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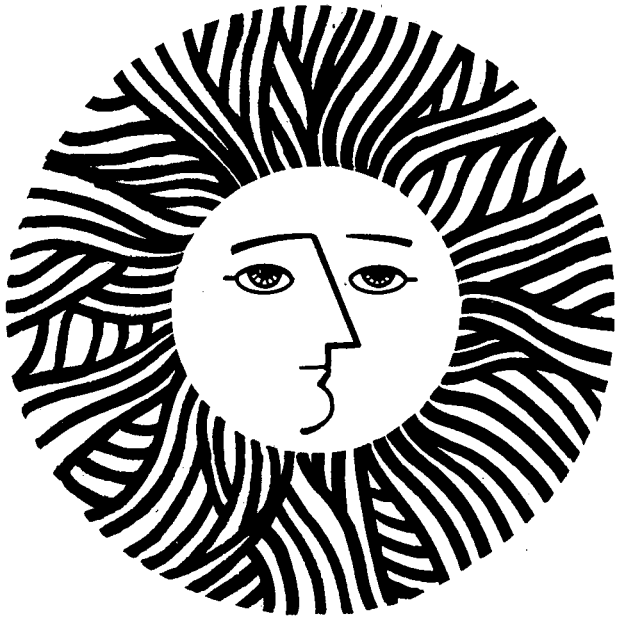

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LAWRENCE BERKELEY LABORATORY
Room: 128 Bldg.: 70 Ext.: 6698

April 17, 1981

TO: Charles Grua

FROM: Amos Newton and Phyllis Fox

RE: Monthly Progress Report for April
Environmental Effects and Controls for Coal-Water Systems
LBID-385

Total Solids in Coal Slurry Waters

In connection with the question of the origin of the total organic solids in coal slurry waters in the region of 5-15 ppm whereas the organic carbon which can be accounted for by GC/MS analysis is only about 10 ppb. The total solids were measured by weighing the residue of evaporation at 70°C. The results are as follows and are in the same range of values found by other investigators for these types of coal.

Table 1. Total Solids in Coal Slurry Waters

Coal	Coal Slurry Water ppm Total Solids
Wyodak	1820
Illinois No. 6	1320
Black Mesa	700
Blank (Starting Water)	200

Absorption of Compounds in Coal during Slurry Formation

Studies have continued in the absorption of various types of compounds on coal during slurry formation. The compounds checked this month were selected for their availability and their possible relationship to one or more parts to one of the assumed structures present in coal. Adamantane, $C_{10}H_{16}$ is a low molecular weight (MW=136) bridged tricyclic hydrocarbon. Dibenzothiophene and carbazole are heterocyclic compounds with structures similar to those postulated to occur in coal. Benz(a)anthracene-7,12-dione is an oxidation product of one of the polynuclear aromatic hydrocarbons.

A spike solution containing 100 ppm of each of these compounds in acetone was analyzed to establish sensitivity of each respective compound. A further check was made by adding the spike solution to separated coal slurry water at a concentration of 100 ppb, extracting the spiked slurry water with hexane and concentrating the hexane to a known volume. The GC/MS sensitivity of each compound as determined in the extract takes account of losses in the extraction and concentration procedures. In Table 2 the recoveries are shown to be excellent.

Table 2. GC/MS Sensitivities of Compounds in Spike Solution and Recovered from Coal Slurry Water.

Compound	M/2	Sensitivity in Counts/ Nanogram	
		In Spike Solution	From Coal Slurry Water
Adamantane	136	282	268
Dibenzothiophene	184	374	304
Carbazole	167	124	120
Benz(a)anthracene-7,12-dione	258	30.9	27.1

When the spike solution is added to the water at a concentration of 100 ppb before slurrying with coal, the only compound found in the separated water was adamantane at a concentration of a few parts per trillion as shown in Table 3.

Table 3. Concentration in Coal Slurry Waters of Compounds added before Slurrying[a]

Compound	Concentration in ppt in Slurry Water from Coal		
	Wyodak	Illinois No. 6	Black Mesa
Adamantane	8	30	135
Dibenzothiophene	<5[b]	<5	<5
Carbazole	<13	<12	<12
Benz(a)anthracene-7,12-dione	<55	<50	<50

[a]Initial concentration of each compound in water before slurry formation was 100 ppb.
[b]Not detected in the concentrated extract. Given is the upper concentration limit of which the compound would have been detected.

As observed previously, lower molecular weight compounds are observed at very low levels, while higher molecular weight compounds are absorbed. Since 100,000 ppt of each compound was added, a concentration of adamantane of 30 ppt in the slurry water represents an absorption of 99.97% and 135 ppt represents absorption of 99.87% of the adamantane added. At this amount of compounds added from each of these classes of chemicals, the absorption by coal is quite efficient. As noted previously, Black Mesa coal does not absorb added chemical compounds to as great an extent as does Wyodak coal.

Field Trip to Mohave Generating Station

One of us (ASN) attended the March 24-27 meeting of the Slurry Transport Association in Las Vegas. In connection with that meeting a field trip to the Mohave Generating Station was made. This power generating station is the user end of the Black Mesa pipeline.

The separation of coal and slurry water at this plant is no where near as efficient as the laboratory separations we have made for separation of coal and slurry water. The centrifuges at Mohave leave some 7-8% coal fines in the water. This centrifugate water is further treated in a clariflocculator. The clariflocculator underflow (concentrate) is sometimes burned but usually put in ponds to dry. Difficulties occur in drying because a top surface crust is formed and the wet mixture below does not dry.

The "black water" from the clariflocculator is used as process water. It contains considerable coal fines hence the name "black water." If this water was not entirely used at the plant, a further cleanup would be necessary for its disposal.

This report was done with support from the Department of Energy. Any conclusions or opinions expressed in this report represent solely those of the author(s) and not necessarily those of The Regents of the University of California, the Lawrence Berkeley Laboratory or the Department of Energy.

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