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BENCH-SCALE TESTING OF THE MULTI-GRAVITY SEPARATOR IN COMBINATION WITH MICROCEL

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Fifth Quarterly Report

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1.0 Introduction and Summary

During the quarter ending December, 31, 1993, the independent, combined and long duration testing were completed for both the Pittsburgh #8 coal and the Illinois #6 coal. Overall, the project is on schedule and the bulk of the critical work, from a timing perspective, is complete. Table 1 summarizes the status of major project tasks as of December 31, 1993.

Preliminary results provide strong evidence that combining the Microcel flotation column with the Multi-Gravity Separator has a synergistic effect. Overall ash and pyritic sulfur rejections of 75 %, at a 90% combustible recovery, were consistently achieved on the Pittsburgh #8 seam coal. On the Illinois #6 coal, pyritic sulfur rejections over 75 % and combustible recoveries of over 85 % were achieved. These results are discussed in this report. Although further analysis is taking place, it is very evident from the results presented herein that a well-designed and -operated flotation column performs well for ash rejection but not as well for pyrite rejection. It is equally evident that a good fine gravity separator can reject pyrite from coal but perform more poorly for ash rejection. The concept of combining the best of both units into one circuit has therefore been successfully tested in this project.

Table 1. Status of major project tasks as of December 31, 1993.

MAJOR TASKS	STATUS
Task 1 - Project Planning	Ongoing
Task 2 - CPPRF Modifications	Complete
Task 3 - Sample Acquisition	Complete
Task 4 - Sample Characterization	Ongoing
Task 5 - Flowsheet Development and Engineering Design	Complete
Task 6 - Procurement and Fabrication	Complete
Task 7 - Process Module Installation	Complete
Task 8 - Shakedown Testing	Complete
Task 9 - MGS Scale-Up	Ongoing
Task 10 - Detailed Testing	Ongoing
Task 11 - Decommissioning	Planned
Task 12 - Sample Analysis	Ongoing
Task 13 - Final Report	Planned

2.0 Project Objectives

The primary objective of the proposed work is to design, install, and operate an advanced fine coal processing circuit combining the MicrocelTM and Multi-Gravity Separator (MGS) technologies. Both of these processes have specific advantages as stand-alone units. For example, the Microcel column effectively removes ash-bearing mineral matter, while the MGS efficiently removes coal-pyrite composites. By combining both unit operations into a single processing circuit, synergistic advantages can be gained. As a result, this circuit arrangement has the potential to improve coal quality beyond that achieved using the individual technologies.

In addition to the primary objective, secondary objectives of the proposed test program include:

- *Circuit Optimization:* The performance of each unit operation, individually and combined, will be optimized by conducting parametric studies as a function of key operating variables. The goal of this work is to maximize the rejections of pyritic sulfur and ash while maintaining a high energy recovery.
- *Process Variability:* The steady-state performance of the optimized processing circuit will be studied (i) by conducting several long-duration test runs over a period of several days and (ii) by testing coal samples from other sources specified by the participating coal companies.
- *Process Evaluation:* Detailed technical and economic evaluations will be conducted to examine the feasibility of the proposed concept for fine coal cleaning on an industrial scale. This evaluation will include a projected cost-benefit analysis and a review of all test data, engineering analyses, scale-up procedures, and process deficiencies.

The test work is being conducted at the Pittsburgh Energy Technology Center's Coal Preparation Process Research Facility (CPPRF) located in Pittsburgh, Pennsylvania. The CPPRF is a state-of-the-art pilot-scale facility for coal preparation research and testing. The Emerging Technology (ET) section of the pilot plant is being used for testing the combined Microcel and MGS circuit. The ET area, and subsequently installed mezzanine, is adjacent to the pilot plant and was established for testing new and emerging technologies in coal preparation. This facility is ideally suited for pilot-scale test work due to the availability of all necessary ancillary facilities (i.e., bulk solids handling, preparation, and waste disposal). In addition, the necessary environmental, safety and health aspects related to the handling and disposal of waste are already in place.

3.0 Project Task Updates

Those tasks shown as completed in previous quarterly reports will not be mentioned herein (i.e. Tasks 2,3,5,6,7,8).

3.1 Task 1.0 - Project Planning

All project planning is complete and with this report all reporting will be current. All required plans and reports have been submitted. Topical reports on sample characterization and on the ET Area Modification are forthcoming.

3.2 Task 4.0 - Sample Characterization

Subtask 4.1 - Preliminary Characterization

Utilizing a hammermill, -28 mesh and -65 mesh samples were produced independently. The size-by-size sulfur and ash analyses for each of the two seams and each of the two feed sizes were given in the *Second Quarterly Report*.

Subtask 4.2 - Washability Characterization

Since all efforts were concentrated on the detailed testing at the CPPRF, no washability type characterizations were performed this quarter. As discussed in the *Fourth Quarterly Report*, initial high-G centrifuge washability results were not satisfactory. Further washability characterizations will include high-G centrifuge separations by an outside group skilled in such work.

Subtask 4.3 - Release Analysis Characterization

Release analysis results for both coals were presented in the *Second Quarterly Report* and will be included in the *Preliminary Characterization Topical Report* along with a complete summary of all the characterization data..

3.3 Task 9.0 - MGS Scale-Up

Subtask 9.1 - Development of Scale-Up Criteria

Development of a process model for the MGS requires identification of those operating parameters which affect performance. Detailed testing results will be used to identify these relevant operating parameters which will be applied to the scale-up in future quarters.

Subtask 9.2 - Scale-Up Validation

After completion of the detailed testing, the criteria required for scale-up modeling will be reviewed and quantified to the extent possible.

3.4 Task 10.0 - Detailed Testing

Tests using the Microcel flotation column and the Multi-Gravity Separator (MGS) unit were conducted with independent raw coal feeds. After the major control parameters were determined, testing began on the combined circuit in which the column product reported to the MGS as feed. The optimum operating settings were then used for a long duration run of the combined circuit. The entire process was then repeated for the second coal.

Detailed testing by subtask is described below. Although the chronological sequence was to complete the independent unit testing, the combined units testing and long duration testing on the Pittsburgh #8 coal before proceeding to the identical sequence of unit testing on the Illinois #6 coal. This section gives results based on sample analysis for ash, total sulfur, and pyritic sulfur. Due to the excellent correlation of ash and BTU, the ash analyses were utilized for performance decisions in lieu of BTU. This allowed the BTU analyses to be delayed in order to keep the project on schedule. BTU results will be included in the final report. A systematic approach was used in assigning test numbers as shown in the following table.

Table 2. Test numbering system.

TEST NUMBER RANGES	CIRCUIT	COAL SEAM
101-199	Microcel Only	Pittsburgh #8
201-299	MGS Only	Pittsburgh #8
301-399	Microcel Conc. to MGS	Pittsburgh #8
PITT-LD	Microcel Conc. to MGS	Pittsburgh #8
401-499	Microcel Only	Illinois #6
501-599	MGS Only	Illinois #6
601-699	Microcel Conc. to MGS	Illinois #6
ILL-LD	Microcel Conc. to MGS	Illinois #6

*Subtask 10.1 - Microcel Testing (Independent)*Pittsburgh #8 Coal

The Microcel test matrix for the Pittsburgh #8 coal, Table PITT-1 of the Appendix, consisted of a three-level Box-Behnken test matrix containing 3 feed sizes, 3 feed rates, and 3 frother dosages. This resulted in 15 tests with 2 more added, to provide a check on repeatability for a total of 17 tests in this series. Table PITT-2 gives the analyses of test numbers 101 - 117, while Microcel performance results are found in Table PITT-3. The performance in terms of ash, sulfur, and pyritic rejection versus combustible recovery is shown in Figure PITT-1.

Illinois #6 Coal

The Microcel test matrix for the Illinois #6 coal, Table ILL-1, involved 9 tests in which collector and frother dosages were varied. The 3 settings for each included a low, medium, and high dosage. Analyses of tests numbers 401 - 409 are given in Table ILL-2, while the performance results are found in Table ILL-3. Figure ILL-1 displays the performance in terms of ash, sulfur, and pyritic rejection versus combustible recovery. Results of all 9 tests were very similar with the optimums having combustible recoveries of 86 to 88%, ash rejections in the low 80's and pyritic sulfur rejections in the low 60's.

*Subtask 10.2 - MGS Testing (Independent)*Pittsburgh #8 Coal

Raw Pittsburgh #8 coal was used as feed for independent MGS tests. This series of tests utilized a 5-level test matrix (Table PITT-4) which included grind size, drum speed, wash water, percent solids feed, and feed rate as variables. Testing these five variables over three ranges yielded 43 test results, test numbers 201-243. Tables PITT-5 to PITT-8 give the analytical results while Figure PITT-2 graphically illustrates the ash, sulfur, and pyritic rejections versus combustible recovery. Comparing Figure PITT-2 to PITT-1 shows that even over a broad range of variables the Microcel is clearly best at ash rejection and the MGS performs best at pyrite rejection.

Illinois #6 Coal

The MGS testing involved a 4 level test matrix in which drum speed, wash water, percent solids in feed, and feed rate were varied. As before, each parameter was varied over 3 ranges: low, medium and high. As a result, 27 tests were conducted and assigned tests numbers 501-527. The MGS constant and variable conditions are listed in Table ILL-4.

Results of the analyses are given in Table ILL-5 to ILL-7. Performance data are found in Table ILL-8 while Figure ILL-2 details graphically the rejections versus

combustible recovery for the MGS unit operating on raw Illinois #6 feed. A comparison of Figure ILL-2 with Figure ILL-1 illustrates that, even with many parameters being adjusted over a broad range, the Microcel excels at ash rejection whereas the MGS rejects pyrite much better than ash. Ash rejection for the MGS is noticeably lower than the column throughout the range of settings.

Subtask 10.3 - Combined Microcel and MGS Testing

Pittsburgh #8 Coal

Combined Microcel and MGS testing allowed the Microcel column product to feed the MGS directly via a holding sump. The intermediate sump absorbed any possible surges as well as allowing the MGS feed rate to be independently controlled. The well-mixed sump ran with a constant overflow which ensured a constant feed rate to the MGS. A 4-level test matrix with a low, medium and high value for each variable was also used for this series of tests. Column feed rate was the only variable used for the Microcel column while the MGS variables were drum speed, wash water, and MGS feed rate. These conditions are listed in Table PITT-9 for test numbers 301-327.

Samples were taken independently around the Microcel and MGS, which allowed for complete evaluation of each unit as well as the total circuit. Analyses and results are found in Tables PITT-10 through PITT-15. Ash, sulfur, and pyritic rejections versus combustible recoveries for the Microcel are graphed in Figure PITT-3. The MGS and combined circuit graphs are in Figures PITT-4 and PITT-5, respectively. Once again the Microcel plot shows that it is best at ash rejection while the MGS plot shows advantages in pyrite rejection. The combined results plotted in Figure PITT-5, however, show that the best of both can be obtained with the combination of Microcel and MGS. The synergy of combining the two units is well illustrated when comparing Figures PITT-3, -4, and -5. The excellent ash and pyrite rejections are obtained while maintaining a high recovery. It is important to remember when viewing these plots, that the scatter in the data is due to intentionally varying several control parameters. Even with these variations, the performance remains within relatively close patterns.

Illinois #6 Coal

Microcel conditions were held constant for the combined testing of the Illinois #6 coal. All four variables of the 4-level matrix were applied to the MGS. As listed in Table ILL-9, these were drum speed, wash water, shake amplitude, and MGS feed rate.

Results of this series of tests are found in Tables ILL-10 through ILL-15. The ash, sulfur, and pyrite rejections versus combustible recoveries for the Microcel are shown graphically in Figure ILL-3. The MGS results are graphed in Figure ILL-4 and the combined circuit results are shown in Figure ILL-5. As with the Pittsburgh #8 seam, the Illinois #6 results show that the combination of Microcel flotation and MGS provide the best of both for rejection of ash and pyrite.

Subtask 10.4 - Combined Microcel/MGS/WOC Testing

Three tests were conducted with the combined circuit including a small water-only cyclone. The Microcel concentrate was pumped to the cyclone from which the overflow was taken as a final product and the underflow was fed to the MGS for pyrite removal. The object of this test series was to reduce the loading on the MGS unit. If successful, this would increase the capacity of the total circuit for a given MGS size. This testing was performed just prior to the end of the quarter and the results will be detailed in subsequent reports.

Subtask 10.5 - Long Duration Testing

Pittsburgh #8 Coal

From the results of the combined testing the best tests were identified based on ash and pyrite rejections. The operating parameters used in those tests provided the basis for the selection of operating parameters to be used for the long duration testing. Long duration testing involved holding all control parameters constant for a continuous run of over 10 hours. These operating parameters are given in Table PITT-16.

The results as listed in Tables PITT-17 to PITT-22 indicate the consistency with which the system performed. Figures PITT-6 to PITT-8 show graphically the ash, sulfur, and pyrite rejection for the Microcel, MGS, and combined circuit. As before, the synergism resulted in the best of both units being brought together. For the combined circuit, ash and pyrite rejections of over 75% were obtained at a 90% combustibles recovery.

Illinois #6 Coal

As discussed above, the best results of the combined testing were used to select the operating parameters to be held constant during the long duration testing of the Illinois #6 coal. The parameters given in Table ILL-16 produced the results listed in Tables ILL-17 to ILL-22. Figures ILL-6 to ILL-8 show graphically the ash, sulfur, and pyrite rejection for the Microcel, MGS, and combined circuit. The synergistic effect is again evident in the performance graphs. For the overall circuit, ash and pyrite rejections of over 75% were obtained at a combustibles recovery of over 85%. Although the Illinois #6 had a much higher feed ash than the Pittsburgh #8 coal, and was definitely more difficult to clean, the results were very close to those of the Pittsburgh #8 coal.

3.5 Task 11.0 - Decommissioning

Decommissioning will begin during the middle of January, 1994, or as soon as the near-term testing is complete, and will last no more than three weeks. As stated in the Decommissioning Plan, all equipment added during this project will be removed and the CPPRF will be restored to the condition found prior to the beginning of this project.

3.6 Task 12.0 - Sample Analysis

Sample analysis is being conducted as required on the detailed testing. Samples are being analyzed initially for % solids, ash, total sulfur, and pyritic sulfur. Selected samples will be further analyzed for heating value, sizing, and washability analysis.

APPENDIX

Tables PITT-1 to PITT-22 and ILL-1 to ILL-22
Figures PITT-1 to PITT-8 and ILL-1 to ILL-8

Microcel/MGS Independent Testing - Pittsburgh #8

Microcel Conditions Held Constant

Collector Dosage (lbs/ton): 1
Wash Water (lpm): 40.13
Percent Solids (w/w): 11-12
Air Flow Rate (SCFM): 9.01

Microcel Variables

Test Number	Feed Size (microns)	Feed Rate (lbs/hr)	Frother Dosage (ml/min)
101	300	300	1.00
102	300	400	0.50
103	300	500	1.00
104	300	400	1.50
105	200	400	1.00
106	200	500	0.50
107	200	500	1.50
108	200	400	1.00
109	100	300	1.00
110	100	400	0.50
111	100	500	1.00
113	200	300	1.50
114	200	400	1.00
116	200	300	1.50
117	200	400	1.00

Table PITT-1

Microcel/MGS Independent Tests Results - Pittsburgh #8

Microcel - Ash

Test Number	Measured Column Feed Ash %	Adjusted Column Feed Ash %	Measured Column Product Ash %	Adjusted Column Product Ash %	Measured Column Reject Ash %	Adjusted Column Reject Ash %	Measured Column Ash Yield %	Adjusted Column Ash Yield %
101	20.67	20.67	12.84	12.84	78.25	78.25	88.03	88.03
102	18.57	18.57	7.63	7.63	63.42	63.42	80.39	80.39
103	21.25	21.25	8.97	8.97	74.65	74.65	81.30	81.30
104	21.45	21.45	11.97	11.97	80.10	80.10	86.09	86.09
105	20.30	20.30	9.14	9.14	78.77	78.77	83.97	83.97
106	19.37	19.40	6.59	6.59	45.74	45.69	67.36	67.24
107	19.57	19.57	9.31	9.31	76.06	76.06	84.63	84.63
108	19.64	19.64	9.30	9.30	78.29	78.29	85.01	85.01
109	19.82	19.82	10.16	10.16	72.89	72.89	84.60	84.60
110	20.60	20.60	10.68	10.68	75.33	75.33	84.66	84.66
111	20.66	20.65	11.04	11.04	75.50	75.52	85.08	85.10
113	20.99	20.99	18.32	18.32	77.73	77.73	95.51	95.51
114	20.62	20.70	9.58	9.57	68.75	68.59	81.34	81.14
116	18.94	18.94	11.24	11.24	76.98	76.98	88.29	88.29
117	14.19	14.23	7.03	7.02	64.47	64.36	87.53	87.43

Microcel - Total Sulfur

Test Number	Measured Column Feed T. Sulfur %	Adjusted Column Feed T. Sulfur %	Measured Column Product T. Sulfur %	Adjusted Column Product T. Sulfur %	Measured Column Reject T. Sulfur %	Adjusted Column Reject T. Sulfur %
101	3.14	3.04	2.88	2.95	3.64	3.66
102	2.31	2.51	2.78	2.54	2.44	2.40
103	3.56	3.26	3.14	3.33	2.95	2.99
104	2.96	3.05	3.11	3.03	3.21	3.20
105	2.96	2.96	2.67	2.67	4.49	4.49
106	3.37	2.93	2.61	2.79	3.09	3.21
107	2.92	2.79	2.65	2.74	2.99	3.01
108	2.79	2.82	2.80	2.78	3.04	3.04
109	2.78	2.78	2.77	2.77	2.81	2.81
110	2.85	2.78	2.83	2.89	2.18	2.19
111	2.68	2.90	2.74	2.54	5.10	4.98
113	2.68	2.76	2.74	2.66	5.10	5.09
114	3.29	3.45	3.42	3.28	4.21	4.16
116	2.83	3.00	3.16	2.97	3.24	3.21
117	2.30	2.22	2.19	2.26	1.94	1.95

Microcel - Pyritic Sulfur

Test Number	Measured Column Feed Pyritic S %	Adjusted Column Feed Pyritic S %	Measured Column Product Pyritic S %	Adjusted Column Product Pyritic S %	Measured Column Reject Pyritic S %	Adjusted Column Reject Pyritic S %
101	1.55	1.56	1.38	1.37	2.98	2.97
102	0.91	0.95	0.81	0.78	1.66	1.63
103	1.64	1.56	1.32	1.36	2.39	2.42
104	1.50	1.66	1.62	1.46	2.99	2.90
105	1.53	1.55	1.20	1.19	3.45	3.43
106	0.96	0.91	0.40	0.41	1.90	1.96
107	1.40	1.34	1.15	1.18	2.22	2.24
108	1.43	1.44	1.31	1.30	2.22	2.22
109	0.83	0.88	0.69	0.66	2.09	2.05
110	1.00	1.05	0.99	0.95	1.58	1.56
111	1.13	1.04	0.43	0.44	4.23	4.43
113	0.75	0.86	1.05	0.84	1.52	1.50
114	1.66	1.07	0.47	0.51	3.11	3.50
116	0.93	0.87	0.61	0.63	2.62	2.67
117	0.59	0.41	0.26	0.29	1.18	1.27

Table PITT-2

Microcel/MGS Independent Tests Results - Pittsburgh #8

Microcel Performance

Test Number	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
101	96.72	45.32	42.04	14.58	11.29	22.69	19.41
102	91.19	66.97	58.16	18.65	9.84	33.99	25.19
103	93.98	65.68	59.66	16.95	10.93	29.12	23.10
104	96.47	51.96	48.44	14.48	10.95	24.29	20.76
105	95.73	62.19	57.92	24.25	19.99	35.53	31.26
106	77.92	77.16	55.08	35.97	13.90	69.71	47.63
107	95.42	59.74	55.16	16.89	12.31	25.48	20.90
108	95.95	59.74	55.70	16.19	12.14	23.25	19.20
109	94.79	56.63	51.43	15.70	10.50	36.55	31.34
110	95.23	56.11	51.34	11.99	7.23	23.41	18.64
111	95.40	54.51	49.91	25.47	20.87	64.00	59.40
113	98.73	16.64	15.38	7.95	6.69	6.72	5.45
114	92.53	62.49	55.02	22.86	15.39	61.32	53.86
116	96.67	47.61	44.28	12.60	9.27	36.07	32.74
117	94.78	56.87	51.65	11.00	5.77	38.16	32.94

Table PITT-3

Independent Testing

Microcel - Pittsburgh #8

I_COL_REJ

Figure PITT-1

Microcel/MGS Independent Testing - Pittsburgh #8

MGS Conditions Held Constant

Shake Amplitude (mm): 15
Shake Frequency (cps): 5
Tilt Angle (degrees): 6

MGS Variables

Test Number	Grind Size (microns)	Drum Speed rpm	Wash Water lpm	Percent Feed Solids w/w	Feed Rate lbs/hr
201	200	280	1.02	35	110
202	200	280	1.02	35	235
203	200	241	1.48	26	169
204	200	280	0.53	25	273
205	200	240	0.53	25	159
206	200	280	0.53	25	100
207	200	280	0.95	26	200
208	200	321	1.10	15	173
209	200	280	0.91	16	261
210	300	281	0.95	35	216
211	300	280	0.98	25	260
212	300	280	1.51	26	215
213	300	280	0.91	25	110
214	300	321	0.95	25	217
215	300	281	0.45	26	215
216	300	241	1.02	25	217
217	300	280	1.02	14	239
218	200	282	0.49	35	210
219	200	280	1.51	35	216
220	200	320	0.98	25	334
221	200	240	0.98	24	347
222	200	280	0.98	26	164
223	200	240	0.98	26	137
224	200	281	1.51	25	313
225	200	281	1.48	16	200
226	200	242	0.98	15	212
227	100	284	0.98	36	197
228	100	282	0.91	25	100
229	100	280	0.98	26	321
230	100	320	0.98	26	198
231	100	280	0.49	25	204
232	100	240	0.98	25	208
233	100	280	1.48	26	200
234	100	280	0.98	15	205
235	200	320	0.95	35	208
236	200	241	0.95	35	223
237	200	320	0.98	25	128
238	200	280	0.98	26	176
239	200	321	0.53	26	186
240	200	321	1.51	25	146
241	200	280	1.59	25	103
242	200	280	0.42	15	236
243	200	280	0.91	16	119

Table PITT-4

Microcel/MGS Independent Tests Results - Pittsburgh #8

MGS - Ash

Test Number	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %
201	18.40	18.42	12.52	12.52	63.86	63.84	88.55	88.50
202	19.36	19.34	12.57	12.58	57.80	57.90	84.99	85.08
203	17.49	17.50	16.13	16.06	73.80	73.76	97.64	97.37
204	20.84	20.80	19.31	14.33	54.04	54.08	95.59	83.72
205	21.41	21.45	19.63	19.60	76.10	76.08	96.85	96.72
206	23.02	22.97	15.00	15.02	73.45	73.52	86.28	86.41
207	21.29	21.24	15.76	15.79	74.51	74.57	90.59	90.73
208	18.14	18.18	13.92	13.90	65.58	65.53	91.83	91.71
209	17.71	17.77	14.13	14.10	44.80	44.75	88.33	88.03
210	19.65	19.66	12.23	12.23	49.77	49.68	80.23	80.16
211	19.92	19.96	19.15	19.11	73.80	73.79	98.59	98.45
212	20.80	20.77	13.70	13.71	59.04	59.08	84.34	84.44
213	21.23	21.20	13.79	13.80	61.81	61.85	84.51	84.60
214	19.80	19.79	12.43	12.43	41.03	41.04	74.23	74.27
215	20.94	20.92	13.93	13.94	51.80	51.82	81.49	81.57
216	20.54	20.50	18.58	18.61	74.54	74.56	96.50	96.62
217	20.06	20.06	17.44	17.44	70.40	70.40	95.05	95.05
218	20.52	20.52	12.57	12.57	48.26	48.26	77.72	77.72
219	20.23	20.21	13.00	13.00	56.13	56.15	83.24	83.29
220	20.31	20.28	12.61	12.62	46.60	46.64	77.35	77.48
221	20.68	20.67	17.63	17.64	69.14	69.15	94.08	94.12
222	21.51	21.48	14.22	14.23	56.77	56.81	82.87	82.97
223	24.72	24.12	22.97	23.48	70.14	70.21	96.29	98.63
224	19.73	19.73	14.05	14.05	56.52	56.52	86.63	86.63
225	19.14	19.13	16.07	16.09	70.74	70.75	94.38	94.44
226	20.06	20.06	19.30	19.30	72.52	72.52	98.57	98.57
227	19.69	19.70	13.50	13.50	55.22	55.21	85.16	85.14
228	20.70	20.69	14.73	14.74	69.12	69.14	89.02	89.06
229	20.89	20.88	16.71	16.72	57.92	57.93	89.86	89.91
230	20.87	20.86	14.54	14.54	51.24	51.25	82.75	82.78
231	20.24	20.28	15.40	15.42	57.05	57.01	88.38	88.31
232	20.19	20.18	17.42	17.43	75.38	75.39	95.22	95.26
233	19.62	19.61	14.64	14.64	64.25	64.26	89.96	89.98
234	19.75	19.76	16.43	16.42	66.11	66.10	93.32	93.28
235	29.22	29.15	11.31	11.31	39.65	39.73	36.80	37.23
236	20.15	20.18	15.99	15.97	72.73	72.70	92.67	92.58
237	22.30	22.25	14.08	14.10	65.96	66.03	84.16	84.31
238	21.00	20.98	15.07	15.07	65.01	65.03	88.13	88.17
239	21.01	21.01	12.46	12.46	47.61	47.61	75.68	75.68
240	21.00	21.00	14.09	14.09	63.50	63.49	86.01	86.01
241	24.47	24.52	17.77	17.75	70.92	70.87	87.39	87.26
242	20.99	21.07	17.30	17.25	65.34	65.28	92.32	92.05
243	19.75	19.79	13.47	13.45	65.16	65.11	87.85	87.73

Table PITT-5

Microcel/MGS Independent Tests Results - Pittsburgh #8

MGS - Total Sulfur

Test Number	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
201	2.72	2.60	1.76	1.81	8.56	8.70
202	2.83	2.90	1.75	1.73	9.71	9.59
203	2.73	2.73	2.03	2.03	28.57	28.67
204	2.74	2.86	1.80	1.76	8.71	8.52
205	2.89	2.83	2.04	2.07	25.40	25.54
206	2.98	3.18	1.81	1.75	12.73	12.25
207	2.86	2.92	1.90	1.87	13.30	13.17
208	2.82	2.66	1.85	1.91	10.89	10.99
209	2.48	2.48	1.88	1.88	6.95	6.95
210	2.96	2.88	1.79	1.81	7.06	7.16
211	2.89	2.79	2.41	2.48	22.15	22.24
212	2.96	3.00	1.93	1.92	8.91	8.86
213	3.11	3.08	2.04	2.05	8.72	8.75
214	3.09	3.00	1.83	1.85	6.21	6.31
215	3.04	3.00	1.97	1.98	7.48	7.52
216	3.05	3.09	2.37	2.35	24.42	24.34
217	3.56	3.03	2.10	2.28	16.91	17.50
218	3.04	2.96	1.82	1.84	6.76	6.85
219	2.89	2.98	1.89	1.86	8.69	8.56
220	2.76	2.91	1.88	1.83	6.87	6.66
221	2.79	2.80	2.05	2.05	14.76	14.75
222	2.69	2.77	1.81	1.78	7.66	7.56
223	3.38	3.01	2.42	2.61	31.61	32.05
224	2.98	2.91	1.85	1.87	9.57	9.66
225	2.65	2.65	1.96	1.96	14.32	14.32
226	2.87	2.87	2.43	2.43	32.87	32.88
227	2.76	2.67	1.68	1.71	8.08	8.19
228	2.85	2.77	1.76	1.79	10.66	10.78
229	2.77	2.76	1.87	1.87	10.66	10.72
230	2.78	2.77	1.76	1.76	7.62	7.63
231	2.92	2.70	1.79	1.86	8.78	9.01
232	2.90	2.86	1.95	1.97	20.80	20.89
233	2.76	2.69	1.78	1.81	10.50	10.60
234	2.82	2.77	1.93	1.95	14.08	14.16
235	4.46	4.25	1.68	1.69	5.55	5.76
236	2.95	2.92	1.95	1.96	14.85	14.90
237	2.99	3.06	1.85	1.83	9.79	9.67
238	2.96	3.00	1.91	1.89	11.39	11.31
239	3.05	3.00	1.79	1.80	6.65	6.71
240	3.05	3.03	1.87	1.88	10.07	10.10
241	3.55	3.43	2.00	2.03	12.79	12.99
242	2.99	2.89	1.98	2.02	12.81	12.96
243	2.77	2.76	1.84	1.85	9.25	9.27

Table PITT-6

Microcel/MGS Independent Tests Results - Pittsburgh #8

MGS - Pyritic Sulfur

Test Number	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
201	1.26	1.29	0.45	0.45	7.84	7.73
202	1.35	1.41	0.43	0.42	7.29	7.03
203	1.24	1.39	0.73	0.68	30.11	27.76
204	1.42	1.51	0.50	0.49	7.17	6.78
205	1.58	1.53	0.73	0.74	24.26	24.68
206	1.30	1.71	0.54	0.50	12.24	9.35
207	1.38	1.55	0.56	0.54	12.74	11.43
208	1.45	1.35	0.50	0.51	10.15	10.57
209	1.17	1.21	0.59	0.58	5.93	5.81
210	1.53	1.51	0.47	0.47	5.63	5.69
211	1.18	1.14	0.81	0.83	21.00	21.18
212	1.26	1.40	0.46	0.44	7.33	6.59
213	1.17	1.34	0.47	0.45	7.22	6.23
214	1.18	1.30	0.36	0.35	4.51	4.05
215	1.42	1.53	0.51	0.50	6.53	6.10
216	1.34	1.43	0.75	0.72	22.40	21.59
217	1.34	1.42	0.76	0.74	14.92	14.45
218	1.44	1.51	0.46	0.45	5.38	5.17
219	1.41	1.40	0.48	0.48	6.36	6.25
220	1.36	1.43	0.48	0.47	4.93	4.72
221	1.47	1.51	0.76	0.75	13.93	13.71
222	1.44	1.55	0.57	0.56	6.85	6.41
223	1.89	1.69	1.19	1.27	32.56	31.75
224	1.29	1.36	0.43	0.42	7.72	7.40
225	1.08	1.14	0.52	0.51	12.36	11.91
226	1.14	1.14	0.77	0.77	27.05	27.02
227	1.27	1.31	0.40	0.40	6.72	6.55
228	1.07	1.20	0.36	0.35	9.20	8.15
229	1.19	1.26	0.48	0.47	8.67	8.30
230	1.44	1.49	0.48	0.48	6.57	6.38
231	1.24	1.20	0.42	0.42	6.94	7.08
232	1.28	1.34	0.56	0.55	17.88	17.28
233	1.28	1.37	0.51	0.50	9.68	9.18
234	0.98	1.13	0.48	0.45	12.02	10.54
235	3.62	2.96	0.37	0.37	3.99	4.49
236	1.32	1.48	0.64	0.60	13.76	12.45
237	1.06	1.23	0.31	0.30	7.69	6.26
238	1.62	1.68	0.61	0.60	9.94	9.69
239	1.27	1.31	0.30	0.30	4.61	4.47
240	1.76	1.76	0.57	0.57	9.02	9.04
241	2.24	2.12	0.70	0.71	12.18	11.79
242	1.53	1.61	0.70	0.68	11.40	12.35
243	1.28	1.38	0.56	0.54	7.80	7.35

Table PITT-7

Microcel/MGS Independent Tests Results - Pittsburgh #8

MGS - Performance

Test Number	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	T.Sulfur Rejection %	T.Sulfur Separation Efficiency %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
201	94.90	39.84	34.75	38.39	33.29	69.13	64.03
202	92.21	44.66	36.87	49.24	41.46	74.66	66.87
203	99.16	11.05	10.21	27.60	26.76	52.37	51.53
204	90.56	42.32	32.88	48.48	39.04	72.83	63.39
205	99.00	11.62	10.62	29.25	28.25	53.22	52.22
206	95.33	43.50	38.83	52.45	47.78	74.73	70.06
207	97.01	32.55	29.56	41.90	38.90	68.39	65.40
208	96.51	29.88	26.39	34.15	30.66	65.35	61.86
209	91.95	30.15	22.11	33.27	25.23	57.81	49.76
210	87.57	50.13	37.71	49.62	37.20	75.05	62.62
211	99.49	5.75	5.24	12.49	11.98	28.32	27.82
212	91.96	44.26	36.23	45.96	37.92	73.46	65.43
213	92.54	44.93	37.47	43.69	36.24	71.59	64.13
214	81.09	53.35	34.44	54.20	35.29	80.00	61.09
215	88.77	45.64	34.42	46.16	34.94	73.34	62.12
216	98.92	12.29	11.21	26.52	25.44	51.35	50.27
217	98.17	17.36	15.53	28.48	26.64	50.47	48.63
218	85.50	52.39	37.89	51.68	37.18	76.84	62.34
219	90.82	46.42	37.24	48.01	38.83	71.44	62.26
220	84.93	51.78	36.71	51.27	36.20	74.53	59.46
221	97.71	19.68	17.39	31.09	28.80	53.25	50.97
222	90.63	45.03	35.67	46.68	37.32	70.02	60.66
223	99.46	3.99	3.45	14.48	13.94	25.88	25.34
224	92.76	38.31	31.07	44.33	37.09	73.25	66.00
225	97.99	20.57	18.56	30.15	28.14	57.75	55.74
226	99.51	5.16	4.67	16.54	16.05	33.42	32.93
227	91.71	41.66	33.37	45.48	37.18	74.00	65.71
228	95.74	36.55	32.29	42.45	38.19	74.02	69.77
229	94.63	28.01	22.64	39.09	33.72	66.46	61.10
230	89.39	42.30	31.69	47.40	36.80	73.33	62.73
231	93.70	32.85	26.55	39.16	32.86	69.09	62.79
232	98.54	17.73	16.26	34.39	32.92	60.90	59.44
233	95.55	32.82	28.37	39.45	35.00	67.16	62.71
234	97.16	22.49	19.65	34.34	31.50	62.85	60.01
235	46.60	85.56	32.16	85.20	31.80	95.35	41.95
236	97.46	26.74	24.20	37.86	35.32	62.47	59.93
237	93.14	46.57	39.72	49.58	42.72	79.44	72.58
238	94.76	36.67	31.43	44.45	39.22	68.51	63.28
239	83.87	55.12	38.99	54.59	38.46	82.67	66.54
240	93.54	42.29	35.83	46.63	40.17	72.14	65.68
241	95.08	36.84	31.92	48.36	43.44	70.78	65.86
242	96.50	24.64	21.14	35.66	32.16	61.12	57.62
243	94.66	40.38	35.04	41.20	35.86	65.67	60.33

Table PITT-8

Independent Testing

MGS - Pittsburgh #8

I_MGS_REJ

Figure PITT-2

Microcel/MGS Combined Testing - Pittsburgh #8

Microcel

Wash Water (lpm): 40.12
 Percent Solids (w/w): 14.5 - 15.5
 Grind Size (d80 (microns)): 200
 Air Flow Rate (SCFM): 8.89
 Diesel dosage (lbs/ton): 1
 Frother Dosage (ml/min): 1

MGS

Percent Solids (w/w): 18 - 22
 Shake Frequency (cps): 5
 Shake Amplitude (mm): 15
 Tilt Angle (degrees): 6

MGS Variables

Test Number	Column Feed (lbs/hr)	Drum Speed rpm	Wash Water lpm	MGS Feed lbs/hr
301	512	282	0.51	249
302	527	283	1.02	378
303	415	241	1.51	259
304	392	242	0.98	373
305	414	280	0.49	381
306	427	282	1.06	260
307	420	322	1.50	241
308	414	242	0.98	124
309	415	320	0.98	351
310	391	280	0.49	135
311	397	280	1.51	393
312	410	280	1.55	134
313	458	280	0.95	259
314	302	280	0.98	160
315	333	241	1.00	267
316	529	281	0.98	141
317	474	241	0.98	276
318	491	320	0.98	267
319	491	282	1.55	285
320	444	242	0.49	326
321	383	280	0.95	313
322	427	320	0.51	297
323	393	320	0.97	170
324	311	281	0.51	268
325	318	281	1.55	285
326	294	280	0.95	474
327	324	320	0.98	328

Table PITT-9

Combined Microcel/MGS Tests Results - Pittsburgh #8

Ash

Test No.	Microcel						MGS						Yields					
	Measured Microcel Feed Ash %	Adjusted Microcel Feed Ash %	Measured Microcel Product Ash %	Adjusted Microcel Product Ash %	Measured Microcel Reject Ash %	Adjusted Microcel Reject Ash %	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %	Measured Microcel Ash Yield %	Adjusted Microcel Ash Yield %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %	Measured Combined Ash Yield %	Adjusted Combined Ash Yield %
301	20.31	20.36	7.47	7.57	72.45	72.32	7.60	7.57	6.83	6.77	53.98	53.92	80.24	80.25	98.37	98.30	78.93	78.89
302	19.41	19.40	7.98	7.96	69.68	69.70	7.98	7.96	6.93	6.95	57.86	57.89	81.47	81.47	97.94	98.02	79.80	79.86
303	20.10	20.02	9.20	9.15	77.29	77.48	9.17	9.15	8.99	9.06	60.68	60.69	83.99	84.09	99.65	99.83	83.70	83.95
304	22.84	23.00	7.08	7.42	64.50	64.16	7.69	7.42	7.35	7.22	47.83	47.80	72.55	72.54	99.16	99.51	71.94	72.18
305	19.66	19.71	7.68	7.77	72.82	72.69	7.83	7.77	6.98	6.94	57.61	57.57	81.61	81.61	98.32	98.36	80.24	80.27
306	20.15	20.26	8.19	8.39	71.77	71.50	8.57	8.39	7.46	7.41	61.01	60.95	81.19	81.19	97.93	98.17	79.51	79.71
307	20.49	20.58	8.00	8.17	73.95	73.72	8.21	8.17	6.72	6.63	58.79	58.57	81.06	81.07	97.14	97.04	78.74	78.66
308	20.11	20.06	8.09	8.69	76.48	76.60	10.04	8.69	7.96	8.23	25.98	26.06	82.42	83.26	88.46	97.42	72.91	81.11
309	20.11	20.48	7.69	7.96	72.73	71.78	8.34	7.96	6.72	6.73	52.71	52.73	80.90	80.38	96.48	97.33	78.05	78.23
310	21.23	21.38	7.57	7.85	75.72	75.33	7.97	7.85	7.17	7.00	59.67	59.47	79.96	79.95	98.48	98.38	78.74	78.65
311	20.67	20.74	7.12	7.26	71.98	71.79	7.29	7.26	6.82	6.71	59.70	59.61	79.11	79.11	99.11	98.96	78.41	78.29
312	19.79	19.94	7.11	7.40	71.50	71.10	7.50	7.40	6.97	6.77	59.38	59.20	80.31	80.31	98.99	98.80	79.50	79.35
313	17.89	17.89	8.14	8.13	77.50	77.51	8.35	8.13	7.07	7.23	58.40	58.60	85.94	85.93	97.51	98.25	83.80	84.43
314	18.17	18.45	7.87	8.08	75.10	74.35	8.27	8.08	7.33	7.26	61.51	61.43	84.68	84.35	98.27	98.49	83.21	83.08
315	20.62	20.58	7.82	7.74	69.35	69.44	7.71	7.74	7.52	7.56	53.81	53.82	79.20	79.19	99.59	99.61	78.87	78.88
316	19.75	19.80	7.42	7.50	67.39	67.28	7.54	7.50	7.07	7.02	58.78	58.75	79.44	79.42	99.09	99.07	78.72	78.69
317	20.59	20.78	7.50	7.85	71.82	71.35	8.18	7.85	7.45	7.36	41.29	41.25	79.65	79.64	97.84	98.55	77.93	78.49
318	19.12	19.13	7.33	7.34	66.15	66.14	7.36	7.34	5.93	5.94	50.41	50.43	79.96	79.95	96.79	96.85	77.39	77.43
319	18.58	18.72	6.97	7.23	60.70	60.38	7.36	7.23	6.59	6.45	57.95	57.79	78.39	78.38	98.50	98.48	77.22	77.19
320	20.44	20.42	7.59	7.55	68.56	68.61	7.54	7.55	7.14	7.17	45.88	45.89	78.92	78.92	98.97	99.02	78.11	78.15
321	22.41	22.42	7.11	7.13	66.11	66.08	7.12	7.13	6.41	6.39	57.48	57.45	74.07	74.06	98.61	98.55	73.04	72.99
322	21.45	21.44	7.08	7.06	71.53	71.55	7.01	7.06	5.58	5.57	38.89	38.86	77.70	77.70	95.71	95.52	74.37	74.22
323	20.10	20.09	7.53	7.52	58.97	58.98	7.51	7.52	5.54	5.54	41.55	41.55	75.56	75.57	94.53	94.50	71.43	71.42
324	22.41	22.43	7.69	7.73	58.40	58.36	7.75	7.73	6.85	6.83	55.72	55.69	70.97	70.97	98.16	98.16	69.67	69.66
325	18.51	18.58	7.03	7.17	64.89	64.71	7.20	7.17	6.51	6.42	57.45	57.34	80.16	80.17	98.65	98.53	79.07	78.99
326	21.45	21.38	7.81	7.75	70.69	70.85	7.69	7.75	6.90	6.90	57.78	57.78	78.31	78.40	98.45	98.33	77.09	77.09
327	23.51	23.73	7.71	7.83	72.81	72.29	8.04	7.83	5.93	5.96	35.50	35.57	75.73	75.33	92.86	93.68	70.33	70.58

Table PITT-10

Combined Microcel/MGS Tests Results - Pittsburgh #8

Total Sulfur

Test Number	Microcel						MGS					
	Measured Microcel Feed T. Sulfur %	Adjusted Microcel Feed T. Sulfur %	Measured Microcel Product T. Sulfur %	Adjusted Microcel Product T. Sulfur %	Measured Microcel Reject T. Sulfur %	Adjusted Microcel Reject T. Sulfur %	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
301	2.58	2.46	2.36	2.42	2.60	2.62	2.43	2.42	1.85	1.87	34.60	34.71
302	2.60	2.57	2.46	2.47	3.03	3.04	2.43	2.47	1.82	1.80	35.50	35.37
303	2.52	2.54	2.51	2.54	2.54	2.54	2.45	2.54	2.62	2.47	43.00	42.92
304	2.50	2.57	2.32	2.47	2.86	2.84	2.49	2.47	2.51	2.31	35.90	35.70
305	2.50	2.45	2.36	2.40	2.68	2.69	2.38	2.40	1.84	1.83	36.50	36.43
306	2.62	2.53	2.61	2.48	2.71	2.73	2.47	2.48	1.79	1.87	34.70	35.28
307	2.67	2.57	2.66	2.54	2.68	2.70	2.55	2.54	1.70	1.78	26.70	27.33
308	2.67	2.79	2.58	2.62	3.62	3.58	2.56	2.62	2.37	2.21	19.00	18.73
309	2.54	2.59	2.53	2.56	2.74	2.73	2.71	2.56	1.88	1.92	25.70	25.88
310	2.70	2.66	2.56	2.60	2.90	2.91	2.65	2.60	1.92	1.94	42.13	42.29
311	2.90	2.65	2.54	2.60	2.78	2.83	2.63	2.60	2.08	2.15	44.60	44.96
312	2.71	2.72	2.52	2.50	3.59	3.59	2.57	2.50	1.92	1.96	46.70	47.01
313	2.67	2.71	2.62	2.68	2.91	2.90	2.63	2.68	2.07	1.98	42.50	41.85
314	2.67	2.52	2.55	2.45	2.91	2.94	2.55	2.45	1.72	1.86	38.80	39.94
315	2.59	2.59	2.44	2.44	3.15	3.15	2.44	2.44	2.29	2.29	41.70	41.69
316	2.33	2.34	2.14	2.19	2.38	2.40	2.20	2.19	1.85	1.86	37.40	37.44
317	2.31	2.40	2.09	2.23	3.07	3.04	2.18	2.23	2.08	1.84	29.90	29.18
318	2.45	2.23	2.08	2.16	2.46	2.50	2.10	2.16	1.52	1.52	22.00	21.97
319	2.52	2.50	2.43	2.46	2.63	2.64	2.47	2.46	1.87	1.87	41.00	40.99
320	2.70	2.61	2.49	2.54	2.82	2.84	2.52	2.54	2.25	2.24	33.04	33.02
321	3.03	2.91	2.45	2.44	4.18	4.24	2.44	2.44	1.88	1.92	37.13	37.38
322	3.06	2.74	2.41	2.44	3.70	3.80	2.39	2.44	1.71	1.75	17.12	17.28
323	2.40	2.48	2.39	2.41	2.70	2.68	2.46	2.41	1.69	1.67	15.30	15.21
324	2.83	2.65	2.44	2.47	3.02	3.08	2.45	2.47	1.89	1.92	31.10	31.26
325	2.51	2.50	2.40	2.45	2.72	2.72	2.52	2.45	1.88	1.89	39.92	39.99
326	2.76	2.64	2.54	2.50	3.11	3.14	2.44	2.50	1.89	1.92	36.65	36.81
327	2.71	2.70	2.48	2.53	3.23	3.23	2.55	2.53	1.71	1.70	14.93	14.87

Table PITT-11

Combined Microcel/MGS Tests Results - Pittsburgh #8

Pyritic Sulfur

Test Number	Microcel						MGS					
	Measured Microcel Feed Pyritic S %	Adjusted Microcel Feed Pyritic S %	Measured Microcel Product Pyritic S %	Adjusted Microcel Product Pyritic S %	Measured Microcel Reject Pyritic S %	Adjusted Microcel Reject Pyritic S %	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
301	1.30	1.28	1.03	1.10	1.95	1.99	1.15	1.10	0.57	0.58	31.40	31.74
302	1.34	1.35	1.07	1.16	2.18	2.18	1.13	1.16	0.58	0.54	34.18	31.65
303	1.34	1.14	1.03	1.06	1.50	1.54	0.99	1.06	1.01	0.99	39.77	39.73
304	1.19	1.21	0.89	0.93	1.96	1.94	1.03	0.93	0.84	0.86	17.09	17.12
305	1.33	1.14	0.90	0.92	2.02	2.10	0.99	0.92	0.58	0.63	17.73	18.45
306	1.30	1.34	1.27	1.19	2.03	2.01	1.12	1.19	0.58	0.57	34.89	34.34
307	1.40	1.26	1.09	1.13	1.78	1.82	1.01	1.13	0.45	0.43	26.01	24.07
308	1.21	1.42	1.06	1.16	2.93	2.72	1.13	1.16	1.07	0.81	15.89	14.43
309	1.26	1.27	1.06	1.10	1.97	1.97	1.06	1.10	0.50	0.48	24.59	23.46
310	1.37	1.34	1.00	1.15	2.10	2.11	1.13	1.15	0.61	0.55	41.05	36.91
311	1.26	1.18	0.92	0.97	1.95	1.99	1.06	0.97	0.55	0.57	37.94	38.86
312	1.07	1.23	0.83	0.94	2.62	2.43	0.96	0.94	0.59	0.51	41.28	36.36
313	0.93	1.04	0.95	0.98	1.43	1.39	0.88	0.98	0.55	0.47	35.37	29.55
314	0.96	1.14	0.94	1.03	1.82	1.72	1.13	1.03	0.57	0.51	38.45	34.35
315	1.16	1.35	1.39	1.10	2.49	2.31	1.02	1.10	1.00	0.96	38.00	37.75
316	1.15	1.15	0.88	0.99	1.77	1.77	1.02	0.99	0.69	0.64	40.28	38.56
317	1.19	1.25	0.90	1.00	2.28	2.23	0.92	1.00	0.81	0.64	29.29	26.06
318	1.15	1.10	0.90	1.00	1.50	1.52	0.90	1.00	0.49	0.44	21.40	18.25
319	1.07	1.22	0.93	1.09	1.78	1.69	2.47	1.09	0.57	0.55	37.31	36.08
320	1.49	1.40	1.17	1.20	2.12	2.16	1.11	1.20	0.97	0.91	32.28	31.57
321	1.90	1.79	1.13	1.13	3.55	3.65	1.11	1.13	0.60	0.60	37.11	37.17
322	1.91	1.64	1.05	1.12	3.28	3.46	1.05	1.12	0.42	0.41	17.08	16.25
323	1.19	1.32	1.06	1.10	2.10	2.00	1.12	1.10	0.36	0.35	14.87	13.91
324	1.40	1.37	1.07	1.07	2.07	2.09	1.04	1.07	0.53	0.53	29.94	29.70
325	1.10	1.12	0.95	0.99	1.66	1.65	1.00	0.99	0.51	0.50	34.39	33.66
326	1.39	1.37	1.03	1.08	2.39	2.40	1.06	1.08	0.57	0.55	33.06	31.99
327	1.36	1.40	0.90	1.08	2.44	2.40	1.22	1.08	0.42	0.40	12.58	11.17

Table PITT-12

Combined Microcel/MGS Tests Results - Pittsburgh #8

Ash Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %
301	93.13	70.16	63.30	99.15	12.09	11.24	92.35	73.77	66.12
302	93.03	66.57	59.61	99.09	14.42	13.51	92.19	71.39	63.58
303	95.52	61.57	57.09	99.92	1.16	1.08	95.45	62.01	57.46
304	87.22	76.60	63.82	99.72	3.17	2.90	86.98	77.34	64.32
305	93.74	67.83	61.57	99.25	12.15	11.39	93.04	71.74	64.77
306	93.28	66.38	59.65	99.22	13.30	12.52	92.55	70.85	63.40
307	93.74	67.82	61.55	98.66	21.26	19.92	92.48	74.66	67.14
308	95.10	63.93	59.03	97.91	7.74	5.65	93.11	66.72	59.84
309	93.04	68.76	61.80	98.63	17.71	16.34	91.76	74.29	66.05
310	93.71	70.65	64.35	99.29	12.27	11.56	93.04	74.25	67.29
311	92.57	72.31	64.87	99.55	8.54	8.08	92.15	74.67	66.82
312	92.89	70.19	63.09	99.47	9.61	9.08	92.40	73.06	65.46
313	96.15	60.95	57.10	99.21	12.63	11.84	95.39	65.88	61.27
314	95.08	63.06	58.14	99.36	11.51	10.87	94.47	67.31	61.78
315	91.99	70.22	62.21	99.81	2.71	2.51	91.81	71.02	62.84
316	91.61	69.91	61.52	99.59	7.27	6.85	91.23	72.10	63.33
317	92.64	69.92	62.55	99.08	7.60	6.68	91.78	72.20	63.98
318	91.60	69.32	60.93	98.32	21.62	19.94	90.06	75.96	66.02
319	89.46	69.73	59.19	99.31	12.14	11.45	88.84	73.40	62.25
320	91.69	70.82	62.51	99.43	5.97	5.39	91.16	72.56	63.72
321	88.66	76.45	65.11	99.34	11.68	11.01	88.07	79.20	67.27
322	91.92	74.41	66.34	97.06	24.64	21.69	89.22	80.72	69.94
323	87.46	71.71	59.17	96.52	30.38	26.91	84.42	80.31	64.73
324	84.41	75.54	59.96	99.12	13.27	12.39	83.67	78.79	62.46
325	91.41	69.06	60.47	99.32	11.78	11.10	90.79	72.71	63.49
326	91.99	71.58	63.57	99.24	12.46	11.69	91.29	75.12	66.41
327	91.04	75.14	66.18	95.59	28.69	24.27	87.02	82.27	69.29

Table PITT-13

Combined Microcel/MGS Tests Results - Pittsburgh #8

Total Sulfur Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %
301	93.13	21.06	14.19	99.15	24.04	23.19	92.35	40.03	32.38
302	93.03	21.70	14.73	99.09	28.57	27.66	92.19	44.07	36.26
303	95.52	15.91	11.43	99.92	2.93	2.85	95.45	18.37	13.82
304	87.22	30.28	17.50	99.72	6.94	6.66	86.98	35.12	22.10
305	93.74	20.06	13.80	99.25	25.00	24.25	93.04	40.04	33.08
306	93.28	20.41	13.69	99.22	25.98	25.20	92.55	41.09	33.64
307	93.74	19.88	13.61	98.66	32.00	30.66	92.48	45.52	38.00
308	95.10	21.82	16.91	97.91	17.83	15.74	93.11	35.75	28.86
309	93.04	20.55	13.59	98.63	27.01	25.63	91.76	42.00	33.77
310	93.71	21.85	15.56	99.29	26.59	25.88	93.04	42.64	35.68
311	92.57	22.38	14.95	99.55	18.17	17.71	92.15	36.48	28.63
312	92.89	26.18	19.08	99.47	22.54	22.01	92.40	42.82	35.22
313	96.15	15.02	11.17	99.21	27.41	26.62	95.39	38.32	33.70
314	95.08	17.99	13.07	99.36	25.23	24.60	94.47	38.68	33.16
315	91.99	25.40	17.39	99.81	6.51	6.32	91.81	30.26	22.07
316	91.61	25.67	17.27	99.59	15.86	15.44	91.23	37.45	28.68
317	92.64	26.00	18.64	99.08	18.68	17.76	91.78	39.83	31.61
318	91.60	22.56	14.17	98.32	31.84	30.16	90.06	47.22	37.28
319	89.46	22.87	12.33	99.31	25.14	24.45	88.84	42.26	31.10
320	91.69	23.19	14.88	99.43	12.68	12.10	91.16	32.93	24.09
321	88.66	37.90	26.56	99.34	22.45	21.79	88.07	51.84	39.91
322	91.92	30.81	22.73	97.06	31.49	28.54	89.22	52.59	41.81
323	87.46	26.56	14.02	96.52	34.52	31.04	84.42	51.91	36.33
324	84.41	33.85	18.27	99.12	23.70	22.81	83.67	49.53	33.20
325	91.41	21.43	12.84	99.32	23.99	23.32	90.79	40.28	31.07
326	91.99	25.76	17.75	99.24	24.48	23.72	91.29	43.93	35.22
327	91.04	29.41	20.45	95.59	37.05	32.64	87.02	55.56	42.58

Table PITT-14

Combined Microcel/MGS Tests Results - Pittsburgh #8

Pyritic Sulfur Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
301	93.13	31.04	24.17	99.15	48.17	47.32	92.35	64.25	56.60
302	93.03	30.00	23.03	99.09	54.37	53.46	92.19	68.06	60.25
303	95.52	21.81	17.33	99.92	6.77	6.69	95.45	27.10	22.55
304	87.22	44.25	31.46	99.72	7.98	7.70	86.98	48.70	35.67
305	93.74	34.14	27.88	99.25	32.64	31.89	93.04	55.64	48.68
306	93.28	27.90	21.17	99.22	52.98	52.20	92.55	66.10	58.65
307	93.74	27.30	21.03	98.66	63.08	61.74	92.48	73.15	65.64
308	95.10	31.99	27.09	97.91	31.97	29.88	93.11	53.73	46.85
309	93.04	30.38	23.42	98.63	57.53	56.16	91.76	70.43	62.19
310	93.71	31.39	25.09	99.29	52.95	52.24	93.04	67.72	60.76
311	92.57	34.97	27.53	99.55	41.85	41.40	92.15	62.18	54.33
312	92.89	38.62	31.52	99.47	46.40	45.87	92.40	67.10	59.50
313	96.15	19.03	15.17	99.21	52.88	52.09	95.39	61.85	57.23
314	95.08	23.79	18.87	99.36	51.23	50.60	94.47	62.83	57.31
315	91.99	35.48	27.47	99.81	13.07	12.87	91.81	43.91	35.72
316	91.61	31.63	23.23	99.59	35.95	35.54	91.23	56.21	47.44
317	92.64	36.29	28.93	99.08	36.93	36.00	91.78	59.81	51.60
318	91.60	27.32	18.92	98.32	57.38	55.70	90.06	69.03	59.09
319	89.46	29.97	19.43	99.31	50.31	49.62	88.84	65.20	54.04
320	91.69	32.35	24.04	99.43	24.91	24.34	91.16	49.20	40.36
321	88.66	53.25	41.90	99.34	47.67	47.01	88.07	75.53	63.61
322	91.92	46.94	38.86	97.06	65.03	62.09	89.22	81.44	70.66
323	87.46	37.02	24.48	96.52	69.93	66.46	84.42	81.06	65.49
324	84.41	44.57	28.99	99.12	51.38	50.50	83.67	73.05	56.72
325	91.41	29.14	20.54	99.32	50.24	49.56	90.79	64.74	55.52
326	91.99	38.20	30.19	99.24	49.92	49.16	91.29	69.05	60.34
327	91.04	41.89	32.92	95.59	65.30	60.89	87.02	79.84	66.85

Table PITT-15

Figure P1T-3

Combined Testing

MGS - Pittsburgh #8

C_MGS_REJ

Figure PITT-4

Combined Testing

Microcel/MGS Circuit - Pittsburgh #8

C_COM_REJ

Figure PITT-5

Microcel/MGS Long Duration Testing - Pittsburgh #8

Microcel

Feed Rate (lbs/ton):	500
Wash Water (lpm):	39
Percent Solids (w/w):	12-14
Grind Size (d80 (microns)):	200
Air Flow Rate (SCFM):	8.89
Diesel dosage (lbs/ton):	1.00
Frother Dosage (ml/min):	0.80

MGS

Feed Rate (lbs/hr):	273
Drum Speed (rpm):	320
Wash water (lpm):	0.50 - 0.56
Percent Solids (w/w):	19 - 20
Shake Amplitude (mm):	15
Shake Frequency (cps):	5
Tilt Angle (degrees):	6

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Ash

Time hours	Microcel						MGS					
	Measured Microcel Feed Ash %	Adjusted Microcel Feed Ash %	Measured Microcel Product Ash %	Adjusted Microcel Product Ash %	Measured Microcel Reject Ash %	Adjusted Microcel Reject Ash %	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %
1	19.84	19.78	7.01	6.98	69.04	69.20	6.92	6.98	5.56	5.54	34.03	33.99
2	19.14	19.11	7.10	7.05	67.85	67.92	7.01	7.05	5.67	5.68	40.30	40.32
3	19.11	19.21	7.12	7.16	70.63	70.37	7.26	7.16	5.75	5.78	35.81	35.86
4	19.50	19.52	7.13	7.17	69.59	69.53	7.21	7.17	5.80	5.79	40.90	40.08
5	19.33	19.14	7.59	7.39	67.52	67.98	7.25	7.39	6.00	6.05	42.34	42.43
6	18.67	18.83	7.13	7.29	65.81	65.42	7.41	7.29	6.12	6.07	41.99	41.91
7	19.11	19.39	6.99	7.17	66.26	65.56	7.49	7.17	5.67	5.71	40.33	40.43
8	18.93	18.86	7.08	7.02	65.19	65.35	6.95	7.02	5.79	5.79	39.93	39.93
9	18.69	18.64	7.43	7.35	67.75	67.86	7.32	7.35	5.88	5.92	40.73	40.80

Time hours	Yields					
	Measured Microcel Ash Yield %	Adjusted Microcel Ash Yield %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %	Measured Combined Ash Yield %	Adjusted Combined Ash Yield %
1	79.32	79.43	95.22	94.94	75.53	75.41
2	80.18	80.19	96.13	96.05	77.08	77.02
3	81.12	80.94	94.98	95.41	77.05	77.22
4	80.20	80.20	95.98	95.98	76.97	76.97
5	80.41	80.61	96.56	96.32	77.64	77.64
6	80.33	80.15	96.40	96.60	77.44	77.42
7	79.55	79.07	94.75	95.79	75.37	75.75
8	79.61	79.70	96.60	96.40	76.90	76.83
9	81.33	81.34	95.87	95.90	77.97	78.01

Table PITT-17

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Total Sulfur

Time hours	Microcel						MGS					
	Measured Microcel Feed T. Sulfur %	Adjusted Microcel Feed T. Sulfur %	Measured Microcel Product T. Sulfur %	Adjusted Microcel Product T. Sulfur %	Measured Microcel Reject T. Sulfur %	Adjusted Microcel Reject T. Sulfur %	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
1	2.54	2.48	2.37	2.34	2.99	3.01	2.36	2.34	1.62	1.66	14.79	14.98
2	2.56	2.49	2.29	2.34	3.06	3.08	2.38	2.34	1.71	1.73	17.32	17.38
3	2.59	2.51	2.35	2.38	3.02	3.04	2.39	2.38	1.71	1.73	15.80	15.88
4	2.53	2.46	2.42	2.42	2.61	2.62	2.37	2.42	1.71	1.71	19.53	19.51
5	2.47	2.44	2.40	2.36	2.77	2.78	2.32	2.36	1.68	1.69	20.03	20.06
6	2.44	2.38	2.34	2.32	2.59	2.60	2.33	2.32	1.68	1.72	19.30	19.47
7	2.51	2.51	2.34	2.37	3.04	3.04	2.34	2.37	1.70	1.67	18.51	18.36
8	2.39	2.42	2.38	2.30	2.90	2.89	2.31	2.30	1.68	1.72	17.70	17.85
9	2.42	2.42	2.36	2.41	2.46	2.46	2.41	2.41	1.72	1.70	18.95	18.85

Table PITT-18

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Pyritic Sulfur

Time hours	Microcel						MGS					
	Measured Microcel Feed Pyritic S %	Adjusted Microcel Feed Pyritic S %	Measured Microcel Product Pyritic S %	Adjusted Microcel Product Pyritic S %	Measured Microcel Reject Pyritic S %	Adjusted Microcel Reject Pyritic S %	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
1	1.33	1.26	1.03	1.01	2.16	2.20	0.96	1.01	0.41	0.41	12.30	12.27
2	1.26	1.25	0.93	0.99	2.31	2.31	0.95	0.99	0.43	0.41	16.38	15.17
3	1.27	1.38	0.94	1.02	3.00	2.89	1.02	1.02	0.42	0.40	15.70	14.02
4	1.28	1.20	1.00	1.02	1.91	1.94	0.99	1.02	0.40	0.40	15.90	15.80
5	1.22	1.21	1.04	1.01	2.04	2.04	0.91	1.01	0.43	0.41	17.68	16.62
6	1.18	1.16	0.95	0.98	1.87	1.88	1.06	0.98	0.41	0.42	16.70	17.09
7	1.34	1.26	0.94	1.00	2.19	2.24	0.88	1.00	0.44	0.41	16.57	14.51
8	1.15	1.18	0.94	0.95	2.11	2.09	0.97	0.95	0.41	0.41	15.73	15.58
9	1.13	1.17	1.03	1.03	1.78	1.76	0.97	1.03	0.42	0.40	16.94	15.78

Table PITT-19

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Ash Performance

Time hours	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %
1	92.10	71.97	64.07	96.41	24.65	21.06	88.79	78.88	67.67
2	92.14	70.42	62.56	97.46	22.62	20.08	89.80	77.11	66.91
3	93.01	69.83	62.84	96.83	22.98	19.81	90.06	76.76	66.83
4	92.50	70.54	63.04	97.40	22.50	19.90	90.10	77.17	67.27
5	92.32	68.88	61.20	97.71	21.15	18.86	90.21	75.46	65.67
6	91.54	68.97	60.51	97.87	19.57	17.44	89.59	75.04	64.63
7	91.06	70.76	61.82	97.30	23.71	21.01	88.60	77.69	66.30
8	91.33	70.33	61.67	97.67	20.49	18.17	89.21	76.41	65.62
9	92.63	67.93	60.56	97.38	22.76	20.14	90.20	75.23	65.43

Table PITT-20

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Total Sulfur Performance

Time hours	<i>Microcel</i>			<i>MGS</i>			<i>Combined Microcel/MGS</i>		
	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %
1	92.10	25.06	17.16	96.41	32.65	29.06	88.79	49.53	38.32
2	92.14	24.64	16.79	97.46	28.99	26.45	89.80	46.49	36.29
3	93.01	23.26	16.26	96.83	30.65	27.48	90.06	46.77	36.83
4	92.50	21.11	13.61	97.40	32.18	29.58	90.10	46.50	36.60
5	92.32	22.04	14.36	97.71	31.03	28.74	90.21	46.23	36.43
6	91.54	21.87	13.42	97.87	28.39	26.25	89.59	44.05	33.64
7	91.06	25.34	16.40	97.30	32.50	29.80	88.60	49.60	38.20
8	91.33	24.25	15.58	97.67	27.91	25.58	89.21	45.39	34.60
9	92.63	18.99	11.62	97.38	32.35	29.73	90.20	45.20	35.40

Table PITT-21

Combined Microcel/MGS Tests Results - Pittsburgh #8

Long Duration Tests - Pyritic Sulfur Performance

Time hours	<i>Microcel</i>			<i>MGS</i>			<i>Combined Microcel/MGS</i>		
	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
1	92.10	36.33	28.43	96.41	61.46	57.87	88.79	75.46	64.26
2	92.14	36.49	28.63	97.46	60.22	57.68	89.80	74.74	64.54
3	93.01	40.18	33.19	96.83	62.58	59.41	90.06	77.62	67.68
4	92.50	31.83	24.34	97.40	62.36	59.76	90.10	74.34	64.44
5	92.32	32.72	25.04	97.71	60.90	58.61	90.21	73.69	63.90
6	91.54	32.29	23.83	97.87	58.60	56.47	89.59	71.97	61.56
7	91.06	37.24	28.30	97.30	60.72	58.03	88.60	75.35	63.95
8	91.33	35.83	27.17	97.67	58.40	56.07	89.21	73.30	62.51
9	92.63	28.39	21.02	97.38	62.76	60.14	90.20	73.33	63.53

Table PITT-22

Long Duration Testing

Microcel - Pittsburgh #8

LD_COL_REJ

Figure PITT-6

Long Duration Testing

MGS - Pittsburgh #8

LD_MGS_REJ

Figure PITT-7

Figure PITT-8

Microcel/MGS Independent Testing - Illinois #6

Microcel Conditions Held Constant

Feed Rate (lbs/ton): 500
Wash Water (lpm): 40.1
Percent Solids (w/w): 11-12
Grind Size (d80 (microns)): 200
Air Flow Rate (SCFM): 8.89

Microcel Collector and Frother Dosages

Test Number	Collector Dosage lbs/ton	Frother Dosage ml/min
401	2.00	2.00
402	2.00	1.00
403	3.00	3.00
404	2.00	3.00
405	1.00	3.00
406	1.00	2.00
407	3.00	1.00
408	3.00	2.00
409	1.00	1.00

Table ILL-1

Microcel/MGS Independent Tests Results - Illinois #6

Microcel - Ash

Test Number	Measured Column Feed Ash %	Adjusted Column Feed Ash %	Measured Column Product Ash %	Adjusted Column Product Ash %	Measured Column Reject Ash %	Adjusted Column Reject Ash %	Measured Column Ash Yield %	Adjusted Column Ash Yield %
401	32.85	32.85	11.89	11.89	73.51	73.51	65.99	65.99
402	39.52	39.56	9.53	9.53	74.00	73.94	53.48	53.38
403	35.85	35.81	12.44	12.44	76.53	76.60	63.47	63.58
404	34.26	34.19	12.17	12.18	75.20	75.32	64.95	65.14
405	35.90	35.90	11.65	11.65	76.25	76.24	62.46	62.46
406	32.23	32.38	12.40	12.38	76.37	76.10	69.00	68.61
407	33.61	33.61	10.52	10.52	73.30	73.30	63.22	63.22
408	34.37	34.32	10.20	10.20	78.12	78.22	64.41	64.54
409	34.53	34.47	8.73	8.73	72.86	72.98	59.77	59.94

Microcel - Total Sulfur

Test Number	Measured Column Feed T. Sulfur %	Adjusted Column Feed T. Sulfur %	Measured Column Product T. Sulfur %	Adjusted Column Product T. Sulfur %	Measured Column Reject T. Sulfur %	Adjusted Column Reject T. Sulfur %
401	4.12	4.22	3.96	3.90	4.90	4.85
402	4.77	4.36	3.88	4.02	4.58	4.75
403	4.23	4.27	4.08	4.06	4.67	4.65
404	4.17	4.60	4.42	4.11	5.81	5.52
405	4.15	3.79	3.25	3.39	4.31	4.46
406	4.13	4.29	4.24	4.12	4.74	4.67
407	3.90	4.07	4.08	3.96	4.32	4.24
408	4.07	4.30	3.70	3.58	5.76	5.60
409	3.99	4.34	3.94	3.74	5.50	5.24

Microcel - Pyritic Sulfur

Test Number	Measured Column Feed Pyritic S %	Adjusted Column Feed Pyritic S %	Measured Column Product Pyritic S %	Adjusted Column Product Pyritic S %	Measured Column Reject Pyritic S %	Adjusted Column Reject Pyritic S %
401	2.58	2.62	1.91	1.90	4.06	4.03
402	3.41	2.80	1.76	1.85	3.58	3.89
403	2.40	2.58	2.01	1.93	3.87	3.70
404	2.47	2.79	2.15	1.99	4.67	4.27
405	2.65	2.61	1.93	1.94	3.69	3.72
406	2.14	2.38	1.97	1.83	3.84	3.59
407	2.10	2.32	1.93	1.82	3.38	3.18
408	2.59	2.74	1.74	1.70	4.82	4.64
409	2.31	2.62	1.72	1.62	4.64	4.13

Table ILL-2

Microcel/MGS Independent Tests Results - Illinois #6

Microcel Performance

Test Number	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
401	86.58	76.12	62.70	39.02	25.60	52.15	38.73
402	79.90	87.14	67.04	50.79	30.68	64.73	44.63
403	86.72	77.91	64.64	39.55	26.27	52.44	39.16
404	86.93	76.79	63.72	41.80	28.73	53.54	40.46
405	86.08	79.73	65.82	44.14	30.22	53.58	39.66
406	88.91	73.77	62.67	34.11	23.01	47.24	36.15
407	85.21	80.21	65.42	38.49	23.70	50.40	35.61
408	88.24	80.82	69.06	46.27	34.51	59.96	48.20
409	83.48	84.82	68.30	48.35	31.83	62.94	46.42

Table ILL-3

Figure ILL-1

Microcel/MGS Independent Testing - Illinois #6

MGS Conditions Held Constant

Shake Amplitude (mm): 15
 Shake Frequency (cps): 5
 Tilt Angle (degrees): 6
 Grind Size (d80 (microns)): 200

MGS Variables

Test Number	Drum Speed rpm	Wash Water lpm	Percent Feed Solids w/w	Feed Rate lbs/hr
501	280	0.76	30.71	345.21
502	280	0.76	24.16	198.64
503	281	1.63	34.63	199.60
504	321	1.51	25.81	212.36
505	280	0.00	18.95	234.40
506	280	0.76	17.14	306.22
507	281	0.80	29.60	241.91
508	283	1.51	24.46	272.41
509	280	0.00	26.32	293.41
510	281	0.83	33.89	140.90
511	283	0.68	25.56	210.43
512	320	0.83	17.06	206.79
513	241	1.55	26.40	216.30
514	320	0.76	28.13	141.23
515	320	0.80	37.77	229.75
516	240	0.76	24.36	267.37
517	280	0.00	30.11	154.62
518	241	0.80	37.18	225.19
519	320	0.76	25.38	279.12
520	281	0.83	18.24	135.93
521	280	1.59	28.63	148.15
522	240	0.80	29.61	153.00
523	241	0.83	17.22	209.50
524	281	1.59	17.30	213.91
525	322	0.00	25.72	216.83
526	241	0.00	26.20	226.57
527	281	0.00	37.75	260.03

Table ILL-4

Microcel/MGS Independent Tests Results - Illinois #6

MGS - Ash

Test Number	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %
501	32.28	32.01	24.08	24.20	65.43	65.64	80.17	81.15
502	35.28	35.54	24.07	23.98	68.64	68.39	74.85	73.97
503	35.83	35.95	24.40	24.36	68.57	68.45	74.12	73.71
504	32.61	32.93	22.13	22.02	65.79	65.46	76.00	74.88
505	37.56	37.74	28.55	28.47	68.19	68.05	77.27	76.58
506	36.14	35.17	29.76	30.34	69.59	70.03	83.98	87.83
507	31.61	31.77	20.70	20.65	65.80	65.63	75.81	75.28
508	32.18	32.24	23.05	23.02	68.55	68.49	79.93	79.72
509	32.40	31.68	20.59	20.80	58.53	59.20	68.87	71.67
510	33.53	33.92	24.56	24.40	65.36	65.01	78.01	76.56
511	37.47	37.03	24.10	24.23	65.89	66.31	68.01	69.58
512	36.43	36.09	27.18	27.33	66.69	66.94	76.59	77.88
513	33.33	33.33	26.24	26.24	75.33	75.33	85.56	85.56
514	31.75	31.90	20.06	20.02	60.45	60.29	71.06	70.50
515	34.55	35.00	23.86	23.71	61.98	61.55	71.96	70.16
516	33.01	33.44	26.82	26.58	70.28	69.97	85.76	84.19
517	34.65	34.69	20.79	20.78	58.39	58.35	63.14	62.98
518	35.65	35.74	28.57	28.52	73.67	73.61	84.30	83.99
519	31.47	31.51	20.76	20.75	60.49	60.45	73.04	72.90
520	35.66	35.31	25.56	25.70	70.58	70.87	77.57	78.72
521	36.83	37.02	24.80	24.74	70.34	70.15	73.58	72.96
522	38.39	38.43	27.62	27.61	73.02	72.99	76.28	76.16
523	39.76	39.70	36.26	37.03	72.02	72.04	90.21	92.37
524	35.76	36.06	35.57	31.42	70.92	70.78	99.46	88.21
525	36.78	36.23	24.29	24.45	58.76	59.23	63.77	66.13
526	38.95	39.15	36.81	34.41	64.69	64.60	92.32	84.30
527	34.68	34.63	25.27	25.29	61.08	61.12	73.72	73.93

Table ILL-5

Microcel/MGS Independent Tests Results - Illinois #6

MGS - Total Sulfur

Test Number	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
501	3.65	3.53	2.43	2.47	7.97	8.08
502	4.02	4.08	2.42	2.40	8.94	8.86
503	4.27	4.22	2.42	2.43	9.18	9.24
504	4.01	3.92	2.43	2.46	8.19	8.29
505	4.27	4.13	2.37	2.40	9.64	9.80
506	3.87	3.60	2.49	2.59	10.70	10.95
507	4.08	4.17	2.53	2.51	9.33	9.22
508	4.00	3.99	2.56	2.56	9.60	9.61
509	4.04	4.02	2.44	2.44	8.00	8.02
510	3.68	3.76	2.30	2.28	8.69	8.59
511	4.92	4.78	2.58	2.61	9.59	9.75
512	4.27	4.08	2.45	2.50	9.45	9.65
513	4.24	4.24	2.73	2.73	13.19	13.19
514	4.19	4.16	2.53	2.54	8.03	8.06
515	4.57	4.11	2.27	2.35	7.84	8.24
516	4.21	4.20	2.66	2.66	12.35	12.37
517	4.42	4.34	2.50	2.52	7.35	7.43
518	4.38	4.34	2.54	2.55	13.67	13.73
519	3.73	3.88	2.42	2.37	8.13	7.94
520	4.39	4.18	2.46	2.51	10.11	10.35
521	4.78	4.73	2.56	2.57	10.48	10.55
522	4.91	4.99	2.74	2.72	12.37	12.25
523	4.26	3.89	2.67	2.81	16.54	16.97
524	4.19	3.66	2.49	2.65	10.81	11.22
525	3.85	3.93	2.29	2.27	7.25	7.16
526	4.34	3.86	2.49	2.62	10.09	10.50
527	4.28	4.02	2.44	2.50	8.06	8.30

Table ILL-6

Microcel/MGS Independent Tests Results - Illinois #6

MGS - Pyritic Sulfur

Test Number	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
501	1.88	1.37	0.78	0.85	3.31	3.61
502	2.35	1.85	0.85	0.90	4.14	4.55
503	2.58	1.78	0.76	0.81	4.00	4.50
504	2.12	1.61	0.72	0.76	3.75	4.14
505	2.34	1.76	0.86	0.92	4.08	4.49
506	2.12	1.53	0.97	1.08	4.46	4.78
507	2.19	1.50	0.74	0.80	3.27	3.65
508	2.13	1.72	0.90	0.96	4.39	4.74
509	1.90	1.52	0.73	0.77	3.14	3.43
510	1.95	1.56	0.74	0.78	3.76	4.10
511	2.91	1.98	0.92	0.98	3.77	4.25
512	2.61	1.73	0.89	0.97	3.98	4.43
513	2.55	1.97	1.08	1.17	6.24	6.74
514	2.09	1.49	0.64	0.68	3.05	3.43
515	2.45	1.65	0.64	0.68	3.45	3.93
516	2.32	1.85	1.01	1.08	5.53	5.95
517	2.36	1.62	0.76	0.81	2.65	3.00
518	2.43	1.88	1.00	1.08	5.60	6.07
519	1.97	1.40	0.67	0.72	2.91	3.25
520	2.62	1.73	0.80	0.87	4.39	4.92
521	2.83	1.91	0.79	0.84	4.23	4.79
522	2.78	2.11	0.92	0.98	5.18	5.73
523	2.54	2.26	1.17	1.22	14.14	14.80
524	2.61	2.27	1.13	1.19	9.79	10.36
525	2.46	2.55	0.78	0.77	6.20	6.01
526	2.98	2.59	1.16	1.21	9.41	10.02
527	2.52	2.37	0.72	0.73	6.73	7.01

Table ILL-7

Microcel/MGS Independent Tests Results - Illinois #6

MGS Performance

Test Number	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	T.Sulfur Rejection %	T.Sulfur Separation Efficiency %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
501	90.48	38.65	29.12	43.22	33.69	49.65	40.12
502	87.24	50.09	37.33	56.49	43.72	64.01	51.25
503	87.05	50.05	37.10	57.55	44.61	66.46	53.51
504	87.07	49.93	36.99	53.01	40.07	64.65	51.72
505	87.98	42.23	30.21	55.50	43.48	59.97	47.95
506	94.37	24.23	18.61	36.81	31.18	38.00	32.38
507	87.55	51.07	38.62	54.69	42.24	59.85	47.40
508	90.57	43.08	33.65	48.85	39.42	55.50	46.07
509	83.08	52.95	36.03	56.50	39.58	63.70	46.77
510	87.59	44.93	32.52	53.58	41.16	61.72	49.31
511	83.73	54.47	38.20	62.01	45.73	65.56	49.29
512	88.56	41.02	29.58	52.28	40.84	56.33	44.89
513	94.66	32.64	27.30	44.91	39.57	49.19	43.84
514	82.80	55.78	38.55	56.95	39.75	67.83	50.62
515	82.35	52.47	34.82	59.88	42.23	71.08	53.43
516	92.87	33.08	25.95	46.68	39.55	50.85	43.72
517	76.39	62.28	38.66	63.43	39.82	68.51	44.90
518	93.42	32.98	26.40	50.65	44.08	51.75	45.18
519	84.35	52.00	36.35	55.47	39.82	62.51	46.86
520	90.42	42.70	33.12	52.73	43.15	60.41	50.83
521	87.18	51.24	38.43	60.36	47.54	67.91	55.10
522	89.54	45.29	34.83	58.49	48.03	64.63	54.17
523	96.46	13.84	10.30	33.27	29.74	50.13	46.60
524	94.61	23.14	17.75	36.13	30.74	53.76	48.37
525	78.35	55.37	33.72	61.80	40.15	80.03	58.38
526	90.87	25.91	16.77	42.78	33.65	60.62	51.48
527	84.50	46.01	30.50	54.02	38.52	77.23	61.72

Table ILL-8

Figure ILL-2

Microcel/MGS Combined Testing - Illinois #6

MGS Conditions Held Constant

Shake Amplitude (mm): 15
 Shake Frequency (cps): 5
 Tilt Angle (degrees): 6
 Grind Size (d80 (microns): 200
 Percent Solids (w/w): 21 - 22

MGS Variables

Test Number	Drum Speed rpm	Wash Water lpm	Shako Amplitude mm	Feed Rate lbs/hr
601	283	1.51	10	269.00
602	283	0.95	15	269.00
603	280	0.47	20	257.08
604	239	1.06	15	341.50
605	239	0.95	20	276.02
606	280	0.95	15	267.90
607	240	1.51	15	272.84
608	280	1.51	15	160.99
609	323	1.10	10	306.12
610	239	0.45	15	259.45
611	322	0.91	20	281.57
612	322	0.98	15	148.13
613	280	1.59	20	241.03
614	282	0.95	15	299.91
615	280	0.45	15	147.53
616	321	1.06	15	342.89
617	282	0.45	15	356.58
618	282	0.93	20	377.79
619	240	0.96	15	163.11
620	282	1.51	15	352.70
621	283	0.53	10	287.10
622	241	1.06	10	219.17
623	322	1.55	15	238.37
624	281	1.10	10	160.41
625	320	0.53	15	305.49
626	280	0.98	20	134.70
627	281	1.10	10	376.77

Microcel

Feed Rate (lbs/ton): 550.00
 Wash Water (lpm): 40.1
 Percent Solids (w/w): 11-12
 Grind Size (d80 (microns): 200
 Air Flow Rate (SCFM): 8.89
 Diesel dosage (lbs/ton): 1
 Frother Dosage (ml/min): 1.5 - 1.6

Table ILL-9

Combined Microcel/MGS Tests Results - Illinois #6
Ash

Test No.	Microcel						MGS						Yields					
	Measured Microcel Feed Ash %	Adjusted Microcel Feed Ash %	Measured Microcel Product Ash %	Adjusted Microcel Product Ash %	Measured Microcel Reject Ash %	Adjusted Microcel Reject Ash %	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %	Measured Microcel Ash Yield %	Adjusted Microcel Ash Yield %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %	Measured Combined Ash Yield %	Adjusted Combined Ash Yield %
601	35.12	35.00	10.26	10.22	77.89	78.10	10.00	10.22	9.00	8.87	54.40	54.25	63.24	63.49	97.80	97.03	61.85	61.61
602	32.73	32.77	9.33	9.43	77.00	76.92	9.33	9.43	8.28	8.13	54.77	54.58	65.42	65.42	97.74	97.20	63.94	63.59
603	32.30	32.97	9.06	9.74	79.92	78.53	10.73	9.74	8.27	8.26	57.81	57.79	67.20	66.23	95.03	97.01	63.87	64.25
604	37.49	38.31	10.42	11.42	74.04	72.63	13.55	11.42	9.94	10.14	63.65	63.85	57.45	56.07	93.28	97.62	53.59	54.73
605	34.82	34.71	10.84	10.72	78.38	78.58	10.62	10.72	9.63	9.64	63.14	63.15	64.50	64.65	98.15	97.98	63.30	63.34
606	34.10	34.40	9.90	10.25	77.56	76.99	10.58	10.25	8.03	7.98	56.91	56.78	64.23	63.81	94.78	95.35	60.88	60.85
607	35.20	34.78	10.36	10.65	79.00	79.75	10.13	10.65	11.05	10.14	63.41	63.12	63.81	65.08	101.76	99.04	64.93	64.45
608	30.28	30.27	10.58	10.55	77.66	77.68	10.53	10.55	9.01	8.95	65.25	65.15	70.63	70.62	97.30	97.15	68.72	68.61
609	34.87	34.91	9.03	9.92	81.77	81.70	11.23	9.92	6.33	6.31	33.25	33.16	64.48	65.19	81.80	86.55	52.74	56.42
610	32.22	32.39	10.22	10.41	79.18	78.85	10.60	10.41	9.38	9.36	63.07	63.05	68.10	67.88	97.73	98.04	66.55	66.56
611	32.39	32.68	10.21	10.49	77.74	77.18	10.98	10.49	6.62	6.67	43.21	43.45	67.16	66.73	83.08	89.61	59.15	59.80
612	34.87	34.87	10.28	10.29	77.19	77.19	10.30	10.29	5.97	5.97	38.15	38.16	63.25	63.26	86.54	86.58	54.74	54.77
613	35.41	35.95	8.57	9.29	76.39	75.37	10.24	9.29	8.04	7.98	61.87	61.78	60.42	59.65	95.91	97.57	57.96	58.20
614	34.95	34.50	9.43	8.95	77.81	78.63	8.48	8.95	7.24	7.20	54.84	54.75	62.68	63.33	97.39	96.32	61.05	61.00
615	35.86	35.60	10.93	10.55	76.98	77.43	10.28	10.55	8.00	8.04	62.59	62.72	62.26	62.54	95.82	95.41	59.66	59.67
616	33.42	33.41	9.16	9.80	77.79	77.80	10.65	9.80	7.22	7.21	35.80	35.78	64.65	65.28	88.00	90.93	56.89	59.36
617	34.46	34.68	9.81	10.03	76.93	76.53	10.28	10.03	7.19	7.19	47.94	47.94	63.27	62.93	92.42	93.03	58.48	58.55
618	30.46	30.45	9.86	9.85	77.86	77.87	9.84	9.85	8.05	8.05	58.53	58.54	69.71	69.71	96.45	96.43	67.23	67.23
619	39.68	39.06	12.06	10.93	76.69	77.66	10.08	10.93	10.04	10.01	63.80	63.78	57.26	57.85	99.93	98.29	57.22	56.86
620	30.61	31.74	8.05	8.86	77.31	74.81	10.26	8.86	6.59	6.59	56.86	56.87	67.43	65.31	92.70	95.49	62.50	62.36
621	33.83	33.81	10.59	10.84	79.05	79.08	11.15	10.84	7.47	7.48	37.86	37.91	66.05	66.34	87.89	88.96	58.05	59.01
622	34.18	35.04	7.34	8.37	73.86	72.19	9.87	8.37	8.55	8.25	62.80	62.76	59.65	58.21	97.57	99.78	58.20	58.08
623	30.25	30.20	10.16	10.29	74.21	74.31	10.51	10.29	6.85	6.88	39.20	39.31	68.63	68.90	88.69	89.49	60.87	61.66
624	35.06	35.58	9.70	10.22	77.47	76.49	10.84	10.22	6.76	6.74	54.56	54.47	62.58	61.73	91.46	92.71	57.24	57.23
625	34.07	33.89	9.29	9.45	78.58	78.91	9.66	9.45	6.31	6.33	31.50	31.55	64.24	64.81	86.70	87.63	55.69	56.80
626	34.50	34.61	8.54	8.85	73.26	73.06	8.94	8.85	8.30	8.08	63.17	62.99	59.89	59.88	98.83	98.60	59.19	59.04
627	37.69	37.68	12.03	11.40	78.33	78.35	10.94	11.40	7.57	7.60	41.88	41.99	61.30	60.75	90.18	88.95	55.28	54.03

Table ILL-10

Combined Microcel/MGS Tests Results - Illinois #6
Total Sulfur

Test Number	Microcel						MGS					
	Measured Microcel Feed T. Sulfur %	Adjusted Microcel Feed T. Sulfur %	Measured Microcel Product T. Sulfur %	Adjusted Microcel Product T. Sulfur %	Measured Microcel Reject T. Sulfur %	Adjusted Microcel Reject T. Sulfur %	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
601	4.00	3.91	3.99	3.77	4.11	4.15	3.90	3.77	2.99	3.22	21.55	21.91
602	4.06	3.88	3.88	3.73	4.11	4.17	3.88	3.73	2.85	3.07	26.29	26.82
603	3.65	3.49	3.20	3.30	3.81	3.87	3.20	3.30	2.57	2.49	30.00	29.66
604	4.30	4.62	4.05	4.20	5.37	5.15	4.01	4.20	3.64	3.24	45.15	43.64
605	4.11	4.01	3.84	3.92	4.12	4.16	3.84	3.92	3.18	3.11	43.80	43.52
606	3.82	3.85	3.55	3.66	4.22	4.20	3.84	3.66	2.46	2.48	27.70	27.80
607	4.00	3.67	3.66	3.68	3.55	3.64	3.48	3.68	3.36	3.31	42.04	41.97
608	3.29	3.54	3.67	3.60	3.47	3.39	3.76	3.60	2.68	2.69	34.50	34.54
609	4.47	3.89	3.93	3.81	3.87	4.02	3.63	3.81	2.61	2.69	10.85	11.05
610	3.76	3.66	3.68	3.74	3.47	3.50	3.80	3.74	2.95	2.99	41.10	41.26
611	3.74	4.05	4.05	4.06	4.16	4.03	3.80	4.07	2.86	2.61	17.80	16.66
612	4.09	4.12	4.00	3.83	4.64	4.62	3.76	3.83	2.23	2.25	14.00	14.10
613	6.00	4.04	3.89	4.11	3.64	3.93	4.06	4.11	3.08	3.21	39.70	40.25
614	4.11	3.40	3.91	3.52	3.06	3.20	3.19	3.52	2.51	2.63	26.40	26.90
615	4.03	3.97	3.93	3.94	4.01	4.03	3.81	3.94	2.51	2.47	34.90	34.51
616	3.85	4.04	3.77	3.83	4.54	4.45	4.12	3.83	2.73	2.76	14.48	14.56
617	4.00	4.06	3.81	3.80	4.52	4.49	3.81	3.80	2.42	2.41	22.40	22.36
618	3.80	3.78	3.75	3.71	3.91	3.92	3.70	3.71	2.64	2.66	32.20	32.30
619	4.39	4.62	4.35	3.87	5.82	5.65	3.74	3.87	3.07	3.16	44.50	44.82
620	3.59	3.81	3.63	3.90	3.70	3.62	4.85	3.90	2.83	2.90	25.00	25.24
621	3.28	3.63	3.70	3.73	3.59	3.45	3.97	3.73	2.53	2.48	14.00	13.81
622	3.80	3.70	3.32	3.39	4.03	4.09	3.88	3.39	3.02	3.31	38.96	39.07
623	3.73	4.18	4.04	3.95	4.92	4.68	4.07	3.95	2.67	2.61	15.59	15.35
624	3.44	3.57	3.54	3.69	3.43	3.38	3.91	3.69	2.45	2.43	19.90	19.78
625	3.40	4.07	3.48	3.47	5.87	5.17	3.66	3.47	2.43	2.31	12.10	11.68
626	3.98	3.67	3.65	3.64	3.61	3.71	3.68	3.64	2.98	3.12	39.90	40.25
627	3.99	4.11	3.80	3.94	4.41	4.35	3.80	3.94	2.59	2.44	16.80	16.04

Table ILL-11

Combined Microcel/MGS Tests Results - Illinois #6
Pyritic Sulfur

Test Number	Microcel						MGS					
	Measured Microcel Feed Pyritic S %	Adjusted Microcel Feed Pyritic S %	Measured Microcel Product Pyritic S %	Adjusted Microcel Product Pyritic S %	Measured Microcel Reject Pyritic S %	Adjusted Microcel Reject Pyritic S %	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
601	1.96	1.98	1.65	1.43	2.97	2.95	1.65	1.43	0.75	0.84	18.91	20.62
602	1.87	1.80	1.53	1.40	2.45	2.50	1.53	1.40	0.64	0.69	23.80	25.88
603	2.33	2.16	1.58	1.69	3.00	3.09	1.88	1.69	0.82	0.84	28.52	29.25
604	2.60	2.60	1.91	2.11	3.22	3.22	2.11	2.11	1.26	1.17	43.13	40.62
605	2.82	2.67	2.13	2.09	3.63	3.72	1.97	2.09	1.29	1.27	42.39	42.00
606	2.46	2.32	1.78	1.81	3.14	3.22	2.02	1.81	0.55	0.57	25.60	27.30
607	2.33	2.17	1.49	1.64	3.05	3.15	1.67	1.64	1.33	1.26	41.80	41.15
608	2.01	2.16	1.91	1.79	3.16	3.05	1.99	1.79	0.89	0.94	29.25	30.71
609	2.85	2.36	1.70	1.77	3.25	3.47	2.00	1.77	0.58	0.60	8.57	9.29
610	2.35	2.38	1.92	1.97	3.25	3.23	2.00	1.97	1.24	1.22	39.92	39.57
611	2.06	2.37	1.87	2.01	3.35	3.08	2.08	2.01	0.68	0.65	15.50	13.72
612	2.90	2.29	2.16	2.12	2.43	2.59	1.93	2.12	0.55	0.55	12.27	12.29
613	4.18	2.37	1.68	1.88	2.78	3.10	1.96	1.88	0.97	0.98	37.60	38.01
614	3.07	2.23	1.77	1.67	2.92	3.20	1.57	1.67	0.76	0.79	23.70	24.72
615	2.62	2.73	2.28	2.17	3.75	3.66	1.99	2.17	0.85	0.83	31.90	30.22
616	2.26	2.22	1.54	1.70	3.16	3.19	1.94	1.70	0.67	0.67	11.97	12.01
617	2.75	2.75	1.88	1.97	4.08	4.08	1.96	1.97	0.77	0.75	18.90	18.20
618	2.17	2.26	1.87	1.79	3.39	3.33	1.76	1.79	0.90	0.90	26.00	25.99
619	3.11	3.19	2.36	2.14	4.71	4.63	1.99	2.14	1.44	1.43	42.80	42.71
620	1.89	2.01	1.44	1.63	2.82	2.73	1.87	1.63	0.69	0.67	22.90	21.89
621	1.84	2.20	2.01	1.90	3.15	2.80	2.01	1.90	0.65	0.64	12.24	12.00
622	2.01	2.04	1.25	1.21	3.24	3.20	1.71	1.21	0.95	1.12	39.00	39.66
623	1.82	2.21	1.80	1.73	3.79	3.26	1.64	1.73	0.64	0.61	13.03	11.33
624	2.35	2.29	1.86	1.85	2.96	3.00	2.02	1.85	0.57	0.59	16.80	17.90
625	2.20	2.62	1.76	1.70	5.13	4.32	1.92	1.70	0.57	0.58	9.46	9.68
626	2.18	1.98	1.47	1.49	2.61	2.72	1.43	1.49	0.99	0.98	38.25	37.95
627	2.43	2.57	2.23	2.16	3.32	3.21	2.18	2.16	0.64	0.64	14.30	14.39

Table ILL-12

Combined Microcel/MGS Tests Results - Illinois #6
Ash Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %
601	87.70	81.46	69.16	98.48	15.79	14.28	86.37	84.39	70.76
602	88.13	81.18	69.30	98.60	16.20	14.80	86.89	84.22	71.12
603	89.18	80.43	69.62	98.60	17.73	16.33	87.94	83.90	71.84
604	80.51	83.29	63.80	99.03	13.32	12.35	79.73	85.51	65.24
605	88.40	80.03	68.44	99.17	11.89	11.06	87.67	82.41	70.07
606	87.31	80.99	68.29	97.76	25.77	23.53	85.35	85.89	71.24
607	89.16	80.07	69.23	99.60	5.71	5.31	88.80	81.21	70.01
608	90.60	75.39	65.98	98.89	17.58	16.47	89.59	79.71	69.31
609	90.21	81.48	71.69	90.02	44.94	34.97	81.21	89.80	71.01
610	89.95	78.18	68.14	99.19	11.84	11.04	89.23	80.77	69.99
611	88.72	78.58	67.30	93.44	43.02	36.46	82.90	87.80	70.70
612	87.13	81.33	68.46	90.75	49.77	40.52	79.07	90.62	69.69
613	84.49	84.58	69.07	98.97	16.19	15.17	83.62	87.08	70.70
614	88.04	83.57	71.61	98.17	22.51	20.68	86.43	87.27	73.70
615	86.87	81.46	68.34	98.09	27.29	25.38	85.21	86.52	71.73
616	88.42	80.85	69.28	93.55	33.10	26.64	82.72	87.19	69.91
617	86.68	81.80	68.48	95.97	33.31	29.28	83.19	87.86	71.05
618	90.36	77.45	67.81	98.36	21.19	19.55	88.88	82.23	71.11
619	84.55	83.81	68.36	99.30	9.98	9.29	83.96	85.43	69.39
620	87.20	81.77	68.97	97.86	28.98	26.84	85.33	87.05	72.39
621	89.36	78.73	68.09	92.31	38.62	30.93	82.49	86.94	69.43
622	82.11	86.10	68.20	99.91	1.65	1.56	82.04	86.32	68.36
623	88.55	76.52	65.08	92.89	40.17	33.06	82.25	85.95	68.21
624	86.03	82.27	68.30	96.30	38.86	35.16	82.85	89.16	72.01
625	88.78	81.93	70.70	90.65	41.30	31.95	80.47	89.39	69.86
626	83.47	84.69	68.16	99.43	9.98	9.41	83.00	86.22	69.21
627	86.36	81.62	67.98	92.77	40.70	33.47	80.12	89.10	69.22

Table ILL-13

Combined Microcel/MGS Tests Results - Illinois #6
Total Sulfur Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %
601	87.70	38.78	26.48	98.48	17.13	15.61	86.37	49.27	35.64
602	88.13	37.11	25.24	98.60	20.00	18.59	86.89	49.69	36.58
603	89.18	37.38	26.56	98.60	26.80	25.40	87.94	54.16	42.10
604	80.51	49.03	29.54	99.03	24.70	23.72	79.73	61.62	41.34
605	88.40	36.80	25.20	99.17	22.26	21.43	87.67	50.87	38.54
606	87.31	39.33	26.64	97.76	35.39	33.15	85.35	60.81	46.16
607	89.16	34.74	23.90	99.60	10.92	10.52	88.80	41.87	30.67
608	90.60	28.18	18.78	98.89	27.41	26.30	89.59	47.86	37.45
609	90.21	36.16	26.37	90.02	38.89	28.91	81.21	60.98	42.20
610	89.95	30.63	20.59	99.19	21.62	20.81	89.23	45.63	34.86
611	88.72	33.11	21.83	93.44	42.53	35.97	82.90	61.46	44.36
612	87.13	41.19	28.33	90.75	49.14	39.89	79.07	70.09	49.16
613	84.49	39.31	23.80	98.97	23.80	22.77	83.62	53.76	37.37
614	88.04	34.43	22.47	98.17	28.03	26.20	86.43	52.81	39.24
615	86.87	37.93	24.80	98.09	40.19	38.27	85.21	62.87	48.08
616	88.42	38.11	26.54	93.55	34.47	28.02	82.72	59.45	42.16
617	86.68	41.10	27.78	95.97	41.00	36.97	83.19	65.25	48.43
618	90.36	31.58	21.94	98.36	30.86	29.22	88.88	52.69	41.57
619	84.55	51.55	36.09	99.30	19.74	19.05	83.96	61.11	45.07
620	87.20	33.15	20.35	97.86	29.00	26.86	85.33	52.54	37.87
621	89.36	31.83	21.19	92.31	40.85	33.16	82.49	59.68	42.17
622	82.11	46.67	28.78	99.91	2.57	2.49	82.04	48.04	30.08
623	88.55	34.89	23.44	92.89	40.87	33.76	82.25	61.50	43.76
624	86.03	36.19	22.23	96.30	38.95	35.25	82.85	61.04	43.90
625	88.78	44.74	33.52	90.65	41.66	32.31	80.47	67.76	48.24
626	83.47	40.61	24.08	99.43	15.49	14.92	83.00	49.81	32.80
627	86.36	41.77	28.13	92.77	44.91	37.68	80.12	67.92	48.04

Table ILL-14

Combined Microcel/MGS Tests Results - Illinois #6
Pyritic Sulfur Performance

Test Number	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
601	87.70	54.14	41.84	98.48	43.01	41.49	86.37	73.86	60.24
602	88.13	49.12	37.25	98.60	52.09	50.69	86.89	75.63	62.52
603	89.18	48.20	37.39	98.60	51.78	50.38	87.94	75.02	62.96
604	80.51	54.50	35.01	99.03	45.87	44.90	79.73	75.37	55.10
605	88.40	49.40	37.80	99.17	40.46	39.63	87.67	69.87	57.54
606	87.31	50.21	37.52	97.76	69.97	67.73	85.35	85.05	70.40
607	89.16	50.82	39.97	99.60	23.91	23.51	88.80	62.58	51.38
608	90.60	41.47	32.07	98.89	48.98	47.87	89.59	70.14	59.73
609	90.21	51.11	41.32	90.02	70.66	60.68	81.21	85.66	66.87
610	89.95	43.81	33.76	99.19	39.28	38.48	89.23	65.88	55.11
611	88.72	43.41	32.13	93.44	71.02	64.46	82.90	83.60	66.50
612	87.13	41.44	28.57	90.75	77.54	68.29	79.07	86.85	65.92
613	84.49	52.68	37.16	98.97	49.14	48.12	83.62	75.93	59.55
614	88.04	52.57	40.61	98.17	54.44	52.61	86.43	78.39	64.82
615	86.87	50.28	37.16	98.09	63.51	61.59	85.21	81.86	67.07
616	88.42	50.01	38.44	93.55	64.16	57.71	82.72	82.08	64.80
617	86.68	54.92	41.60	95.97	64.58	60.55	83.19	84.03	67.22
618	90.36	44.78	35.15	98.36	51.51	49.87	88.88	73.23	62.11
619	84.55	61.19	45.74	99.30	34.32	33.63	83.96	74.51	58.47
620	87.20	47.04	34.24	97.86	60.75	58.61	85.33	79.21	64.55
621	89.36	42.71	32.07	92.31	70.04	62.35	82.49	82.83	65.32
622	82.11	65.47	47.58	99.91	7.64	7.55	82.04	68.11	50.15
623	88.55	46.06	34.62	92.89	68.45	61.33	82.25	82.98	65.24
624	86.03	50.13	36.16	96.30	70.43	66.74	82.85	85.25	68.11
625	88.78	57.94	46.72	90.65	70.10	60.75	80.47	87.43	67.90
626	83.47	54.94	38.41	99.43	35.15	34.58	83.00	70.78	53.77
627	86.36	48.94	35.31	92.77	73.64	66.41	80.12	86.54	66.66

Table ILL-15

Figure ILL-3

Figure ILL-4

Figure ILL-5

Microcel/MGS Long Duration Testing - Illinois #6

Microcel

Feed Rate (lbs/ton):	600
Wash Water (lpm):	40.1
Percent Solids (w/w):	11-12
Grind Size (d80 (microns)):	200
Air Flow Rate (SCFM):	8.89
Diesel dosage (lbs/ton):	1
Frother Dosage (ml/min):	1.7

MGS

Feed Rate (lbs/hr):	340
Drum Speed (rpm):	283
Wash water (lpm):	0.49
Percent Solids (w/w):	23 - 24
Shake Amplitude (mm):	15
Shake Frequency (cps):	5
Tilt Angle (degrees):	6

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Ash

Time hours	Microcel						MGS					
	Measured Microcel Feed Ash %	Adjusted Microcel Feed Ash %	Measured Microcel Product Ash %	Adjusted Microcel Product Ash %	Measured Microcel Reject Ash %	Adjusted Microcel Reject Ash %	Measured MGS Feed Ash %	Adjusted MGS Feed Ash %	Measured MGS Lights Ash %	Adjusted MGS Lights Ash %	Measured MGS Heavies Ash %	Adjusted MGS Heavies Ash %
1	35.06	35.05	10.17	9.84	77.21	77.24	9.51	9.84	7.50	7.47	45.75	45.69
2	27.66	27.59	8.31	8.79	75.67	75.81	9.51	8.79	7.18	7.23	46.22	46.31
3	29.49	29.57	8.33	8.38	72.54	72.38	8.41	8.38	6.97	6.96	49.42	49.40
4	28.41	28.53	8.03	8.14	72.42	72.16	8.25	8.14	6.85	6.85	51.29	51.28
5	25.53	25.74	7.79	7.94	71.45	70.99	8.18	7.94	6.69	6.72	54.51	54.57

Time hours	Measured Microcel Ash Yield %	Adjusted Microcel Ash Yield %	Measured MGS Ash Yield %	Adjusted MGS Ash Yield %	Measured Combined Ash Yield %	Adjusted Combined Ash Yield %
1	62.87	62.60	94.75	93.80	59.57	58.71
2	71.27	71.95	94.03	96.01	67.02	69.08
3	67.05	66.89	96.61	96.65	64.77	64.65
4	68.35	68.15	96.85	97.10	66.20	66.17
5	72.13	71.77	96.88	97.45	69.89	69.94

Table ILL-17

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Total Sulfur

Time hours	Microcel						MGS					
	Measured Microcel Feed T. Sulfur %	Adjusted Microcel Feed T. Sulfur %	Measured Microcel Product T. Sulfur %	Adjusted Microcel Product T. Sulfur %	Measured Microcel Reject T. Sulfur %	Adjusted Microcel Reject T. Sulfur %	Measured MGS Feed T. Sulfur %	Adjusted MGS Feed T. Sulfur %	Measured MGS Lights T. Sulfur %	Adjusted MGS Lights T. Sulfur %	Measured MGS Heavies T. Sulfur %	Adjusted MGS Heavies T. Sulfur %
1	3.98	4.30	3.87	4.15	4.73	4.56	3.78	4.15	2.81	3.02	20.60	21.33
2	3.14	3.56	3.16	3.31	4.42	4.19	3.78	3.31	2.65	2.56	21.70	21.45
3	3.33	3.40	3.12	3.22	3.79	3.76	3.40	3.22	2.48	2.49	24.10	24.14
4	3.29	3.42	3.14	3.15	4.04	3.98	3.26	3.15	2.42	2.43	27.30	27.33
5	3.00	3.38	2.76	2.81	5.12	4.81	2.98	2.81	2.23	2.15	28.60	28.24

Table ILL-18

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Pyritic Sulfur

Time hours	Microcel						MGS					
	Measured Microcel Feed Pyritic S %	Adjusted Microcel Feed Pyritic S %	Measured Microcel Product Pyritic S %	Adjusted Microcel Product Pyritic S %	Measured Microcel Reject Pyritic S %	Adjusted Microcel Reject Pyritic S %	Measured MGS Feed Pyritic S %	Adjusted MGS Feed Pyritic S %	Measured MGS Lights Pyritic S %	Adjusted MGS Lights Pyritic S %	Measured MGS Heavies Pyritic S %	Adjusted MGS Heavies Pyritic S %
1	2.28	2.29	1.66	1.67	3.12	3.16	1.52	1.67	0.69	0.66	18.41	17.02
2	1.56	1.85	1.25	1.37	3.53	3.11	1.52	1.37	0.69	0.65	20.20	18.67
3	1.96	1.89	1.38	1.37	2.89	2.94	1.37	1.37	0.67	0.68	21.16	21.41
4	1.58	1.70	1.63	1.30	2.66	2.55	1.16	1.3	0.64	0.63	23.90	23.64
5	1.40	1.73	1.13	1.15	3.92	3.19	1.21	1.15	0.61	0.57	24.73	23.22

Table ILL-19

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Ash Performance

Time hours	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %	Comb. Recovery %	Ash Rejection %	Ash Separation Efficiency %
1	86.89	82.43	69.32	96.26	28.79	25.06	83.65	87.49	71.13
2	90.63	77.08	67.71	97.65	21.03	18.68	88.50	81.90	70.40
3	87.02	81.04	68.06	98.15	19.72	17.88	85.41	84.78	70.19
4	87.59	80.56	68.15	98.46	18.29	16.75	86.24	84.11	70.36
5	88.97	77.86	66.83	98.74	17.52	16.26	87.85	81.74	69.59

Table ILL-20

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Total Sulfur Performance

Time hours	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %	Comb. Recovery %	T. Sulfur Rejection %	T. Sulfur Separation Efficiency %
1	86.89	39.59	26.48	96.26	31.74	28.01	83.65	58.76	42.41
2	90.63	33.10	23.73	97.65	25.75	23.40	88.50	50.33	38.83
3	87.02	36.65	23.67	98.15	25.26	23.41	85.41	52.65	38.06
4	87.59	37.23	24.82	98.46	25.10	23.56	86.24	52.98	39.23
5	88.97	40.33	29.31	98.74	25.44	24.18	87.85	55.51	43.36

Table ILL-21

Combined Microcel/MGS Tests Results - Illinois #6

Long Duration Tests - Pyritic Sulfur Performance

Time hours	Microcel			MGS			Combined Microcel/MGS		
	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %	Comb. Recovery %	Pyritic S Rejection %	Pyritic S Separation Efficiency %
1	86.89	54.35	41.24	96.26	62.93	59.19	83.65	83.08	66.73
2	90.63	46.72	37.35	97.65	54.45	52.10	88.50	75.73	64.23
3	87.02	51.51	38.53	98.15	52.03	50.18	85.41	76.74	62.15
4	87.59	47.88	35.48	98.46	52.95	51.41	86.24	75.48	61.72
5	88.97	52.29	41.26	98.74	51.70	50.44	87.85	76.96	64.81

Table ILL-22

Figure ILL-6

Figure ILL-7

Figure ILL-8

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