Progress Report

for the Period of

April 1, 2000 to June 30, 2000
Phase III, Quarter XIV
And
July 1, 2000 to September 30, 2000
Phase III, Quarter XV

Project - ETD05 "Disposal of Fluidized Bed Combustion Ash in an Underground Mine to Control Acid Mine Drainage and Subsidence"
DE-FC21-94MC29244

EXECUTIVE SUMMARY

This project evaluated the technical, economic and environmental feasibility of filling abandoned underground mine voids with coal combustion byproducts. Success was measured in terms of technical feasibility of the approach (i.e. % void filling), cost, environmental benefits (acid mine drainage and subsidence control) and environmental impacts (noxious ion release).

Phase I of the project was completed in September 1995 and was concerned with the development of the grout and a series of predictive models. These models were verified through the Phase II field phase and will be further verified in the large scale field demonstration of Phase III. The verification will allow the results to be packaged in such a way that the technology can be easily adapted to different site conditions. Phase II was successfully completed with 1000 cubic yards of grout being injected into Anker Energy's Fairfax mine. The grout flowed over 600 feet from a single injection borehole. The grout achieved a compressive strength of over 1000 psi (twice the level that is needed to guarantee subsidence control). Phase III was a full scale test at Anker's eleven acre Longridge mine site.

The CCB grout replaced what was an open mine void with a solid so that the groundwater tends to flow around and through the pillars rather than through the previously mined areas. The project has demonstrated that CCBs can be successfully disposed in underground mines. Additionally, the project has shown that filling an abandoned underground mine with CCBs can lead to the reduction and elimination of environmental problems associated with underground mining such as acid mine drainage and subsidence. The filling of the Longridge Mine with 43,000 cubic yards of CCB grout resulted in a 97% reduction in acid mine drainage coming from the mine.

A. Hydraulic Injection

1.0 Task Description:

Task 11 - Hydraulic Injection: The purpose of this task is to grout the eleven acre Longridge mine with a grout consisting of coal combustion byproducts.

Task 12 - Economic Analysis: Burnett Engineering, Inc. shall develop economic analyses to compare the cost associated with disposal of coal ash in landfills with disposal of coal ash in underground mines to control subsidence and acid mine drainage.

Landfill disposal of MEA AFBC Power Plant ash. Burnett Engineering, Inc. shall develop an economic analysis for disposing of MEA AFBC ash in a landfill located near the Fairfax and Longridge mines. Costs to be included in the economic analysis include, but are not limited to, loading of ash at the power plant, transportation to the disposal site, landfill construction, landfill operation, landfill maintenance, and regulatory compliance. In addition, long-term cost impact on property values shall be estimated.

Landfill disposal practices of Northeast utilities. Burnett Engineering, Inc. shall use published data from the Electric Power Research Institute, and data from Monongahela Power Company and Allegheny Power Company to generate a range of cost estimates for disposing power plant ash in landfills. Burnett Engineering, Inc. shall describe the similarities and differences in ash disposal practices and costs for three utilities. Description of the similarities and differences shall include, but is not limited to, regulatory environment, environmental protection features in landfill design (e.g., liners), monitoring requirements, transportation, and ash handling.

Underground coal mine disposal of MEA AFBC Power Plant ash. Burnett Engineering, Inc. shall develop an economic analysis for disposing of MEA AFBC ash in the Longridge coal mine. Costs to be included in the economic analysis include, but are not limited to, loading of ash at the power plant, transportation to the disposal site, production of grout, injection of grout, mine maintenance, and regulatory compliance.

Burnett Engineering, Inc. shall analyze the costs associated with the benefits of underground mine disposal of the MEA AFBC Power Plant ash. These benefits include, but are not limited to, lower quantities of waste to be placed in the landfill, reduction in land subsidence, and improvements in water quality.

Task 13 - Water Quality Model: WVU shall use existing water quality model(s) or modifications of existing water quality model(s) to estimate the impact of ash disposal in underground mines on the concentrations of contaminants in nearby surface and ground water. Data from a geographical information system (GIS) shall be coupled with the water quality model results to estimate the impact of disposal of MEA AFBC ash in the Longridge mine on concentrations of contaminants in nearby surface and ground water.

Task 14 - Regulatory Analysis: WVU shall review existing Federal, State of West Virginia, and local regulations and policies, which could impact the disposal of ash from advanced coal combustion technologies in underground mines. The contractor shall identify any regulatory barriers to the widespread adoption of this disposal practice in West Virginia.

2.0 Summary of Accomplishments

2.1 Completion of grouting operations at Longridge.
2.2 97% reduction in acid mine drainage from the Longridge Mine.

3.0 To-Date Accomplishments

Successfully completed Phase II grout injection. Successfully completed Phase III Demonstration.

4.0 Technical Progress Report

The Economic and Regulatory Analysis sections and the Water Quality Modeling task are included in the Draft Final Report that will be prepared and delivered on 29 December 2000.

Work this quarter consisted of the monthly sampling of the Longridge Mine auger hole. Table 1 displays the monthly data from the auger hole for the entire project period. Table 2 displays a summary of data prior to, during and after grouting the Longridge Mine void. As seen in Table 2, prior to grouting 1418 pounds per day of acidity flowed form the Longridge Mine. During grouting, this total was reduced in half. After grouting the flow of water averages 9.2 gallons per minute and the acid load from discharge is 47.1 pounds per day. This is a 97% reduction in acid load.

5.0 Plans for Next Quarter

5.1 Preparations for Draft Final Report will be made.

TABLE 1 Patriot Mining
Longridge mine discharge

Date	pH	Cond.	Alkalinity mg/l	Acidity mg/l	Al mg/l	As mg/l	B mg/l	Be mg/l	Ca mg/l	Cd mg/l	Fe mg/l	Mg mg/l	Mn mg/l	Pb mg/l	Se mg/l	SO4 mg/l	Avg. Flow gpm	Acid Load lbs per day
12/06/96	2.7	2020	0.0	597.0	43.0	0.4	0.1	<0.001	76.0	<0.001	84.0	47.0	14.0	<0.040	0.3	970.0	148.8	1065.7
12/13/96	3.1	1970	0.0	644.0	50.0	0.5	<0.030	<0.001	92.0	<0.001	93.0	55.0	16.0	<0.040	0.3	1100.0	137.5	1062.3
12/27/96	2.9	2070	0.0	622.0	49.0	0.5	0.1	0.0	96.0	<0.001	92.0	54.0	15.0	0.2	0.4	1200.0	66.6	496.7
01/04/97	2.9	1960	0.0	537.0	42.0	0.4	0.1	0.0	83.0	<0.001	80.0	46.0	14.0	0.1	0.4	1000.0	101.2	652.0
01/11/97	3.0	2050	0.0	585.0	47.0	0.5	0.1	0.0	93.0	<0.001	90.0	52.0	14.0	0.1	0.4	1100.0	53.6	375.1
01/21/97	2.7	2300	0.0	646.0	46.0	0.6	0.1	0.0	110.0	<0.001	110.0	59.0	17.0	0.2	0.5	1100.0	48.4	375.4
02/12/97	2.7	2000	0.0	644.0	41.0	0.5	0.1	<0.001	120.0	<0.001	110.0	78.0	16.0	0.2	0.5	1100.0	66.2	511.9
03/18/97					58.0	<0.175	0.2	0.0	109.0	0.0	102.0	59.0	19.0	<0.040	<0.139		165.4	
04/29/97	2.5	1940	0.0	528.0	37.0	0.4	0.1	<0.001	80.0	<0.001	67.0	49.0	14.0	0.0	0.2	1100.0	59.7	378.1
05/29/97	2.8	1800	0.0	548.0	36.0	0.5	0.2	0.0	85.0	0.0	74.0	46.0	13.0	0.2	0.4	920.0	60.4	397.0
06/18/97	2.7	1920	0.0	533.0	40.0	0.5	<0.030	0.0	91.0	0.0	90.0	54.0	14.0	0.2	0.4	960.0	38.5	292.3
07/28/97	2.7	1740	0.0	533.0	46.0	0.5	0.2	0.0	100.0	0.0	98.0	59.0	14.0	0.2	0.5	1100.0	22.1	141.0
08/29/97	2.7	2150	0.0	757.0	53.0	0.6	0.2	0.0	120.0	0.0	91.0	66.0	16.0	0.2	0.5	1000.0	16.4	149.1
09/25/97	2.7	2280	0.0	868.0	73.0	0.8	0.2	<0.001	160.0	<0.001	150.0	86.0	23.0	0.3	0.6	1500.0	20.0	208.3
10/17/97	2.8	2110	0.0	800.0	67.0	0.7	0.2	0.0	160.0	0.0	140.0	82.0	23.0	0.2	0.6	1800.0	198.0	1900.8
11/19/97	2.8	1880	0.0	707.0	58.0	0.5	0.1	<0.1	120.0	<0.1	130.0	80.0	24.0	0.2	0.4	1600.0	367.0	3113.6
12/22/97	2.5	2065	0.0	606.0	47.0				61.0		116.0	80.0	18.0			1590.0	405.0	2945.2
01/30/98	2.8	1640	0.0	612.0	49.0	0.6	0.2	<0.1	110.0	<0.1	110.0	64.0	18.0	0.2	0.4	1200.0	412.0	3025.7
02/25/98	2.8	1500	0.0	517.0	42.0	0.4	0.2	<0.1	88.0	<0.1	42.0	52.0	76.0	0.2	0.3	900.0	437.0	2711.1
03/27/98	2.7	1650	0.0	503.0	36.0	0.5	<0.1	<0.1	76.0	<0.1	66.0	49.0	14.0	0.1	0.4	840.0	432.0	2607.6
04/28/98	2.9	1590	0.0	524.0	38.0	0.5	0.1	<0.1	83.0	<0.1	68.0	50.0	14.0	0.1	0.4	880.0	200.0	1257.6
05/28/98	2.9	1600	0.0	538.0		0.5		<0.1		<0.1	85.0		12.0	<0.040	0.4	910.0	317.0	2046.6
6/98	2.9		<.1	540.0	33.0	0.4	<.2	<.2	83.0	<.2	68.0	44.0	12.0	<.2	0.4	900.0	366.0	2371.7
7/98	2.8		0.0	563.9	21.0	0.2	0.0	0.0	40.3	<0.1	35.3	23.2	6.3	0.0	0.2	1078.8	292.0	1975.9
8/98	2.8		0.0	727.6	24.0	0.3	0.0	0.0	52.8	0.0	46.3	28.1	7.3	0.1	0.2	1259.9	283.0	2470.9
9/98	4.1	1835	0.0	825.7	30.0	0.3	0.0	0.0	40.3	<0.1	53.6	31.5	7.9	0.1	0.2	2476.8	270.0	2675.3
10/98	2.9	2190	0.0	902.2	67.8	1.0	0.3	<0.1	132.5	<0.1	138.8	81.3	19.7	0.3	0.7	1277.7	246.0	2663.2
11/98	2.9	2180	0.0	833.3	73.8	1.0	0.3	<0.1	191.5	<0.1	112.2	87.3	20.2	0.3	0.8	1484.7	235.0	2349.8
12/98	7.2	683	0.0	45.5	73.4	1.1	0.1	0.2	209.2	<0.1	98.1	90.1	20.0	0.1	0.8	1616.4	53.0	28.9
average	3.0		0.0	621.0													190.3	1437.5
1/99	2.9	2090	0.0	698.3	81.1	0.0	0.1	0.0	155.2	<0.1	172.5	94.3	16.3	0.2	0.5	1095.9	288.0	2413.5
02/19/99	2.8	2530	0.0	701.4	17.5				179.2		77.0	62.5	43.2			3691.8	100.0	841.7
04/05/99	3.0	1816	0.0	414.0	35.3				164.4		44.7	42.6	11.7			770.2	92.0	457.0
05/07/99	3.1	1891	0.0	529.1	36.3	<.1		0.1	196.2	0.0	50.0	39.9	6.4	0.3	0.4	784.5	9.0	57.1
11/30/99	2.9	3250	0.0	555.0	41.2	0.5	0.2	0.0	40.4	0.0	72.0	43.3	3.0	0.2	0.4	2579.0	9.0	59.9
	2.9	3250	0.0	559.0	4.8	0.6	0.2	0.0	40.1	0.0	8.6	5.0	1.8	0.2	0.4	2115.0		
12/16/99	2.9	3200	0.0	614.0	46.2	0.5		<0.005	41.6	0.1	134.0	0.7	5.7	435.0	2157.0	0.2	9.0	66.3
	2.9	3060	0.0	618.0	46.7	0.5		<0.005	42.4	0.1	139.0	0.6	5.3	437.0	2018.0	0.2		
01/24/00	2.9	4270	0.0	367.0	30.3	0.0	0.2	<0.01	397.0	0.0	30.8	35.8	5.0	<0.001	<0.002	3200.0	10.0	44.0
02/19/00	2.7	2831	0.0	686.4	3.4				404.1		116.6	31.7					10.0	82.4
06/09/00	3.1	2140	0.0	216.7	20.6				417.2		19.9	28.5	0.5				10.0	26.0
07/18/00	3.0	2170	0.0	340.9	18.8				401.0		33.8	28.3	4.5				6.0	24.5
08/17/00	3.3	1964	0.0	226.0	18.8				364.1		29.4	29.6	4.7				7.9	21.4
09/14/00	3.2	1135	0.0	424.1	30.1				358.0		64.9	50.3	8.8				10.0	50.9
10/12/00	3.1	2380	0.0	423.1	31.6				387.6		67.4	55.6	8.0			1473.6	10.0	50.8
11/14/00	2.9	2160	0.0	398.1	34.0				366.3		61.8	52.2	8.2			1820.6	10.0	47.8

Table 2 Patriot Mining
Longridge mine discharge- Summary

	Date	pH	Alkalinity mg/l	Acidity mg/l	Avg. Flow gpm	Acid Load lbs per day	% reduction
Pre-grouting	12/96-12/98	3.0	0.0	621.0	190.3	1417.8	
During grouting	1/99 - 9/99	2.9	0.0	585.6	99.6	699.9	50.64%
Post-grouting	11/99-11/00	3.0	0.0	425.1	9.2	47.1	96.68%