UNITED STATES DEPARTMENT OF COMMERCE
National Institute of Standards and Technology
(formerly National Bureau of Standards)
Gaithersburg, Maryland 20899

July 26, 1989

Mr. Charles Peterson
Technical Review Branch
Division of High-Level Waste Management
Office of Nuclear Materials Safety and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Re: Monthly Letter Status Report for February 1989 (FIN-A-4171-9)

Dear Mr. Peterson:

Enclosed is the February 1989 monthly progress report for the project "Evaluation and Compilation of DOE Waste Package Test Data" (FIN-A-4171-9). The financial information is attached to this letter.

Sincerely,

Charles G. Interrante

Charles G. Interrante
Program Manager
Corrosion Group
Metallurgy Division

Enclosures

Distribution:
WM Docket Control Center (1-original)

Monthly Letter Report for February 1989

Published July 1989

(FIN-A-4171-9)

Performing Organization: National Institute for Standards and Technology (NIST)
Gaithersburg, MD 20899

Sponsor: Nuclear Regulatory Commission (NRC)
Office of Nuclear Materials Safety and Safeguards
Washington, DC 20555

TASK 1 -- REVIEW OF WASTE PACKAGE DATA BASE

STATUS OF DATABASE

	Current Month	Previous Month
Number of citations	1086	1040
Number of completed reviews	83	78

Status of Recently Listed Reviewable Documents

Reviewable documents are classified as follows: papers currently being reviewed (Category 1), review when time permits (Category 2) and file with cross reference(s) to related report(s) (Category 3).

NNWSI

8 NNWSI reports currently under review (Category 1).
19 NNWSI reports to review when time permits (Category 2).
4 NNWSI reports to file with cross reference(s) to other reports (Category 3).

6 NNWSI reports identified and not yet categorized.
10 NNWSI reports received and not yet categorized.

GLASS -- VITRIFIED WASTE FORM

1 Reports currently under review (Category 1).
4 Reports to review when time permits (Category 2).
0 Reports to file with cross reference(s) to other reports (Category 3).
0 Reports identified and not yet categorized.

Database searches for the month of February 1989 include NTIS, Metadex and Engineering Abstract. Examples of the search conducted for each of these databases are in this report (see p. 7 to 9).

STATUS OF REVIEWS OF NNWSI REPORTS

NNWSI -- Reports recently identified for review

Six reports have been identified for review. Two are on leaching of spent fuel, two are on water chemistry, one is on waste container design, and the last is spent-fuel cladding.

Leaching rates of Li, B, Na, and Si, from Savannah River Borosilicate Glass, using J-13 water, were measured for 28 and 91 day exposures. It was found that the leach rates in deionized water were an order of magnitude higher than leach rates in J-13 water [Bazan 1985].

This study examines the effect of geometry of sample on leach rate, and concludes that leaching rates based on geometric surface are more reliable than calculations based on surface area obtained from gas absorption data. Furthermore, activation energy for leaching varies if more than one process (precipitation, dissolution, adsorption) is occurring [Oversby 1982].

Samples of Topopah Spring Tuff are reacted with J-13 water at 150°C. The results indicate that samples of tuff taken from surface sampling are just as reliable as tuff samples obtained by drilling [Oversby 1985].

Leaching data for Bullfrog Tuff in J-13 water at 90°C and 150°C indicate that steady-state leach rate is reached more rapidly as the ratio of rock to water is increased. Leach rate for Al is higher at 90°C than at 150°C [Oversby 1983].

The containment performance objective for the engineered barrier system, as regulated by the NRC, requires substantially complete containment of the nuclear waste for 300 to 1000 years. This report considers the conceptual design of the engineered barrier using PANDORA and PANDORA1, and concludes that only through proper modeling can there be any hope of predicting the effectiveness of the system [Ramspott 1988].

This report describes a test plan for studying the corrosion of Zircaloy, as a spent-fuel cladding, in a simulated repository environment. Initial tests will be done on pressurized water reactor (PWR) materials, but will include boiler water reactors (BWR) when those materials become available [Smith 1984].

1. Bazan, F. and Rego, J., "Parametric Testing of a DWFF Borosilicate Glass," UCRL-90857, January 1985.

2. Oversby, V. M., "Leach Testing of Waste Forms Interrelationshp of ISO and MCC Type Tests," UCRL-87621, May 1982.

3. Oversby, V. M., "The Reaction of Topopah Spring Tuff with J-13 Water at 150°C - Samples from Drill Cores USW G-1, USW Gu-3, USW G-4, and UE-25h#1," UCRL-53629, March 1985.

4. Oversby, V. M., "Reaction of Bullfrog Tuff with J-13 Well Water at 90°C and 150°C, UCRL-53442, September 1983.

5. Ramspott, L. D., "Assessment of Engineered Barrier System and Design of Waste Packages," UCRL-98029, June 1988.

6. Smith, H. D., "Spent Fuel Cladding Characteristics and Choice of Experimental Specimens for Cladding-Corrosion Evaluation Under Tuff Repository Conditions," HEDL-TC-2530, November 1984.

NNWSI --

Category 1 -- Reports currently being reviewed

1. HEDL-TME 85-22, "Results from Cycles 1 and 2 of NNWSI Series 2 Spent Fuel Dissolution Tests," May 1987.

2. UCRL-21019, SAN-662,-027, "Recent Results from NNWSI Spent Fuel Leaching/Dissolution Tests," April 1987.

3. UCRL-21013, "Summary of Results from the Series 2 and Series 3 NNWSI Bare Fuel Dissolution Tests," November 1987.

4. ANL-88-14, "The Reaction of Glass During Gamma Irradiation in a Saturated Tuff Environment, Part 3: Long-Term Experiments at $1x10^4$ rad/hr," February 1988.

5. Ringas, C. and Robinson, F., "Corrosion of Stainless Steel by Sulfate-Reducing Bacteria - Total Immersion Test Results," NACE, Corrosion, Vol. 44(9), September 1988.

6. UCRL-97805, "An Approximate Calculation of Advective Gas Phase Transport of ^{14}C at Yucca Mountain, Nevada," December 1987.

7. McCright, R. D., "An Annotated History of Container Candidate Material Selection," UCID-21472, July 1988.

8. Smith, H. D., "Initial Report on Stress-Corrosion-Cracking Experiments Using Zircaloy-4 Spent Fuel Cladding C-Rings," WHC-EP-0096 (formerly HEDL-7665), September 1988.

Category 1 (continued) - Status of Reviews not yet sent to NRC and WERB

Document No.	Assigned to Reviewer	First Draft Completed	Lead Worker	Program Manager
HEDL-TME 85-22	11/22/88			
UCRL-21019	12/06/88			
UCRL-21013	2/17/89			
ANL-88-14	2/17/89			
Ringas, 1988		1/30/88	2/10/89	
UCRL-97805			2/10/89	
UCID-21472	2/21/89			
WHC-EP-0096	2/21/89			

*Document to be reassigned.
**Reassigned

Category 2 -- Review as time permits (new entries for this reference data file)

1. O'Neal, W. C., Ballou, L. B., Grigg, D. W., and Russell, E. W., "Nuclear Waste Package Design for the Vadose Zone in Tuff," UCRL-89830, February 1984.

Category 3 -- File and cross reference

None this month.

OTHER REPORTS ON VITRIFIED WASTE FORM --

Category 1 -- Reports currently being reviewed

1. PNL-5157, "Final Report of the Defense High-Level Waste Leaching Mechanisms Program," August 1984.

Status of Reviews not yet sent to NRC and WERB

Document No.	Assigned to Reviewer	First Draft Completed	Lead Worker	Program Manager
PNL-5157 Chapter 4	6/20/88	1/28/89	2/3/89	

Category 2 -- Review as time permits

None this month.

Category 3 -- File and cross reference

None this month.

TASK 3 -- LABORATORY TESTING

A. Title of Study: Evaluation of Methods for Detection of Stress Corrosion Crack Propagation in Fracture Mechanics Samples.
Principal Investigator: Charles Interrante

Six specimens (designated ST6 to ST11) were modified along the notch that runs along the length of the specimen. The root radius was changed from 0.010 to 0.025 inches, while maintaining the same depth. On some specimens, the sharp root was still somewhat visible at the root of the more generous curvature of the 0.025-inch groove, but prior frustrations associated with the preparation of these specimens was sufficient as to lead us to live with this rather minor perturbation. Groove depth was measured and recorded for each specimen. Pinducer holes and set-screw guides were machined into the corner of each specimen.

Specimen ST8 was prepared for testing. This involved precracking to a crack length of 1.42 inches, and wedge emplacement at a value near 60 ksi(in)½.

B. Title of Study: Effect of Resistivity and Transport on Corrosion of Waste Package Materials.
Principal Investigator: Edward Escalante

The report is for February and March 1989:

The surface of the specimens, after exposure, has been characterized using a profilometer, a device that measures surface irregularity. Both sides of each specimen were examined, and the maximum depth of attack was determined. An optical microscope, at 50x, was used to determine the number of pits on the metal surface. In general, specimens in a high-resistivity environment show localized attack while specimens removed from low-resistivity environments have undergone a more uniform form of attack.

C. Title of Study: Pitting Corrosion of Steel Used for Nuclear Waste Storage.
Principal Investigator: Anna C. Fraker

Studies of literature and additional data and specimen analysis in preparation for writing a paper continue. The report that was submitted to NRC earlier will be put in the form of an NIST Internal Report.

D. Title of Study: Corrosion Behavior of Zircaloy Nuclear Fuel Cladding.
Principal Investigator: Anna C. Fraker

The equipment was modified and upgraded. A new circuit card (Model 273/92) was added to the Model 273 Potentiostat/Galvanostat. This will improve the stability and accuracy of the equipment. Some of the software was revised. A number of different electrochemical tests on Zircaloy and other materials were conducted to assure that the equipment and computer programs were operating satisfactorily.

Specimens of Zircaloy-4 and Zircaloy-2 were prepared for future tests. Preparations were made for testing in unconcentrated J-13 water.

TASK 4 -- GENERAL TECHNICAL ASSISTANCE

The Site Characterization Plan for the Yucca Mountain Site (dated December 1988) was reviewed by the NIST staff. An earlier review of the Consultation Draft SCP (CDSCP) had resulted in submission of 16 point papers which contained all the NIST comments and questions on the CDSCP. The NIST review of the December 1988 SCP contained changes that indicated that the DOE had implemented 13 of these 16 items to the satisfaction of the NIST staff members. The review, is being coordinated by Mr. Escalante.

The term "substantially complete containment" as used in the Code of Federal Regulations, in 10CFR-60, has lead the NMSS staff of the NRC to question whether or not it should develop a scoping paper for a proposed rulemaking to minimize the regulatory uncertainty regarding the usage of this term. Dr. Interrante of the NIST staff has been assisting in this activity and it is intended that this work will continue until the questions have been resolved.

SDI032, UD 8903, SER. DD022

File(s) searched:

File 32:METADEX 66-89/MAR
(Copr. 1989 ASM International)

Sets selected:

Set	Items	Description
1	10	HIGH()LEVEL()WASTE? ? OR RADIOACTIVE()WASTE? OR NUCLEAR()WASTE?
2	1930	STEEL? ? OR ZIRCALOY? ? OR TITANIUM? ? OR COPPER
3	1	1*2
4	0	ANNA FRAKER, 223, B-254, X6009

Prints requested ('*' indicates user print cancellation) :

Date	Time	Description
18feb	09:54EST	PR 3/5/1-25 (items 1-1)

Total items to be printed: 1

SDI006, UD 8906, SER. DD016

File(s) searched:

File 6:NTIS - 64-89/ISS06
(COPR. 1989 NTIS)

Sets selected:

Set	Items	Description
1	2	WASTE(W)PACKAGE?
2	3	CANISTER?
3	35	CORROSION
4	7	LEACHING
5	69	GLASS
6	9	VITRIFICATION
7	104	S3-S6/OR
8	3	HIGH(W)LEVEL(W)WASTE?
9	71	RADIOACTIVE(W)WASTE?
10	7	NUCLEAR(W)WASTE?
11	2	(S1 OR S2) AND S7 AND (S8 OR S9 OR S10)
12	0	ANNA FRAKER RM. B-106 BLDG. 223 X6009
13	0	JILL RUSPI

Prints requested ('*' indicates user print cancellation) :

Date	Time	Description
18feb	12:59EST	PR 11/5/1-25 (items 1-2)

Total items to be printed: 2

SDI293, UD 8903, SER. DD023

File(s) searched:

File 293:Engineered Materials Abs 86-89/Mar
(Copr. 1989 ASM INTERNATIONAL)

Sets selected:

Set	Items	Description
1	0	HIGH()LEVEL()WASTE? ? OR RADIOACTIVE()WASTE? OR NUCLEAR()WASTE?
2	209	STEEL? ? OR ZIRCALOY? ? OR TITANIUM? ? OR COPPER
3	0	S1*S2
4	0	ANNA FRAKER, 223, B-254, X6009

Prints requested ('*' indicates user print cancellation) :

Date	Time	Description
18feb	04:47EST	PR 3/5/1-25 (no items to PRINT)

Total items to be printed: 0