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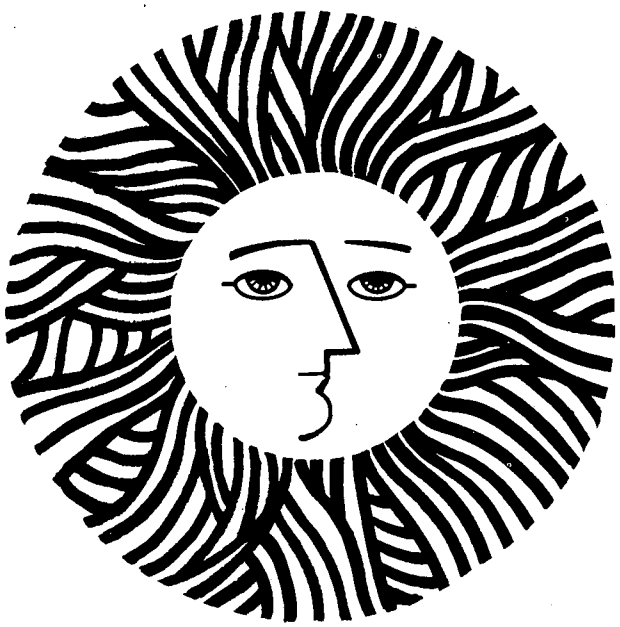

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LAWRENCE BERKELEY LABORATORY
Room: 128 Bldg.: 70 Ext.: 6698

March 16, 1981

TO: Charles Grua

FROM: Amos Newton and Phyllis Fox

RE: Monthly Progress Report for February
Environmental Effects and Controls for Coal-Water Systems
LBID-373

Carbon in Coal Slurry Water

A carbon analyzer for the measurement of total carbon, organic carbon in water samples has two channels of operation. In one the sample is injected into a hot oxidant bed on which everything containing carbon is converted to CO_2. Measurement of the CO_2 (by IR) measures the total carbon content of the sample. In a second channel of operation, the sample is injected onto a warm bed of silica beads coated with phosphoric acid. This converts all inorganic carbon (carbonates and bicarbonates) to CO_2. This is a direct measure of the inorganic carbon content of the water. Subtraction of the inorganic carbon from the total carbon gives an indirect measure of the organic carbon content of the sample. A direct measurement of the organic content can be made by acidifying the sample with HCl and blowing out the CO_2 with N_2 gas before injecting the sample onto the hot oxidant bed.

The organic carbon contents of coal slurry waters made from Black Mesa coal, Wyodak coal, and Illinois No. 6 coal have been measured by both the direct and indirect methods with excellent agreement. The inorganic carbon in each water was determined by the direct method for inorganic carbon. The results are shown in Table 1.

Table 1. Total carbon, inorganic carbon and organic carbon content of slurry waters from three types of coal.

	Coal Type		
	Black Mesa	Wyodak	Illinois No. 6
pH of slurry water	7.83	6.57	6.78
Total carbon (ppm)	56.6	23.1	32.1
Inorganic carbon (ppm)	38.2	5.0	20.6
Organic carbon (ppm) (Indirect)	18.4	18.1	11.5
Organic carbon (ppm) (Direct)	19.8	17.9	10.5

The slurry water from the Black Mesa coal contains more inorganic carbon than does the Wyodak or Illinois No. 6 coal. This increased inorganic carbon causes the pH of the Black Mesa slurry water to be higher, 7.83, compared to 6.57 for the Wyodak coal and 6.78 for the Illinois No. 6 coal. Illinois No. 6 coal slurry water has the lowest organic carbon content. This slurry water also shows the greatest optical clarity of the three.

The slurry water from Illinois No. 6 coal has two properties not observed with the other coal slurry waters. First is the difficulty of methylating phenols in this water. Success in methylation was only made when the water was pre-extracted with hexane or methylene dichloride. Secondly the slurry water from Illinois No. 6 coal develops a red precipitate on standing. An X-ray fluroescence scan of this precipitate on a filter paper shows the only metal present to be iron. We conclude that the precipitate is ferric hydroxide, but we have no explanation of why it forms in this slurry water and not in the other two. Is the iron in the other two waters complexed by an organic ligand so it is not readily oxidized? The questions raised by these observations should be answered since they bear on the purity of coal slurry water.

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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