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## Recent Work

### Title

NOVEMBER MONTHLY PROGRESS FOE SPENT SHALE AS A CONTROL TECHNOLOGY FOR OIL SHALE RETORT WATERS.

### Permalink

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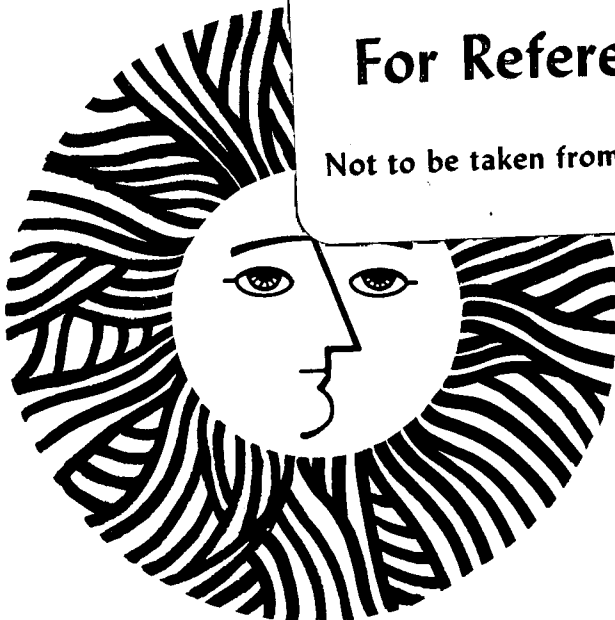
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December 6, 1979

TO: Charles Grua

FROM: Phyllis Fox

RE: November Monthly Progress for Spent Shale as a  
Control Technology for Oil Shale Retort Waters  
LBID-148

#### TASK 2. BATCH STUDIES

Equilibrium batch adsorption studies with TOSCO II spent shale and  $\Omega$ -9 and 150-ton retort water were completed. These studies indicate that this shale, unlike others tested, does not elevate pH or reduce the conductivity of the  $\Omega$ -9 and 150-ton retort water. The specific adsorption values for  $\Omega$ -9 and 150-ton retort water are 40.0 and 33.3 mg organic carbon/gm shale, respectively, after 5 days of contact. The reduction in inorganic carbon was about 50% for the  $\Omega$ -9/TOSCO II shale combination and 31% for the 150-ton/TOSCO II shale combination. TOSCO II is a better shale for organic carbon removal but very poor for pH elevation and inorganic carbon reduction compared to other spent shales tested.

#### TASK 3. PHYSICAL PROPERTIES AND PRETREATMENT

The development of a suitable oil and grease analytical method for determining the mineral oil content of retort water is continuing. A sample of crude oil from the Oxy retorting process is being used in this work. The oil is taken up in  $\text{CH}_2\text{Cl}_2$  and the nonpolar fraction is eluted from a silica column. The solvent is

evaporated from this fraction and the residue is dried. Preliminary tests on the effect of drying temperatures and the use of chemical desiccants have been completed. The results indicate that the residue is volatilized, causing a continual loss of weight in the sample over time. This work suggests that drying to a constant weight may be difficult. Normal and reverse silica columns are being used for this study. Multiple reuse of the columns for sample preparation is part of the investigation.

#### TASK 4. CONTINUOUS COLUMN STUDIES

Large-scale continuous-flow column studies have been initiated. Two columns, 1 inch in diameter and 36 inches long, have been fabricated from lucite and are presently being set up. The columns will be operated in an upflow configuration. Water will be pumped from a constant head reservoir with a positive displacement pump. Sample ports at 6-inch intervals are spaced along the column length.

L-2 spent shale will be used in the first experiments because it demonstrated good pH elevation and inorganic carbon removal in the batch studies. This shale has been graded in preparation for the column runs.

#### TASK 5. SYSTEM STUDIES

Negotiations have been initiated with LETC to obtain a 1000-gallon sample of Occidental retort water from Logan Wash Retort 6 for use in the system studies. Dave Farrier of LETC collected five 800-gallon samples during this run. Each sample was collected at a different point in time and analyses of the five samples completed at LETC indicate significant differences in elemental abundances and water quality parameters. We are working with LETC to resolve these differences and to develop a suitable compositing strategy. We have analyzed the LETC data and completed measurements of pH, alkalinity, COD, ammonia, TDS, electrical conductivity,

and oxides of nitrogen on two of these five samples. A comparison of LBL and LETC results reveals significant differences between the COD and oxides of nitrogen as analyzed by the two laboratories and wide scatter in the electrical conductivity and alkalinity data. Work will continue in order to resolve these discrepancies.

Biological reactors are being set up in preparation for interfacing with the continuous-flow spent shale columns. A small continuous-flow activated sludge reactor is in operation. The reactor is being acclimated to 150-ton retort water which has been pretreated to reduce the ammonia concentration. The reactor is currently being fed a solution of 75% retort water. The hydraulic residence time in the reactor is 48 hours.

The batch activated sludge reactors that were initiated in previous months are now being fed 100% retort water. The water, from LETC's 150-ton retort, has been pretreated to lower the ammonia concentration to below 4000 ppm  $\text{NH}_3\text{-N}$ . Daily, 25% of the settled supernatant is removed from the reactor and replaced by fresh influent. In addition, one reactor is being supplemented with glucose and a trace metal solution to investigate nutritional deficiencies. Preliminary results show that biological growth is very dispersed and does not readily settle. This will cause problems in flocculation and settling in the treatment system. Soluble chemical oxygen demand is reduced in the reactor by 25% - 40%. The high pH values in the reactor are being controlled by acid addition.

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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