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February 12, 1985

Dr. J. W. Bradbury  
Geotechnical Branch  
Office of Nuclear Material  
Safety and Safeguards  
U.S. Nuclear Regulatory Commission  
Room 623-SS  
Washington, D.C. 20555

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WMA Record File  
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Dear John:

Enclosed is the progress report for the month of January 1985 for B0290, "Laboratory Evaluation of DOE Radionuclide Solubility Data and Selected Retardation Parameters, Experimental Strategies, Laboratory Techniques and Procedures."

Sincerely,

Susan K. Whatley, Manager  
Engineering Analysis And Planning  
Chemical Technology Division

SKW: cet

Enclosure

cc: Office of the Director, NMSS (Attn: Program Support Branch)  
Division Director, NMSS Division of Waste Management (2)  
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R. J. Starmer, Geotechnical Branch  
D. J. Brooks, Geotechnical Branch  
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4. AUTHORS (If more than three, name first author followed by "and others")

A. D. Kelmers, and others

5. NAME OF CONTRACTOR

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6. DATE MANUSCRIPT  
COMPLETED  
February 1985

7. NRC PROGRAM SPONSOR/TECHNICAL MONITOR

J. W. Bradbury

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427-4055

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~~XXXXXXXXXXXX~~, Laboratory Records Supervisor

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*Nancy V. Taylor*

2-12-85

MONTHLY PROGRESS REPORT FOR JANUARY 1985

PROJECT TITLE: Laboratory Evaluation of DOE Radionuclide Solubility Data and Selected Retardation Parameters, Experimental Strategies, Laboratory Techniques, and Procedures

PROJECT MANAGER: S. K. Whatley

TASK LEADER: A. D. Kelmers

SCIENTIFIC STAFF: W. D. Arnold, G. K. Jacobs, S. Y. Lee, R. E. Meyer, and F. G. Seeley

ACTIVITY NUMBER: ORNL #41 37 54 92 6 (FIN No. B0290)  
NRC #50 19 03 1

PROGRESS HIGHLIGHTS:

Technetium Studies:

A 50-day-duration batch contact sorption experiment under anoxic redox conditions at 60°C which was designed to observe the effect of basalt particle size on the sorption of technetium(VII) in synthetic groundwater GR-4 onto Cohasset basalt was completed during January. The results will be reported in the next monthly. We also completed additional data points in a sorption isotherm with Cohasset basalt under anoxic conditions at 60°C. These results also will be described next month.

Uranium Studies:

A 14-day-duration sorption isotherm was completed for uranium(VI) sorption onto Cohasset basalt from synthetic groundwater GR-4 under anoxic redox conditions at 60°C. The isotherm was linear at the lower uranium concentrations, but at higher concentrations the isotherm had the shape typical of an apparent concentration limit at about  $3 \times 10^{-6}$  mol/L uranium in the groundwater. Sorption ratios at the lower concentrations were about a factor of ten higher than those observed under the same test parameters for sorption onto McCoy Canyon basalt from synthetic groundwater GR-2. At a groundwater concentration of about  $2 \times 10^{-8}$  mol/L uranium(VI), the sorption ratio with Cohasset basalt was 30 L/kg. In separate experiments designed to investigate the stability of  $10^{-4}$  mol/L uranyl chloride in synthetic groundwater GR-4 (control experiments without basalt present), it was found that 70% of the uranium was removed from the solution after 20 days at 60°C as a light yellow precipitate. This precipitate is being analyzed. The formation of sodium boltwoodite from synthetic groundwater GR-2 was reported in our December monthly.

Neptunium Studies:

A 0.1 mCi sample of the  $^{237}\text{NpO}_2$  successfully dissolved in HF-catalyzed 8 M  $\text{HNO}_3$ ; the solution was brown colored, suggesting that the neptunium had been oxidized to Np(VI). Determination of the Np(IV)/(V)/(VI) ratio is underway. The  $^{235}\text{Np}$  needed to trace the  $^{237}\text{Np}$  solutions is still not in hand; see PROBLEM AREAS below.

Chromatographic Studies:

No progress to report.

Sample Acquisition:

A meeting is planned for February 4 at Mercury, NV, to discuss transfer of Yucca Mountain material to ORNL.

Geochemical Calculations:

Some progress has been made in rewriting EQ3/EQ6 in FORTRAN 77 to run on our IBM machines. EQ3 is 100% debugged and ready to run. EQ6 is 60% debugged. Work to set up a formatted data file for the thermodynamic data base will be started soon.

Sample Characterization:

Scanning electron micrographs of the various particle-size fractions of Cohasset basalt used in the neptunium and technetium sorption experiments showed no microfracturing; microfracturing had been proposed as a possible explanation of the lack of correlation of BET surface area measurements with the basalt particle size. The micrographs also showed no evidence of mineral segregation in the various particle-size fractions; thus, differences in the neptunium sorption ratio observed with different size fractions can not be attributed to observable mineral enrichment/depletion in the various fractions.

General Aspects:

None

MEETINGS AND TRIPS:

None

REPORTS AND PUBLICATIONS:

Preparation of a draft of the Annual Report for FY 1984 for review by the NRC Project Manager continued.

PROBLEM AREAS:

Our current supply of  $^{235}\text{Np}$  has been completely depleted. We anticipated this and placed an order for more  $^{235}\text{Np}$  from ANL in October. We still have not received it and recent phone conversations with personnel at ANL did not succeed in establishing a shipping date. Work with neptunium sorption isotherms is on hold until more  $^{235}\text{Np}$  can be obtained.

COST/BUDGET REPORT:

Expenditures were \$42.6K for the month of January and \$180.8K for the fiscal year to date. A detailed cost/budget report will be sent under separate cover.