Title
MONTHLY PROGRESS REPORT FOR MAY. CONTROL TECHNOLOGY FOR IN-SITU OIL SHALE REPORTS

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Publication Date
1981-06-01

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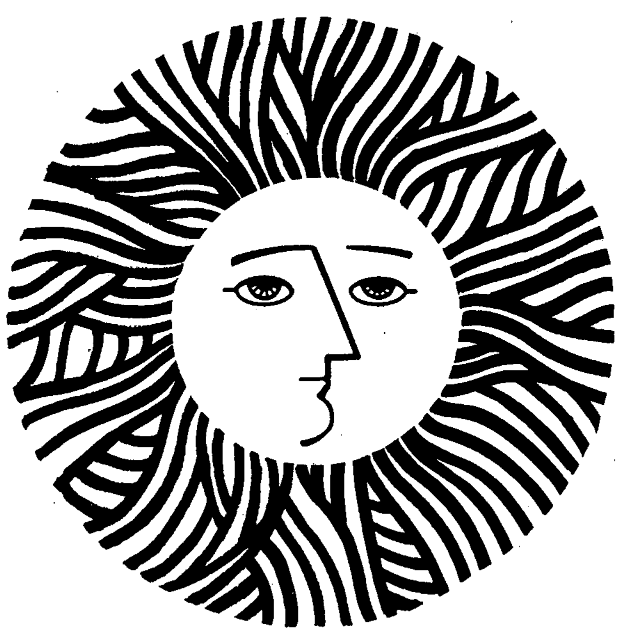

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June 18, 1981

TO: Charles Grua, Brian Harney, and Art Hartstein

FROM: Peter Persoff, Bill Hall, and Mohsen Mehran

RE: Monthly Progress Report for May
Control Technology for In-Situ Oil Shale Reports
LBID-407

TASK 3. BARRIER OPTIONS

Evaluation of Waste Materials Other Than Spent Shale as Grout Ingredients

We have been studying the use of Comanche fly ash (class C) as a grout ingredient because it is a hydraulic cement. However, it is quick setting and can not be used without a set retarder. Last month we evaluated several set retarders for Comanche fly ash and found that the most effective is 0.1% citric acid, which increased the time of initial set (measured by Gillmore needle) from 3 min. to 31 min. This month we obtained strength data on mortar cubes made with Comanche fly ash and various retarder combinations. Gypsum is a less effective retarder than citric acid, but it contributes to strength development. Both reagent gypsum and waste gypsum from a large phosphoric acid plant near Salt Lake City were evaluated. Times of initial and final set, as measured by Gillmore needle, and strength of 2-inch mortar cubes (ASTM C-109) are shown in Table 1. For comparison, type 1 portland cement has a 28-day compressive strength about 5000 psi.

Surface Disposal of Spent Shale

This month we reviewed published literature on geotechnical properties of spent shale, directing attention to selecting a method for permeability measurement of compacted spent shale samples. The method tentatively selected for permeability measurement is to compact the spent shale, under specified conditions of compactive effort, moisture content, moistening water quality,

TABLE 1. Strength and Time of Set of Comanche Fly Ash and Retarders.

		10% reagent gypsum	10% waste gypsum	no gypsum
0.1% Citric Acid	7-day strength, psi[a]	1625	1821	690
	28-day strength, psi	2075	2075	1040
	Initial set, min.[b]	8	—	31
	Final set, min.	15	—	38
No Citric Acid	7-day strength, psi[a]	1240	1035	c
	28-day strength, psi	1800	1388	
	90-day strength, psi	2180	—	
	Initial set, min.[b]	—	—	3
	Final set, min.	—	—	6

[a] Compressive strength of 2-inch mortar cubes by ASTM C109

[b] Time of set by modified Gillmore needle test

[c] Unretarded fly ash set too quickly to prepare samples

and fly ash addition, in a Proctor mold, and then fit the top and bottom of the mold with drains so that de-aired water can percolate through the sample under falling or constant head. This method eliminates re-handling of the compacted material and permits measurement of permeability of spent shale in the same condition as will be specified for compaction for disposal. Permeate will be collected and analyzed.

The addition of small amount of pozzolanic local fly ash (class F fly ash from Craig, Colorado) may be cost-beneficial because some spent shales contain small amounts of free lime which reacts with pozzolans to aid cementing. Work is also now in progress to evaluate spent shales themselves for pozzolanic activity (by ASTM C 311).

TASK 5. LEACHING OPTIONS

Leaching of Organics from Spent Oil Shale

Work continued on the development and verification of the leaching and transport model. We have developed a procedure to use total dissolved solids (TDS) data from the column studies for model verification. Previously we had used only total organic carbon (TOC) data.

The leaching of the three 12-inch diameter by 10-foot long columns was begun. Two of these columns are loaded with spent shale particles in the -1 to +1/2-inch range. The third is packed with -1/2 to +1/8 inch shale. Pore velocities are approximately 12 cm per hour for one column of each size shale. The remaining -1 to +1/2 inch shale column has a pore velocity of about 6 cm per hour. The leaching fluid is tap water. Flow is downward to minimize effects of density currents.

We are taking conductivity, pH, and TOC measurements at column lengths of about 70 and 145 cm. We plan to run the large columns until the conductivity measurements in the effluent approach those in the influent tap water supply.

Work continues on the preparation of the final report on this task.

TASK 6. GEOHYDROLOGIC MODIFICATION

Solute Transport Model Development

Work is continuing on development of a model for simultaneous fluid and solute transport with unsaturated flow. This model, when developed, will be suitable either for abandoned retorts or for surface disposal piles. A previously existing program developed at LBL has been modified to exclude stress calculations for more efficient computations. A simple problem, involving fluid transport in a fractured medium, that was previously solved with stress calculations, has now been solved without them, with identical results. This assures us that fluid flow calculations are not distorted by the deletion of stress calculations. Simple heat flow problems are now being run so that the results can be compared to analytic solutions for model verification.

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