



UNITED STATES
NUCLEAR REGULATORY COMMISSION
WASHINGTON, D. C. 20555

Reply to:

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MEMORANDUM

DATE: March 26, 1992
FOR: Joseph Holonich, Director, HLPD
FROM: John W. Gilray, Sr. DR - YMP
SUBJECT: YMP Site Report for the month of March

I. QUALITY ASSURANCE

A. Management and Operating (M&O) Contractor Work

Ken Hooks requested that I review the YMPO contract letters of direction to the M&O contractor and determine the extent of QA program coverage being applied to ongoing M&O contractor work. I have had several discussions with the YMPO personnel regarding this subject and will be meeting with the M&O contractor to gain further information before finalizing a report. As a result of the initial meetings I have determined that:

1. The M&O contractor's overall QA Program Document (QAPD) has been reviewed by the Office of Quality Assurance at DOE headquarters and found conditionally acceptable.
2. The M&O contractor performs work either (a) direct support to the YMPO or (b) in accordance with the M&O's Nevada Site scope of work.

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3. The M&D contractor is authorized to start work through a contract Technical Direction Letter (TDL) by the YMPO. This letter explains the scope of work and the quality related procedures to be followed. These conditions are reviewed and concurred with by the YMPO QA organization.

When the M&D contractor is authorized to take over ongoing work previously performed by some other organization (such as the Local Records Center) it is required, in addition to the TDL, that a Transition Plan be prepared describing the scope of work and the quality related procedures governing this work. This Transition Plan is reviewed and concurred with by the YMPO prior to the start of work.

4. The M&D contractor has been authorized to perform the following activities.
 - (a) Managing the Central Records Facility at Las Vegas under the control of an approved Transition Plan.
 - (b) Preparation, revisions, review, distribution and control of YMPO Plans and Procedures Review Method under the control of an approved Transition Plan.
5. The M&D contractor is presently reviewing with the YMPO the Transition Plan for Configuration Management which they plan to be implementing in April or May.

Additional meetings will be held with the M&D contractor and YMPO to gain a more complete understanding of all ongoing activities, the identification of QA program procedures covering these activities and the YMPO letters authorizing the start of these activities. Results of this review will be reported to Ken Hooks.

B. Site Visits of Drilling and Coring Activities and Scientific Investigations at the Hydrological Research Facility (HRF)

Regular on-site visits have been conducted by the OR office of the drilling, coring and handling activities and the scientific investigations at the HRF. These visits included the review of procedural controls, observations of site activities and interactions and discussions with on-site technical and QA personnel. Particular attention and emphasis was placed in observing the measurement, care, handling and identification of the core as it was retrieved from the drilling hole and handled, identified and packaged at the Sample Management Facility Trailer. Also importance was given to observing the documented traceability and protection of the core samples retrieved from the Sample Management Facility and used in scientific investigations at the HRF. In addition the extent the methods and results of the investigations are being documented in the scientific notebooks were reviewed.

In general the observed site activities are being conducted and supervised in a controlled manner using approved quality related procedures and qualified trained personnel. The documents reviewed appeared to be complete, legible and in order. The YMP QA organization is in the process of enhancing the overall operations at the site by introducing a traveler system whereby processes of involved interacting organizations will be consolidated and documented on one form. This should provide added assurance that all prerequisites and implementing procedural controls are properly carried out.

In addition I found the YMPD QA organization is visiting the site on a more frequent basis reviewing and inspecting the quality related field activities. I have been assured that the documented results of field activities will be reviewed 100% by

the QA organization to gain added confidence that work is being adequately documented and is acceptable. This effort will continue until there is a high degree of confidence that the field activities are acceptably being performed on a regular basis. This 100% review practice will then be changed to a surveillance function. This DR office will observe this 100% review effort.

Improvements are still ongoing for developing a method for recording and documenting the more important aspects of the on site YMPO QA daily activities.

C. The Yucca Mountain Quality Assurance Division (YMQAD) Reorganization

The Director of the YMQAD, Richard Spence, has announced the completion of the YMQAD reorganization effective February 28, 1992. This reorganization provides for assigned QA specialists from either MacTec or T&MSS reporting to one of the five offices (QA Engineering, QA Surveillance, QA Audit, QA Programs, QA Field/Test) within the YMQAD. These assignments will be dedicated to carry out the functions of their assigned office utilizing a pool of MacTec and T&MSS QA Engineers. Refer to the enclosed organization chart (Enclosure 1) for the particular assignments.

D. The Quality Assurance Requirements Document (QARD)

DOE/Headquarters is developing a new QARD which will be the umbrella QA document applicable to Transportation, Waste Form Acceptance, MRS, and MGDS. This new QARD will supersede the existing OCRWM QARD and QAPD. The QARD is expected to go out to all participants for review and comments in April. At present it is anticipated that the document will be submitted to NRC for review sometime in late May or June.

E. Quality Grading/Classification of Items and Activities

As a result of the QA grading workshops the YMPO has revised and improved its quality grading classification process. The YMPO technical and QA staff through an assessment team will classify all items and activities either under the control of the YMPO QA program or not. This classification will be identified on future procurement orders and provided to all participants. It will be the responsibility of the affected participants to determine the extent QA/QC controls are applied to particular tasks and in turn develop the necessary implementing procedures to carry out these controls. As a check and balance the YMPO QA organization will conduct surveillances and audits of participants' and contractors' work to determine if the classification and grading process is properly being carried out. In addition a transition Plan is being prepared by the YMPO to explain how to handle existing grading and classification information and how and when to implement the new classification process. The revised procedure AP-6-17Q is expected to be effective in late April or May.

F. The Software QA Program

The YMPO is currently complying with the QA software controls described in Section 19 of the approved YMPO QA Program. However as a result of the QA workshops on software the Software Advisory Group has recommended improved changes to Section 19. These recommendations are keyed to eliminating redundant controls and incorporating improved controls resulting from lessons learned. These recommendations are now being factored into Supplement 1 of the YMPO newly developed QARD.

G. Monthly TPD Meeting

During our attendance at the TPD monthly meetings there are usually several technical presentations given pertaining to the

results of ongoing scientific and/or engineering activities. While these presentations are informative and worthwhile they do not however provide a discussion of the QA/QC controls applied to these activities. The OR office suggested to the YMPD that such a QA/QC discussion would be informative to the extent it would explain the particular QA/QC controls that are being applied to particular scientific/engineering activities. Also this added discussion would serve as a reminder and demonstrate the importance of QA implementation. The YMPD is considering adding such QA/QC discussions to future presentations.

H. OCRWM Audit of Ratheon Services Nevada (RSN)

The OR office partially observed the OCRWM audit of RSN (YMP-92-011) from March 10 through 13, 1992. The audit covered organization, test control, nonconformance control, corrective actions and audits. The audit team concluded that RSN is satisfactorily implementing their QA program in those areas audited except for nonconformance control which lacked sufficient activity to be audited. In addition, the audit team identified two deficiencies which are not considered major. These deficiencies concerned the lack of documentation attesting to the training of selected personnel and the lack of full compliance with the Readiness Review procedure. In general I found this audit effective.

I. Miscellaneous

This OR office will be observing the 50% design review of the ESF Design North Portal Complex and also observing the OCRWM audit of the USGS site activities the week of March 30.

II. LLWM ACTIVITIES

At the request of LLWM I have reviewed a contractor's QA program associated with storage of low level wastes and have provided comments and results of my review to Larry Pittigilo of LLWM.

III. WASTE PACKAGE

The LLNL monthly status report for February is enclosed (Enclosure 2). It is encouraged that comments and/or questions regarding the contents of these reports be directed through this office for action and resolution in order to minimize the impact of the YMP.

There are no new issues that this office has identified that have not been brought to management's attention.

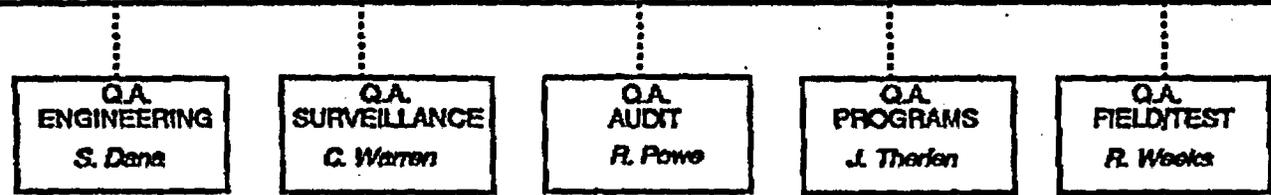
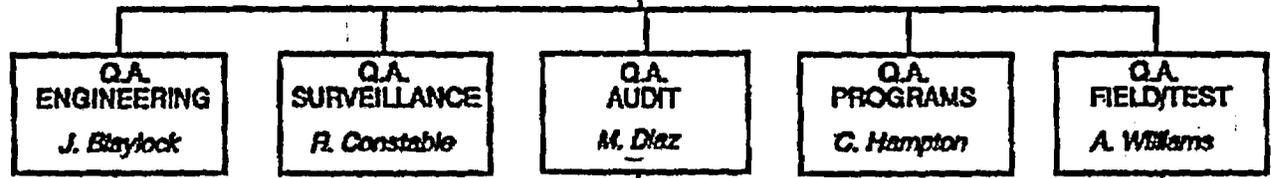
cc: w/enc: K. Hooks, M/S 4H3; R. Ballard, M/S 4H3, J. Latz
wo/enc: J. Roberts, C.P. Gertz, R.E. Loux, C. Pflum, G. Cook,
D.M. Kunihiro, D. Weigel, B. Youngblood, J. Linehan, M/S 4H3;
H. Denton, M/S 17F2, R. Bernero, M/S 6A4; H. Thompson, 17G21;
S. Gagner, M/S 2G5; E. O'Donnell, M/S NLS260

Enclosure I

proved by: *RE. Spence 2/28/92*

**DIRECTOR, YUCCA MOUNTAIN
QUALITY ASSURANCE DIVISION**
Richard E. Spence

SECRETARY
H. Masuda



Project Office QA
Liaison (T&MSS)
P. Kamaski

Project Office QA
Liaison (MACTEC)
J. Rusk

Sr. Project Office
QA Advisor
D. Harris

M&O Project Office
QA Advisor
S. Horton

- | | | |
|--------------------|----------------------|-------------------|
| <i>A. Arceo</i> | <i>J. Heaney</i> | <i>J. Matras</i> |
| <i>S. Bates</i> | <i>T. Higgins</i> | <i>R. Maudlin</i> |
| <i>H. Brogan</i> | <i>D. Kottel</i> | <i>K. McFall</i> |
| <i>E. Cocoros</i> | <i>B. Klemens</i> | <i>T. Noland</i> |
| <i>N. Cox</i> | <i>F. Kratzinger</i> | <i>C. Preter</i> |
| <i>R. Harpster</i> | <i>J. Martin</i> | <i>T. Vandel</i> |
| <i>S. Harris</i> | | |

ADMIN. ASST.
S. Trifilo

- Secretary
S. Dippner
- Secretary
G. Boulding
- Office Assistant
U. Umbenhower

YUCCA MOUNTAIN QUALITY ASSURANCE DIVISION SUPPORT STAFF



LLYMP9203024
March 6, 1992

WBS 1.2.9
"QA: N/A"

Carl Gertz, Project Manager
Department of Energy
Yucca Mountain Project Office
P.O. Box 98518
Las Vegas, Nevada 89193-8518

SUBJECT: Yucca Mountain Project Status Report - February 1992

Attached is the February Project Status Report for LLNL's participation in the Yucca Mountain Project.

If further information is required, please contact Elizabeth Campbell of my staff at FTS 532-7854.

Sincerely,



W. L. Clarke
LLNL Technical Project Officer
for YMP

WC/EC

cc:
Distribution

DISCLAIMER

The LLNL Yucca Mountain Project cautions that any information is preliminary and subject to change as further analyses are performed or as an enlarged and perhaps more representative data base is accumulated. These data and interpretations should be used accordingly.

LAWRENCE LIVERMORE NATIONAL LABORATORY YUCCA MOUNTAIN PROJECT
FEBRUARY 1992 TECHNICAL HIGHLIGHTS AND STATUS REPORT

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LLYMP9203024
March 6, 1992

WBS 1.2.9
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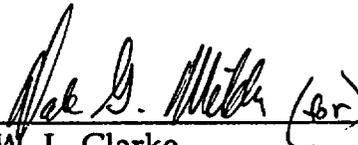
Carl Gertz, Project Manager
Department of Energy
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P.O. Box 98518
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Distribution

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LAWRENCE LIVERMORE NATIONAL LABORATORY
(LLNL)
YUCCA MOUNTAIN PROJECT (YMP) STATUS REPORT

FEBRUARY 1992

EXECUTIVE SUMMARY

(Items Proposed for Reporting in YMPO or OGD Reports)

1) As a result of the analyses of repository-heat-driven hydrothermal calculations, it has been recognized that three critical hypothesis tests can be used to help focus model validation work and related site characterization activities. The three hypothesis are:

1) Does repository heat-driven-hydrothermal flow dominate the ambient hydrological system?

2) Do boiling conditions and rock dry-out effects dominate hydrological performance?

3) Does the dry-out front correspond to the nominal boiling point isotherm and is far field heat flow dominated by heat conduction?

These three hypothesis tests will require large-scale heater tests at multiple hydrostratigraphic horizons within the unsaturated zone at Yucca Mountain or a suitably analogous site, such as Busted Butte. If the answer to each of the three hypothesis tests is yes, then the validation of hydrologic performance models of the site can be greatly focussed, thereby enhancing the probability that adequate validation can be achieved.

2) The flow through spent fuel dissolution testing continued at PNL. Results continued to show that dissolution of unoxidized spent fuel and spent fuel oxidized to U_4O_9 are similar. Similarly, unirradiated UO_2 and unirradiated UO_2 oxidized to U_3O_7 at $25^\circ C$ in a dilute bicarbonate solution had approximately the same dissolution rates.

3) Samples of PNL-76-68, SRL-131, and SRL-165 glasses reacted in water vapor (100% relative humidity) for three years at $75^\circ C$ were removed from the reaction chamber and are being investigated using analytical electron microscopy (AEM). These samples are part of a suite of samples that are being tested to evaluate reaction under conditions likely to be present after containment breach. The questions to be answered are how much reaction will take place and what are the reaction products. The results from this suite of tests can be compared with tests performed at higher temperature to evaluate temperature as a parameter to accelerate the reaction. Sections of PNL-76-68 and SRL-131 glass have been examined. The SRL-131 glass has reacted about ten times faster than the PNL-76-68 glass. This result is similar to previous results at higher temperature in which PNL-76-68 glass reaction appeared to be inhibited due to the formation of Al-bearing secondary phases which quench the ion-exchange process. At lower temperatures, the secondary phases are not present in sufficient quantity for analysis, but the similarity of low and high temperature relative reaction rates for these glasses implies that the mechanism might be the same.

4) The contract with J. Leckie (Stanford University) has begun. He is developing a semi-empirical model of uranium-goertite surface speciation at elevated temperatures and at a range of pH values.

1.2.1 SYSTEMS

1.2.1.1 Management and Integration

No significant activities.

1.2.1.2.4 Systems Engineering Implementation

J. Blink worked with the RSED and SAIC staff to arrange a review and CCB submission of LLNL's proposed revision to the SCPB in the areas of Near Field Geochemistry and Man-Made Materials.

1.2.1.2.6 YMP Support to Management Systems Improvement Strategy

No significant activities.

1.2.1.3.5 Technical Database Input

M. Revelli participated in the two technical data meetings in Las Vegas on February 4. The first meeting addressed the development status of the Reference Information Base and the near term engineering/design needs. The second meeting reviewed progress made on the Parameter Normalization task and requested participant comments on the Task Plan, the Parameter Identification listing and the Data Dictionary format.

1.2.1.4.2 Waste Package Performance Assessment

The PANDORA-1.1 code development continued. A prototype version with advancements in the waste form alteration and release models is being merged into the main version. A functional and design description was written and reviewed for the merge, and implementation is in progress. The prototype model uses analytical solutions rather than finite difference solutions and calculates whether to apply the concentration or matrix-limited release control for each radionuclide, as it depends on the inputs and on the time-varying inventories. A draft Individual Software Plan for prototyping the PANDORA-1.1 is being reviewed.

D. Stahl, R. Fish, and T. Doering of the M&O staff visited LLNL February 13-14 for discussions on integrated testing and performance assessment.

1.2.1.4.5 Geochemical Modeling and Database Development

Effort is now focused on review of the four user manuals submitted in December and for the verification/qualification activity for version 7.0 of the EQ3/6 family code. The verification/qualification effort is being conducted as an independent activity, in the sense that the code author is not directing or conducting it. The code author is available for consultation on this activity, as needed.

At the request of the database task, work was completed in checking a tentative set of new data files. Some time was spent addressing the technical issues involved in resumption of code development. Discussions have been held within LLNL to identify these issues and how they might be resolved. There are two immediate technical issues. The first issue is a set of changes that would coordinate with changes to the thermodynamic database including using upper and lower case letters to identify chemical species. The database task would like some of these changes to be implemented in the near future. The second issue concerns the incorporation of an ion exchange submodel into a qualified version of EQ3/6. This submodel has already been developed in a prototype branch version. These issues could be dealt with by extending version 7.0 to version 7.1. However, version 7.0 contains a data structure which dates back to the original version of EQ3/6. A new data structure is required in order to add a number of other code capabilities necessary for some anticipated YMP-related calculations at LLNL and LANL. These capabilities include redox disequilibrium in reaction path models, mineral surface speciation submodels, and solid solution submodels in which important radionuclides are incorporated at trace levels. It is anticipated that this change of data structure would be accomplished in version 8.0, which would also incorporate one or more of the above new capabilities. Another option for dealing with data file changes and the ion exchange submodel would be to work these into version 8.0 directly, bypassing version 7.1. The 7.1 option would give some benefit in the shorter term, the trade-off being that some of the work would have to be redone in version 8.0.

On President's Day weekend, the hard-disk on the Sun server crashed. GEMBOCHS and its associated software were located on that disk. Most of the files were restored from weekly backup tapes, but the database itself could not be restored from normal backup tapes (an unanticipated problem due to the recent INGRES upgrade). A December INGRES backup was used for database restoration. Efforts are focused on restoring the database and its software library to their pre-crash state. Operations are expected to be back to normal by the end of March.

1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

This WBS element has not been funded in FY92.

1.2.2 WASTE PACKAGE

1.2.2.1 Management and Integration

J. Blink attended a LANL meeting to establish a working group for control of Tracers/Fluids/Materials. The meeting was held in Las Vegas on February 11.

1.2.2.2 Waste Package Environment

The Preliminary Near Field Environment Report is nearly complete. All review comments have been incorporated, and the report will be sent to the Project Office in March.

The near field technical area staff participated in an internal audit February 11-21.

1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

B. Viani attended the Geochemistry Integration Team Meeting in Las Vegas February 24-25. J. Blink met with A. Simmons on February 28 to arrange LLNL support of future GIT activities.

1.2.2.2.2 Hydrologic Properties of the Waste Package Environment

T. Buscheck continued to analyze repository-scale and drift-scale hydrothermal model calculations of repository-heat-driven hydrothermal flow. For Areal Power Density (APD) > 80 kW/acre and 30- and 60-yr-old fuels, the maximum vertical extent of the dry-out zone below the repository horizon was found to be approximately 166 m, regardless of APD. Above the repository horizon, the maximum vertical extent of dry-out increases with APD.

An important conceptual point is that boiling and rock dry-out occur because the thermal loading conditions and heat conductance of the dry-out zone can drive heat flow to the boiling front faster than the far-field heat conductance can dissipate it. Therefore, an increase in heat convection within the dry-out zone will tend to enhance the rock dry-out rate, while an increase in far field heat convection will tend to retard the dry-out rate. It was found that even when a very large heat-convection-dominated heat-pipe zone existed in the two-phase zone above the boiling zone, boiling and dry-out performance were not significantly reduced by the presence of the heat-pipe zone. However, heat-convection-dominated heat flow in the far field (beyond the two-phase zone) has the potential of reducing boiling and dry-out benefits.

The insensitivity of the vertical extent of the lower dry-out zone was attributed to two effects. First, the water table in the model is represented as a boundary with fixed temperature, saturation, and pressure. Because the water table behaves like a temperature sink, it enhances far field cooling as the dry-out front approaches the water table, thereby reducing boiling and dry-out effects. The second reason for the insensitivity of the vertical extent of the lower dry-out zone is the fixed location of the water table. Because the water table is not de-watered in these calculations, it provides an infinite source of water for capillary-driven flow of water back to the dry-out zone. The Equivalent Continuum Model (ECM) assumes that fracture flow will only occur when the bulk saturation of the equivalent medium, S_b , is greater than the critical bulk saturation, $S_{b,crit}$. For the 100 μm fractures assumed in the ECM, $S_{b,crit} = 98.4\%$. The saturation profile below the repository horizon approaches 100 percent in the vicinity of the water table. The critical bulk saturation, $S_{b,crit}$, occurs approximately 166 m below the repository horizon. The contribution of fracture flow to capillary driven flow back toward the dry-out zone has the effect of limiting the net dry-out to the region where $S_b > 98.4\%$.

As a result of the analyses of repository-heat-driven hydrothermal calculations, it has been recognized that three critical hypothesis tests can be used to help focus model validation work and related site characterization activities. The three hypothesis are:

1) Does repository heat-driven-hydrothermal flow dominate the ambient hydrological system?

2) Do boiling conditions and rock dry-out effects dominate hydrological performance?

3) Does the dry-out front correspond to the nominal boiling point isotherm and is far field heat flow dominated by heat conduction?

These three hypothesis tests will require large-scale heater tests at multiple hydrostratigraphic horizons within the unsaturated zone at Yucca Mountain or a suitably analogous site, such as Busted Butte. If the answer to each of the three hypothesis tests is yes, then the validation of hydrologic performance models of the site can be greatly focussed, thereby enhancing the probability that adequate validation can be achieved.

T. Quinn obtained all comments for the Individual Software Plan (ISP) for the initial qualification of V-TOUGH. She finished implementing the comments and has sent out the ISP for comment resolution verification.

T. Quinn and S. Daveler have established the process for writing the V-TOUGH User Manual. This document will be maintained on S. Daveler's Sun workstation in a Framemaker format. S. Daveler completed a draft of the user input to V-TOUGH which was reviewed and commented on by T. Quinn.

T. Quinn reviewed the software configuration management system with J. Blink. They are verifying compliance with the TIP in preparation for an upcoming DOE audit. Although it is not currently required to perform configuration management in accordance with the TIP, by the end of March, compliance with this TIP will be met.

For the purpose of testing V-TOUGH and the EQ3/6 suites of codes, T. Quinn attended a briefing at the Software Technology Center (STC) on analyzing FORTRAN and C Codes. The STC is a repository for tools that can be used for re-engineering codes and determining testing strategies. T. Quinn discussed testing strategies with T. Wolery for EQ3NR, EQ6 and EQPT.

T. Quinn ported the STARS reservoir engineering code to the NERSC UNICOS Cray computers.

S. Daveler debugged several options of Extool which had not been running properly on Xview (but had been running properly on Sunview).

1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

Study Plan 8.3.4.2.4.3 is in comment response verification at YMPO and OCRWM.

S. Daveler has been assisting S. Blair in debugging a prototype geomechanical code. The code was converted from S-plus to C, and the changes were verified. S. Daveler wrote a tool to assist in running S. Blair's code and added post-processing graphics capabilities.

1.2.2.2.4 EBS Field Tests/ESF Test Design

J. Blink met with H. Kalia (LANL TCO) to discuss options for off-block prototype testing. T. Buscheck will calculate potential thermal-hydrological experiments in the Busted Butte stratigraphy.

1.2.2.2.5 Man-Made Materials

This WBS element has not been funded in FY92.

1.2.2.3 Waste Form and Materials Testing

1.2.2.3.1.1 Waste Form Testing - Spent Fuel

A combined meeting was held on February 10-11 with LLNL, PNL and Canadian staff at which the US/Canada collaboration agreement (SA-2) was discussed. R. Stout gave an overview presentations of the spent fuel activities at this meeting and at the NRC Technical Exchange in Pasco on February 25.

Spent Fuel Oxidation

Oxidation dry bath testing continued at PNL.

Presentations were given by R. Einziger of PNL on oxidation testing at the DOE/AECL meeting held in Pleasanton on February 10-11 and also at the NRC technical exchange at Pasco on February 25.

Spent Fuel Dissolution

Modifications are being made to the experimental procedure used during dissolution of UO_2 because dissolved oxygen in the leaching solution permeates the tubing walls and escapes into the glove box. This will be corrected by using impermeable metal tubing or by using the same oxygen fugacity outside the system as is present inside. This change will be reflected in an Activity Plan D-20-53a update.

The flow through spent fuel dissolution testing continued at PNL. Results continued to show that dissolution of unoxidized spent fuel and spent fuel oxidized to U_4O_9 are similar. Similarly, unirradiated UO_2 and unirradiated UO_2 oxidized to U_3O_7 at 25°C in a dilute bicarbonate solution had approximately the same dissolution rates.

H. Leider gave a presentation on dissolution testing at the DOE/AECL meeting held in Pleasanton on February 10-11. S. Steward gave a presentation on dissolution testing at the NRC technical exchange at Pasco on February 25.

W. Gray of PNL made presentations on dissolution testing at the DOE/AECL meeting held in Pleasanton on February 10-11 and also at the NRC technical exchange at Pasco on February 25.

A paper is being co-authored by W. Gray (PNL), H. Leid, S. Nguyen, S. Steward, and H. Weed of LLNL on the most recent UO₂ dissolution results (LLNL) and Spent Fuel dissolution results (PNL). This paper will be submitted to the Journal of Nuclear Materials.

Materials Characterization Center

The following paper has been sent to YMPO for review:

"Microstructural Analyses of LWR Spent Fuel at High Burnup" by L. Thomas, C. Beyer and L. Charlot.

1.2.2.3.1.2 Waste Form Testing - Glass

This WBS element has received limited funding in FY92. These funds are being used to maintain the N2 and N3 tests at ANL.

The N2 tests (SRL actinide-doped glass) continue with no sampling period occurring this month. These tests have been in progress for 312 weeks. The N3 tests (ATM-10, a West Valley actinide-doped glass) continue and have been in progress for 230 weeks.

Samples of PNL-76-68, SRL-131, and SRL-165 glasses reacted in water vapor (100% relative humidity) for three years at 75°C were removed from the reaction chamber and are being investigated using analytical electron microscopy (AEM). These samples are part of a suite of samples that are being tested to evaluate reaction under conditions likely to be present after containment breach. The questions to be answered are how much reaction will take place and what are the reaction products. The results from this suite of tests can be compared with tests performed at higher temperature to evaluate temperature as a parameter to accelerate the reaction. These data are being collected, and a paper entitled "Low-Temperature Vapor Alteration of Glass Under Potential Storage Conditions" is being prepared for inclusion in the Yucca Mountain Project Special Issue of the Journal of Nuclear Materials.

Sections of PNL-76-68 and SRL-131 glass have been examined. The SRL-131 glass has reacted about ten times faster than the PNL-76-68 glass. This result is similar to previous results at higher temperature in which PNL-76-68 glass reaction appeared to be inhibited due to the formation of Al-bearing secondary phases which quench the ion-exchange process. At lower temperatures, the secondary phases are not present in sufficient quantity for analysis, but the similarity of low and high temperature relative reaction rates for these glasses implies that the mechanism might be the same.

The following paper was reviewed and verbally approved by YMPO:

"Colloid Formation During Waste Form Reaction: Implications for Nuclear Waste Disposal" by J. K. Bates, J. P. Bradley, A. Teetsov, C. R. Bradley (all of ANL) and M. Buchholtz ten Brink (LLNL).

1.2.2.3.2 Metal Barriers

J. Blink met with TIMET staff in Henderson, NV on February 12 to discuss advances in titanium alloy design and the potential for single point monitoring of titanium containers to detect the onset of crevice corrosion.

J. Blink met in Las Vegas with D. Jones of the University of Nevada (Reno) on January 29 to discuss potential work by UNR on waste package corrosion using cooperative agreement funding. LLNL can provide QA support and technical direction of the work in FY92 and perhaps augment it with programmatic funds in FY93.

1.2.2.3.4.1 Integrated Radionuclide Release

G-20-2 Determination of Elemental Profiles in Rocks, Minerals, and Glasses using the Ion Microscope

The following TIPs were completed and distributed:

- 1) TIP-PA-01, Depth Profiling on the Ion Microscope,
- 2) TIP-PA-02, Data Reduction for Depth Profiles, and
- 3) TIP-YM-9, Dektak IIA, Surface Profiling

G-20-3 Interactions of Actinide-bearing Solutions with Rock Core Samples

Preliminary Scanning Electron Microscopy (SEM) analysis of the core sample to be used in the initial flow-through experiment was completed. The surface of a fracture was found to be mineralogically similar to a non-fracture surface with the exception that the fracture surface contained an unidentified iron-bearing phase.

G-20-5 Interaction of Materials under Repository Conditions

A tentative protocol was established for sampling the fluids in the UO₂ flow through experiments.

G-20-6 Source Term Development

The contract with J. Leckie (Stanford University) has begun. He is developing a semi-empirical model of uranium-goertite surface speciation at elevated temperatures and at a range of pH values.

1.2.2.3.4.2 Thermodynamic Data Determination

This WBS element has not been funded in FY92.

1.2.2.4. Design, Fabrication, and Prototype Testing

1.2.2.4.1 Waste Package Design

This WBS element has not been funded in FY92.

1.2.2.4.2 Container Fabrication and Closure Development

This WBS element has not been funded in FY92.

1.2.2.4.3 Container/Waste Package Interface Analysis

CAD waste package drawings were generated for the M&O. Plans to conduct thermal analyses of robust waste package internals were initiated: these analyses will begin in late March.

J. Blink reviewed the draft Waste Package Implementation Plan.

1.2.5 REGULATORY AND INSTITUTIONAL

1.2.5.2.1 NRC Interaction Support

D. Wilder and J. Blink attended a meeting of the NWTRB Engineered Barriers Panel held in Augusta, GA on February 11. D. Wilder participated in the SRL tour the following day. J. Blink attended the dry run for the meeting on February 4 and 7 and provided information to R. Morissette for incorporation into his presentation.

R. Stout, S. Steward and J. Blink participated in the NRC Technical Exchange on Spent Fuel in Pasco, WA on February 25. They also participated in the PNL (Hanford) tour the following day.

J. Blink worked with YMPO staff to establish the agenda for the March 18 NRC Technical Exchange in Albuquerque, NM (Air and Vapor Movement due to Thermal Gradients).

1.2.5.2.2 Site Characterization Program

M. Revelli represented LLNL at the February 14 meeting of the Integrated Test Evaluation (ITE) task.

A copy of the Scientific Notebook maintained by LLNL as part of the ESSE task was forwarded to SAIC in response to their request to complete the ESSE Records Package.

1.2.5.2.4 Technical Support Documentation

No significant activities.

1.2.5.2.5 Study Plan Coordination

D. Chesnut completed the review of the USGS Study Plan 8.3.1.2.2.9, "Site Unsaturated-Zone Modeling and Synthesis" on February 10 and transmitted his comments to YMPO.

S. Blair has started the review of the SNL Study Plan 8.3.1.15.1.4, "Laboratory Determination of the Mechanical Properties of Fractures".

J. Nitao has started the review of the USGS Study Plan 8.3.1.2.2.2, Rev. 1, "Water Movement Test".

1.2.5.2.6 Semi-Annual Progress Reports

No significant activities.

1.2.9 PROJECT MANAGEMENT

1.2.9.1.1 Management

R. Godman and H. Benton of the M&O visited LLNL on February 20, 1992 and were briefed by the technical staff.

W. Clarke attended the Engine of Evolution meetings in Las Vegas on February 24, 27 and 28.

J. Blink met with M&O and SAIC staff on January 27 to discuss installation of a spent fuel assembly at the LLNL/B&W exhibit in the FOC.

J. Blink met with H. Kahlia (LANL) to discuss approaches to off-block field testing needed prior to ESF testing, e. g., testing of the extended-dryout repository scenario.

J. Blink met with W. Andrews, D. McNelis, W. Wells, R. Boehm, and other UNLV professors on February 13 to discuss opportunities for LLNL-UNLV collaboration. J. Blink arranged for the V-TOUGH (heat and mass transport), TOPAZ (3-D transient heat transfer), and NIKE/DYNA (stress analysis) codes to be provided by LLNL to UNLV. He also provided information on criticality codes, concluding that MCNP-4.2 and KENO-5A are the best options for UNLV. Those codes are available from the Radiation Shielding Information Center at Oak Ridge. KENO is part of a larger package (SCALE-4.1) that also includes the ORIGEN code that can be used to calculate radionuclide generation and decay.

J. Blink attended an update meeting of the DIGE (QA Grading/Classification) task on February 6 in Las Vegas.

J. Blink served as a moderator for the DOE Science Bowl competition in Las Vegas on February 29.

P. Comstock and E. Campbell participated in a tour of Yucca Mountain and supporting facilities at YMPO on February 3-4.

1.2.9.1.4 Records

Document Control issued seven Change Notices and two new documents under controlled distribution. Routine follow-up for receipt acknowledgements continues.

A total of 165 items were logged into the LLNL-YMP tracking system. This includes 31 records/records packages that were processed through to the CRF. Five action items were closed.

1.2.9.2 Project Control

The January FTE report was submitted to YMPO. The monthly actual costs for October 1991 through January 1992 for the PACS database were submitted to YMPO.

J. Podobnik attended a meeting with the GAO auditors on February 14 to discuss issues associated with management accounts (WBS element 1.2.9) for FY90 through FY92.

J. Norman was assigned to focus on issues raised in the YMPO-DOE Property Control/Management audit conducted in January. A conference call was held with YMPO-DOE Property Management on February 18 to discuss progress on resolving the findings in the audit. A training program has been developed in association with LLNL Property Management. All LLNL-YMP staff will be required to attend one of three sessions scheduled for March.

J. Podobnik attended an ICE briefing held in Las Vegas on February 20 to discuss the purpose, methods, topics and schedule of reviews which will to be conducted at each participant site. LLNL will be visiting during the week of March 23.

J. Podobnik attended the YMPO project control steering committee meeting in Las Vegas on February 21. Topics discussed included ICE review background and requirements, integration and planning out to 2001, and transition of tasks to the M&O. The M&O presented related guidance they have received from DOE in terms of conducting oversight planning. Level 0 and 1 milestones will be proposed by the M&O and its subcontractors to define and integrate future work. Dates will be set and participants will be offered the opportunity to review. Participants will then be required to cost the plan. Formal kickoff for this effort will take place at the next scheduled TPO meeting. The steering committee also heard a progress report from the procedures subcommittee and took action to submit a revision of the existing Capital Equipment procedure.

J. Podobnik, J. Blink and LLNL-YMP technical managers provided information to the M&O in support of the PACS scrub exercise.

J. Podobnik attended an Assist Training course conducted by LLNL AIS personnel on February 13.

J. Podobnik participated in a tour of Yucca Mountain and supporting facilities on February 19.

1.2.9.3 Quality Assurance

LLNL-YMP Audit Report 92-02, Engineering and Performance Analyses, was completed and distributed. Three Adverse Finding Reports were issued.

Internal Audit 92-03, Near Field Environment Characterization, was conducted on February 13 - 18.

The Trend Analysis Report for calendar year 1991 was completed and distributed on February 27.

Quality Assurance Program Plan Change Notice R 1-1-2, Organization, was completed and submitted to YMPO for review and approval.

Quality Procedure Change Notice 17.0-3-1, Quality Assurance Records, was completed and distributed.

Technical Implementing Procedure TIP-YM-09, Dektak IIA Surface Profiling System, was distributed.

Technical Implementing Procedure TIP-YM-12, Electronic Record Keeping, authored by J. Blink, was distributed internally for review and comment.

Work continues on revisions of Quality Procedures 4.0 and 17.0.

J. Blink met with R. Weeks on January 31 and February 11 in Las Vegas to discuss LLNL-YMP QA grading packages and the scope of LLNL-YMP technical work. R. Weeks will be the lead auditor for the April 21-24 YMPO audit of LLNL-YMP.

R. Monks attended the DIGE (QA Grading/Classification) meeting in Las Vegas on February 6.