	20.03	5.97	4.01	80.2	8.17	3.87	1.73
			Tail Final	2.0	54.05	8.60	7.53	82.2	9.29	3.98	1.87
			Tail #1	17.8	84.64	6.08	6.05	100.0	22.70	4.35	2.61

APPENDIX G
MULTIVARIABLE TESTING RESULTS
(Pittsburgh No. 8 Seam Coal)

Table 18.G.1 - VT#1-VT#3 Test Results and Conditions (5/06//93)

Table 18.G.2 - VT#4-VT#6 Test Results and Conditions (5/07//93)

Table 18.G.3 - VT#7-VT#8 Test Results and Conditions (5/10//93)

Table 18.G.4 - VT#10-VT#15 Test Results and Conditions (5/11//93)

Table 18.G.5 - VT#16-VT#21 Test Results and Conditions (5/12//93)

Table 18.G.6 - VT#22-VT#25 Test Results and Conditions (5/13//93)

Table 18.G.7 - VT#26-VT#34 Test Results and Conditions (5/17//93)

Table 18.G.8 - VT#36-VT#38 Test Results and Conditions (5/24//93)

Table 18.G.9 - VT#39-VT#46 Test Results and Conditions (5/25//93)

Table 18.G.10 - Detailed Sample Results (Dry Basis)

Table 18.G.1
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/06/93
Tests: VT#1-VT#3

<u>Time</u>	<u>Sample Number</u>	<u>Feed Solids (#/Hr.)</u>	<u>F&T</u>	<u>C&T</u>	<u>A.B. Yield (Wt%)</u>	<u>Diluted Feed</u>			<u>Diluted Concentrate</u>			<u>Tailings</u>		
			<u>F.B. Yield (Wt%)</u>	<u>F.B. Yield (Wt%)</u>		<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>	<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>	<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>
1722	VT#1	226	66.1	74.8	75.1	6.3	6.95	20.70	5.8	4.99	7.21	8.0	1.22	61.40
1805	VT#2	207	73.1	72.2	70.2	6.3	6.37	21.49	5.8	5.06	8.80	7.5	1.51	51.41
1900	VT#3	224	52.5	52.2	49.2	6.2	7.00	22.13	5.1	4.47	7.69	8.1	2.58	36.13
							VT#3 Conc. Grab:		—	4.11	7.70			

Table 18.G.1 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/06/93

Feed Lot: 1 Pittsburgh

	<u>VT#1</u>	<u>VT#2</u>	<u>VT#3</u>
Water Type	City	City	City
Feed Rate (#/Hr)	225	225	225
Feed Solids (Wt%)	7.0	7.0	7.0
Feed Rate (GPM)	6.3	6.3	6.3
Froth Bar Depth (In)	15	15	15
Froth Depth (In)	36	24	24
Froth Setpoint (In)	36	24	24
Air rate (CFM) @ 50 Psi	1.2	1.8	1.5
Froth Wash (GPM)	4.0	3.5	3.5
Launder Wash (GPM)	3.5	3.5	3.5
Hammermill Screen (In)	1/4	1/4	1/4
Inner Sleeve (O.D.)	None	None	None
Conc. Sample Time	17:22	18:05	19:00
MIBC Frother (#/T)	1.0	1.0	0.5
MIBC Frother (g/min.)	0.851	0.851	0.426
F.O. Collector (#/T)	2.0	2.0	1.0
F.O. Collector (g/min.)	1.702	1.702	0.851

Table 18.G.2
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/07/93
Tests: VT#4-VT#6

<u>Time</u>	<u>Sample Number</u>	<u>Feed</u>	<u>F&T</u>	<u>C&T</u>	<u>A.B.</u>	<u>Diluted Feed</u>			<u>Diluted Concentrate</u>			<u>Tailings</u>		
		<u>Solids</u>	<u>F.B.</u>	<u>F.B.</u>		<u>Flow</u>	<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>
		<u>(#/Hr.)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
930	VT#4	230	31.5	31.3	35.0	6.3	7.09	23.91	4.3	3.27	5.96	8.0	3.86	33.59
1030	VT#5	186	52.4	52.4	63.9	4.5	8.00	23.43	4.5	4.19	8.26	6.5	2.36	50.30
1200	VT#6	275	64.5	66.3	65.4	5.8	9.19	25.77	6.5	5.29	10.02	6.3	2.78	55.49

Note: Flows are best estimate, database crashed.

Table 18.G.2 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/07/93

Feed Lot: 1 Pittsburgh

	<u>VT#4</u>	<u>VT#5</u>	<u>VT#6</u>
Water Type	City	City	City
Feed Rate (#/Hr)	225	150	300
Feed Solids (Wt%)	7.0	6.5	10.0
Feed Rate (GPM)	6.3	4.5	5.8
Froth Bar Depth (In)	15	15	15
Froth Depth (In)	36	30	30
Froth Setpoint (In)	36	35	33
Air rate (CFM) @ 50 Psi	1.8	1.8	1.8
Froth Wash (GPM)	2.5	3.0	3.5
Launder Wash (GPM)	3.5	3.5	3.5
Hammermill Screen (In)	1/4	1/4	1/4
Inner Sleeve (O.D.)	None	None	None
Conc. Sample Time	9:30	10:30	12:00
MIBC Frother (#/T)	0.36	0.71	0.70
MIBC Frother (g/min.)	0.298	0.397	0.794
F.O. Collector (#/T)	0.70	0.70	1.40
F.O. Collector (g/min.)	0.596	0.397	1.589

Table 18.G.3
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/10/93
Lot: #1

ByPass Samples

Time	Test Number	Solids Feed (#/Hr.)	F&T	C&T	A.B. Yield (Wt%)	Diluted Feed			Diluted Concentrate			Tailings		
			F.B. Yield (Wt%)	F.B. Yield (Wt%)		Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
1430	VT#7	146	82.6	82.9	81.8	4.4	6.44	18.56	5.2	4.61	10.01	5.2	0.95	51.10
1555	VT#8	150	67.3	66.9	66.4	9.8	2.96	17.22	5.1	3.76	8.76	10.2	0.93	33.92

Note: Yields match very well, indicating good closure and sampling approach.

Analyzer Drain & Rinse

Time	Test Number	Solids Feed (#/Hr.)	F.B.	F.B.	A.B. Yield (Wt%)	Diluted Feed			Diluted Concentrate			Tailings		
			Yield (F&T) (Wt%)	Yield (C&T) (Wt%)		Drain (GPM)	Solids (Wt%)	Ash (Wt%)	Drain (GPM)	Solids (Wt%)	Ash (Wt%)	Drain (GPM)	Solids (Wt%)	Ash (Wt%)
1430	VT#7	** Same As Above	**	**	80.4	5.0	—	18.51	5.5	—	9.95	5.5	—	*53.63
1555	VT#8	** Same As Above	**	**	65.5	5.5	—	17.59	5.5	—	8.96	5.5	—	34.01

* Did not match bypass, probably due to small sample amount (3.0 gallons).
Problem with level prove for tailings sample, otherwise all are good.

Grab Samples

Time	Test Number	Solids Feed (#/Hr.)	S.B.	F.B.	A.B. Yield (Wt%)	S.B.	Undiluted Feed		Diluted Concentrate			Tailings		
			Yield (F&T) (Wt%)	Yield (C&T) (Wt%)		Yield (C&T) (Wt%)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
1430	VT#7	158	85.4	83.6	80.4	83.3	22.32	18.31	5.2	4.39	9.21	5.2	0.86	55.54
1555	VT#8	145	80.3	71.7	58.6	76.5	22.68	18.55	5.1	3.86	8.39	10.2	0.76	32.91

Test	Sample	Time	Ash (Wt%)
VT#7	Bin #2A	1430-1500	19.24
VT#8	Bin #2B	1545-1615	19.10
VT#7	Lock Hopper A	1445	19.21
VT#8	Lock Hopper A	1600	18.42

Table 18.G.3 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/10/93
Feed Lot: #1

	<u>VT#7</u>	<u>VT#8</u>
Water Type	City	City
Feed Rate (#/Hr)	150	150
Feed Solids (Wt%)	6.5	3.0
Feed Rate (GPM)	4.5	9.9
Froth Bar Depth (In)	15	12
Froth Depth (In)	30	24
Froth Setpoint (In)	32	28
Air rate (CFM) @ 50 Psi	1.2	1.7
Froth Wash (GPM)	2.5	2.0
Launder Wash (GPM)	3.5	3.5
Hammermill Screen (In)	1/4	1/4
Inner Sleeve (O.D.)	None	None
Conc. Sample Time	14:30	15:55
MIBC Frother (#/T)	1.0	1.0
MIBC Frother (g/min.)	0.568	0.568
F.O. Collector (#/T)	2.0	2.0
F.O. Collector (g/min.)	1.135	1.135

Table 18.G.4
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/11/93
Lot: #1 (93-95)

ByPass Samples

Time	Test Number	Solids Feed (#/Hr.)	F&T	C&T	A.B. Yield (Wt%)	Diluted Feed			Diluted Concentrate			Tailings		
			F.B. Yield (Wt%)	F.B. Yield (Wt%)		Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
1320	VT#10	220	65.0	63.0	60.5	6.2	6.87	21.21	5.7	4.45	9.21	7.5	1.99	39.61
1425	VT#11	220	80.1	80.6	78.8	6.2	6.87	21.27	6.2	5.67	10.75	5.6	1.51	60.28
1510	VT#12	213	73.3	73.6	69.2	4.4	9.37	22.50	5.2	6.11	8.31	4.7	2.43	54.43
1555	VT#13	214	54.5	57.0	55.6	8.8	4.72	22.62	5.0	5.01	7.03	9.3	2.03	42.11
1655	VT#14	294	72.8	72.8	72.8	5.7	10.00	22.79	6.7	6.20	10.22	4.5	3.45	56.48
1740	VT#15	312	70.9	70.0	66.7	5.7	10.63	24.43	5.8	7.09	8.70	5.4	3.26	55.88

Analyzer Drain & Rinse

Drain & Rinse															
Time	Test Number	Solids Feed (#/Hr.)	F.B.	F.B.	A.B. Yield (Wt%)	Diluted Feed			Diluted Concentrate			Tailings			
			Yield (F&T)	Yield (C&T)		Drain (GPM)	Solids (Wt%)	Ash (Wt%)	Drain (GPM)	Solids (Wt%)	Ash (Wt%)	Drain (GPM)	Solids (Wt%)	Ash (Wt%)	
			(Wt%)	(Wt%)											
1740	VT#15		** Same As Above **			65.6	3.7	10.81	24.80	4.5	7.27	8.93	3.6	3.35	55.04

Grab Samples

Samples		S.B.	F.B.		S.B.	Solids						Tailings		
	Test	Yield	Yield	A.B.	Yield	Feed	Undiluted Feed		Diluted Concentrate					
	Number	(F&T)	(C&T)	Yield	(C&T)	Rate	Solids	Ash	Flow	Solids	Ash	Flow	Solids	Ash
Time		(Wt%)	(Wt%)	(Wt%)	(Wt%)	(#/Hr.)	(Wt%)	(Wt%)	(GPM)	(Wt%)	(Wt%)	(GPM)	(Wt%)	(Wt%)
1740	VT#15	73.0	69.4	67.6	69.1	332	24.15	24.28	5.8	6.92	8.42	5.4	3.27	57.40

Bin # 2 Samples

Test	Time	Ash (Wt%)
VT#10	1315-1345	23.76
VT#12	1500-1530	23.08
VT#13	1600-1615	24.12
VT#15	1740-1755	25.88

Lock Hopper Samples

Time	Ash (Wt%)
1330	23.52
1511	23.17
1600	24.28
1750	25.39

Table 18.G.4 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/11/93

Feed Lot: #1

	<u>VT#10</u>	<u>VT#11</u>	<u>VT#12</u>	<u>VT#13</u>	<u>VT#14</u>	<u>VT#15</u>
Water Type	City	City	City	City	City	City
Feed Rate (#/Hr)	225	225	225	225	300	300
Feed Solids (Wt%)	7.0	7.0	10.0	5.0	10.0	10.0
Feed Rate (GPM)	6.3	6.3	4.4	8.8	5.8	5.8
Froth Bar Depth (In)	18	12	15	15	15	18
Froth Depth (In)	36	24	30	30	30	36
Froth Setpoint (In)	40	28	34	34	34	40
Air rate (CFM) @ 50 Psi	1.5	2.0	1.7	1.7	2.0	1.4
Froth Wash (GPM)	3.5	2.5	2.5	2.5	2.5	2.5
Launder Wash (GPM)	3.5	3.0	3.0	3.0	3.0	3.0
Hammermill Screen (In)	1/4	1/4	1/4	1/4	1/4	1/4
	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)
Inner Sleeve (O.D.)	None	None	None	None	None	None
Conc. Sample Time	13:20	14:25	15:10	15:55	16:55	17:40
MIBC Frother (#/T)	1.0	1.5	0.7	1.0	1.0	0.7
MIBC Frother (g/min.)	0.851	1.277	0.596	0.851	1.135	0.795
F.O. Collector (#/T)	2.0	2.5	1.4	1.0	2.0	2.0
F.O. Collector (g/min.)	1.702	2.128	1.191	0.851	2.270	2.270

Table 18.G.5
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/12/93
Lot: #1 (93-97)

<u>Time</u>	<u>Test Number</u>	<u>Solids Feed (#/Hr.)</u>	<u>F&T</u>	<u>C&T</u>	<u>A.B. Yield (Wt%)</u>	<u>Diluted Feed</u>			<u>Diluted Concentrate</u>			<u>Tailings</u>		
			<u>F.B. Yield (Wt%)</u>	<u>F.B. Yield (Wt%)</u>		<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>	<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>	<u>Flow (GPM)</u>	<u>Solids (Wt%)</u>	<u>Ash (Wt%)</u>
905	VT#16	295	82.7	82.7	80.2	5.7	10.02	22.17	7.0	6.74	10.87	4.2	2.35	67.98
955	VT#17	305	71.3	71.0	68.4	7.7	7.69	22.68	5.8	7.17	7.64	7.4	2.30	55.16
1100	VT#18	327	76.2	75.6	72.3	7.8	8.12	23.68	6.5	7.18	9.28	6.8	2.22	61.27
1150	VT#19	236	82.0	81.1	80.4	4.4	10.38	23.80	5.9	5.98	12.13	4.0	2.05	71.53
1240	VT#20	221	72.5	74.6	69.8	5.8	7.38	25.34	4.9	7.07	9.32	6.4	1.84	62.36
1335	VT#21	222	77.3	77.0	73.5	5.7	7.56	26.13	5.3	6.20	10.56	5.9	1.66	69.32

<u>Test</u>	<u>Bin #2 Samples</u>		<u>Lock Hopper Samples</u>	
	<u>Time</u>	<u>Ash (Wt%)</u>	<u>Time</u>	<u>Ash (Wt%)</u>
VT#16	900-920	22.72	910	22.63
VT#18	1055-1115	25.59	1105	24.03
VT#20	1240-1300	26.26	1250	26.67

Table 18.G.5 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/12/93

Feed Lot: #1

	<u>VT#16</u>	<u>VT#17</u>	<u>VT#18</u>	<u>VT#19</u>	<u>VT#20</u>	<u>VT#21</u>
Water Type	City	City	City	City	City	City
Feed Rate (#/Hr)	300	300	300	225	225	225
Feed Solids (Wt%)	10.0	7.5	7.5	10.0	7.5	7.5
Feed Rate (GPM)	5.8	7.8	7.8	4.4	5.8	5.8
Froth Bar Depth (In)	12	15	18	12	15	18
Froth Depth (In)	24	30	36	24	30	36
Froth Setpoint (In)	26	32	40	26	34	42
Air rate (CFM) @ 50 Psi	2.2	1.4	1.8	2.2	1.4	1.8
Froth Wash (GPM)	2.5	2.5	2.5	2.5	2.5	2.5
Launder Wash (GPM)	3.0	3.0	3.0	3.0	3.0	3.0
Hammermill Screen (In)	1/4	1/4	1/4	1/4	1/4	1/4
	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)	(6090 RPM)
Inner Sleeve (O.D.)	None	None	None	None	None	None
Conc. Sample Time	9:05	9:55	11:00	11:50	12:40	13:35
MIBC Frother (#/T)	1.5	0.7	1.0	1.5	0.7	1.0
MIBC Frother (g/min.)	1.703	0.795	1.135	1.277	0.596	0.851
F.O. Collector (#/T)	2.5	1.5	2.0	2.5	1.5	2.0
F.O. Collector (g/min.)	2.838	1.703	2.270	2.128	1.191	1.702

Table 18.G.6
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/13/93
 Lot: #1 (93-98)

<u>Time</u>	<u>Test Number</u>	<u>Solids Feed</u> (#/Hr.)	<u>F&T</u>	<u>C&T</u>	<u>A.B.</u>	<u>Diluted Feed</u>			<u>Diluted Concentrate</u>			<u>Tailings</u>		
			<u>F.B.</u> <u>Yield</u> (Wt%)	<u>F.B.</u> <u>Yield</u> (Wt%)	<u>Yield</u> (Wt%)	<u>Flow</u> (GPM)	<u>Solids</u> (Wt%)	<u>Ash</u> (Wt%)	<u>Flow</u> (GPM)	<u>Solids</u> (Wt%)	<u>Ash</u> (Wt%)	<u>Flow</u> (GPM)	<u>Solids</u> (Wt%)	<u>Ash</u> (Wt%)
1150	VT#22	310	73.1	73.1	71.9	6.4	9.39	27.64	6.9	6.37	13.12	5.5	2.94	64.74
1255	VT#23	301	77.2	76.6	77.3	6.4	9.12	22.38	6.4	6.82	10.02	6.0	2.22	64.44
1340	VT#24	226	73.9	73.1	71.6	8.2	5.35	22.44	5.6	5.55	8.02	8.6	1.33	58.73
1430	VT#25	204	71.9	74.0	75.1	8.3	4.77	22.11	5.6	5.66	8.16	8.7	1.28	64.11

<u>Bin #2 Samples</u>			<u>Lock Hopper Samples</u>	
<u>Test</u>	<u>Time</u>	<u>Ash (Wt%)</u>	<u>Time</u>	<u>Ash (Wt%)</u>
VT#23	1300-1315	22.09	1300	22.17
VT#25	1430-1440	23.44	1435	22.73

Note: Feed Lot #1 Composite was 24.45 Wt% Ash.

Table 18.G.6 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/13/93

Feed Lot: #1 (93-98)

	<u>VT#22</u>	<u>VT#23</u>	<u>VT#24</u>	<u>VT#25</u>
Water Type	City	City	City	City
Feed Rate (#/Hr)	300	300	300	225
Feed Solids (Wt%)	9.0	9.0	5.3	5.3
Feed Rate (GPM)	6.5	6.5	8.3	8.3
Froth Bar Depth (In)	14	9	9	14
Froth Depth (In)	28	18	18	28
Froth Setpoint (In)	30	17	17	29
Air rate (CFM) @ 50 Psi	2.2	1.8	1.8	2.2
Froth Wash (GPM)	3.0	3.0	3.0	3.0
Launder Wash (GPM)	3.0	3.0	3.0	3.0
Hammermill Screen (In)	1/4	1/4	1/4	1/4
	(4910 RPM)	(4910 RPM)	(4910 RPM)	(4910 RPM)
Inner Sleeve (O.D.)	None	None	None	None
Conc. Sample Time	11:50	12:55	13:40	14:30
MIBC Frother (#/T)	1.5	1.0	1.0	1.5
MIBC Frother (g/min.)	1.703	1.135	0.851	1.277
F.O. Collector (#/T)	2.5	2.0	2.0	2.5
F.O. Collector (g/min.)	2.838	2.270	1.703	2.129

Table 18.G.7
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/17/93
Lot: #1 (93-100)

Time	Test Number	Solids Feed (#/Hr.)	F&T	C&T	A.B. Yield (Wt%)	Diluted Feed			Diluted Concentrate			Tailings		
			F.B. Yield (Wt%)	F.B. Yield (Wt%)		Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
915	VT#26	227	74.3	77.0	73.8	6.1	7.21	23.40	5.9	6.39	9.76	6.2	1.82	61.76
1040	VT#27	243	50.5	51.4	50.8	6.0	7.85	26.65	4.7	5.25	8.48	6.8	3.43	45.44
1130	VT#28	281	75.9	71.8	74.7	6.0	9.09	26.29	5.3	6.32	11.35	6.2	2.12	70.35
1240	VT#29	242	77.4	78.7	78.4	6.0	7.82	23.64	6.1	6.43	12.77	4.9	2.16	63.04
1325	VT#30	259	77.4	77.1	76.4	5.4	9.29	23.70	6.0	6.37	11.20	5.9	1.92	64.08
1415	VT#31	299	77.1	77.6	76.9	6.3	9.20	23.74	6.7	6.87	12.07	5.6	2.37	62.63
1500	VT#32	304	77.4	77.6	75.3	6.4	9.20	22.88	6.1	7.53	10.21	6.3	2.11	61.57
	VT#33													
	VT#34													

Count Data Only
Count Data Only

Test	Bin #2 Samples		Lock Hopper Samples	
	Time	Ash (Wt%)	Time	Ash (Wt%)
VT#27	1040-1100	26.43	1043	26.79
VT#29	1240-1300	23.47	1243	22.78
VT#31	1415-1430	22.00	1417	24.67

**Table 18.G.7 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)**

Date: 05/17/93
Feed Lot: #1 (93-100)

	<u>VT#26</u>	<u>VT#27</u>	<u>VT#28</u>	<u>VT#29</u>	<u>VT#30</u>	<u>VT#31</u>	<u>VT#32</u>	<u>VT#33</u>	<u>VT#34</u>
Water Type	City	City	City	City	City	City	City	City	City
Feed Rate (#/Hr)	250	250	250	250	250	300	300	Same	Same
								As	As
Feed Solids (Wt%)	8.0	8.0	8.0	8.0	9.0	9.0	9.0	VT#32	VT#32
Feed Rate (GPM)	6.1	6.1	6.1	6.1	5.4	6.4	6.4	But	But
								No	No
Froth Bar Depth (In)	12	12	12	10	10	12	12	H2SO4	H2SO4
Froth Depth (In)	24	24	24	20	20	24	24		
Froth Setpoint (In)	26	26	25	22	22	26	26		
Air rate (CFM) @ 50 Psi	1.8	1.8	1.4	2.3	2.3	2.3	1.4	No	No
								Bypass	Bypass
Froth Wash (GPM)	3.0	2.5	2.5	2.0	3.5	3.0	3.0	Sample	Sample
Launder Wash (GPM)	3.0	3.0	3.0	3.0	3.0	3.0	3.0		
Hammermill Screen (In)	1/4	1/4	1/4	1/4	1/4	1/4	1/4		
	(4190 RPM)	(4190 RPM)	(4190 RPM)	(4190 RPM)	(4190 RPM)	(4190 RPM)	(4190 RPM)		
Inner Sleeve (O.D.)	None	None	None	None	None	None	None		
Conc. Sample Time	9:15	10:40	11:30	12:40	13:25	14:15	15:00		
MIBC Frother (#/T)	1.2	0.4	1.2	1.2	1.2	1.2	1.2		
MIBC Frother (g/min.)	1.135	0.378	1.135	1.135	1.135	1.362	1.362		
F.O. Collector (#/T)	2.4	0.8	2.4	2.4	2.4	2.4	2.4		
F.O. Collector (g/min.)	2.270	0.757	2.270	2.270	2.270	2.724	2.724		

Table 18.G.8
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/24/93

Lot: #2

		Solids Feed	F&T	C&T	A.B.	Diluted Feed	Undiluted Feed		Diluted Concentrate			Tailings		
			F.B. Yield	F.B. Yield			Solids	Ash	Flow	Solids	Ash	Flow	Solids	Ash
<u>Time</u>	<u>Test Number</u>	<u>(#/Hr.)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
1500	VT#36	236	—	67.9	67.7	6.0	23.80	21.48	5.1	6.53	7.81	6.9	2.28	50.10
1547	VT#37	244	—	67.9	67.4	6.0	23.24	21.65	5.5	5.88	7.44	6.5	2.35	51.00
1629	VT#38	254	—	N/A	69.6	N/A	24.55	21.75	N/A	6.17	8.82	N/A	2.19	56.30

Table 18.G.8 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/24/93

Feed Lot: #2

	<u>VT#36</u>	<u>VT#37</u>	<u>VT#38</u>
Water Type	City	City	City
Feed Rate (#/Hr)	250	250	250
Feed Solids (Wt%)	8.0	8.0	8.0
Feed Rate (GPM)	6.1	6.1	6.1
Froth Bar Depth (In)	12	12	12
Froth Depth (In)	30	30	18
Froth Setpoint (In)	30	30	18
Air rate (CFM) @ 50 Psi	1.7	2.3	1.7
Froth Wash (GPM)	3.0	3.0	3.0
Launder Wash (GPM)	3.0	3.0	3.0
Hammermill Screen (In)	1/4	1/4	1/4
Inner Sleeve (O.D.)	None	None	None
Conc. Sample Time	15:00	15:47	16:29
MIBC Frother (#/T)	0.7	0.7	0.7
MIBC Frother (g/min.)	0.660	0.660	0.660
F.O. Collector (#/T)	1.4	1.4	1.4
F.O. Collector (g/min.)	1.320	1.320	1.320

Table 18.G.9
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Multivariable Testing

Date: 5/25/93
Lot: #2

Time	Test Number	Solids Feed (#/Hr.)	F&T F.B. Yield (Wt%)		C&T F.B. Yield (Wt%)		A.B. Yield (Wt%)	Diluted Feed Flow (GPM)	Undiluted Feed		Diluted Concentrate			Tailings	
			Solids	Ash	Solids	Ash			Flow (GPM)	Solids	Ash	Flow (GPM)	Solids	Ash	
1250	VT#39	270	—	67.5	62.3	6.0	25.28	23.50	5.3	6.33	7.07	6.7	2.41	50.60	
1335	VT#40	252	—	64.9	64.4	6.0	24.90	24.29	5.2	6.13	7.84	6.8	2.53	53.80	
1520	VT#41	259	—	69.2	67.0	6.1	24.93	22.72	5.4	6.15	8.96	7.2	2.06	50.60	
1605	VT#42	263	—	68.3	65.5	6.0	25.36	24.95	5.8	5.52	10.06	6.7	2.22	53.20	
1655	VT#43	264	—	74.7	74.5	6.0	25.66	24.79	5.3	7.30	9.84	7.2	1.82	68.30	
1741	VT#44	266	—	78.2	78.3	6.0	24.91	21.98	5.8	6.77	9.71	6.7	1.63	66.20	
1830	VT#45	241	—	79.7	79.9	6.0	25.11	22.22	5.7	6.89	11.43	6.8	1.47	65.15	
1915	VT#46	275	—	75.7	73.3	6.1	25.25	26.31	6.1	6.23	13.37	6.5	1.88	61.85	

Table 18.G.9 (cont.)
PRIMARY MULTIVARIABLE TESTS
(Pittsburgh No. 8 Seam Raw Coal)

Date: 05/25/93

Feed Lot: #2

	<u>VT#39</u>	<u>VT#40</u>	<u>VT#41</u>	<u>VT#42</u>	<u>VT#43</u>	<u>VT#44</u>	<u>VT#45</u>	<u>VT#46</u>
Water Type	City	City	City	City	City	City	City	City
Feed Rate (#/Hr)	250	250	250	250	250	250	250	250
Feed Solids (Wt%)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Feed Rate (GPM)	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1
Froth Bar Depth (In)	12	12	12	12	12	12	12	12
Froth Depth (In)	30	30	18	18	30	30	18	18
Froth Setpoint (In)	30	30	18	18	30	30	18	18
Air rate (CFM) @ 50 Psi	1.7	2.3	1.7	2.3	1.7	2.3	1.7	2.3
Froth Wash (GPM)	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Launder Wash (GPM)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Hammermill Screen (In)	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4
	(4912 RPM)	(4912 RPM)	(4912 RPM)	(4912 RPM)	(4912 RPM)	(4912 RPM)	(4912 RPM)	(4912 RPM)
Inner Sleeve (O.D.)	None	None	None	None	None	None	None	None
Conc. Sample Time	12:50	13:35	15:20	16:05	16:55	17:41	18:30	19:45
MIBC Frother (#/T)	0.7	0.7	0.7	0.7	1.3	1.3	1.3	1.3
MIBC Frother (g/min.)	0.660	0.660	0.660	0.660	1.230	1.230	1.230	1.230
F.O. Collector (#/T)	1.4	1.4	1.4	1.4	2.6	2.6	2.6	2.6
F.O. Collector (g/min.)	1.320	1.320	1.320	1.320	2.460	2.460	2.460	2.460

Table 18.G.10
DETAILED SAMPLE RESULTS
Pittsburgh No. 8 Seam Coal Multivariable Testing
(Dry Basis)

Test Number	Reconstituted Feed			Actual Feed			Concentrate				Tailings		
	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S. (Wt%)
VT#1	20.70	3.99	2.26	20.70	4.04	2.25	75.1	7.21	3.88	1.77	61.40	4.31	3.75
VT#4	23.92	4.45	2.78	23.91	4.31	2.69	35.0	5.96	3.39	1.29	33.59	5.02	3.58
VT#10	21.22	3.89	2.24	21.21	4.00	2.30	60.5	9.21	3.65	1.71	39.61	4.27	3.04
VT#11	21.25	4.08	---	21.27	4.12	2.42	78.8	10.75	4.21	2.10	60.28	3.61	---
VT#18	23.68	---	---	23.68	4.42	---	72.3	9.28	4.30	---	61.27	---	---
VT#19	23.77	4.46	2.75	23.80	4.44	2.59	80.4	12.13	4.66	2.66	71.53	3.63	3.11
VT#21	26.13	4.50	---	26.13	4.70	3.21	73.5	10.56	4.61	2.64	69.32	4.21	---
VT#22	27.63	---	---	27.64	5.38	3.82	71.9	13.12	4.60	2.70	64.74	---	---
VT#23	22.37	4.43	2.74	22.38	4.33	2.67	77.3	10.02	4.21	2.22	64.44	5.18	4.52
VT#26	23.38	---	---	23.40	4.06	---	73.8	9.76	4.05	1.99	61.76	---	---
VT#27	26.66	4.74	3.13	26.65	4.49	2.80	50.8	8.48	3.82	1.79	45.44	5.68	4.52
VT#29	23.63	4.50	---	23.64	4.63	---	78.4	12.77	4.41	2.44	63.04	4.81	---
VT#39	23.49	4.29	---	23.50	4.99	3.13	62.3	7.07	3.92	1.73	50.63	4.90	---
VT#40	24.28	4.48	---	24.29	4.44	2.44	64.4	7.94	3.99	1.84	53.83	5.36	---
VT#41	22.72	3.76	---	22.72	4.07	2.26	67.0	8.96	3.73	1.68	50.66	3.81	---
VT#42	24.97	4.23	---	24.95	4.57	2.91	65.5	10.06	3.93	1.99	53.27	4.80	---
VT#43	24.76	4.42	2.66	24.79	4.87	3.12	74.5	9.84	4.46	2.36	68.34	4.29	3.55
VT#44	21.97	4.53	---	21.98	4.71	2.63	78.3	9.71	4.42	2.24	66.20	4.91	---
VT#45	22.23	4.60	2.70	22.22	4.86	2.81	79.9	11.43	4.58	2.38	65.15	4.70	3.96
VT#46	26.31	5.11	---	26.31	5.56	3.65	73.3	13.37	4.89	2.88	61.85	5.72	---

APPENDIX H
CONTROL TESTING SUMMARY RESULTS
(Pittsburgh No. 8 Seam Coal)

Table 18.H.1 - WT#1 Uncontrolled (5/27/93)

Table 18.H.2 - WT#2 Controlled (5/28/93)

Table 18.H.3 - WT#3 Uncontrolled (6/01/93)

Table 18.H.4 - WT#4 Controlled (6/04/93)

Table 18.H.5 - WT#5 Controlled (6/07/93)

Table 18.H.6 - WT#7 Controlled (6/09/93)

Table 18.H.7 - WT#8 Controlled (6/10/93)

Table 18.H.8 - WT#9 Uncontrolled (6/15/93)

Table 18.H.9 - WT#10 Controlled (6/16/93)

Table 18.H.10 - Detailed Sample Analyses (WT#3-WT#9)

Table 18.H.1
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 5/27/93

Tests: Uncontrolled WT#1

<u>Time</u>	<u>Sample No.</u>	<u>Solids</u>	<u>F.B.</u>	<u>A.B.</u>	<u>Diluted</u>	<u>Undiluted Feed</u>		<u>Diluted Concentrate</u>			<u>Tailings</u>		
		<u>Feed</u>	<u>Yield</u>	<u>Yield</u>	<u>Feed</u>	<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>
		<u>(#/hr.)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
8:40 AM	1	247	---	66.01	6.1	23.99	27.84	NA	5.37	10.54	NA	2.08	61.40
9:20 AM	3	284	71.01	71.25	6.1	23.86	26.11	5.8	6.82	11.49	6.7	2.41	61.10
10:00 AM	5	287	73.81	70.78	6.1	24.64	25.35	5.4	6.80	9.23	7.2	1.81	64.30
10:40 AM	7	210	74.54	74.86	6.1	23.99	23.55	5.0	6.14	10.47	7.6	1.38	62.49
11:20 AM	9	293	74.96	66.99	6.1	24.54	22.41	6.1	6.50	8.94	6.4	2.07	49.79
12:00 PM	11	296	76.98	72.37	6.1	24.71	20.22	6.0	6.63	8.87	6.5	1.83	49.95
12:40 PM	13	249	74.63	72.93	6.1	24.54	20.53	5.7	6.41	8.58	6.9	1.80	52.73
1:20 PM	15	224	74.55	72.95	6.1	24.92	23.92	5.1	6.03	9.24	7.5	1.40	63.51
2:00 PM	17	225	72.60	70.09	6.1	24.61	25.61	5.1	6.00	9.55	7.5	1.54	63.25

Table 18.H.1 (cont.)
WT#1 SUMMARY ACTUAL VS. PREDICTED

<u>Time</u>	<u>Product Ash</u>		<u>Product Solids</u>		<u>Tails Ash</u>		<u>Tails Solids</u>	
	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>
8:40 AM	10.54	13.44	5.37	6.58	61.44	80.55	2.08	1.50
9:20 AM	11.99	14.21	6.82	6.71	61.10	82.97	2.41	1.38
10:00 AM	9.23	14.66	6.80	6.51	64.39	81.39	1.81	1.27
10:40 AM	10.47	13.35	6.14	6.82	62.49	80.26	1.38	1.43
11:20 AM	8.94	14.10	6.50	7.01	49.74	83.22	2.07	1.38
12:00 PM	8.87	14.86	6.63	7.10	49.95	78.77	1.83	1.24
12:40 PM	8.58	14.81	6.41	7.04	52.73	84.97	1.80	1.91
1:20 PM	9.24	13.48	6.03	7.14	63.51	80.03	1.40	1.40
2:00 PM	9.55	14.53	6.00	6.52	63.25	86.75	1.54	1.08

Table 18.H.1 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 5/27/93

Test: Uncontrolled WT#1

Feed Rate: 6.1 GPM

Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM

Spray Bar: 12 Inches

Sump Level: 30%

<u>Time</u>	<u>Sample</u>	<u>Mode</u>	MIBC Target (#/T)	F.O. Target (#/T)	Air Rate Target (CFM)	Froth Ht. Target (In)	<u>Concentrate</u>		<u>Tailings</u>		F.B. Yield (Wt%)
							<u>Solids</u> (Wt%)	<u>Ash</u> (Wt%)	<u>Solids</u> (Wt%)	<u>Ash</u> (Wt%)	
8:20 AM	0	Uncontrolled	1.0	2.0	2.0	24	6.52	14.42	1.52	83.85	—
8:40 AM	1	Uncontrolled	1.0	2.0	2.0	24	6.58	13.44	1.50	80.55	—
9:00 AM	2	Uncontrolled	1.0	2.0	2.0	24	6.60	15.10	—	—	—
9:20 AM	3	Uncontrolled	1.0	2.0	2.0	24	6.79	14.21	1.38	82.97	81.12
9:40 AM	4	Uncontrolled	1.0	2.0	2.0	24	6.76	14.15	1.43	83.31	80.50
10:00 AM	5	Uncontrolled	1.0	2.0	2.0	24	6.51	14.66	1.27	81.39	79.22
10:20 AM	6	Uncontrolled	1.0	2.0	2.0	24	7.01	12.79	1.33	81.89	73.05
10:40 AM	7	Uncontrolled	1.0	2.0	2.0	24	6.82	13.35	1.43	80.26	75.60
11:00 AM	8	Uncontrolled	1.0	2.0	2.0	24	6.83	12.94	1.36	83.77	79.92
11:20 AM	9	Uncontrolled	1.0	2.0	2.0	24	7.01	14.10	1.38	83.22	82.80
11:40 AM	10	Uncontrolled	1.0	2.0	2.0	24	6.83	13.46	1.36	80.86	84.10
12:00 PM	11	Uncontrolled	1.0	2.0	2.0	24	7.10	14.86	1.24	78.77	84.20
12:20 PM	12	Uncontrolled	1.0	2.0	2.0	24	6.83	14.14	1.20	80.88	82.10
12:40 PM	13	Uncontrolled	1.0	2.0	2.0	24	7.04	14.81	1.91	84.97	75.30
1:00 PM	14	Uncontrolled	1.0	2.0	2.0	24	6.84	14.86	1.27	77.85	79.90
1:20 PM	15	Uncontrolled	1.0	2.0	2.0	24	7.14	13.48	1.40	80.03	77.60
1:40 PM	16	Uncontrolled	1.0	2.0	2.0	24	6.81	14.12	1.20	83.60	79.60
2:00 PM	17	Uncontrolled	1.0	2.0	2.0	24	6.52	14.53	1.08	86.75	80.50

Table 18.H.1 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 5/27/93

Test: Uncontrolled Wt#1

<u>Time</u>	<u>Sample</u>	<u>MIBC Dose</u>		<u>F.O. Dose</u>		<u>Air Rate</u> (CFM)	<u>Froth Height</u> (In.)	<u>Froth</u> <u>Wash Water</u>	<u>Launder</u> <u>Water</u>
		<u>(g/min.)</u>	<u>(#/T)</u>	<u>(g/min.)</u>	<u>(#/T)</u>			<u>(GPM)</u>	<u>(GPM)</u>
8:25 AM	1	0.914	0.96	1.850	1.96	2.05	23.0	3.6	3.0
8:45 AM	2	0.944	1.00	1.867	1.97	2.05	23.0	3.7	3.2
9:05 AM	3	0.930	0.98	1.892	2.00	2.05	23.0	3.7	3.0
9:25 AM	4	0.932	0.99	1.867	1.97	2.05	23.0	3.6	3.2
9:45 AM	5	0.928	0.98	1.880	1.99	2.05	24.0	3.6	3.1
10:05 AM	6	0.936	0.99	1.880	1.99	2.05	24.0	3.5	3.1
10:25 AM	7	0.946	1.00	1.880	1.99	2.05	24.0	3.6	3.1
10:45 AM	8	0.932	0.99	1.880	1.99	2.05	24.0	3.7	3.0
11:05 AM	9	0.948	1.00	1.880	1.99	2.05	24.0	3.7	3.1
11:25 AM	10	0.920	0.97	1.896	2.00	2.05	25.0	3.6	3.0
11:45 AM	11	0.926	0.98	1.892	2.00	2.05	24.5	3.7	3.1
12:05 PM	12	0.916	0.97	1.874	1.98	2.05	24.5	3.5	3.1
12:25 PM	13	0.924	0.98	1.884	1.99	2.05	24.5	3.8	3.1
12:45 PM	14	0.945	1.00	1.910	2.02	2.05	25.5	3.5	3.0
1:05 PM	15	0.928	0.98	1.880	1.99	2.05	23.0	3.7	3.2
1:25 PM	16	0.930	0.98	1.900	2.01	2.05	23.5	3.6	3.1
1:45 PM	17	0.926	0.98	1.900	2.01	2.05	23.5	3.5	3.1
2:05 PM	18	0.960	1.01	1.880	1.99	2.05	23.5	3.6	3.0

Table 18.H.2
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 5/28/93

Tests: Controlled WT#2

<u>Time</u>	<u>Sample No.</u>	<u>Solids</u>	<u>F.B.</u>	<u>A.B.</u>	<u>Feed Flow</u>	<u>Undiluted Feed</u>		<u>Diluted Concentrate</u>			<u>Tailings</u>		
		<u>Feed</u>	<u>Yield</u>	<u>Yield</u>		<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>	<u>Flow</u>	<u>Solids</u>	<u>Ash</u>
		<u>(#/hr.)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(GPM)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
10:20 AM	1	244	73.99	70.18	6.1	23.77	24.58	5.2	6.75	8.32	7.3	1.69	62.85
11:00 AM	3	238	77.50	76.50	6.1	23.34	21.48	5.2	6.96	7.91	7.4	1.42	65.66
11:40 AM	5	270	77.62	75.42	6.1	23.61	21.86	5.6	7.11	8.58	7.0	1.64	62.61
12:20 PM	7	226	76.59	78.22	6.1	24.33	20.34	4.8	6.56	7.98	7.7	1.25	64.73
1:00 PM	9	210	80.36	79.67	6.1	23.33	20.24	5.3	6.67	9.06	7.2	1.20	64.04
1:40 PM	11	286	73.95	77.28	6.1	23.57	21.41	5.4	6.70	9.37	7.2	1.77	62.37
2:20 PM	13	215	81.18	80.75	6.1	23.36	18.57	5.5	6.18	9.40	7.1	1.11	57.03
3:00 PM	15	252	77.37	73.26	6.1	23.69	20.95	5.8	6.73	9.14	6.6	1.73	53.00
3:40 PM	17	269	71.68	71.50	6.1	22.99	22.68	5.8	6.41	9.02	6.8	2.16	56.95

Table 18.H.2 (cont.)
WT#2 SUMMARY ACTUAL VS. PREDICTED

<u>Time</u>	<u>Concentrate Ash</u>		<u>Concentrate Solids</u>		<u>Tails Ash</u>		<u>Tails Solids</u>		<u>F.B. Yields</u>	
	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>	<u>Actual</u>	<u>Predicted</u>
10:20 AM	8.32	9.12	6.75	4.24	62.85	59.71	1.69	2.42	73.99	55.00
11:00 AM	7.91	9.65	6.96	4.32	65.66	57.53	1.42	2.29	77.50	57.10
11:40 AM	8.58	9.09	7.11	4.51	62.61	61.49	1.64	2.22	77.62	61.80
12:20 PM	7.98	10.46	6.56	4.66	64.73	55.68	1.25	2.26	76.59	56.50
1:00 PM	9.06	9.74	6.67	5.33	64.04	59.38	1.20	2.15	80.36	64.60
1:40 PM	9.37	8.85	6.70	5.29	62.37	56.56	1.77	2.50	73.95	61.30
2:20 PM	9.40	9.52	6.18	4.74	57.03	64.10	1.11	1.82	81.18	66.80
3:00 PM	9.14	10.03	6.73	5.16	53.30	58.54	1.73	2.16	77.37	67.70
3:40 PM	9.02	10.03	6.41	5.19	56.95	54.04	2.16	2.30	71.68	65.40

Table 18.H.2 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 5/28/93
Test: Controlled WT#2

Feed Rate: 250 #/Hr.
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

<u>Time</u>	<u>Sample</u>	<u>Mode</u>	MIBC	F.O.	Air Rate	Froth Ht.	<u>Concentrate</u>		<u>Tailings</u>		F.B.
			Target	Target	Target	Target	Solids	Ash	Solids	Ash	Yield
			<u>(#/T)</u>	<u>(#/T)</u>	<u>(CFM)</u>	<u>(In)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
9:40 AM	-1	Auto	1.00	2.00	2.00	24	4.98	9.60	2.47	59.66	62.83
10:00 AM	0	Auto	1.00	2.00	2.00	24	4.33	8.90	2.49	53.61	58.00
10:20 AM	1	Auto	1.16	2.33	2.00	24	4.24	9.12	2.42	59.71	55.60
10:40 AM	2	Auto	1.15	2.29	2.00	24	4.60	8.97	2.04	63.92	61.90
11:00 AM	3	Auto	1.22	2.44	2.00	24	4.32	9.65	2.29	57.53	57.10
11:20 AM	4	Auto	1.19	2.38	2.00	24	4.89	9.76	2.36	55.92	60.60
11:40 AM	5	Auto	1.29	2.59	2.00	24	4.51	9.09	2.22	61.49	61.80
12:00 PM	6	Auto	1.30	2.60	2.00	24	4.62	8.93	2.22	55.78	58.90
12:20 PM	7	Auto	1.30	2.60	2.09	24	4.66	10.46	2.26	55.68	56.50
12:40 PM	8	Auto	1.30	2.60	2.11	24	4.91	10.20	2.18	60.08	59.90
1:00 PM	9	Auto	1.30	2.60	2.12	24	5.33	9.74	2.15	59.38	64.60
1:20 PM	10	Auto	1.30	2.60	2.20	24	5.54	9.51	2.30	54.18	67.30
1:40 PM	11	Auto	1.30	2.60	2.30	24	5.29	8.85	2.50	56.56	61.30
2:00 PM	12	Auto	1.30	2.60	2.30	21.68	4.82	8.47	2.14	57.71	63.10
2:20 PM	13	Auto	1.00	2.00	2.00	24	4.74	9.52	1.82	64.10	66.90
2:40 PM	14	Auto	1.00	2.00	2.00	24	5.55	9.54	2.40	56.74	62.50
3:00 PM	15	Auto	1.00	2.00	2.00	24	5.16	10.03	2.16	58.54	67.70
3:20 PM	16	Auto	1.03	2.05	2.00	24	5.07	8.93	2.56	57.53	61.50
3:40 PM	17	Auto	0.93	1.87	2.00	24	5.19	10.03	2.30	54.04	65.40
4:00 PM	18	Auto	0.93	1.86	2.00	24	5.39	9.22	2.92	46.49	59.20

Table 18.H.2 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 5/28/93

Test: Controlled Wt#2

Time	Sample	MIBC Dose		F.O. Dose		Air Rate (CFM)	Froth Height (In.)	Froth	Launder
		(g/min.)	(#/T)	(g/min.)	(#/T)			Wash Water (GPM)	Water (GPM)
9:45 AM	-1	0.90	0.95	1.90	2.00	2.05	23.0	3.5	3.3
10:05 AM	0	0.90	0.95	1.90	2.00	2.05	22.0	3.7	3.1
10:25 AM	1	0.92	0.97	1.89	2.00	2.05	24.0	3.7	3.1
10:45 AM	2	1.08	1.14	2.19	2.32	2.05	24.0	3.6	3.1
11:05 AM	3	1.06	1.12	2.20	2.33	2.05	23.5	3.6	3.1
11:25 AM	4	1.13	1.18	2.37	2.51	2.05	25.0	3.7	3.1
11:45 AM	5	1.12	1.18	2.26	2.39	2.05	24.0	3.7	3.1
12:05 PM	6	1.21	1.28	2.47	2.61	2.05	24.5	3.6	3.2
12:25 PM	7	1.22	1.29	2.46	2.60	2.05	24.5	3.7	3.1
12:45 PM	8	1.23	1.30	2.52	2.66	2.15	24.0	3.6	2.8
1:05 PM	9	1.22	1.29	2.52	2.66	2.20	23.5	3.6	3.1
1:25 PM	10	1.23	1.30	2.52	2.66	2.20	24.0	3.7	3.1
1:45 PM	11	1.22	1.29	2.46	2.60	2.30	25.0	3.6	3.0
2:05 PM	12	1.20	1.27	2.46	2.60	2.40	24.0	3.7	3.1
2:25 PM	13	1.20	1.27	2.46	2.60	2.40	21.0	3.5	3.0
2:45 PM	14	0.92	0.97	1.89	2.00	2.05	22.0	3.6	3.1
3:05 PM	15	0.90	0.95	1.89	2.00	2.05	25.5	3.6	3.1
3:25 PM	16	0.91	0.96	1.92	2.03	2.05	25.0	3.7	3.1
3:45 PM	17	0.93	0.98	1.95	2.06	2.05	25.0	3.6	3.0
4:05 PM	18	0.86	0.91	1.71	1.81	2.05	24.5	3.6	3.1

Table 18.H.3
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/01/93

Tests: Uncontrolled WT#3

Time	Sample No.	Solids Feed	F.B. Yield	A.B. Yield	Feed Flow	Undiluted Feed		Diluted Concentrate			Tailings		
		(#/hr.)	(Wt%)	(Wt%)	(GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
8:40 AM	1	240	64.59	65.64	6.1	27.15	24.22	5.2	5.53	8.82	7.3	2.16	53.61
9:20 AM	3	266	67.28	67.73	6.1	23.52	27.00	5.6	6.31	10.10	6.9	2.49	62.47
10:00 AM	5	300	70.43	72.26	6.1	24.06	25.68	5.0	6.66	9.18	7.6	1.84	68.66
10:40 AM	7	210	77.47	75.58	6.1	23.30	22.86	5.6	5.89	8.74	6.9	1.39	66.56
11:20 AM	9	228	76.16	70.77	6.1	23.74	22.96	5.9	6.04	9.17	6.6	1.69	56.35
12:00 PM	11	235	74.76	72.39	6.1	23.43	21.31	6.0	5.84	9.35	6.5	1.82	52.67
12:40 PM	13	244	75.92	75.32	6.1	24.27	21.09	6.2	6.15	9.49	6.3	1.92	56.50
1:20 PM	15	284	71.66	69.53	6.1	24.50	24.21	6.2	6.50	9.51	6.4	2.49	57.75
2:00 PM	17	291	69.39	68.02	6.1	25.20	27.94	5.2	6.65	9.79	7.3	2.09	66.54
2:40 PM	19	219	74.53	70.33	6.1	24.59	25.95	5.2	6.12	9.66	7.4	1.47	64.57
3:20 PM	21	257	74.94	72.33	6.1	24.81	22.17	6.1	6.15	10.04	6.5	1.93	53.88
4:00 PM	23	266	75.55	73.07	6.1	25.05	21.10	6.1	5.90	10.10	6.4	1.82	50.94
4:40 PM	25	213	75.54	75.62	6.1	24.31	21.88	5.4	5.93	9.85	7.2	1.44	59.21
5:20 PM	27	290	70.77	69.13	6.1	24.19	25.59	6.2	6.52	10.32	6.3	2.65	59.73
6:00 PM	29	314	64.51	64.33	6.1	25.19	30.70	6.0	6.36	11.17	6.5	3.23	65.92

Table 18.H.3 (cont.)
WT#3 SUMMARY ACTUAL VS. PREDICTED

Time	Concentrate Ash			Concentrate Solids		Tails Ash		Tails Solids		F.B. Yields	
	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Actual	Predicted	Actual	Predicted
8:40 AM	8.82	8.44	9.65	5.53	6.83	53.64	66.23	2.16	1.34	64.59	78.26
9:20 AM	10.10	7.78	9.57	6.31	7.10	62.47	63.19	2.49	1.85	67.28	75.94
10:00 AM	9.18	8.43	9.83	6.66	6.69	68.66	61.73	1.84	1.71	70.43	72.09
10:40 AM	8.74	7.85	9.43	5.89	6.88	66.56	67.39	1.39	1.22	77.47	82.08
11:20 AM	9.17	8.01	10.07	6.04	7.07	56.35	66.56	1.69	1.25	76.16	83.46
12:00 PM	9.35	8.41	9.58	5.84	7.21	52.67	60.20	1.82	1.62	74.76	80.44
12:40 PM	9.49	9.01	9.90	6.15	7.16	56.50	64.54	1.92	1.48	75.92	82.79
1:20 PM	9.51	8.41	9.22	6.50	7.22	57.75	68.46	2.49	1.54	71.66	81.94
2:00 PM	9.79	8.16	9.63	6.65	7.09	66.54	62.68	2.07	1.70	69.39	74.63
2:40 PM	9.66	8.32	9.05	6.12	6.73	64.57	58.50	1.47	1.70	74.53	73.88
3:20 PM	10.04	8.77	9.56	6.15	7.19	53.88	56.93	1.93	1.93	74.94	78.00
4:00 PM	10.10	9.01	10.07	5.90	7.32	50.94	63.56	1.82	1.31	75.55	84.11
4:40 PM	9.85	8.27	9.46	5.93	6.94	59.20	65.92	1.44	1.38	75.54	79.23
5:20 PM	10.32	8.57	9.72	6.52	7.12	59.78	68.28	2.65	1.66	70.77	80.82
6:00 PM	11.17	7.65	9.94	6.36	7.19	65.92	61.31	3.23	2.61	64.51	71.65

* Predicted values using density as an independent variable.

Table 18.H.3 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/01/93

Test: Uncontrolled WT#3

Feed Rate: 6.1 GPM

Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM

Spray Bar: 12 Inches

Sump Level: 30%

Time	Sample	Mode	MIBC	F.O.	Air Rate	Froth Ht.	Concentrate		Tailings		F.B.
			Target (#/T)	Target (#/T)	Target (CFM)	Target (In)	Solids (Wt%)	Ash (Wt%)	Solids (Wt%)	Ash (Wt%)	Yield (Wt%)
8:40 AM	1	Manual	1.0	2.0	2.0	24	6.83	8.44	1.34	66.23	78.26
9:00 AM	2	Manual	1.0	2.0	2.0	24	6.89	7.75	1.70	66.35	76.00
9:20 AM	3	Manual	1.0	2.0	2.0	24	7.10	7.78	1.85	63.99	75.90
9:40 AM	4	Manual	1.0	2.0	2.0	24	7.08	8.09	1.95	61.60	75.30
10:00 AM	5	Manual	1.0	2.0	2.0	24	6.69	8.43	1.71	61.73	72.09
10:20 AM	6	Manual	1.0	2.0	2.0	24	6.95	7.86	1.07	70.74	82.56
10:40 AM	7	Manual	1.0	2.0	2.0	24	6.88	7.85	1.22	67.39	82.08
11:00 AM	8	Manual	1.0	2.0	2.0	24	6.99	7.94	1.52	62.60	77.01
11:20 AM	9	Manual	1.0	2.0	2.0	24	7.07	8.01	1.25	66.56	83.46
11:40 AM	10	Manual	1.0	2.0	2.0	24	7.44	8.00	1.61	62.55	81.50
12:00 PM	11	Manual	1.0	2.0	2.0	24	7.21	8.41	1.62	60.20	80.40
12:20 PM	12	Manual	1.0	2.0	2.0	24	7.13	8.57	1.26	67.58	84.88
12:40 PM	13	Manual	1.0	2.0	2.0	24	7.16	9.01	1.48	64.54	82.70
1:00 PM	14	Manual	1.0	2.0	2.0	24	7.27	8.79	1.69	63.21	79.70
1:20 PM	15	Manual	1.0	2.0	2.0	24	7.22	8.41	1.54	68.46	81.90
1:40 PM	16	Manual	1.0	2.0	2.0	24	7.06	8.90	1.89	61.80	78.20
2:00 PM	17	Manual	1.0	2.0	2.0	24	7.09	8.16	1.70	62.68	74.60
2:20 PM	18	Manual	1.0	2.0	2.0	24	7.13	7.83	1.27	70.40	78.50
2:40 PM	19	Manual	1.0	2.0	2.0	24	6.73	8.32	1.70	58.50	73.80
3:00 PM	20	Manual	1.0	2.0	2.0	24	6.84	8.74	1.23	66.26	81.75
3:20 PM	21	Manual	1.0	2.0	2.0	24	7.19	8.77	1.93	56.93	78.00
3:40 PM	22	Manual	1.0	2.0	2.0	24	7.26	8.86	1.81	56.10	80.42
4:00 PM	23	Manual	1.0	2.0	2.0	24	7.32	9.01	1.31	63.56	84.11
4:20 PM	24	Manual	1.0	2.0	2.0	24	6.74	8.80	1.38	65.95	80.31
4:40 PM	25	Manual	1.0	2.0	2.0	24	6.94	8.27	1.38	65.92	79.20
5:00 PM	26	Manual	1.0	2.0	2.0	24	7.01	8.37	1.69	63.84	79.00
5:20 PM	27	Manual	1.0	2.0	2.0	24	7.12	8.57	1.66	68.28	—
5:40 PM	28	Manual	1.0	2.0	2.0	24	6.98	9.28	2.26	57.64	75.40
6:00 PM	29	Manual	1.0	2.0	2.0	24	7.19	7.65	2.61	61.31	71.60

Date: 6/01/93

Test: Uncontrolled Wt#3

Time	Sample	MIBC Dose		F.O. Dose		Air Rate (CFM)	Froth Height (In.)	Froth	Laundry
		(g/min.)	(#/T)	(g/min.)	(#/T)			Wash Water (GPM)	Water (GPM)
8:40 AM	1	0.90	0.95	1.85	1.96	2.05	23.0	3.6	3.1
9:00 AM	2	0.92	0.97	1.86	1.97	2.05	25.0	3.6	3.1
9:20 AM	3	0.93	0.98	1.86	1.97	2.05	24.0	3.6	3.1
9:40 AM	4	0.93	0.98	1.89	2.00	2.05	24.0	3.8	3.0
10:00 AM	5	0.95	1.00	1.86	1.97	2.05	23.0	3.5	3.2
10:20 AM	6	0.94	0.99	1.86	1.97	2.05	23.0	3.9	3.0
10:40 AM	7	0.93	0.98	1.87	1.98	2.05	24.0	3.8	3.1
11:00 AM	8	0.93	0.98	1.89	2.00	2.05	24.0	3.5	3.0
11:20 AM	9	0.92	0.97	1.86	1.97	2.05	24.5	3.4	3.2
11:40 AM	10	0.92	0.97	1.86	1.97	2.05	24.0	3.6	3.1
12:00 PM	11	0.91	0.96	1.86	1.97	2.05	25.0	3.5	3.1
12:20 PM	12	0.93	0.98	1.86	1.97	2.05	24.0	3.6	3.0
12:40 PM	13	0.90	0.95	1.83	1.93	2.05	24.0	3.7	2.9
1:00 PM	14	0.91	0.96	1.90	2.01	2.05	24.5	3.6	3.1
1:20 PM	15	0.93	0.98	1.90	2.01	2.05	24.5	3.7	3.1
1:40 PM	16	0.95	1.00	1.89	2.00	2.05	24.0	3.6	3.1
2:00 PM	17	0.93	0.98	1.82	1.92	2.05	24.5	3.5	3.1
2:20 PM	18	0.93	0.98	1.85	1.96	2.05	24.0	3.6	3.1
2:40 PM	19	0.93	0.98	1.86	1.97	2.05	23.5	3.5	3.0
3:00 PM	20	0.93	0.98	1.89	2.00	2.05	24.5	3.6	3.1
3:20 PM	21	0.93	0.98	1.88	1.99	2.05	23.5	3.7	3.2
3:40 PM	22	0.93	0.98	1.83	1.93	2.05	24.0	3.6	3.1
4:00 PM	23	0.91	0.96	1.92	2.03	2.05	24.0	3.6	3.1
4:20 PM	24	0.92	0.97	1.87	1.98	2.05	24.5	3.7	3.1
4:40 PM	25	0.94	0.99	1.84	1.95	2.05	24.0	3.6	3.1
5:00 PM	26	0.92	0.97	1.86	1.97	2.05	24.0	3.6	3.1
5:20 PM	27	0.94	0.99	1.86	1.97	2.05	24.0	3.7	3.2
5:40 PM	28	0.95	1.00	1.87	1.98	2.05	25.5	3.6	3.1
6:00 PM	29	0.92	0.97	1.87	1.98	2.05	24.5	3.6	3.1

Table 18.H.4
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/04/93

Tests: Controlled WT#4

Time	Sample No.	Solids Feed (#/hr.)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Feed Flow (GPM)	Undiluted Feed		Diluted Concentrate			Tailings		
						Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
9:00 AM	1	237	67.64	68.55	6.1	23.99	26.46	5.3	6.19	10.71	7.2	2.18	60.70
9:20 AM	2	256	66.57	65.26	6.1	23.63	25.96	5.5	6.35	10.08	7.1	2.47	55.70
9:40 AM	3	277	66.24	65.48	6.1	23.90	25.17	5.3	6.45	9.20	7.2	2.42	55.40
10:00 AM	4	266	69.16	70.60	6.1	23.82	24.00	4.8	6.67	8.52	7.8	1.83	61.17
10:20 AM	5	208	70.11	71.92	6.1	23.67	23.20	4.4	6.26	7.87	8.1	1.45	62.46
10:40 AM	6	193	72.03	71.36	6.1	23.81	22.78	4.8	6.11	8.03	7.8	1.46	59.50
11:00 AM	7	209	68.66	67.61	6.1	24.43	24.89	4.8	5.87	8.45	7.7	1.67	59.20
11:20 AM	8	297	61.03	56.66	6.1	25.10	27.71	5.2	6.31	8.67	7.3	2.87	52.60
11:40 AM	9	284	68.45	64.61	6.1	24.21	24.76	5.8	6.54	8.89	6.7	2.61	55.73
12:00 PM	10	---	71.47	68.43	6.1	23.94	25.23	5.3	6.59	9.85	7.3	1.91	53.57
12:20 PM	11	245	73.03	74.83	6.1	23.97	22.57	5.0	6.54	9.84	7.5	1.61	60.41
12:40 PM	12	246	76.22	75.86	6.1	24.28	22.74	5.2	6.84	9.82	7.3	1.52	63.35
1:00 PM	13	248	76.45	76.68	6.1	23.68	22.69	4.9	6.53	9.46	7.7	1.28	66.20
1:20 PM	14	211	76.07	76.27	6.1	23.74	22.87	5.0	6.33	9.46	7.6	1.31	65.98
1:40 PM	15	208	75.42	77.75	6.1	23.53	22.93	4.9	6.14	9.96	7.6	1.29	68.25
2:00 PM	16	215	75.02	74.29	6.1	23.81	24.35	5.0	5.99	9.74	7.5	1.33	66.57

Table 18.H.4 (cont.)
WT#4 SUMMARY ACTUAL VS. PREDICTED

Time	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
9:00 AM	10.71	10.57	9.41	6.19	5.80	60.79	54.91	55.76	2.18	0.67	67.64	86.41
9:20 AM	10.80	10.66	9.06	6.35	5.66	55.79	49.41	56.19	2.47	1.75	66.57	71.24
9:40 AM	9.20	10.76	9.33	6.45	5.71	55.46	48.04	56.89	2.42	1.69	66.24	71.36
10:00 AM	8.52	11.63	9.18	6.67	5.36	61.17	43.03	61.07	1.83	1.20	69.16	73.27
10:20 AM	7.87	10.82	9.24	6.26	5.66	62.46	40.73	63.52	1.45	0.91	70.11	77.27
10:40 AM	8.03	10.77	9.06	6.11	5.62	59.53	44.14	62.48	1.46	0.97	72.03	77.83
11:00 AM	8.45	10.81	9.08	5.87	5.61	59.21	47.28	61.55	1.67	1.04	68.66	77.05
11:20 AM	8.67	11.39	9.08	6.31	5.41	52.60	45.48	57.22	2.87	1.76	61.03	69.61
11:40 AM	8.89	9.51	9.36	6.54	5.46	53.73	41.92	59.03	2.61	1.53	68.45	75.76
12:00 PM	9.85	9.11	9.23	6.59	5.55	53.57	43.55	61.03	1.91	1.20	71.47	77.23
12:20 PM	9.84	8.77	9.44	6.54	5.74	60.41	41.92	62.21	1.61	0.97	73.03	79.90
12:40 PM	9.82	8.63	9.56	6.84	5.83	63.35	46.54	60.97	1.52	1.13	76.22	78.50
1:00 PM	9.46	8.93	9.09	6.53	5.57	66.20	43.90	63.75	1.28	0.83	76.45	80.98
1:20 PM	9.46	8.95	9.36	6.33	5.65	65.98	49.47	60.47	1.31	1.11	76.07	77.10
1:40 PM	9.96	8.48	9.66	6.14	5.91	68.25	44.34	62.90	1.29	0.91	75.42	80.81
2:00 PM	9.74	8.74	9.24	5.99	5.69	66.57	38.68	68.62	1.33	0.22	75.02	94.44

* Predicted values using density as an independent variable.

Table 18.H.4 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/04/93
Test: Controlled WT#4

Feed Rate: 6.1 GPM
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

Time	Sample	Mode	MIBC Target (#/T)	F.O. Target (#/T)	Air Rate Target (CFM)	Froth Ht. Target (In)	Concentrate		Tailings		F.B. Yield (Wt%)
							Solids (Wt%)	Ash (Wt%)	Solids (Wt%)	Ash (Wt%)	
8:20 AM	-1	Controlled	1.00	2.00	2.00	24	5.28	11.65	0.30	46.21	91.90
8:40 AM	0	Controlled	1.00	2.00	2.00	24	5.95	10.51	0.40	49.75	90.85
9:00 AM	1	Controlled	0.83	1.66	2.00	24	5.80	10.57	0.67	54.91	86.41
9:20 AM	2	Controlled	0.73	1.46	2.00	24	5.66	10.66	1.75	49.41	71.24
9:40 AM	3	Controlled	0.70	1.40	2.00	24	5.71	10.76	1.69	48.04	71.36
10:00 AM	4	Controlled	0.70	1.40	1.83	24	5.36	11.63	1.20	43.03	73.27
10:20 AM	5	Controlled	0.70	1.40	1.73	24	5.66	10.82	0.91	40.73	77.27
10:40 AM	6	Controlled	0.70	1.40	1.70	24	5.62	10.77	0.97	44.14	77.83
11:00 AM	7	Controlled	0.70	1.40	1.70	25	5.61	10.81	1.04	47.28	77.05
11:20 AM	8	Controlled	0.70	1.40	1.70	26.82	5.41	11.39	1.70	45.48	69.61
11:40 AM	9	Controlled	1.00	2.00	2.00	24	5.46	9.51	1.53	41.92	75.76
12:00 PM	10	Controlled	1.20	2.00	2.00	24	5.55	9.11	1.20	43.55	77.23
12:20 PM	11	Controlled	1.17	2.34	2.00	24	5.74	8.77	0.97	41.92	79.90
12:40 PM	12	Controlled	1.29	2.59	2.00	24	5.83	8.63	1.13	46.54	78.50
1:00 PM	13	Controlled	1.30	2.60	2.00	24	5.57	8.93	0.83	43.90	80.98
1:20 PM	14	Controlled	1.30	2.60	2.10	24	5.65	8.95	1.11	49.47	77.10
1:40 PM	15	Controlled	1.30	2.60	2.22	24	5.91	8.48	0.91	44.34	80.81
2:00 PM	16	Controlled	1.30	2.60	2.04	24	5.69	8.74	0.22	38.68	94.44

Table 18.H.4 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/04/93
Test: Controlled Wt#4

<u>Time</u>	<u>Sample</u>	<u>MIBC Dose</u>		<u>F.O. Dose</u>		<u>Air Rate</u> (CFM)	<u>Froth Height</u> (In.)	<u>Froth</u> <u>Wash Water</u>	<u>Launder</u> <u>Water</u>
		<u>(g/min.)</u>	<u>(#/T)</u>	<u>(g/min.)</u>	<u>(#/T)</u>			<u>(GPM)</u>	<u>(GPM)</u>
8:20 AM	-1	0.94	0.99	1.84	1.95	2.05	23.5	3.7	3.1
8:40 AM	0	0.92	0.97	1.84	1.95	2.05	23.0	3.6	3.1
9:00 AM	1	0.92	0.97	1.84	1.95	2.05	23.0	3.6	3.0
9:20 AM	2	0.78	0.83	1.60	1.69	2.05	24.0	3.7	3.2
9:40 AM	3	0.67	0.71	1.35	1.42	2.05	23.5	3.5	3.1
10:00 AM	4	0.64	0.68	1.31	1.38	2.05	24.0	3.6	3.1
10:20 AM	5	0.63	0.67	1.28	1.35	1.85	23.5	3.6	3.0
10:40 AM	6	0.63	0.67	1.31	1.38	1.75	23.5	3.6	3.0
11:00 AM	7	0.65	0.69	1.30	1.37	1.72	24.0	3.4	3.0
11:20 AM	8	0.64	0.68	1.31	1.38	1.72	25.5	3.6	3.0
11:40 AM	9	0.92	0.97	1.87	1.98	2.05	24.0	3.6	3.1
12:00 PM	10	0.92	0.97	1.89	2.00	2.05	23.5	3.7	3.0
12:20 PM	11	0.93	0.98	1.92	2.03	2.05	24.0	3.6	3.1
12:40 PM	12	1.08	1.14	2.22	2.35	2.05	24.5	3.7	3.1
1:00 PM	13	1.17	1.24	2.42	2.56	2.05	24.0	3.6	3.1
1:20 PM	14	1.20	1.27	2.44	2.58	2.05	23.5	3.7	3.1
1:40 PM	15	1.22	1.29	2.42	2.56	2.15	24.0	3.6	3.1
2:00 PM	16	1.19	1.26	2.44	2.58	2.25	24.0	3.7	3.1

Table 18.H.5
MANUAL SAMPLE RESULTS
Pittsburgh No. 8 Control Testing

Date: 6/07/93

Tests: Controlled WT#5

Time	Sample No.	Solids Feed (#/hr.)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Diluted Feed Flow (GPM)	Undiluted Feed		Diluted Concentrate			Tailings		
						Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
10:00 AM	1	293	71.70	71.00	5.9	24.36	24.67	5.6	7.23	8.57	6.8	2.35	64.08
10:40 AM	3	208	75.56	79.79	5.8	23.91	24.55	4.6	6.52	9.01	7.7	1.26	70.65
11:20 AM	5	213	75.83	75.27	5.7	24.19	23.80	5.0	6.46	9.08	7.2	1.43	68.60
12:00 PM	7	238	77.04	78.75	5.4	23.45	20.99	5.4	6.14	9.53	6.5	1.52	63.41
12:40 PM	9	247	77.40	77.81	5.2	23.54	21.47	5.7	6.38	9.64	6.0	1.77	62.95
1:20 PM	11	262	74.23	74.81	6.1	24.21	24.78	6.1	6.63	10.61	6.5	2.16	66.87
2:00 PM	13	298	62.51	62.78	6.1	24.31	29.05	5.4	6.78	11.97	7.2	3.05	57.86

Table 18.H.5 (cont.)
WT#5 SUMMARY ACTUAL VS. PREDICTED

Time	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
10:00 AM	8.57	8.13	8.97	7.23	6.53	64.08	50.90	60.06	2.35	2.74	71.70	66.34
10:40 AM	9.01	8.96	9.29	6.52	6.58	70.65	60.10	68.23	1.26	1.75	75.56	69.24
11:20 AM	9.08	7.41	8.52	6.46	6.32	68.60	57.71	63.49	1.43	2.07	75.83	67.85
12:00 PM	9.53	7.87	8.71	6.14	6.32	63.41	58.40	64.22	1.52	1.95	77.04	72.95
12:40 PM	9.64	10.11	10.08	6.38	7.02	62.95	58.12	61.59	1.77	1.98	77.40	72.18
1:20 PM	10.61	8.48	8.96	6.63	6.38	66.87	66.32	65.31	2.16	1.06	74.23	84.86
2:00 PM	11.97	9.40	9.49	6.78	6.64	57.86	---	63.75	3.05	---	62.51	---

* Predicted values using density as an independent variable.

Table 18.H.5 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/07/93

Test: Controlled WT#5

Feed Rate: 6.1 GPM

Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM

Spray Bar: 12 Inches

Sump Level: 30%

<u>Time</u>	<u>Sample</u>	<u>Mode</u>	MIBC	F.O.	Air Rate	Froth Ht.	<u>Concentrate</u>		<u>Tailings</u>		F.B.
			Target	Target	Target	Target	Solids	Ash	Solids	Ash	Yield
			<u>(#/T)</u>	<u>(#/T)</u>	<u>(CFM)</u>	<u>(In)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
9:20 AM	-1	Auto	1.00	2.00	2.00	24	6.73	9.58	2.04	57.95	70.54
9:40 AM	0	Auto	---	---	---	24	6.36	8.08	2.46	54.42	69.75
10:00 AM	1	Auto	1.17	2.34	2.00	24	6.53	8.13	2.74	50.90	66.34
10:20 AM	2	Auto	1.28	2.55	2.00	24	6.64	8.44	1.97	58.71	69.47
10:40 AM	3	Auto	1.30	2.60	2.00	24	6.58	8.96	1.75	60.10	69.24
11:00 AM	4	Auto	1.30	2.60	2.10	24	6.55	8.47	1.56	62.04	72.43
11:20 AM	5	Auto	1.30	2.60	2.27	24	6.32	7.91	2.07	57.71	67.85
11:40 AM	6	Auto	1.30	2.60	2.30	24	6.26	7.58	2.03	58.05	71.69
12:00 PM	7	Auto	1.30	2.60	2.30	23	6.32	7.87	1.95	58.40	72.95
12:20 PM	8	Auto	1.30	2.60	2.30	22	6.70	7.83	1.96	58.98	76.55
12:40 PM	9	Auto	1.30	2.60	2.30	22	7.02	10.11	1.98	58.12	77.18
1:00 PM	10	Auto	1.30	2.60	2.30	21.25	6.63	8.83	2.01	57.88	76.31
1:20 PM	11	Auto	1.30	2.60	2.30	19.67	6.38	8.48	1.06	66.32	84.86
1:40 PM	12	Auto	1.30	2.60	2.30	18	6.45	8.42	2.27	56.33	71.43
2:00 PM	13	Auto	1.30	2.60	2.30	18	6.64	9.40	-114.13	880.23	-4.55
2:20 PM	14	Auto	1.30	2.60	2.30	18	6.58	8.62	-114.20	880.32	-3.16

Table 18.H.5 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/07/93

Test: Controlled Wt#5

Time	Sample	MIBC Dose		F.O. Dose		Air Rate (CFM)	Froth Height (In.)	Froth Wash Water (GPM)	Launder Water (GPM)	Weighted Averages	
		(g/min.)	(#/T)	(g/min.)	(#/T)					Ash	Yield
10:00 AM	1	0.91	0.96	1.91	2.02	2.05	23.0	3.7	3.2	8.35	68.18
10:20 AM	2	1.11	1.17	2.24	2.37	2.05	23.5	3.4	3.1	8.28	68.48
10:40 AM	3	1.22	1.29	2.40	2.54	2.05	24.5	3.6	3.1	8.65	68.84
11:00 AM	4	1.20	1.27	2.42	2.56	2.05	24.0	3.6	3.0	8.63	70.87
11:20 AM	5	1.22	1.29	2.46	2.60	2.15	23.5	3.5	3.0	8.03	69.61
11:40 AM	6	1.21	1.28	2.45	2.59	2.30	23.5	3.6	3.1	7.67	70.54
12:00 PM	7	1.22	1.29	2.44	2.58	2.35	23.0	3.7	3.2	7.70	71.60
12:20 PM	8	1.22	1.29	2.47	2.61	2.35	22.5	3.5	3.0	7.80	74.50
12:40 PM	9	1.21	1.28	2.49	2.63	2.35	22.0	3.6	3.1	8.98	76.20
1:00 PM	10	1.21	1.28	2.47	2.61	2.35	21.5	3.6	3.1	9.09	76.60
1:20 PM	11	1.21	1.28	2.49	2.63	2.35	21.0	3.7	3.1	8.87	80.70
1:40 PM	12	1.24	1.31	2.48	2.62	2.35	18.5	3.4	3.0	8.51	76.72
2:00 PM	13	1.19	1.26	2.42	2.56	2.35	18.0	3.6	3.1	8.92	35.60
2:20 PM	14	1.23	1.30	2.46	2.60	2.35	18.0	3.6	3.0	8.85	8.80

Table 18.H.6
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/09/93

Tests: Controlled WT#7

Time	Sample No.	Solids Feed	F.B. Yield	A.B. Yield	Feed Flow	Undiluted Feed		Diluted Concentrate			Tailings		
		(#/hr.)	(Wt%)	(Wt%)	(GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
8:40 AM	1	248	70.46	67.72	6.0	23.34	21.91	5.5	5.89	8.89	7.0	1.94	49.20
9:20 AM	3	296	75.11	75.56	5.9	24.09	21.81	5.9	6.85	8.70	6.5	2.06	62.30
10:00 AM	5	286	79.76	78.31	6.0	23.68	23.74	5.3	7.39	8.00	7.2	1.38	71.30
10:40 AM	7	215	74.17	77.62	6.0	23.83	21.74	4.9	5.70	8.84	7.6	1.28	66.70
11:20 AM	9	248	76.87	70.30	6.0	25.08	22.59	6.0	5.87	9.27	6.5	1.63	54.10
12:00 PM	11	249	77.93	74.08	6.0	24.56	20.77	6.3	6.01	10.49	6.2	1.73	50.15
12:40 PM	13	240	78.24	75.26	6.1	23.93	20.89	6.0	6.21	9.79	6.6	1.52	54.65
1:20 PM	15	286	74.90	75.87	6.0	23.95	21.87	6.1	6.45	9.66	6.4	2.06	60.26
2:00 PM	17	277	71.82	74.53	6.2	24.01	24.49	5.0	6.71	9.64	7.7	1.71	67.95
2:40 PM	19	224	74.85	75.07	6.2	24.00	22.62	4.9	6.30	9.17	7.8	1.33	63.17
3:20 PM	21	231	78.00	75.39	6.1	23.88	21.51	5.5	6.27	9.80	7.1	1.37	57.39
4:00 PM	23	253	77.62	78.04	6.2	23.88	20.47	5.5	6.22	10.29	7.2	1.37	56.64
4:40 PM	25	211	77.81	77.70	6.2	23.53	20.07	5.2	6.02	9.56	7.5	1.19	56.68
5:20 PM	27	254	76.30	76.56	6.1	23.53	22.38	5.8	6.34	9.98	6.8	1.68	62.89
6:00 PM	29	261	75.44	72.10	6.1	23.69	25.09	6.2	6.66	10.18	6.4	2.10	63.63

Table 18.H.6 (cont.)
WT#7 SUMMARY ACTUAL VS. PREDICTED

Time	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
8:40 AM	8.89	7.90	---	5.89	6.78	49.22	58.14	---	1.94	1.93	70.46	73.66
9:20 AM	8.70	9.03	9.01	6.85	7.21	62.34	54.16	55.85	2.06	2.36	75.11	73.52
10:00 AM	8.00	8.85	8.42	7.39	7.04	71.34	57.72	60.96	1.38	1.94	79.76	72.86
10:40 AM	8.84	8.36	8.81	5.70	6.90	66.48	54.22	63.04	1.28	2.19	74.17	67.00
11:20 AM	9.27	8.92	9.29	5.87	7.09	54.12	50.24	57.29	1.63	1.88	76.87	77.69
12:00 PM	10.49	7.41	9.44	6.01	7.23	50.15	60.19	55.46	1.73	1.63	77.93	81.98
12:40 PM	9.79	7.98	9.42	6.21	7.26	54.65	62.57	56.48	1.57	1.46	78.24	81.91
1:20 PM	9.66	7.84	8.97	6.45	7.02	60.26	57.84	54.39	2.06	1.96	74.90	77.21
2:00 PM	9.64	8.18	8.69	6.71	6.75	67.95	52.79	60.06	1.71	2.42	71.82	64.25
2:40 PM	9.17	9.88	9.46	6.30	7.13	63.17	55.80	61.63	1.33	2.03	74.85	68.92
3:20 PM	9.80	7.68	8.96	6.27	7.14	57.39	58.82	60.39	1.37	1.81	78.00	74.97
4:00 PM	10.29	7.48	8.98	6.22	7.04	56.64	59.14	59.96	1.37	1.78	77.62	75.20
4:40 PM	9.56	8.92	9.43	6.02	6.94	56.68	58.49	61.11	1.19	1.79	77.81	72.79
5:20 PM	9.98	8.77	9.23	6.34	6.97	62.89	58.69	56.76	1.68	1.78	76.30	76.93
6:00 PM	10.18	8.79	9.13	6.66	6.92	63.63	57.22	54.15	2.10	2.09	75.44	75.97

* Predicted values using density as an independent variable.

Table 18.H.6 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/09/93
Test: Controlled WT#7

Feed Rate: 6.1 GPM
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

Time	Sample	Mode	MIBC	F.O.	Air Rate	Froth Ht.	Concentrate		Tailings		F.B.
			Target (#/T)	Target (#/T)	Target (CFM)	Target (In)	Solids (Wt%)	Ash (Wt%)	Solids (Wt%)	Ash (Wt%)	Yield (Wt%)
8:00 AM	-1	Auto	1.00	2.00	2.00	24	7.37	7.71	1.25	64.67	81.27
8:20 AM	0	Auto	—	—	—	—	6.96	8.47	2.07	56.46	72.75
8:40 AM	1	Auto	1.17	2.34	2.00	24	6.78	7.90	1.93	58.14	73.60
9:00 AM	2	Auto	1.28	3.56	2.00	24	7.20	7.79	2.71	50.23	70.39
9:20 AM	3	Auto	1.30	2.60	2.00	24	7.21	9.03	2.36	54.16	73.52
9:40 AM	4	Auto	1.30	2.60	2.10	24	6.77	8.19	2.57	52.94	69.38
10:00 AM	5	Auto	1.30	2.60	2.20	24	7.04	8.85	1.94	57.72	72.86
10:20 AM	6	Auto	1.30	2.60	2.30	24	6.78	8.17	1.76	59.49	73.26
10:40 AM	7	Auto	1.30	2.60	2.30	22.95	6.90	8.36	2.19	54.22	67.00
11:00 AM	8	Auto	1.30	2.60	2.30	20.39	6.66	6.78	1.31	62.28	53.39
11:20 AM	9	Auto	1.30	2.60	2.30	19.50	7.09	8.92	1.88	50.24	77.69
11:40 AM	10	Auto	1.30	2.60	2.30	18	6.84	6.62	1.95	57.72	77.67
12:00 PM	11	Auto	1.30	2.60	2.30	18	7.23	7.41	1.63	60.19	81.98
12:20 PM	12	Auto	1.30	2.60	2.30	18	7.39	7.69	1.80	59.20	80.44
12:40 PM	13	Auto	1.30	2.60	2.30	18	7.26	7.98	1.46	62.57	81.91
1:00 PM	14	Auto	1.30	2.60	2.30	18	7.22	8.46	1.94	57.66	76.66
1:20 PM	15	Auto	1.30	2.60	2.30	18	7.02	7.84	1.96	57.84	77.21
1:40 PM	16	Auto	1.30	2.60	2.30	18	7.17	8.18	1.93	57.54	77.40
2:00 PM	17	Auto	1.30	2.60	2.30	18	6.75	8.18	2.42	52.79	64.25
2:20 PM	18	Auto	1.30	2.60	2.30	18	6.85	7.54	1.58	60.54	74.72
2:40 PM	19	Auto	1.30	2.60	2.30	18	7.13	9.88	2.03	55.80	68.97
3:00 PM	20	Auto	1.30	2.60	2.30	18	6.98	7.61	1.89	56.43	72.30
3:20 PM	21	Auto	1.30	2.60	2.30	18	7.14	7.68	1.81	58.82	74.97
3:40 PM	22	Auto	1.30	2.60	2.30	18	6.95	8.05	1.64	59.84	78.43
4:00 PM	23	Auto	1.30	2.60	2.30	18	7.04	7.48	1.78	59.14	75.24
4:20 PM	24	Auto	1.30	2.60	2.30	18	7.06	8.47	1.66	58.96	75.30
4:40 PM	25	Auto	1.30	2.60	2.30	18	6.94	8.92	1.79	58.49	72.79
5:00 PM	26	Auto	1.30	2.60	2.30	18	6.87	8.77	1.17	64.68	83.10
5:20 PM	27	Auto	1.30	2.60	2.30	18	6.97	8.77	1.78	58.69	76.93
5:40 PM	28	Auto	1.30	2.60	2.30	18	6.96	8.69	2.09	56.99	75.40
6:00 PM	29	Auto	1.30	2.60	2.30	18	6.92	8.79	2.09	57.22	75.97

Table 18.H.6 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/09/93

Test: Controlled Wt#7

Time	Sample	MIBC Dose		F.O. Dose		Air Rate (CFM)	Froth Height (In.)	Froth Wash Water (GPM)	Launder Water (GPM)	Weighted Averages	
		(g/min.)	(#/T)	(g/min.)	(#/T)					Ash	Yield
8:00 AM	-1	0.88	0.93	1.83	1.93	—	—	—	—	—	—
8:20 AM	0	0.91	0.96	1.92	2.03	—	—	—	—	—	—
8:40 AM	1	0.91	0.96	1.91	2.02	2.05	24.0	3.7	3.1	8.06	74.63
9:00 AM	2	1.09	1.15	2.22	2.35	2.05	24.0	3.6	3.1	7.94	71.87
9:20 AM	3	1.20	1.27	2.46	2.60	2.05	24.0	3.4	3.0	8.43	72.50
9:40 AM	4	1.19	1.26	2.50	2.64	2.05	25.0	3.6	3.1	8.40	70.93
10:00 AM	5	1.23	1.30	2.50	2.64	2.15	24.5	3.6	3.0	8.66	71.81
10:20 AM	6	1.23	1.30	2.50	2.64	2.25	24.5	3.6	3.1	8.40	72.48
10:40 AM	7	1.25	1.32	2.50	2.64	2.40	24.0	3.7	3.1	8.38	70.06
11:00 AM	8	1.26	1.33	2.51	2.65	2.35	23.0	3.6	3.0	7.54	61.24
11:20 AM	9	1.20	1.27	2.50	2.64	2.35	20.5	3.7	3.1	8.12	67.81
11:40 AM	10	1.21	1.28	2.50	2.64	2.35	19.0	3.6	3.1	7.41	73.60
12:00 PM	11	1.21	1.28	2.44	2.58	2.35	18.5	3.7	3.0	7.40	79.81
12:20 PM	12	1.21	1.28	2.50	2.64	2.35	18.5	3.7	3.1	7.42	80.48
12:40 PM	13	1.23	1.30	2.49	2.63	2.40	18.0	3.7	3.1	7.79	81.43
1:00 PM	14	1.23	1.30	2.44	2.58	2.40	18.5	3.7	3.1	8.17	79.54
1:20 PM	15	1.24	1.31	2.46	2.60	2.35	17.0	3.6	3.1	8.07	78.14
1:40 PM	16	1.19	1.26	2.44	2.58	2.35	17.0	3.6	3.1	8.11	77.38
2:00 PM	17	1.19	1.26	2.50	2.64	2.35	18.5	3.5	3.0	8.12	70.79
2:20 PM	18	1.20	1.27	2.49	2.63	2.40	18.5	3.7	3.2	7.86	71.68
2:40 PM	19	1.20	1.27	2.49	2.63	2.40	17.0	3.7	3.1	8.82	70.08
3:00 PM	20	1.22	1.29	2.50	2.64	2.40	17.0	3.9	3.0	8.36	71.62
3:20 PM	21	1.20	1.27	2.48	2.62	2.40	18.0	3.6	3.1	8.02	73.10
3:40 PM	22	1.22	1.29	2.46	2.60	2.35	18.5	3.7	3.2	7.85	76.22
4:00 PM	23	1.20	1.27	2.46	2.60	2.35	18.5	3.7	3.2	7.70	76.24
4:20 PM	24	1.21	1.28	2.48	2.62	2.35	18.0	3.6	3.2	8.07	75.83
4:40 PM	25	1.21	1.28	2.49	2.63	2.40	17.0	3.5	3.0	8.53	79.00
5:00 PM	26	1.23	1.30	2.48	2.62	2.35	18.0	3.6	3.1	8.77	78.40
5:20 PM	27	1.22	1.29	2.48	2.62	2.35	18.0	3.6	3.1	8.79	78.30
5:40 PM	28	1.23	1.30	2.50	2.64	2.35	18.5	3.6	3.1	8.73	77.20
6:00 PM	29	1.20	1.27	2.50	2.64	2.35	18.0	3.7	3.2	8.76	75.94

Table 18.H.7
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/10/93

Tests: Controlled WT#8

Time	Sample No.	Solids Feed (#/hr.)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Feed Flow (GPM)	Undiluted Feed		Diluted Concentrate			Tailings		
						Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
10:20 AM	1	217	70.56	66.91	6.1	23.07	25.51	5.1	5.92	8.74	7.5	1.68	59.42
11:00 AM	3	256	69.44	69.50	6.1	22.56	25.35	5.4	6.18	9.03	7.2	2.04	62.54
11:40 AM	5	234	70.40	69.17	6.0	22.29	20.82	4.8	6.41	9.24	7.7	1.68	66.26
12:20 PM	7	193	76.74	72.07	6.1	23.23	25.37	5.8	5.30	9.95	6.8	1.37	65.16
1:00 PM	9	247	75.29	70.96	5.9	24.16	23.97	5.5	6.46	8.90	6.9	1.69	60.79
1:40 PM	11	241	73.14	70.02	6.1	23.72	20.55	5.7	6.13	8.18	6.9	1.86	50.72
2:20 PM	13	259	67.10	63.63	6.1	24.73	21.89	5.5	5.74	7.95	7.1	2.18	46.28
3:00 PM	15	264	62.18	62.83	6.0	23.58	22.28	5.4	6.27	8.37	7.1	2.80	45.76
3:40 PM	17	269	65.36	64.07	6.0	23.61	23.64	5.1	6.46	8.77	7.4	2.36	50.16
4:20 PM	19	216	66.66	62.26	6.0	24.05	24.90	4.6	5.46	8.93	7.9	1.59	51.25
5:00 PM	21	236	63.40	58.34	6.0	23.71	24.87	4.8	5.64	9.00	7.7	2.12	47.09
5:40 PM	23	234	64.26	57.93	6.2	23.96	23.51	4.8	5.89	8.64	7.9	1.99	43.99
6:20 PM	25	215	64.14	63.26	6.1	23.35	22.53	5.0	5.03	9.41	7.6	1.85	45.12
7:00 PM	27	262	52.93	51.42	6.1	23.16	24.93	5.2	5.12	8.48	7.4	3.20	42.34
7:40 PM	29	267	49.42	44.63	5.9	23.15	28.93	5.0	4.96	8.41	7.4	3.43	45.41

Table 18.H.7 (cont.)
WT#8 SUMMARY ACTUAL VS. PREDICTED

Time	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
10:20 AM	8.74	8.79	9.11	5.92	7.16	59.42	60.00	57.98	1.63	1.30	90.56	78.72
11:00 AM	9.03	9.91	8.93	6.18	6.43	62.54	69.37	55.56	2.04	1.54	69.44	76.08
11:40 AM	9.24	9.24	8.83	6.41	6.85	66.26	68.30	58.99	1.68	1.52	70.40	74.00
12:20 PM	9.95	8.60	9.35	5.30	7.27	65.16	66.43	60.19	1.37	1.06	76.74	85.50
1:00 PM	8.90	10.66	8.68	6.46	5.90	60.79	73.32	58.55	1.69	1.32	75.29	78.05
1:40 PM	8.18	10.08	9.40	6.13	6.13	50.72	62.16	56.44	1.86	1.27	73.14	79.30
2:20 PM	7.85	11.16	9.79	5.74	5.30	46.28	68.22	52.99	2.18	1.26	67.10	76.49
3:00 PM	8.39	10.54	9.38	6.27	5.85	45.76	68.67	46.59	2.90	1.91	62.18	70.14
3:40 PM	8.77	8.99	8.98	6.46	6.98	50.16	70.90	52.72	2.36	1.39	65.36	77.47
4:20 PM	8.93	10.29	9.85	5.46	5.96	51.25	56.97	56.44	1.54	0.79	66.66	81.44
5:00 PM	9.00	10.70	9.56	5.64	5.75	47.09	72.75	55.84	2.12	1.45	63.40	71.21
5:40 PM	8.64	10.13	9.02	5.89	6.21	43.99	58.83	52.63	1.99	1.10	64.26	77.44
6:20 PM	9.41	9.32	9.61	5.03	6.71	45.12	61.41	55.12	1.85	1.13	64.14	79.52
7:00 PM	8.48	9.67	9.30	5.12	6.60	42.34	65.47	43.69	3.20	1.72	52.93	72.87
7:40 PM	8.41	10.16	9.72	4.96	6.10	45.47	53.07	41.60	3.43	2.00	49.42	67.20

* Predicted values using density as an independent variable.

Table 18.H.7 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/10/93
Test: Controlled WT#8

Feed Rate: 6.1 GPM
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

Time	Sample	Mode	MIBC	F.O.	Air Rate	Froth Ht.	Concentrate		Tailings		F.B.
			Target	Target	Target	Target	Solids	Ash	Solids	Ash	Yield
			(#/T)	(#/T)	(CFM)	(In)	(Wt%)	(Wt%)	(Wt%)	(Wt%)	(Wt%)
9:40 AM	-1	Auto	1.00	2.00	2.00	24	6.26	9.99	1.40	63.59	78.74
10:00 AM	0	Auto	1.00	2.00	2.00	24	6.41	9.93	1.52	60.41	75.98
10:20 AM	1	Auto	1.11	2.22	2.00	24	7.16	8.79	1.30	60.00	78.72
10:40 AM	2	Auto	1.03	2.07	2.00	24	6.20	10.18	1.58	73.08	74.79
11:00 AM	3	Auto	0.96	1.91	2.00	24	6.43	9.91	1.54	69.37	76.08
11:20 AM	4	Auto	1.02	2.05	2.00	24	6.93	8.97	1.63	67.27	75.97
11:40 AM	5	Auto	1.10	2.19	2.00	24	6.85	9.24	1.52	68.30	74.00
12:00 PM	6	Auto	1.20	2.39	2.00	24	7.09	8.77	1.06	56.63	82.01
12:20 PM	7	Auto	1.30	2.60	2.00	24	7.27	8.60	1.06	66.43	85.50
12:40 PM	8	Auto	1.18	2.35	2.00	24	7.12	8.89	1.08	66.21	87.65
1:00 PM	9	Auto	1.06	2.11	2.00	24	5.90	10.66	1.32	73.32	78.05
1:20 PM	10	Auto	1.05	2.09	2.00	24	6.12	10.15	0.97	71.88	83.95
1:40 PM	11	Auto	0.94	1.88	2.00	24	6.13	10.08	1.27	62.16	79.80
2:00 PM	12	Auto	0.84	1.67	2.00	24	5.89	10.40	1.71	64.77	73.77
2:20 PM	13	Auto	0.70	1.40	2.00	24	5.30	11.16	1.26	68.22	76.49
2:40 PM	14	Auto	0.70	1.40	1.88	24	5.40	11.07	1.62	62.33	70.47
3:00 PM	15	Auto	0.70	1.40	1.78	24	5.85	10.54	1.91	68.67	70.14
3:20 PM	16	Auto	0.70	1.40	1.76	24	6.56	9.72	1.46	65.43	76.72
3:40 PM	17	Auto	0.70	1.40	1.86	24	6.98	8.99	1.39	70.90	77.40
4:00 PM	18	Auto	0.70	1.40	1.93	24	6.83	9.35	1.03	65.28	80.40
4:20 PM	19	Auto	0.70	1.40	1.84	24	5.96	10.29	0.79	56.97	81.40
4:40 PM	20	Auto	0.70	1.40	1.75	24	6.39	9.87	1.33	70.62	75.70
5:00 PM	21	Auto	0.70	1.40	1.70	24	5.75	10.70	1.45	72.75	71.20
5:20 PM	22	Auto	0.70	1.40	1.70	24.87	5.88	10.21	1.55	73.75	70.06
5:40 PM	23	Auto	0.70	1.40	1.70	25.68	6.21	10.13	1.10	58.83	77.49
6:00 PM	24	Auto	0.70	1.40	1.70	26.26	6.39	9.98	1.00	54.89	80.32
6:20 PM	25	Auto	0.70	1.40	1.70	26.02	6.71	9.32	1.13	61.41	79.52
6:40 PM	26	Auto	0.70	1.40	1.70	25.31	6.79	9.16	1.51	64.16	79.01
7:00 PM	27	Auto	0.70	1.40	1.70	25.34	6.60	9.67	1.72	65.47	72.87
7:20 PM	28	Auto	0.70	1.40	1.70	26.42	5.95	10.50	1.89	65.61	70.91
7:40 PM	29	Auto	0.70	1.40	1.70	27.59	6.10	10.16	2.00	57.07	67.20

NOTE: 9.5 Wt% Ash Target

Table 18.H.7 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/10/93

Test: Controlled Wt#8

Time	Sample	MIBC Dose		F.O. Dose		Air Rate (CFM)	Froth Height (In.)	Froth Wash Water (GPM)	Launder Water (GPM)	Weighted Averages	
		(g/min.)	(#/T)	(g/min.)	(#/T)					Ash	Yield
9:40 AM	-1	0.89	0.94	1.89	2.00	2.05	25.0	3.7	3.2	—	—
10:00 AM	0	0.93	0.98	1.91	2.02	2.05	24.5	3.6	3.1	—	—
10:20 AM	1	0.92	0.97	1.90	2.01	2.05	24.0	3.6	3.0	9.37	77.81
10:40 AM	2	1.02	1.08	2.14	2.26	2.05	24.0	3.7	3.0	9.67	76.30
11:00 AM	3	0.97	1.03	1.96	2.07	2.05	24.0	3.6	3.0	9.82	76.09
11:20 AM	4	0.90	0.95	1.84	1.95	2.05	24.5	3.6	3.1	9.49	75.81
11:40 AM	5	0.94	1.00	1.93	2.04	2.05	24.0	3.6	3.0	9.27	75.01
12:00 PM	6	1.00	1.06	2.06	2.18	2.05	24.5	3.7	3.1	8.96	78.33
12:20 PM	7	1.13	1.19	2.28	2.41	2.05	24.0	3.6	3.1	8.76	82.42
12:40 PM	8	1.23	1.30	2.48	2.62	2.05	24.0	3.6	3.0	8.78	85.99
1:00 PM	9	1.11	1.17	2.22	2.35	2.05	24.5	3.7	3.1	9.73	82.49
1:20 PM	10	0.96	1.01	1.96	2.07	2.05	24.5	3.5	3.0	10.11	82.60
1:40 PM	11	0.96	1.01	1.98	2.09	2.05	23.5	3.6	3.1	10.20	80.89
2:00 PM	12	0.84	0.89	1.80	1.90	2.05	25.0	3.7	3.0	10.25	77.48
2:20 PM	13	0.77	0.81	1.62	1.71	2.05	24.5	3.6	3.1	10.73	76.13
2:40 PM	14	0.64	0.68	1.36	1.44	2.05	24.0	3.7	3.1	10.99	73.03
3:00 PM	15	0.63	0.67	1.32	1.40	1.95	24.0	3.6	3.0	10.82	71.31
3:20 PM	16	0.62	0.66	1.32	1.40	1.85	25.0	3.7	3.1	10.22	73.51
3:40 PM	17	0.61	0.64	1.34	1.42	1.80	25.0	3.6	3.1	9.49	76.01
4:00 PM	18	0.63	0.67	1.33	1.41	1.90	23.5	3.7	3.2	9.29	78.85
4:20 PM	19	0.63	0.67	1.32	1.40	2.00	25.0	3.6	3.1	9.76	80.45
4:40 PM	20	0.64	0.68	1.34	1.42	1.95	23.5	3.6	3.2	9.93	78.42
5:00 PM	21	0.64	0.68	1.36	1.44	1.85	24.5	3.7	3.0	10.35	74.42
5:20 PM	22	0.62	0.66	1.33	1.41	1.75	24.0	3.4	3.1	10.31	71.30
5:40 PM	23	0.63	0.67	1.33	1.41	1.75	24.5	3.6	3.0	10.25	73.95
6:00 PM	24	0.62	0.66	1.32	1.40	1.75	26.0	3.5	3.1	10.07	77.65
6:20 PM	25	0.61	0.65	1.32	1.40	1.75	26.5	3.5	3.1	9.68	79.40
6:40 PM	26	0.60	0.64	1.34	1.42	1.75	26.5	3.7	3.1	9.35	79.39
7:00 PM	27	0.63	0.67	1.34	1.42	1.75	26.0	3.7	3.2	9.44	76.02
7:20 PM	28	0.62	0.66	1.33	1.41	1.75	26.0	3.7	3.2	10.00	72.91
7:40 PM	29	0.61	0.65	1.32	1.40	1.75	26.5	3.6	3.0	10.19	69.38

Table 18.H.8
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/15/93

Tests: Uncontrolled WT#9

Time	Sample No.	Solids Feed	F.B. Yield	A.B. Yield	Feed Flow	Undiluted Feed		Diluted Concentrate			Tailings		
		(#/hr.)	(Wt%)	(Wt%)	(GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
1:40 PM	1	243	75.19	75.77	6.1	25.99	22.29	4.8	7.19	7.64	7.8	1.46	68.09
2:20 PM	3	251	75.82	74.24	6.1	24.32	22.67	5.2	7.23	7.72	7.4	1.62	65.76
3:00 PM	5	275	71.46	74.10	6.0	24.30	22.12	5.0	7.06	8.08	7.5	1.88	62.26
3:40 PM	7	198	76.10	76.96	6.1	23.84	21.09	4.8	6.78	7.89	7.8	1.31	65.15
4:20 PM	9	225	75.26	76.30	5.9	24.09	20.24	5.3	6.44	8.04	7.1	1.58	59.51
4:00 PM	11	252	79.39	76.32	6.1	24.11	19.22	6.3	6.82	8.15	6.3	1.77	54.90
5:40 PM	13	244	76.79	74.18	5.9	24.83	20.10	5.4	6.56	8.48	7.0	1.53	53.48
6:20 PM	15	300	73.44	74.35	6.0	23.89	21.21	5.9	6.93	8.76	6.6	2.24	57.29
7:00 PM	17	261	75.60	74.80	6.0	22.94	22.24	5.5	7.02	9.17	7.0	1.78	61.04

Table 18.H.8 (cont.)
WT#9 SUMMARY ACTUAL VS. PREDICTED

Time	Sample	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
		Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
1:40 PM	1	7.64	9.52	8.06	7.19	6.90	68.09	61.46	61.50	1.46	1.62	75.19	72.38
2:20 PM	3	7.72	9.94	8.18	7.23	6.98	65.76	71.99	62.12	1.62	1.84	75.82	72.72
3:00 PM	5	8.09	9.57	7.79	7.06	6.56	62.26	61.73	59.61	1.88	2.08	71.46	67.77
3:40 PM	7	7.89	9.92	8.05	6.78	6.47	65.15	68.78	64.99	1.31	1.30	76.10	75.39
4:20 PM	9	8.04	9.28	8.27	6.44	6.26	59.51	67.75	60.91	1.58	1.60	75.26	74.49
5:00 PM	11	8.15	9.91	8.36	6.82	6.40	54.90	62.00	59.94	1.77	1.78	79.39	78.24
5:40 PM	13	8.48	9.59	8.73	6.56	6.33	53.48	52.06	59.49	1.53	1.84	76.79	72.63
6:20 PM	15	8.76	9.63	8.36	6.93	6.04	57.29	78.75	59.50	2.24	2.57	73.44	67.75
7:00 PM	17	9.17	10.10	8.56	7.02	6.09	61.04	63.59	59.92	1.78	1.97	75.60	70.84

* Predicted values using density as an independent variable.

Table 18.H.8 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/15/93
Test: Uncontrolled WT#9

Feed Rate: 6.1 GPM
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

<u>Time</u>	<u>Sample</u>	<u>Mode</u>	MIBC Target (#/T)	F.O. Target (#/T)	Air Rate Target (CFM)	Froth Ht. Target (In)	<u>Concentrate</u>		<u>Tailings</u>		F.B. Yield (Wt%)
							Solids (Wt%)	Ash (Wt%)	Solids (Wt%)	Ash (Wt%)	
1:40 PM	1	Manual	1.0	2.0	2.0	24	6.90	9.52	1.62	61.46	72.41
2:00 PM	2	Manual	1.0	2.0	2.0	24	7.06	8.99	2.02	67.52	69.99
2:20 PM	3	Manual	1.0	2.0	2.0	24	6.98	9.94	1.84	71.99	72.57
2:40 PM	4	Manual	1.0	2.0	2.0	24	6.76	10.01	1.63	80.08	75.56
3:00 PM	5	Manual	1.0	2.0	2.0	24	6.56	9.57	2.08	61.73	67.73
3:20 PM	6	Manual	1.0	2.0	2.0	24	6.89	9.55	1.58	59.96	69.12
3:40 PM	7	Manual	1.0	2.0	2.0	24	6.47	9.92	1.30	68.78	75.58
4:00 PM	8	Manual	1.0	2.0	2.0	24	6.04	9.96	1.26	66.52	76.94
4:20 PM	9	Manual	1.0	2.0	2.0	24	6.26	9.28	1.60	67.75	74.52
4:40 PM	10	Manual	1.0	2.0	2.0	24	6.49	9.98	1.71	68.92	76.84
5:00 PM	11	Manual	1.0	2.0	2.0	24	6.40	9.91	1.78	62.00	78.40
5:20 PM	12	Manual	1.0	2.0	2.0	24	6.45	10.46	1.26	69.40	79.71
5:40 PM	13	Manual	1.0	2.0	2.0	24	6.33	9.59	1.84	52.06	72.69
6:00 PM	14	Manual	1.0	2.0	2.0	24	6.46	10.14	1.63	58.49	75.10
6:20 PM	15	Manual	1.0	2.0	2.0	24	6.04	9.63	2.57	78.75	67.80
6:40 PM	16	Manual	1.0	2.0	2.0	24	5.70	10.59	1.82	61.44	71.96
7:00 PM	17	Manual	1.0	2.0	2.0	24	6.09	10.10	1.97	63.59	71.05

Table 18.H.8 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/15/93

Test: Uncontrolled Wt#9

<u>Time</u>	<u>Sample</u>	<u>MIBC Dose</u>		<u>F.O. Dose</u>		<u>Air Rate</u> <u>(CFM)</u>	<u>Froth Height</u> <u>(In.)</u>	<u>Froth</u> <u>Wash Water</u> <u>(GPM)</u>	<u>Launder</u> <u>Water</u> <u>(GPM)</u>
		<u>(g/min.)</u>	<u>(#/T)</u>	<u>(g/min.)</u>	<u>(#/T)</u>				
1:40 PM	1	0.88	0.93	1.86	1.97	2.00	24.0	3.7	3.1
2:00 PM	2	0.85	0.89	1.90	2.01	2.00	23.5	3.6	3.1
2:20 PM	3	0.90	0.95	1.86	1.97	2.00	23.5	3.7	3.0
2:40 PM	4	0.92	0.97	1.88	1.99	2.05	24.0	3.7	3.1
3:00 PM	5	0.92	0.97	1.89	2.00	2.05	24.5	3.6	3.0
3:20 PM	6	0.92	0.97	1.92	2.03	2.05	23.0	3.5	3.0
3:40 PM	7	0.91	0.96	1.90	2.01	2.05	25.0	3.6	3.1
4:00 PM	8	0.92	0.97	1.86	1.97	2.05	24.5	3.5	3.1
4:20 PM	9	0.93	0.98	1.92	2.03	2.05	24.0	3.6	3.2
4:40 PM	10	0.92	0.97	1.92	2.03	2.05	24.0	3.6	3.0
5:00 PM	11	0.92	0.97	1.89	2.00	2.05	23.5	3.5	3.0
5:20 PM	12	0.92	0.97	1.88	1.99	2.05	23.0	3.5	3.0
5:40 PM	13	0.92	0.97	1.89	2.00	2.05	23.5	3.6	3.1
6:00 PM	14	0.92	0.97	1.90	2.01	2.05	24.0	3.7	3.0
6:20 PM	15	0.91	0.96	1.90	2.01	2.05	24.5	3.6	3.1
6:40 PM	16	0.92	0.97	1.86	1.97	2.05	23.5	3.7	3.0
7:00 PM	17	0.90	0.95	1.86	1.97	2.05	24.0	3.6	3.2

Table 18.H.9
SUMMARY SHEET
Pittsburgh No. 8 Control Testing

Date: 6/16/93

Tests: Controlled WT#10

Time	Sample No.	Solids Feed (#/hr.)	F.B. Yield (Wt%)	A.B. Yield (Wt%)	Feed Flow (GPM)	Undiluted Feed		Diluted Concentrate			Tailings		
						Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)	Flow (GPM)	Solids (Wt%)	Ash (Wt%)
10:00 AM	1	263	74.26	72.18	6.2	25.32	21.36	5.9	7.05	8.48	6.8	2.12	54.77
10:40 AM	3	286	74.29	72.48	6.1	24.19	21.17	5.7	7.31	7.76	6.9	2.09	56.49
11:20 AM	5	215	76.13	75.57	6.0	24.31	21.22	4.5	6.52	7.38	8.0	1.15	64.03
12:00 PM	7	215	74.52	75.22	6.1	24.88	21.84	5.3	5.72	8.54	7.3	1.42	62.22
12:40 PM	9	247	78.14	77.45	6.0	24.24	20.64	5.6	6.74	8.86	6.9	1.53	61.10
1:20 PM	11	254	77.64	75.70	6.0	24.69	20.87	5.6	6.59	8.98	6.9	1.54	57.92
2:00 PM	13	211	76.18	75.11	6.0	24.31	21.83	5.5	6.92	8.66	7.0	1.70	61.57
2:40 PM	15	286	77.08	75.09	6.1	23.85	21.98	5.9	7.14	8.83	6.7	1.87	61.63

Table 18.H.9 (cont.)
WT#10 SUMMARY ACTUAL VS. PREDICTED

Time	Sample	Concentrate Ash			Concentrate Solids		Tails Ash			Tails Solids		F.B. Yields	
		Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted	Predicted*	Actual	Predicted	Actual	Predicted
10:00 AM	1	8.48	8.98	8.23	7.05	7.07	54.77	69.94	58.31	2.12	1.57	74.26	79.52
10:40 AM	3	7.76	9.02	7.95	7.31	6.70	56.49	65.75	54.12	2.09	1.55	74.29	78.03
11:20 AM	5	7.38	9.15	---	6.52	7.22	64.03	58.69	63.81	1.15	0.99	76.13	80.30
12:00 PM	7	8.54	9.58	8.48	5.72	7.27	62.22	54.85	61.01	1.42	1.54	74.52	77.48
12:40 PM	9	8.86	10.13	8.62	6.74	6.83	61.10	63.16	61.66	1.53	1.16	78.14	82.60
1:20 PM	11	8.98	9.78	9.02	6.59	6.61	57.92	55.92	59.45	1.54	1.19	77.64	81.82
2:00 PM	13	8.66	9.84	8.76	6.92	6.72	61.57	68.90	61.65	1.70	1.28	76.18	80.42
2:40 PM	15	8.83	8.69	8.78	7.14	6.31	61.63	58.52	56.82	1.87	1.33	77.08	80.68

* Predicted values using density as an independent variable.

Table 18.H.9 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Control Room Measurement)

Date: 6/16/93
Test: Controlled WT#10

Feed Rate: 6.1 GPM
Launder Water: 3.0 GPM

Froth Wash: 3.5 GPM
Spray Bar: 12 Inches

Sump Level: 30%

<u>Time</u>	<u>Sample</u>	<u>Mode</u>	MIBC	F.O.	Air Rate	Froth Ht.	<u>Concentrate</u>		<u>Tailings</u>		F.B.
			<u>Target</u>	<u>Target</u>	<u>Target</u>	<u>Target</u>	<u>Solids</u>	<u>Ash</u>	<u>Solids</u>	<u>Ash</u>	<u>Yield</u>
			<u>(#/T)</u>	<u>(#/T)</u>	<u>(CFM)</u>	<u>(In)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>	<u>(Wt%)</u>
9:20 AM	-1	Auto	1.00	2.00	2.00	24	6.87	9.72	0.88	61.41	85.06
9:40 AM	0	Auto	1.00	2.00	2.00	24	6.99	9.39	0.97	60.30	86.21
10:00 AM	1	Auto	0.90	1.79	2.00	24	7.07	8.98	1.57	69.94	79.58
10:20 AM	2	Auto	0.89	1.77	2.00	24	6.46	10.19	1.72	70.86	75.25
10:40 AM	3	Auto	0.99	1.98	2.00	24	6.70	9.02	1.55	65.75	78.03
11:00 AM	4	Auto	1.01	2.02	2.00	24	6.79	9.83	1.03	67.19	82.56
11:20 AM	5	Auto	1.12	2.23	2.00	24	7.22	9.15	0.99	58.69	80.30
11:40 AM	6	Auto	1.19	2.38	2.00	24	7.08	9.58	0.86	57.07	83.06
12:00 PM	7	Auto	1.28	2.56	2.00	24	7.27	9.58	1.54	54.85	77.48
12:20 PM	8	Auto	1.30	2.60	2.00	24	6.68	9.68	1.35	62.42	80.25
12:40 PM	9	Auto	1.28	2.56	2.00	24	6.83	10.13	1.16	63.16	82.60
1:00 PM	10	Auto	1.18	2.36	2.00	24	6.44	9.92	0.89	60.35	85.16
1:20 PM	11	Auto	1.17	2.35	2.00	24	6.61	9.78	1.19	55.92	81.82
1:40 PM	12	Auto	1.22	2.44	2.00	24	6.91	9.83	1.22	58.45	81.29
2:00 PM	13	Auto	1.26	2.51	2.00	24	6.72	9.84	1.28	68.90	80.42
2:20 PM	14	Auto	1.30	2.60	2.00	24	6.55	9.76	1.50	57.60	79.24
2:40 PM	15	Auto	1.30	2.60	2.12	24	6.31	8.69	1.33	58.52	80.68

Table 18.H.9 (cont.)
PITTSBURGH NO. 8 CONTROL TESTING
(Field Measurements)

Date: 6/16/93

Test: Controlled Wt#10

<u>Time</u>	<u>Sample</u>	<u>MIBC Dose</u>		<u>F.O. Dose</u>		<u>Air Rate</u> (CFM)	<u>Froth</u> <u>Height</u> (In.)	<u>Froth</u> <u>Wash Water</u> (GPM)	<u>Launder</u> <u>Water</u> (GPM)	<u>Weighted Average</u>	
		<u>(g/min.)</u>	<u>(#/T)</u>	<u>(g/min.)</u>	<u>(#/T)</u>					<u>Ash</u>	<u>Yield</u>
9:20 AM	-1	0.91	0.96	1.83	1.93	---	---	---	---	---	---
9:40 AM	0	0.93	0.98	1.86	1.97	---	---	---	---	---	---
10:00 AM	1	0.93	0.98	1.87	1.98	2.05	24.0	3.5	3.0	9.24	82.70
10:20 AM	2	0.84	0.89	1.69	1.79	2.05	24.0	3.6	3.1	9.65	78.52
10:40 AM	3	0.80	0.85	1.66	1.75	2.05	24.5	3.5	3.0	9.40	77.38
11:00 AM	4	0.89	0.94	1.89	2.00	2.05	23.5	3.7	3.0	9.62	79.83
11:20 AM	5	0.93	0.98	1.92	2.03	2.05	24.0	3.7	3.0	9.36	80.67
11:40 AM	6	1.04	1.10	2.15	2.27	2.05	25.0	3.6	3.0	9.48	82.05
12:00 PM	7	1.12	1.18	2.21	2.34	2.05	24.5	3.6	3.0	9.51	79.81
12:20 PM	8	1.18	1.25	2.49	2.63	2.05	24.0	3.6	3.1	9.63	79.80
12:40 PM	9	1.20	1.27	2.49	2.63	2.05	23.5	3.7	3.0	9.89	81.01
1:00 PM	10	1.16	1.23	2.43	2.57	2.05	24.0	3.5	3.2	9.95	83.52
1:20 PM	11	1.09	1.15	2.24	2.37	2.05	24.5	3.5	3.1	9.88	83.08
1:40 PM	12	1.10	1.16	2.22	2.35	05	24.5	3.7	3.1	9.83	82.11
2:00 PM	13	1.13	1.19	2.35	2.48	05	23.5	3.7	3.1	9.82	80.95
2:20 PM	14	1.14	1.21	2.42	2.56	05	24.0	3.6	3.0	9.80	79.97
2:40 PM	15	1.22	1.29	2.46	2.60	2.05	25.0	3.6	3.1	9.24	80.15

Table 18.H.10
DETAILED SAMPLE ANALYSIS
Pittsburgh No. 8 Seam Coal Control Testing
(Dry Basis)

Test Number	Actual Feed			Concentrate				Tailings
	Ash (Wt%)	Sulfur (Wt%)	Pyr. S (Wt%)	Yield (Wt%)	Ash (Wt%)	Sulfur (Wt%)	Pyr. S (Wt%)	Ash (Wt%)
WT#3 T#3	27.00	4.90	3.09	67.73	10.10	4.33	2.27	62.47
WT#3 T#5	25.68	5.41	3.74	72.26	9.18	4.05	1.97	68.66
WT#3 T#7	22.86	4.40	2.33	75.58	8.74	4.04	1.89	66.56
WT#3 T#15	24.21	4.76	2.76	69.53	9.51	4.13	2.05	57.75
WT#3 T#19	25.95	---	---	70.33	9.66	4.20	1.99	64.57
WT#3 T#23	21.10	4.83	2.91	73.07	10.10	4.09	1.80	50.94
WT#3 T#29	30.70	5.83	4.01	64.33	11.17	4.55	2.34	65.92
WT#5 T#1	24.67	4.60	3.00	71.00	8.57	4.05	1.91	64.08
WT#5 T#3	24.55	---	---	74.79	9.01	4.03	1.92	70.65
WT#5 T#5	23.80	4.55	2.71	75.27	9.08	4.08	2.06	68.60
WT#5 T#7	20.99	4.47	2.52	78.73	9.53	4.18	1.95	63.41
WT#5 T#9	21.47	---	---	77.81	9.64	4.05	1.80	62.95
WT#5 T#11	24.78	4.72	2.74	74.81	10.61	4.32	2.13	66.87
WT#5 T#13	29.05	5.41	3.62	62.78	11.97	4.63	2.45	57.86
WT#7 T#5	21.74	4.46	2.38	78.31	8.00	3.83	1.68	71.34
WT#7 T#7	21.74	---	---	77.62	8.84	4.01	1.83	66.48
WT#7 T#9	22.59	---	---	70.30	9.27	4.07	1.86	54.12
WT#7 T#11	20.77	4.97	2.80	74.08	10.49	4.14	1.99	50.15
WT#7 T#17	24.49	---	---	74.53	9.64	4.09	1.92	67.95
WT#7 T#19	22.62	4.63	2.54	75.07	9.17	4.09	1.95	63.17
WT#7 T#23	20.47	---	---	78.04	10.29	4.19	2.09	56.64
WT#7 T#25	20.07	4.55	2.67	77.70	9.56	4.14	2.03	56.68
WT#7 T#29	25.09	5.07	3.15	72.10	10.18	4.26	2.18	63.63
WT#9 T#1	22.29	---	---	75.77	3.98	3.98	1.82	68.09
WT#9 T#3	22.67	4.40	2.52	74.24	4.07	4.07	1.84	65.76
WT#9 T#5	22.12	---	---	74.10	3.94	3.94	1.87	62.26
WT#9 T#7	21.08	---	---	76.96	4.10	4.10	1.83	65.15
WT#9 T#9	20.24	4.69	2.74	76.30	3.94	3.94	1.81	59.51
WT#9 T#11	19.22	4.46	2.60	76.32	3.94	3.94	1.72	54.90
WT#9 T#13	20.10	---	---	74.18	4.00	4.00	1.80	53.48
WT#9 T#15	21.21	4.63	2.62	74.35	4.12	4.12	1.91	57.29
WT#9 T#17	22.24	4.79	2.92	74.80	4.15	4.15	1.98	61.04

APPENDIX I
DEWATERING STUDIES ON CONCENTRATE FROM BOTH COALS
(UK/CAER)

A
Report
on

**Dewatering Studies of Column Flotation
Concentrate obtained from the
Upper Freeport and Pittsburgh Seam Coals**

**Submitted
to
Process Tech**

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by

**Center for Applied Energy Research
University of Kentucky
Lexington, KY**

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ABSTRACT

An experimental study of the dewatering of fine coal obtained with the 'Ken-Flote' column was conducted. The dewatering study was conducted with and without additives using laboratory vacuum and pressure filtration devices. The variables studied included the driving force, filtration time, cake thickness and slurry pH. The effects of surfactant, flocculants and their combination on final moisture content of the filter cakes were determined. Combined effect of vacuum and pressure on residual cake moisture was also examined. Overall, it was found that the filtration of the slurry was enhanced by higher applied pressure, longer filtration time, lower cake thickness. Also, in general, it was found that the use of additives improved the filtration behavior of the fine coal slurries. It was observed that a combination of surfactant and flocculant provided only marginal improvement in filter cake moisture reduction. Split dewatering using both vacuum and pressure simultaneously provided less cake moisture than that obtained using pressure alone. The operating cost of vacuum and pressure filtration was estimated to be \$1.75/ton and \$5.00/ton, respectively.

INTRODUCTION

Full-seam mechanization in modern coal mining results in a large fraction of fines. Also effective removal of impurities such as pyritic sulfur and ash present in coal requires ultrafine grinding of the coal. Most of the coal presently used by the utility industry is cleaned at preparation plants employing wet processes. While water is the main component of coal washing, it is also one of the least desirable components in the final product causing a reduction of the heating value as well as handling difficulties. Generally, most of the water is associated with the fine (minus 28 mesh) size coal, which is difficult to remove to a lower moisture level using conventional techniques. Thermal drying, even though provides a low moisture product is unacceptable by industry due to high cost and air pollution problems associated with it.

In the present research program dewatering studies were conducted on a clean coal products obtained using the 'Ken-Flote' column at the DOE Pittsburgh Energy Technology Center pilot plant facilities. The dewatering studies were conducted on the Upper Freeport and Pittsburgh clean coals using pressure and vacuum filtration technique. Preliminary operating cost of both the dewatering processes are also given.

MATERIALS AND METHODS

Materials

Twenty gallon samples of clean coal froth from Upper Freeport and Pittsburgh seam coals were received from the Process Technology Inc. Representative samples of slurries were characterized for percent solids, particle size and ash distribution. Tables 1 and 2 list the characterization data for Upper Freeport and Pittsburgh samples, respectively. The Upper Freeport sample had 78.3 weight percent of minus 500 mesh which contained about 85 percent of total ash, whereas Pittsburgh seam sample had 33.4 weight percent of minus 500 mesh size material which contained 45.2 percent of total ash. The percent solids in the Upper Freeport and Pittsburgh coal froth were 5.5 and 16.4 percent, respectively.

Table 1. Size and Ash Analysis of Upper Freeport Coal

Size, Mesh	Weight Percent	Ash Percent	Ash Distribution Percent
+100	0.26	6.92	0.1
100x200	1.69	9.24	1.0
200x325	4.08	9.89	2.6
325x500	15.65	10.76	11.0
-500	78.32	16.75	85.3
	100.0	15.38	100.0

Table 2. Size and Ash analysis of Pittsburgh Seam Coal

Size, Mesh	Weight Percent	Ash Percent	Ash Distribution Percent
+100	12.8	5.90	9.9
100x200	22.9	6.70	20.1
200x325	17.7	6.10	14.1
325x500	13.2	6.18	10.7
-500	33.4	10.34	45.2
	100.0	7.64	100.0

Filtration Procedure

Dewatering studies were conducted using laboratory vacuum and pressure filtration devices shown in Figure 1. A known quantity of the slurry was prepared and poured into a sampling cell. The air inlet line (or vacuum line) initially adjusted to a desired pressure was opened to expose a constant pressure to the test sample slurry. Whatman No.1 filter paper was used as a filter medium. The rate of filtration was monitored with time using a load cell system, in particular, for the pressure dewatering experiments. The filtration was continued for a period of 3 or 4 minutes whereupon the cake was removed from the filtration cell. It was carefully transferred to a dish, its thickness and weight were measured. The final moisture content of the filter cake was determined by drying the cake in an oven at 100 °F for 24 hours in accordance with A.S.T.M. procedure.

RESULTS AND DISCUSSION

Dewatering Studies Without Additive

Baseline dewatering data of the Upper Freeport sample, without adding any reagent, are shown in Figure 2. Note, that 4 minutes filtration time under vacuum provided a filter cake containing about 33.2 percent moisture.

For the Pittsburgh coal, the effect of filtration time on cake moisture is shown in Figures 3 - 7 using four different pressures and vacuum at various cake thicknesses. For any given pressure and cake thickness the residual cake moisture was found to decrease continuously over range of filtration time from 10 to 120 seconds. Beyond 120 seconds, moisture remained approximately constant. The data show in Figures 3 - 7 are replotted in the form of cake moisture against applied pressure and cake thickness for a given 120 seconds of filtration time in Figures 8 and 9(b), respectively. Increasing applied pressure from 60 to 80 psi provided only marginal improvement on cake moisture reduction. The final moisture content of the filter cake was not significantly improved over the range of 1.3 to 1.5 cm cake thickness.

It was surprisingly observed that moisture of filter cake obtained under vacuum was lowered by about 5 percent compared to that obtained by the same magnitude of pressure drop under pressure filter system as shown in Figure 9(b). This means that the force exerted to pull down the particle, produced by negative pressure (-13 psi) at downstream side, is more effective than that exerted to push down the particle, provided by positive pressure (14 psi) at upstream side, to

Figure 1. Laboratory Dewatering Equipment

(a) Vacuum Filtration Set-Up

(b) Pressure Filtration Unit

Figure 2. Effect of Filtration Time on Cake Moisture with Vacuum

Figure 3. Effect of Filtration Time on Cake Moisture with Vacuum

Figure 4. Effect of Filtration Time on Cake Moisture with 14 psi

Figure 5. Effect of Filtration Time on Cake Moisture with 40 psi

Figure 6. Effect of Filtration Time on Cake Moisture with 60 psi

Figure 7. Effect of Filtration Time on Cake Moisture with 80 psi

Figure 8. Effect of Applied Pressure on Cake moisture Using Four Cake Thicknesses

(a)

(b)

Figure 9. Effect of Cake Thickness on Cake Moisture

(a) Upper Freeport Coal

(b) Pittsburgh Seam Coal

reduce the filter cake moisture. Further research is required to assess the studies of vacuum and pressure dewatering phenomenon.

The effect of cake thickness on moisture content for Upper Freeport sample coal is shown in Figure 9(a). In order to eliminate effect of filtration time on cake thickness, the dewatering time was kept constant instead of total filtration time. It was observed that the final moisture content of the filter cake was not improved noticeably over the entire range of cake thickness under investigation.

Statistically-designed experiments on basic parametric dewatering studies were conducted with Upper Freeport sample using a 2^{5-1} factorial design to identify the significant variables in filtration. Five variables including applied pressure, filtration time, cake thickness, slurry pH and slurry concentration were tested at all possible combinations of two levels for a total sixteen tests. The design status and experimental results are illustrated in Figure 10 in which average cake moisture reduction is plotted against tested variables. When pressure was changed from 30 to 70 psi the average moisture content of filter cake was decreased by 9.5 percent by weight. However, it was found that the change in levels of the filtration time had no effect at all on moisture reduction. Thus the most significant parameters in filtration were applied pressure, cake thickness and slurry concentration as shown in Figure 10.

Figure 11 shows the electrophoretic mobility of both coal samples and moisture content of the filter cakes with respect to pH. For the Upper Freeport coal sample, the filter cake moisture was lowered significantly in the region of point of zero charge (PZC). However, Pittsburgh coal sample did not show significant improvement on cake moisture reduction over the entire range of pH. It was also observed that the Pittsburgh seam coal was positively charged at all pH. This may be due to the adsorption of positively charged ion such as Ca^{++} .

Effect of Surfactant on Dewatering

A number of dewatering experiments were conducted over the range of surfactant concentration from 0.1 to 1.5 kg/ton to determine the influence of the amount of surfactant dosage and the type of surfactant (anionic, nonionic and cationic) on final cake moisture content. Table 3 lists basic information on the three surfactant utilized for the present study.

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Figure 10. Results on Statistically-Designed Experiments of Basic Parameter Study

(a)

(b)

Figure 11. Electrophoretic Mobility and Filter Cake Moisture with respect to pH

(a) Upper Freeport Coal

(b) Pittsburgh Seam Coal

Table 3. List of Surfactant Investigated

	Sodium 2-Ethylhexyl Sulfate	Octyl Phenoxy Polyethoxy Ethanol	1-Hexadecyl Pyridinium Chloride
Type	Anionic	Non-ionic	Cationic
Abbreviation	S2ES	OPPE	CPC
Commercial Name	NAS 08	TRITON X-114	Cetyl Pyridinium Chloride
Active Ingredient, weight, %	40%	100%	100%
Formula	$C_4H_9(C_2H_5)CH_2-SO_4Na$	$C_8H_{17}-C_6H_4-(OCH_2CH_2)_{7-8}OH$	$C_{16}H_{33}C_5H_5NC1$
Molecular Weight	232	536	340
Manufacturer	Niacet Corporation Niagara Falls, NY	Rohm and Haas Philadelphia, PA	Sigma Chemical St. Louis, MO

The effect on final moisture content of the filter cakes is shown as a function of surfactant dosage in Figure 12. These results indicate that for all surfactant there exist an optimum dosage resulting in a minimum residual filter cake moisture. The optimum dosage were found to be between 0.1 and 0.2 kg/ton for all surfactant. The cationic surfactant was found to perform better than the other two types of surfactant which resulted in approximately 5.4 and 10.4 weight percent decreases in final moisture content for the Upper Freeport and Pittsburgh seam coals, respectively, compared to that of the untreated filter cake.

Effect of Flocculants on Dewatering

The experiments on effects of flocculant addition on dewatering behavior were conducted over the range of flocculant dosage from 2 to 30 ppm to determine the optimum dosage of flocculants and the influence of the type of flocculant. Three different types of flocculants with the same molecular weight and ionic charge density obtained from American Cyanamid Co. were used in flocculant-assisted filtration studies. Data on these flocculants are listed in Table 4 according to type, molecular weight and relative charge density.

Figure 12. Effect of Surfactant Dosage on Cake Moisture
(a) Upper Freeport Coal
(b) Pittsburgh Seam Coal

Table 4. List of Flocculants Investigated

Name	Type	Molecular Weight (million)	Rel. Charge Density (mol %)
Superfloc 204 Plus	Anionic	4-6	35
Superfloc 16	Nonionic	4	0
Magnifloc 494C	Cationic	4	35

The effects of flocculant dosage on residual cake moisture are shown in Figure 13 for the Upper Freeport and Pittsburgh coals. The results indicated that for all flocculants there exist optimum dosage being between 2 and 5 ppm at which the final cake moisture was about 6.0 and 10.0 percent by weight lower than that observed in the absence of flocculant for the Upper Freeport and Pittsburgh coal samples, respectively. The nonionic flocculant was found to do the best job over the range of flocculant dosage investigated.

Statistical experimental design on flocculant-assisted filtration was employed using a 2^3 factorial design. Three variables consisting of flocculant concentration, flocculation time and mixing speed were tested at all possible combination of two levels. The experimental results are shown in Figure 14. Among the three tested parameters flocculant dosage was found to be most important variable in flocculant-assisted filtration. By altering flocculant dosage the final cake moisture was reduced by about 10.0 weight percent. Note, that using all possible combination of two levels for three parameters one can obtain the minimum and maximum final cake moistures of 9.4 and 26.0 weight percent, respectively.

Combined Effect of Surfactant and Flocculant

For the Upper Freeport coal sample, optimum dosage for each type of flocculant was combined with varying dosage of cationic surfactant. Figure 15 shows the combined effect of the cationic surfactant with various flocculants on cake moisture content. With cationic flocculant, 26.7 percent cake moisture was obtained at 0.5 kg/ton of cationic surfactant. However, there was no noticeable improvement in filter cake moisture reduction with either nonionic and anionic flocculants over the range of cationic surfactant concentration.

To determine the significant variable between surfactant and flocculant in filtration statistical experimental design was utilized. As shown in Figure 16 flocculant concentration turns out to be

(a)

(b)

Figure 13. Effect of Flocculant Dosage on Cake Moisture

(a) Upper Freeport Coal

(b) Pittsburgh Seam Coal

Upper Freeport Coal

Figure 14. Results on Statistical Experimental Design on Flocculant-Assisted Filtration

Figure 15. Combined Effect of Surfactant and Flocculant

Upper Freeport Coal

Figure 16. Results on Statistical Experimental Design on Combined Surfactant and Flocculant-Assisted Filtration

most significant variables among the tested parameters. However, the average cake moisture reduction for changing flocculant dosage was within 1.5 percent deviation.

For the Pittsburgh seam coal, optimum dosages of each surfactant and flocculant were combined to investigate the effect on residual cake moisture. The experimental results as well as cake moisture data obtained using anionic, nonionic and cationic both surfactant and flocculants alone are given in Table 5.

For the nonionic surfactant having 0.2 kg/ton of concentration the lowest cake moisture of about 15.5 percent was obtained with all flocculants. However, anionic and cationic surfactant did not improved cake moisture with all flocculants. The combination of nonionic surfactant and nonionic flocculant was found to perform the best work on moisture reduction of filter cake for the Pittsburgh seam coal.

Table 5. Combined Effect of Surfactant with Flocculant on Filter Cake Moisture of Pittsburgh Coal

	Surfactant		Flocculant	
	Dosage(kg/ton)	Moisture	Dosage(ppm)	Moisture
Anionic	1.0	22.7	5	17.4
Nonionic	0.2	17.7	10	16.9
Cationic	0.5	17.1	5	17.2

Surfactant Flocculant	Anionic (1.0 kg/ton)	Nonionic (0.2 kg/ton)	Cationic (0.5 kg/ton)
Anionic (5 ppm)	17.6	15.5	17.2
Nonionic (10 ppm)	17.2	15.3	17.9
Cationic (5 ppm)	18.6	15.7	17.5

Effect of Combined Vacuum and Pressure Dewatering

Dewatering studies were conducted using combined vacuum and pressure to investigate the effect of pressure alone and both vacuum and pressure on final cake moisture. Both pressure and vacuum was utilized for 3 minutes of filtration time at four different pressures. The residual cake moisture data under pressure alone and combined vacuum and pressure are shown in Figure 17. For instance, if total pressure is 60 psi, then either 60 psi of pressure alone or 13 psi of vacuum and 47 psi of pressure are employed to the filter system. It was found that moisture of the filter cake formed using both vacuum and pressure was lowered 1.5 to 2.0 percent more compared to that obtained using pressure only, over the pressure range of 20 to 80 psi. Again, further intensive research should be addressed in this subject.

Economics of Dewatering of Fine Coal

Dewatering of the fine clean coal to about 20 percent moisture level will be necessary to meet the moisture specification of the final product. The dewatering studies conducted in this program indicated that for Upper Freeport coal the lowest moisture in the filter cake obtained was 26.8 percent with vacuum and 9.4 percent with pressure dewatering technique, when a flocculant is used. Similarly, for Pittsburgh coal 16.9 percent and 19.1 percent filter cake moistures were obtained using vacuum and pressure filtration techniques, respectively. Table 6 lists the dewatering cost for both the coals using vacuum and pressure techniques. The moisture numbers listed are for the best results obtained in the program. Vacuum dewatering with a flocculant cost approximately \$1.74/ton for both the coals. Pressure filtration costs, which were based on Eimco Pressure - 2000 machine, were about \$5.03/ton of clean coal, which is close to three times the cost of vacuum, however, the moisture content of the filter cake obtained with pressure is about three times lower than vacuum technique.

Pittsburgh Seam Coal

Figure 17. Comparison of Split Dewatering Study

Table 6. Dewatering Cost of Upper Freeport and Pittsburgh Coals using Vacuum and Pressure Filter (Feed Rate 40 tons per hour)

Process Type	Reagent	Upper Freeport		Pittsburgh	
		Moisture, wt%	Cost, \$/ton	Moisture, wt%	Cost, \$/ton
Vacuum	No Reagents	33.2	1.72	25.2	1.72
	Surfactant	27.6	2.34	17.9	2.34
	Flocculant	26.8	1.74	16.9	1.75
Pressure	No Reagents	11.7	5.0	19.1	5.0
	Surfactant	11.9	5.77	—	—
	Flocculant	9.4	5.03	—	—

CONCLUSIONS

An overall assessment of the results in this report leads to the following principal conclusions:

1. Optimum process conditions for most effective dewatering of Upper Freeport and Pittsburgh seam coals were found as following:

	Pressure psi	Cake Thickness cm	Filtration Time min	Cake Moisture wt%
Upper Freeport	-13	0.4	4	33.2
	70	0.7	8	11.7
Pittsburgh	-12.8	0.8	2	25.2
	60	1.3	2	19.1

*Cost estimated based on the information provided in **Advanced Coal Cleaning Technology**, Gordon Couch, IEA Coal Research, IEA CR144, Dec. 1991

2. Of the five filtration variables studied based upon statistically-design experiments, applied pressure, cake thickness, slurry concentration were the most significant.
3. For Upper Freeport coal sample, filter cake moisture was lowered significantly in the region of PZC while filtration of behavior of Pittsburgh seam coal did not depend on slurry pH.
4. Among the three classes of surfactant evaluated the cationic surfactant was found to do the best job which resulted in about 5.4 and 10.4 percent of cake moisture reductions for Upper Freeport and Pittsburgh coals, respectively, compared to that of the untreated filter cake.
5. In the case of flocculant addition it was found that there exists optimum dosage at 2 - 3 ppm for all flocculants. At this optimum dosage the final cake moisture of Upper Freeport and Pittsburgh coals was about 6.0 and 10.0 percent lower than that observed in the absence of flocculant, respectively.
6. 10 ppm of cationic flocculant with 0.5 kg/ton of cationic surfactant for Upper Freeport coal and 10 ppm of nonionic flocculant with 0.2 kg/ton of nonionic surfactant for Pittsburgh seam coal were found to be most effective combination of dosage to provide lower moisture content of the filter cake.
7. Split pressure dewatering using both vacuum and pressure simultaneously provided better improvement in cake moisture reduction compared to that using pressure alone. However, further research is required to develop detailed understanding of the process.
8. Vacuum filtration cost about \$1.75/ton, whereas pressure filtration was estimated to cost \$5.00/ton.

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