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MEMORANDUM FOR: Philip S. Justus, Section Leader
Siting Section
High-Level Waste Technical
Development Branch
Division of Waste Management

FROM: David J. Brooks
Geochemistry Group
High-Level Waste Technical
Development Branch
Division of Waste Management

SUBJECT: HLW GEOCHEMISTRY CONTRACTS AND RELATED WASTE PACKAGE CONTRACTS: REVIEW AND RECOMMENDATION FOR CLOSER COORDINATION

The Geochemistry Group is responsible for evaluating the effects of repository conditions on earth/rock materials. The Waste Package Group is responsible for evaluating waste package performance. Further, the Geochemistry Group must provide to the Waste Package Group an accurate representation of the environmental parameters that are expected to envelop the waste package through time at a site. The Waste Package Group must provide to the Geochemistry Group the radionuclide/waste-package source-term chemistry that will perturb the waste package/nearfield geochemical environment. As distinct as these applied science and engineering responsibilities appear to be, changing geochemical conditions cannot be divorced entirely from waste package testing; some overlap of program efforts must exist. However, coordination of each Group's activities must be pursued at a level that will ensure that unnecessary overlaps are avoided and areas of omission are identified. At present, the coordination needed to provide such integrated planning is not as effective as it could be. I suggest that use of "interface review sheets" (such as attachment 1) by each project manager would ensure the needed coordination between the Geochemistry Group and the Waste Package Group in the areas of their principal interfaces.

The following is a brief discussion of waste package and geochemistry contracts and associated interface considerations. As a base line for

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conducting my reviews, I have defined the responsibilities of the Geochemistry Group and the Waste Package Group as follows. The Geochemistry Group is responsible for (1) defining the environment of the waste package (as it changes with time), (2) the effects that this environment has on earth/rock materials (mineral stability) surrounding the waste package and (3) the fate of radionuclides moving through this material taking into consideration solubility, sorption and hydrochemistry. The Waste Package Group is responsible for defining (1) the chemical and physical properties of metal and solid waste form materials through time, (2) corrosion, (3) leaching, (4) the stability of the metal and solid waste form materials and (5) the waste chemistry released to the earth/rock system. The specific geochemistry and waste package contracts most recently reviewed for interface or coordination needs are listed in Attachments 2 and 3. Attachment 4 shows (a) the relationship between geochemistry and waste package responsibilities and (b) the primary area of activity for each contract. In addition, Attachment 4 indicates the contracts crossing the geochemistry/waste package interface and thus, requiring coordination.

The results of my most recent contract review show that three waste package contracts (B0288 - Effects of Repository Environment and A4165 - Preparation of Engineering Analysis for HLW Packages and A3167 - Review of Waste Package Verification Tests) must interface and be coordinated with geochemical technical assistance contracts and various research investigations, that the Geochemistry Group is supporting, if they are going to be accomplished without unnecessary duplication of effort. For example, all three of these contracts deal with aspects of backfill failure modes/performance characteristics such as (1) mineralogical changes, (2) loss of swellability, (3) loss of impermeability through hydration/dehydration, and (4) radionuclide transport mechanisms. Information concerning these topics has been and is being supported and/or funded by the Geochemistry Group. For example, Technical Assistance contract B0287 reviews the geochemical data related to DOE's candidate site for repositories, compiles and evaluates site specific geochemical data needed to quantify radionuclide migration, and characterizes the chemical environment important in determining waste package performance; and Technical Assistant contract B0290 establishes the reproducibility of the geochemical data being generated by DOE by conducting selected routine laboratory and/or field measurements and tests. Further, research contract B3040 identifies geochemical variables, processes and mechanisms that affect the performance of the canisters and overpack-backfill, research contract A2230 correlates laboratory data on waste leaching and migration with available field

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data, and research contract A2239 summarizes changes in environmental conditions that a waste form or a container may experience. It is not clear from the PDSs, SOWs and 189s of B0288, A4165 or A3167 how the related work from geochemistry contracts are being integrated into the waste package work.

The logic and reasonableness for integrating, coordinating and designing geochemistry and waste package projects so that the maximum value can be gleaned from the work being done in each individual project is obvious. For example, a waste package project designed to study the physical stability of waste packages must consider the effects of a changing geochemical environment (such as the chemical composition of the groundwater and rock/earth materials) contacting the waste package. Thus, while the focus of the work would be on examination of the various components that form the waste package and waste-package stability (and the lead would obviously be with the Waste Package Group), the opportunity to gather information of a geochemical nature concerning the stability of the earth/rock materials surrounding the waste package should not be ignored. However, this aspect of the work should be coordinated with the Geochemistry Group, who have the lead concerning issues involving the geochemical nature of earth/rock materials and repository performance. To be most effective, this coordination and integration must be developed concurrently with the development of a project.

In order to initiate a more effective means to coordinate our efforts, I suggest that during the week of 1-5 August, we distribute the attached "interface review sheet" (attachment 1) to all contract managers for the various waste package and geochemistry projects. During the week of 8-12 August, the forms could be completed and returned. Next, following our evaluation of the forms the Geochemistry Group would meet with the Waste Package Group and discuss mutual information and model input needs to avoid duplication of effort at the interfaces. Also, if it is considered necessary, a geochemistry interface workshop in which geochemistry and waste package contractors would be requested to participate, would be arranged.

Finally, I view this process as a simple and practical way of being sure that contracts do not unknowingly duplicate other efforts and a way for both the Geochemistry Group and the Waste Package Group to track those contracts needing coordination. Also, if this "review sheet" concept proves to have merit, we would extend its use to other areas of

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geochemistry interface such as with the Hydrology Group, the Engineered Systems Group and the Performance Assessment Group.

"ORIGINAL SIGNED BY"

David J. Brooks
High-Level Waste Technical
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Attachment -

GEOCHEMISTRY CONTRACT INTERFACE REVIEW SHEET

OBJECTIVE	Geochemistry	Waste Package	Engineered Barrier	Performance Assessment
1. Characterize geochemical environment of waste package (initial and as it changes through time)				
a) Groundwater Chemistry				
b) Fraction filling mineral				
c) Backfill water chemistry				
d) Backfill composition				
e) Canister water chemistry				
f) Canister composition				
g) Inner packing material				
h) Waste form water chemistry				
i) Waste form composition and physical form				
j) Temperature				
k) Pressure				
2) Characterize Geochemical Retardation				
a) rock/water chemistry				
b) radionuclide speciation				
c) radionuclide solubility				
d) chemical reaction mechanism (sorption)				
e) physical reaction mechanism (particulate/colloid transport, diffusion)				

Key
i = initial
t = through time
m = modeling

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ATTACHMENT 2

Waste Package Support Contracts

1) Technical Assistance Contracts (Waste Package)

a)	A3164/BNL/Wick:	Review of DOE Waste Package Program
b)	A3167/BNL/Wick:	Review of Waste Package Verification Tests
c)	C3168/BNL/Wick:	Draft Staff Technical Position
d)	A4165/AFSC/Chang:	Preparation of Engineering Analysis for HLW Packages - Preparation of Engineering Analysis for HLW Packages in Geologic Repositories
e)	B0288/ORNL/Chang:	Effect of Repository Environment

2) Research Contracts (Waste Package)

a)	B6764/BCL/Kim-McNeil-Randall:	Long Term Performance of Material Used for HLW Packaging
b)	B6352/UF/Kim:	Surface Properties and Performance Prediction of Alternative Waste Forms
c)	B6340/Iowa State Univ/Kim:	Thermal Stress in Waste Disposal Systems
d)	A3027/BNL/Kim:	Properties of Radioactive Waste and Waste Contaminants
e)	B6686/ORNL/?:	Assess Predictive Methods for Natural Events
f)	B7278/?/McNeil:	Manufacturing Processes and Material Properties Affecting Failure Mechanism of HLW containers.

ATTACHMENT-3

Geochemistry Support Contracts

1) Technical Assistance Contracts (Geochemistry)

   a) B0287/ORNL/Brooks: Technical Assistance in Geochemistry

   b) B0290/ORNL/Starmer: Evaluation of DOE Radionuclide Data

   c) B3109/LBL/Corrado: Geotechnical Sciences Program

2) Research Contracts (Geochemistry)

   a) B3040/LBL/Birchard: Geochemical Assessment of Nuclear Waste Isolation

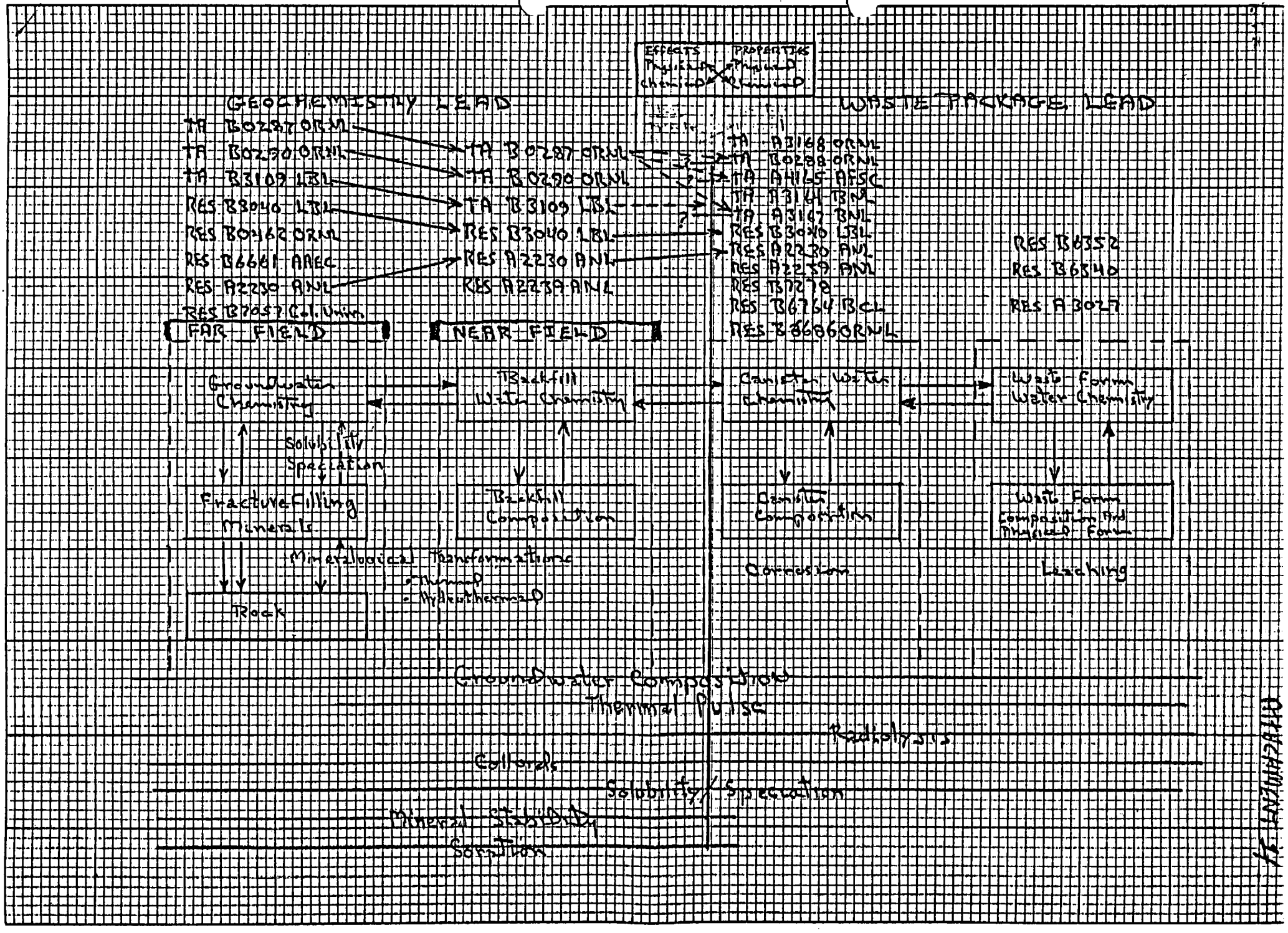
   b) B7057/Lamont/Birchard: Chemical complexation of Actinides

   c) B6661/AAEC/Birchard: Radionuclide Migration Around U ore bodies.

   d) B0462/ORNL/Birchard: Valance Effects on Adsorption

   e) A2230/ANL/Birchard: Laboroatry Repository Analog of Leaching and Migration

   f) A2239/ANL/Birchard: Modification fo Backfill Material


EFFECTS
PROPERTIES
GEOCHEMISTRY LEAD
TA B0287ORNL
TA B0290ORNL
TA B3109 LBL
RES B3040 LBL
RES B0162 ORNL
RES B6681 AAEC
RES A2230 ANL
RES B7052 C.U.Univ.
WASTE PACKAGE LEAD
TA A3168 ORNL
TA B0288 ORNL
TA A4145 AFSC
TA A3164 BNL
TA A3167 BNL
RES B3040 LBL
RES A2230 ANL
RES A2239 ANL
RES B7278
RES B6764 BCL
RES B6860ORNL
RES B6352
RES B6540
RES A3027
TA B0287 ORNL
TA B0290 ORNL
TA B3109 LBL
RES B3040 LBL
RES A2230 ANL
RES A2239 ANL
FAR FIELD
NEAR FIELD
Groundwater Chemistry
Backfill Water Chemistry
Canister Water Chemistry
Waste Form Water Chemistry
Solubility
Speciation
Fracture Filling Minerals
Backfill Composition
Canister Composition
Waste Form Composition And Form
Mineralogical Transformations
Thermal
Hydrothermal
Rock
Corrosion
Leaching
Groundwater Composition
Thermal Pulse
Radiolysis
Colloids
Solubility/Speciation
Mineral Stability
Solutions
OTHER MATERIALS