SURFACE MINING FOR WATER QUALITY SYMPOSIUM

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I would like to use a small job which I have just completed as a basis for determining special overburden handling considerations and to relate direct out-of-pocket costs to the mining operation. It is given here that detailed site analysis, including a detailed chemical characterization of the overburden,

has been performed and it is determined that:

1. No very potentially toxic strata exists in the burden until 6 inches immediately above the coal.
2. A blending of the sandstone and mudstone overburden will result in spoil which has excess calcium carbon or is at least not potentially toxic.
3. The pavement of the coal is toxic.

Based upon on this overburden information it is determined that:

1. No segregation of primary overburden strata is necessary. All strata will be blended and amalgamated until within 6 inches of the coal.
2. The material within 6 inches of the coal will be removed, segregated, and handled as toxic material.
3. After the coal is removed, the pit floor will be cleaned of coal and loose pavement material and these cleanings will be segregated and handled as toxic material.
4. Toxic material will be placed in the backfill well above the pavement, at least twenty feet from the final highwall, and not closer than 4 feet to the final graded surface.
5. When toxic material is placed in the backfill, it will be compacted, treated with lime to neutralize at least two times the negative neutralization potential or with 3 to 4 tons of lime for each pit. After treatment with lime, the toxic material is covered with a compacted layer of good spoil material.
6. After all coal and loose pavement material is removed -rom the pit and before blasting onto the pit floor, agricultural lime will be applied at a rate sufficient to neutralize two times the negative neutralization Potential or with 4 to 5 tons of lime per pit.

The following slides show these overburden handling techniques:

Slide #1

A typical section of overburden from the Kittanning coal. The upper brownish material is about 35 feet of sandstone. The high croma brown color is a good indicator that weathering and oxidation processes have removed most of the acid producing potential of this material. The quality of this sandstone ranges from excess neutralization potentials of 23 Tons/ 1000 Tons to deficiencies of 22 Tons/1000 Tons with a paste pH range of 5.5 to 8.2. There are No negative NP's.

There is about a 10-foot layer of mudstone immediately below the sandstone which again has zones of excess carbonates and zones deficient in carbonates. The mudstone and binder immediately above the coal and the pavement floor is toxic.

Slide #2

This slide shows the toxic material from immediately above and below the coal seam being selectively placed in the backfill by a loader.

Slide #3

This slide shows toxic material being selectively placed in a partially backfilled strip pit. The pit is filled with about 25' to 30' of overburden and the toxic material is placed away from the highwall and compacted.

Slide -#4

This slide shows toxic material being segregated in the backfill away from the highwall and well above the pit floor. Compaction is being performed with a dozer. We are becoming increasingly aware of the need for compacting this toxic material.

Slide #5

This slide shows agricultural lime being applied to the segregated toxic material after it is placed high in the backfill, away from the highwall, and has been compacted.

Slide #6

This slide shows the toxic material segregated and treated in the backfill being covered with some of the most favorable overburden material available. The toxic material will be about 20 feet from the final graded surface of the backfill.

Slide #7

This slide shows an agricultural lime spreader and truck used by our company for revegetation and special overhandling procedures.

Slide #8

This slide shows agricultural lime being applied to the coal pit floor after all loose caol pavement material has been removed. In a pit approximately 80 x 100 the rate of application is about 4 tons on the toxic material in the backfill

Slide #9

This slide shows a pit floor which has been treated with agricultural lime.

Slide #10

This slide shows back-up lime spreading equipment for special conditions or breakdowns. The tractor is 4 wheel drive with 60 horsepower pulling a 6 ton spreader bin.

Slide #11

This slide shows the pond, backfill and vegetation of this job. No water treatment has been necessary to date.

To project the actual cost of special overburden handling techniques, I have used the method of operation just reviewed and projected this information into a hypothetical permit. The hypothetical

Permit XYZ has a disturbed area of 75 acres with 50 acres of Lower Kittanning Coal four feet thick. The planned production is 10,000 tons per month for a period of 35 months. Stripping equipment includes trucks, loaders and dozers. The drainage system consists of diversion ditches carrying water to two ponds. Both ponds receive drainage from areas mined after May 3, 1978, and are consequently under the jurisdiction of the Federal office of Surface I-lining as well as the West Virginia Department of Natural Resources. The combined flow from both ponds is 100 gallons per minute with a pH of 3.5 and total acidity of 500.

In addition to projecting the cost of special overburden handling techniques, I will project the cost of water treatment on this job without special overburden handling and make a comparison of the two alternatives.

I. Cost of Special Overburden Handling Techniques

Pit Size: 80 X 100 = 8000 ft2 w/ 4 ft coal = 1285 Tons Coal

Loader (12yd)	@ $96*	per	hour X 60%	(fair to good)	=$57
Truck (50 ton)	@ $58	per	hour X 85%		=$50
Loader (3yd)	@ $48	per	hour X 60%		=$29
Dozer (D-9)	@ $91	per	hour X 80%		=$73
Lime Spreader	@ $16	per	hour X 90%		=$14
Lime	@ $ 4	per	ton		=$ 4

*30th Edition Nationally Averaged 1978 Rental Rates for Construction Equipment

Clean rash from top and bottom of coal

100' X 80' X .5 ft.	=	4000 ft^2	=	148 yards
100' X 80' X .25 ft.	=	2000 ft^2	=	74 yards
				222 yards of toxic material

Coal Cleaning	=		2 hours w/ 12 yd Loader	$ 114
	=		2 hours w/ 3 yd Loader	$ 58
	=		Subtotal	$172
Pit Cleaning	=		2 hours w/ 12 yd Loader	$ 114
	=		Subtotal	$ 114
Trucking	=		1 hour tow 50 Ton trucks	$100
	=		Subtotal	$100
Compacting & Grading	=		1 hour w/ D9 Dozer	$73
	=		Subtotal	$73
Liming	=	Pit floor	a. Lime 4 tons	$16
	=		b. Spreader 1-1/2 hours	$24
	=		Subtotal	$40
		Toxic Material in backfill		
			a. Lime 4 tons	$16
			b. Spreader 1-1/2 hours	$24
			Subtotal	$40
GRAND TOTAL (out-of-pocket) hour w/ D9 Dozer				$ 549

Coal in pit (4' coal X 1750 T/Ac ft X 8000ft2) = 1285 Tons
Cost per ton = $0.43 Per Ton
Cost per month @ 10,000 Ton Level = $4,300

III. Potential Water Treatment Costs: Permit XYZ

1. Assumed flow: 100 Gpm with 500 ppm acidity
2. Water Quality form Field Tour November 29, 1978

Site No.	1	2	3	4	5	6	7	8
A. pH	3. 0	2. 5	3.0	3.1	3. 1:	2.6	4.6	4. 3
B. Acidity	320	3100	760	190	320	1070	21	19
C. Alkalinity	<1	<1	<1	<1	<1	<1	7	5
D. Iron	52	638	110	13	14	92	0.05	.83
D. Manganese	12	100	41.	6.2	23	6.0	4.6	2.0

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100' X 80' X .25 ft. = 2000 ft^2 = 74 yards
222 yards of toxic material

Coal Cleaning =	2 hours w/ 12 yd Loader	$ 114	
	2 hours w/ 3 yd Loader	$ 58	
	Subtotal		$ 172
Pit Cleaning =	2 hours w/ 12 yd Loader	$ 114	
	Subtotal		$ 114
Trucking =	1 hour two 50 Ton Trucks	$ 100	
	Subtotal		$ 100
Compacting & Grading =	1 hour w/ D9 Dozer	$ 73	
	Subtotal		$ 73
Liming = pit floor	a. Lime 4 Tons	$ 16	
	b. Spreader 1-1/2 hr.	$ 24	
	Subtotal		$ 40
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D. Iron	52	638	110	13	14	92	0.05	.83
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3. lb of Soda Ash Briquettes per minute = $\frac{\text{Magic Number (1)} \times \text{GPM} \times \text{ppm Acidity}}{1{,}000{,}000} \times \frac{1}{.99\ \text{purity}} \times \frac{1}{.99\ \text{efficiency}} = .44$

(1) Magic Number - The pounds of neutralizer required to neutralize 1,000,000 gallons of coal mine drainage to a pH of 8.3

Cost per day = $.44 \times 60 \times 24 \times \frac{100\ ¢\text{ per pound}}{14} = \$88.70$

(.44 = lb Soda Ash per minute; 60 = minutes per hour; 24 = hours per day)

Cost per month

88.70 per day × 30 days per month = $2661.00 per month

4. Water treatment Costs

Materials (Soda Ash Briquettes)	$2661.00 per month
Labor (1 Man)	1380.00 per month
	$4041.00 per month

IV. Current Requirements of Permit #XYZ

1. Assumptions

Total Acreage	75 acres
Coal Acreage	50 acres
Production Rate	10,000 Tons per month
Shipping Ratio	12:1
Total Coal Reserve	350,00d Tons
Length of Operation	35 Months
Permit Started	January, 1977
Planned Completion	December, 1980

2. Water Treatment Costs

Per Month (Materials & Labor)	$	4,041.00
Per Year	$	48,492.00
Per Job (35 Months)	$	141,435.00

3. Special Handling Costs

Per Ton	$	0.43
Per Month	$	4,300.00
Per Year	$	51,600.00
Per Job	$	150,500.00

4. Special Handling vs. Water Treatment

Special Handling Costs	$	150,500.00
Water Treatment Costs	$	141,435.00
Difference	$	9,065.00

5. Federal and State Legal Requirements

A. Performance Standard for effluent limits

pH 6.0 to 9.0

iron 3.5 to 7.0 ppm

mn 2.0 to 4.0 ppm

alkalinity greater than acidity

suspended solids 35 to 70 ppm

B. Who regulates these discharges?

a. WVDNR, Reclamation Division
b. WVDNR, Water Resources Division
c. U.S. Office of Surface Mining
d. U.S. Environmental Protection Agency
e. Environmental Groups

C. What are the requirements for water quality?

1. OSM requires water from the pond discharge to meet the effluent limits for areas mined after May 3, 1978 regardless of <u>any</u> mitigating circumstances. The effluent limits must be met until final bond release.
2. EPA responds only to citizen complaints and requires that the effluent limits be met until release of the grading bond. Monitoring and lab reports required.
3. DNR requires that <u>no</u> grading bond will be released which has an acid discharge (pH less than 6.0) regardless of ~~= circumstances. In addition, water quality must meet the effluent limits without treatment to qualify for grading and final bond release. Monitoring and lab reports are required.

D. What is an operator's limit of liability?

Legal requirements as currently interpreted by State and Federal Regulator Agencies dictate that the bond release process cannot begin until water quality

meets the effluent limits without treatment regardless of the pre-existing water quality or circumstances. This con stitutes unlimited liability for water quality. Permit Status December, 1980

E. Permit Status December, 1980

1. With special handling of overburden for water quality the discharges should meet the effluent limits and be eligible for grade release in the spring. If the West Virginia Permanent Regulatory Program Proposal submitted to OSM is approved, the permit will be eligible for final vegetative release within a time frame of 2 to 5 years. Water Quality must meet the effluent limitations to qualify for final bond release.
2. With water treatment under current DNR interpretations the permit does not qualify for grading release until the water meets the effluent limitations without treatment.
3. Economic Implications

Cost of Special Handling	$ 150,500
Cost of Water Treatment	$ 141,435
Savings during mining thru Dec. 1980	$ (9,065)

Water Treatment Cost - 1981	$ 48,492
Savings thru December, 1980	9,065
Difference	$(39,427)
Water Treatment Cost - 1982	$ 48,492
Cumulative to date	$ 87,919
Water Treatment Cost - 1983	$ 48,492
Cumulative to date	$136,411
Water Treatment Cost - 1984	$ 48,492
Cumulative to date	$184,903

FOOD FOR THOUGHT?