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November 20, 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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Dear John:

Please find enclosed the progress report for the month of October 1985 for B0290, "Laboratory Evaluation of DOE Radionuclide Solubility Data and Selected Retardation Parameters, Experimental Strategies, Laboratory Techniques and Procedures."

Sincerely,

Gary K. Jacobs
Environmental Sciences Division

/GKJ

Enclosure:

Monthly Progress Report for October 1985, w/attachment

- cc: Office of the Director, NMSS (Attn: Program Support Branch)
- Division Director, NMSS Division of Waste Management (2)
- M. R. Knapp, Chief, Geotechnical Branch
- K. C. Jackson, Geotechnical Branch
- D. J. Brooks, Geotechnical Branch
- Branch Chief, Waste Management Branch, RES
- C. Hackbarth, Waste Management Branch, RES
- A. D. Kelmers A. P. Malinauskas
- R. E. Meyer S. K. Whatley
- Lab Records (2) GKJ File

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PDR WMRES EXIORNL
B-0290 PDR

Contract Program Title:
Laboratory Evaluation of DOE Radionuclide Solubility
Data and Selected Retardation Parameters,
Experimental Strategies, Laboratory Techniques and Procedures

Subject of this Document:
Monthly Progress Report

Type of Document: Technical Letter Report

Author: G. K. Jacobs and R. E. Meyer

Project Manager: G. K. Jacobs (ORNL)

NRC Monitor: J. W. Bradbury, Office of Nuclear Material
Safety and Safeguards

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Prepared by
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Oak Ridge, Tennessee 37831
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MONTHLY PROGRESS REPORT FOR OCTOBER 1985

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

PROJECT MANAGER: G. K. Jacobs

SCIENTIFIC STAFF: W. D. Arnold, J. G. Blencoe, A. D. Kelmers, R. E. Meyer, and V. S. Tripathi

ACTIVITY NUMBER: ORNL #41 88 54 92 6 (FIN No. B0290)
 NRC #50 19 03 1

PROGRESS HIGHLIGHTS:

Evaluation of Yucca Mountain Information

Sorption isotherms for strontium and cesium on crushed tuff (Busted Butte outcrop) contacted with synthetic J-13 groundwater were completed this month. Two sets of experiments were performed. In one set, the tuff samples were pre-equilibrated twice for three days with the synthetic J-13 groundwater prior to the final seven-day contact period. The initial concentration of cesium and strontium in these "pre-equilibrated" tuff experiments ranged from trace levels to 10^{-8} mol/L. In the other set of experiments, the tuff samples were not pre-equilibrated prior to the final seven-day contact period with radionuclide-bearing synthetic J-13 groundwater. The initial concentration of cesium and strontium in these "not pre-equilibrated" tuff experiments ranged from trace levels to 10^{-4} mol/L. The final contact period for both sets of experiments was performed at room temperature (23°C) in an atmosphere box that contained air with 1.5% CO₂. The pH of the solutions was approximately 7.1. The results of these tests are summarized in Tables 1 and 2.

Table 1. Sorption of Cesium on Busted Butte Crushed Tuff.

Initial Conc. (mol/L)	Cesium Sorption Ratio	
	"not pre-equil." (L/kg)	"pre-equil."
2×10^{-12}	222.3 \pm 7.8	
2×10^{-10}		453.5 \pm 16.9
1×10^{-8}	204.6 \pm 3	447.7 \pm 57.6
1×10^{-6}	105.6 \pm 5.3	
1×10^{-4}	63.9 \pm 1.4	

Table 2. Sorption of Strontium on Busted Butte Crushed Tuff.

Initial Conc. (mol/L)	Strontium Sorption Ratio	
	"not pre-equil." (L/kg)	"pre-equil."
2×10^{-12}	6.3 \pm .2	
2×10^{-9}		12.5 \pm .5
1×10^{-8}	6.7 \pm 2.3	
1.2×10^{-8}		11.8 \pm 0.3
1×10^{-6}	7.6 \pm 1.0	
1×10^{-4}	5.3 \pm 0.8	

The purpose of these experiments was to begin to investigate the LANL sorption methodology and to determine whether Busted Butte outcrop material can be used to obtain meaningful sorption information. The results in Tables 1 and 2 clearly show that there is a significant difference between pre-equilibrating and not pre-equilibrating outcrop samples of tuff. Sorption ratios for the pre-equilibrated samples are approximately twice those that were not pre-equilibrated. The observed substantial sorption from the solutions in which initial concentrations were 1×10^{-4} mol/L indicate that the Busted Butte outcrop samples have a substantial sorption capacity. Planned tests include "washing" Busted Butte outcrop samples of tuff with distilled water to determine what effects any soluble material may have on the sorption characteristics of the tuff samples.

Experiments are underway to determine whether synthetic J-13 groundwater solutions containing 10^{-4} mol/L uranium are stable. In experiments reported earlier, sodium boltwoodite precipitated at 60°C under either oxic or anoxic conditions from synthetic Grande Ronde groundwaters representative of the Hanford Site. No visible precipitate from the synthetic J-13 solutions containing uranium has been observed yet. However, approximately 10% of the uranium was lost from solution during the first three days of the test, probably by adsorption onto the walls of the glass bottles.

Experiments were initiated to investigate the stability of Eu(III) in synthetic J-13 and to determine the effects of atmosphere (CO₂ control vs no CO₂ control) and contact time on the sorption of strontium and cesium. We are investigating Eu(III) as a stand-in for americium while we begin to familiarize ourselves with techniques for dealing with the complicated behavior of americium. Contact time can be an important variable in all sorption tests and we are investigating this variable to evaluate the methodology used thus far by the DOE in obtaining sorption information for the Yucca Mountain Site.

Geochemical Modeling

During the next few months we plan to perform an uncertainty analysis using MINEQL. The uncertainty analysis will include errors associated with both the thermodynamic data and the input parameters. At this time we plan to model the uranium system because of its extensive data base and relevance to waste isolation. The analysis should illustrate the importance of error propagation in the modeling of geochemical systems, a topic discussed by H. L. Barnes in his recent presidential address to the Geochemical Society during the Annual Meeting of the Geological Society of America.

MEETINGS AND TRIPS:

A Program Review was held October 16-17 at Silver Spring, MD for both the B0290 and B0287 projects (see attached agenda). Staff members participating included J. G. Blencoe, G. K. Jacobs, A. D. Kelmers, R. E. Meyer, S. K. Whatley, and D. G. Brookins, a subcontractor under FIN No. B0287.

REPORTS AND PUBLICATIONS:

The photo-ready mats for the report Evaluation of Radionuclide Geochemical Information Developed by DOE High-Level Nuclear Waste Repository Site Projects: Report for January-March 1985, NUREG/CR-4236, Vol. 2, were sent to the NRC Project Manager.

PROJECT MANAGEMENT:

V. S. Tripathi has joined the staff for B0290 beginning October 1985. Vijay will be performing geochemical model calculations related to licensing issues and to support the laboratory efforts.

PROBLEM AREAS:

None.

COST/BUDGET REPORT:

Expenditures were \$44.8K for the month of October and \$44.8K for the fiscal year to date. A detailed cost/budget report will be sent under separate cover.

PROGRAM REVIEW

TECHNICAL ASSISTANCE IN GEOCHEMISTRY (B0287)

AND

~~LABORATORY EVALUATION OF RETARDATION PARAMETERS (B0290)~~

Silver Spring, MD


October 16-17, 1985

October 16, 1985

(AM)	8:30	Overview of B0287 and B0290 Projects	S. K. Whatley
	8:45	Status and Plans for Technical Assistance in Geochemistry	S. K. Whatley
	9:00	Concerns Relative to the Applicability of the Yucca Mountain Sorption Information for Site Performance Assessment	A. D. Kelmers
	9:30	BREAK	
	9:45	Status of Laboratory Evaluations: I. Sorption of Uranium, Neptunium, and Technetium on Basalt II. Geochemical Modeling III. Plans for Yucca Mountain Evaluations	R. E. Meyer G. K. Jacobs R. E. Meyer
	11:30	LUNCH	
(PM)	12:45	Summary of Topical Reports I. BWIP Geochemical Conditions	J. G. Blencoe
	1:30	Application of Radionuclide Sorption Information for Prediction of Retardation in Fracture-Flow Systems	A. D. Kelmers
	2:15	BREAK	
	2:30	Progress Report on Catalog of Natural Analogs	D. G. Brookins
	3:00	Demonstration of ORNL Document Data Base for Geochemical Information	G. K. Jacobs/R. M. Gove

October 17, 1985

Discussion of FY 1986 Work for B0287 and B0290 ORNL Staff and NRC Project Managers

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5. NAME OF CONTRACTOR G.K. Jacobs Oak Ridge National Laboratory		MAILING ADDRESS (Number and street, city, state and zip code) P.O. Box X Oak Ridge, TN 37831		TELEPHONE NO. 626-0567							
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TITLE Laboratory Evaluation of DOE Radionuclide Solubility Data and Selected Retardation Parameters, Experimental Strategies, Laboratory Techniques, and Procedures

AUTHOR(S) (List all authors and division codes; if not an ORNL employee, indicate institutional address)
G. K. Jacobs (42), W. D. Arnold (04), J. G. Blencoe (04), A. D. Kelmers (03),
R. E. Meyer (04), and V. S. Tripathi (42)

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Supervisor	<i>10/17/85 in NHC</i>	11-5-85	_____
Program Manager	<i>Jack K. Jacobs</i>	11/5/85	_____
Division Director	<i>[Signature]</i>	11/5/85	_____
Program Director	<i>gk] for A.P. Malinauskas</i>	11/5/85	_____
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