



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

Reply to:
301 E. Stewart Ave., #203
Las Vegas, NV 89101
Tel: (702) 388-6125
FTS: 598-6125

M E M O R A N D U M

DATE: May 20, 1991

FOR: Joseph Holonich, Acting Director, HLPD,
Division of High-Level Waste Management, M/S 4 H 3

FROM: John W. Gilray, Sr. OR - YMP

SUBJECT: YMP Site Report for the months of March and April, 1991

I. QUALITY ASSURANCE

A. Status of YMP QA Workshops

◆ QA Grading Workshop

In March of 1991 the YMPD requested that a workshop be held on the QA grading process. The goals of the workshop were to identify specific problems with the QA grading process and to develop recommendations for improving the QA grading process.

Phase one and two of the workshop were held at Las Vegas April 2 through 3 and April 16 and 19, 1991, respectively. The overall problem statement developed at this workshop

102
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with involvement from all YMP participants was defined as follows: The process for preparing grading lists, grading packages and defining grading controls, including purpose (a) is not clearly defined, (b) lacks clear guidance and training (c) is too cumbersome and (d) is too slow and costly. The workshop members attributed the causes of the grading problems to:

1. Current grading process is too complex and does not provide clear guidance.
2. Lack of consistent interpretation and definition of purpose, terms, Regs, & DOE orders.
3. Process requires QA grading for administrative activities and non-quality affecting items and activities.
4. Inappropriate management direction.

The workshop members concluded that the upper YMP management must be involved in establishing a clearer policy statement and guidance for the grading process for quality affecting items and activities that meet regulatory requirements. The workshop recommended that the QA grading process not apply to non-quality related items and activities such as project control, administration, management, preliminary and scoping activities. The YMP management accepted the overall findings of the QA grading workshop and committed to study the lessons learned from the grading process and initiate actions to modify and simplify the overall grading process and related procedures. A detailed action plan is under development to accomplish identified tasks and to establish dates for follow-up meetings.

The YMP QA Grading Workshop report, which explains in detail the results of this workshop, has been sent to HLPD/QA (K. Hooks) under separate cover by this office.

• QA Workshop on Software

Based on the recommendation from the Software Workshop a projectwide Software Advisory Group (SAG) has been established to oversee the actions underway to improve the overall QA software program. The first meeting of the SAG was held April 24-25, 1991, in Las Vegas, Nevada.

The SAG group reviewed, revised, and finalized their charter and presented this to YMP management for acceptance. (The charter is addressed in Enclosure 1).

The following is a list of SAG Members:

Claudia Newbury, YMP, Chairperson
John Matras, Science Applications International Corporation (SAIC), Recording Secretary
Stephen Bauer, Sandia National Laboratories
Daniel Gockel, U.S. Geological Survey
Russ Hilsinger, Raytheon Services Nevada (RSN)
Teresa Quinn, Lawrence Livermore National Laboratory
Bruce Robinson, Los Alamos National Laboratory
Christine M. Thompson, Reynolds Electrical & Engineering Co., Inc.
Albert Williams, YMP

The first task of the SAG is to revise the QARD Section 19 by July 31, 1991. The schedule of SAG meetings for accomplishing this task is as follows: May 16-17 at Las Vegas. The agenda for the May 16-17 meeting is (a) review status items, and (b) initiate rewrite QARD Section 19. In regards to the scheduled May 16 and 17 SAG meeting, Raytheon is bringing their Missile Systems Division Software QA

personnel from Connecticut to discuss their controls in the development, qualification and controlled use of their software. I will be attending this meeting and will provide the results of the Rathen presentation and other issues to NRC/HLPD QA (K. Hooks). Meetings are scheduled for June 5-7 at Albuquerque; June 19-21 at Denver; July (week of 7/29) at Las Vegas. During the Week of July 29 SAG will finalize changes to QARD, and present results to management.

The SAG believes that the following concerns and problems must be addressed in the revision of Section 19 of the QARD.

1. That iterative development and rapid prototyping are acceptable in the software lifecycle.
2. Clarification as to when documentation is placed under configuration management.
3. Clarification of the requirements of Section 19 on commercial codes (operating systems, Lotus, compilers, word processors, etc.).
4. Some of the requirements of NUREG-0856 are obsolete as applied to the present art of developing code (e.g., flow charts, block diagrams, variable lists, etc.).
5. Clarify the need for Verification and Validation (V&V) schedules in Section 19.
6. The requirement for V&V planning needs clarification.
7. Clarification as to when acquired codes fall under Section 19.

8. Section 19 needs to address more flexible controls for lifecycle through clarification of minimum documentation, reviews, and verification activities.
9. Consistency in the use of the word application.
10. The need for independent V&V.

B. Miscellaneous

- ◆ OCRWM has posted the job announcement position for the YMP QA Division Director recently vacated by Don Horton. The closing date for receiving applications for this position is May 29, 1991. A copy of this announcement is enclosed for information. (Enclosure 2).
- ◆ I will be assisting Teek Verma (HLPD/QA) in observing the YMP audit (No. YMP-91-05) of USGS the week of May 20, 1991.

The audit team will evaluate the effectiveness of USGS QA Program requirements and implementing procedures. In addition, implementation of corrective action(s) as provided in the response(s) to open Project Office Standard Deficiency Reports will be evaluated and, if found satisfactory, will be closed. The technical specialist of the audit team will audit activities associated with (1) Unsaturated Zone Hydrochemistry, (2) Site Saturated Zone Ground-water Flow System, (3) Quaternary Regional Hydrology, and (4) Historical and Current Seismicity.

The evaluation of these above activities will include a determination of adequacy of technical qualifications of scientific personnel, the understanding of procedural requirements as they pertain to scientific investigation activities, the adequacy of technical procedures, the development of study plans, and work supporting the Site Characterization Plan.

- ◆ Under the direction of John Bartlett an independent management assessment of the OCRWM and YMP activities and QA program has been performed. A formal report is in preparation and should be available for review by mid June.

- ◆ The YMP is restructuring their QA audit policy whereby they will rely on a series of mini audits and surveillances of participants quality related activities rather than performing yearly large scale audits. YMP QA program procedures will be revised accordingly and be in effect in the near future.

- ◆ YMP QAD Surveillance of Los Alamos

The YMP QAD conducted a surveillance, No. YMP-SR-91-014, at the Los Alamos Test Manager's Office (TMO) office in Las Vegas, Nevada, and in Los Alamos, New Mexico, on April 15-25, 1991. Based on the surveillance results, it was determined that the Los Alamos QA program is being satisfactorily implemented in the criteria examined. There were no Corrective Action Requests issued as a result of this surveillance.

- ◆ YMP QAD Surveillance of USGS

As a result of YMP QAD surveillance, No. YMP-SR-91-012 of USGS, Don Horton has notified Dwight Shelor that the remaining exception, "Personnel Qualifications" for the OCRWM acceptance of the USGS QA Program has been resolved. This surveillance was performed to evaluate implementation of the USGS procedure governing the development and conduct of training and the qualification and certification of personnel to perform quality-affecting activity. The surveillance verified that the Privacy Act issues, and Personnel Qualifications related to the OCRWM exception, have been adequately resolved. Also during this

surveillance, corrective action for related Standard Deficiency Reports (SDRs), 143, 145, and 331 were verified and subsequently closed.

Based on this information, the OCRWM Office of Quality Assurance concludes that the USGS QA Program is acceptable for implementation of new site characterization activities and other quality-related activities for the Yucca Mountain Site Characterization Project with no exceptions.

II. WASTE PACKAGE

The LLNL February, March, and April monthly status reports are enclosed (Enclosure 3). 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 on 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: D. Shelor, C.P. Gertz, R.E. Loux, M. Gora, 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,
M/S 17G21; S. Gagner, M/S 2G5; E. O'Donnell, M/S NLS260

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP)

SOFTWARE ADVISORY GROUP (SAG)
CHARTER

OBJECTIVE

- o Contribute to the evolution and implementation of a software management program that:
 1. makes optimum use of standard software engineering practices;
 2. is compatible with accepted scientific and engineering practices;
 3. ensures that the products of Yucca Mountain activities will support the licensing process; and
 4. provides a coherent and stable environment for software development and use.
- o Provide advice and consultation to the U.S. Department of Energy, Yucca Mountain Site Characterization Project Office (YMPO) on software-related matters.
- o Facilitate communication, discussion, and resolution of software-related concerns arising from management, quality assurance (QA), or technical staff on YMP.

APPROACH

The SAG shall foster communication and resolution of software issues by:

- o Initiating activities to improve communication and to produce integrated solutions to software-related problems.
- o Submission of observations, recommendations, and proposed courses of action to the YMPO Project Manager or designee, and QA Manager or designee. Copies shall be forwarded to the Technical Project Officers (TPOs) and each member.
- o Serving as a sounding board for identifying problems, discussing issues, and proposing solutions to software-related concerns that may have broad programmatic implication, are interdisciplinary in nature, or could impact multiple activities and organizations. Emphasis will be on innovative improvements that could positively impact the technical direction or scope of the YMP activities.

MEMBERSHIP

The YMPO will have SAG Chair responsibility. TPOs will select members from their staff and take into consideration such factors as diversity and representation of viewpoints and disciplines and breadth of understanding of the program and goals of YMP activities. The SAG Chair will have responsibility to ensure that all appropriate disciplines are represented. Representation should consist of technical staff, software engineers, QA personnel and management. Each participant will have one voting member.

A SAG secretary will be assigned by the Chair to coordinate preparation of the agenda, distribution of meeting minutes, and other administrative matters.

The SAG will evaluate meeting and membership effectiveness on an annual basis. Membership will be rotated on a periodic basis.

MEETINGS

Frequency and Location—

The SAG shall meet at least quarterly. Business will only be conducted when a quorum is present. A quorum will consist of 75 percent of the voting members. Meeting sites will rotate among the SAG member home sites.

Agenda—

The SAG shall follow a formal meeting agenda. A summary of the previous meeting topics and list of proposed agenda items will be distributed at least two weeks prior to each meeting.

Participation—

The SAG may invite experts in various disciplines from within or outside the YMP to participate in meetings and to advise on the topics under consideration. YMP staff members are encouraged to provide input to the SAG.

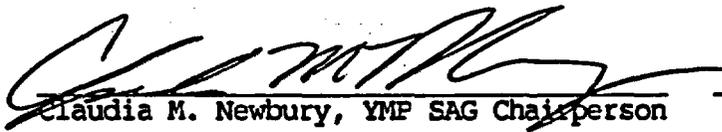
SIGNATURES:



Carl P. Gertz, YMPO Project Manager 5/13/91
Date



Donald G. Horton, Director QA Division 5/9/91
Date



Claudia M. Newbury, YMP SAG Chairperson 5/14/91
Date

Vacancy Announcement

Announcement No.: 91-RW-194

Issue Date: 05-08-91 Closing Date: 05-29-91

Area of Consideration: 1 First Tier Org.; 2 DOE Headquarters; 3 Commuting Area (Status Candidates Only); 4 DOE Nationwide; 5 Nationwide: (Status/Nonstatus Candidates)

U.S. DEPARTMENT OF ENERGY

POSITION: Supervisory General Engineer, GH-801-15

NO. OF POSITIONS: 1

SALARY RANGE: \$61,643 - \$80,138 per annum

ORGANIZATION LOCATION: Office of Civilian Radioactive Waste Management, Office of Quality Assurance, Yucca Mountain Project Office Quality Assurance Division

PROMOTION POTENTIAL: To GS- No Known

BARGAINING UNIT POSITION: Yes No

SUBJECT TO PMRS: Yes No

SUPERVISOR/MANAGER: Yes No

GEOGRAPHIC LOCATION: Las Vegas, Nevada

*Newly appointed supervisors/managers must serve a one year probationary period.

DUTIES AND RESPONSIBILITIES: Plans, supervises, and directs all activities of the Yucca Mountain Quality Assurance Division (YMQAD). Establishes priorities, deadlines, and goals. Assigns work; evaluates progress; identifies training and developmental needs, and develops and directs technical training requirements and programs for on-the-job training of personnel. Manages and directs the YMQAD and participates in development of the organization's Quality Assurance (QA) Program. Provides guidance, review, and approval of project participants' QA program plans and oversight of procedures and activities. Evaluates activities to enhance research and development methods, processes, and quality verification methods that contribute to improvements in quality methods, construction methods and technical performances. Evaluates requirements for major program changes, and recommends them to the Office Director. Develops and maintains effective communications and liaison relationships with various federal organizations at the national and local levels, such as the Nuclear Regulatory Commission (NRC), U.S. Geological Survey, etc., regarding project quality plans, activities, short and long-term goals and objectives. Directs the formulation, development, analysis, review, and preparation of budget assumptions and submission for the Division, and for assigned responsibilities.

QUALIFICATION REQUIREMENTS: Applicants must have general, specific, and specialized experience as described below. This requirement is in accordance with the OPM Handbook X-118, available for review in your personnel office, which specifies when and how education may be substituted for experience. When specified, applicants must also meet the Selective Placement Factors listed below.

BASIC REQUIREMENTS: Candidates must show successful completion of the requirements described in either A or B: (A) A full 4-year course of study in an accredited college or university leading to a bachelor's or higher degree in engineering; OR (B) Appropriate combination education and experience.

SPECIALIZED EXPERIENCE: In addition to the basic requirements, candidates must have one (1) year of specialized experience which is in or directly related to the line of work of the position to be filled and which has equipped the applicant with the particular knowledge, skills, and abilities to successfully perform the duties of the position. To be creditable, specialized experience must have been at least equivalent to the next lower grade level in the normal line of progression for the occupation in the organization.

RANKING FACTORS: Applicants who meet the qualification requirements described above will be further evaluated to determine the extent to which their education, work, related experience, training, awards and supervisory appraisals indicate they possess or have the potential to acquire knowledge, skills, abilities, and personal characteristics required to perform the duties and responsibilities described above.

1. Ability to communicate effectively with management and employees, delegate authority and responsibility, utilize personnel management concepts, and motivate and develop employees.
2. Skill in the development of a quality assurance program involved in nuclear waste activities.
3. Knowledge of pertinent Nuclear Regulatory Commission policies and procedures pertaining to quality assurance.
4. Ability to organize, plan, schedule, and supervise the conduct of audits and surveillances.
5. Ability to understand and support Equal Opportunity Program plans; use position management techniques and special employment and training programs to improve prospects for the handicapped, women, and minorities; and maintain a working environment free of discrimination and sexual harassment.

APPLICATION WILL BE ACCEPTED FROM SEVERELY HANDICAPPED APPLICANTS, CERTAIN VIETNAM ERA AND DISABLED VETERANS AND VOLUNTEERS FROM THE PEACE CORPS AND VISTA WHO ARE ELIGIBLE FOR APPOINTMENT UNDER SPECIAL AUTHORITIES. WHEN APPLYING, PLEASE SPECIFY ELIGIBILITY FOR SUCH APPOINTMENT.

ALL RANKING FACTORS WILL BE WEIGHED EQUALLY

Applications will be accepted from severely handicapped applicants, certain Vietnam Era and disabled veterans and volunteers from the Peace Corps and VISTA who are eligible for appointment under special authorities. When applying, please specify for such employment.

TO APPLY: For each announcement under which application is made, submit the following: (a) current completed "Application for Federal Employment" SF-171, with original signature, (b) completed "Supervisory Appraisal of Potential Performance" found on reverse, (c) applicant's statement of knowledge, skills and abilities as they relate to the ranking factors, (d) current performance appraisal of record, and (e) "Request for Merit Promotion Consideration" HO F 3335.1 (3-85). The SF-171 should include all pertinent experience, awards, commendations, training and any other pertinent information. Do not include position descriptions. Rankings will be based on information contained in the applicant's SF-171; the Supervisory Appraisal of Potential Performance; applicant's statement of knowledge, skills and abilities; current performance appraisal; and any other relevant documents submitted by the applicant. Applications submitted in response to this announcement become the property of the personnel office. APPLICATIONS RECEIVED IN POSTAGE-PAID GOVERNMENT ENVELOPES WILL NOT BE ACKNOWLEDGED OR CONSIDERED. APPLICATIONS MUST BE RECEIVED NO LATER THAN THE CLOSING DATE. They should be sent to the U.S. Department of Energy, 1000 Independence Ave., SW, Room 4H-090, Forrestal Building, DC 20585. The necessary forms are at the above address.

SUPERVISORY APPRAISAL OF POTENTIAL PERFORMANCE

PLEASE HAVE THIS APPRAISAL COMPLETED BY YOUR SUPERVISOR AND SUBMIT IT WITH YOUR APPLICATION, SF-171.

Announcement No.: 91-801-194

Position: Supervisory General Engineer, GM-801-15

Name of Applicant: _____

Basis for Appraisal				RANKING FACTORS <i>(Knowledges, skills, abilities, and personal characteristics)</i>	Level of Potential Performance				
Check One					Please check (✓) as appropriate:				
Outside Activities	On-the-Job Performance	Formal Training	Unable to Appraise		4	3	2	1	0
				1. Ability to communicate effectively with management and employees, delegate authority and responsibility, utilize personnel management concepts, and motivate and develop employees.					
				2. Skill in the development of a quality assurance program involved in nuclear waste activities.					
				3. Knowledge of pertinent Nuclear Regulatory Commission policies and procedures pertaining to quality assurance.					
				4. Ability to organize, plan, schedule, and supervise the conduct of audits and surveillances.					
				5. Ability to understand and support Equal Opportunity Program plans; use position management techniques and special employment and training programs to improve prospects for the handicapped, women, and minorities; and maintain a working environment free of discrimination and sexual harassment.					

NARRATIVE: Please include any other information pertinent to the applicant's potential knowledge, skills or abilities and personal characteristics that may not be adequately expressed above. (Attach additional sheets if needed.)

IN WHAT CAPACITY ARE YOU MAKING THIS APPRAISAL? (Please ✓ as appropriate)

- Present Immediate Supervisor
 Present 2nd Level Supervisor
 Other (Specify)
- Former Immediate Supervisor
 Former 2nd Level Supervisor

Period Covered by this Appraisal:

From:

To:

Appraiser:

(Signature)

(Date)

(Phone No.)



Lawrence Livermore National Laboratory

LLYMP9103006
March 13, 1991

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 1991

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,

For Leslie Jardine
LLNL Technical Project Officer
for YMP

LJJ/EC/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
MONTHLY TECHNICAL HIGHLIGHTS AND STATUS REPORT
FEBRUARY 1991
TABLE OF CONTENTS

1.2.1 Systems

WBS 1.2.1.1 Management and Integration (Ballou)

WBS 1.2.1.2.4 Systems Engineering Implementation (Revelli)

Performance Analyses (Chesnut)

WBS 1.2.1.4.2 Waste Package Performance Assessment (Chesnut)

Geochemical Modeling

WBS 1.2.1.4.5 Geochemical Modeling & Database Development
(Wolery/Johnson)

1.2.2 Waste Package

WBS 1.2.2.1 Management and Integration (Ballou)

Waste Package Environment (Wilder)

WBS 1.2.2.2.1 Chemical & Mineralogical Properties of the Waste Package
(Wilder)

WBS 1.2.2.2.2 Hydrologic Properties of Waste Package Environment (Chesnut)

WBS 1.2.2.2.3 Mechanical Attributes of the Waste Package Environment (Blair)

WBS 1.2.2.2.4 EBS Field Tests (Wilder)

Waste Form & Materials Testing (Stout/Clarke)

WBS 1.2.2.3.1.1 Waste Form Testing - Spent Fuel (Stout)

WBS 1.2.2.3.1.2 Waste Form Testing - Glass (Bourcier)

WBS 1.2.2.3.2 Metal Barriers (McCright)

WBS 1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models (ten Brink)

WBS 1.2.2.3.4.2 Thermodynamic Data Determination (Silva)

Engineering & Systems Analyses (Ruffner/Clarke)

WBS 1.2.2.4.1 Waste Package Design

WBS 1.2.2.4.2 Container Fabrication & Closure Development (Clarke)

WBS 1.2.2.4.3 Container/Waste Package Interface Analysis (Ruffner)

1.2.5 Regulatory and Institutional

WBS 1.2.5.2.1 NRC Interaction Support (Blink)

WBS 1.2.5.2.2 Site Characterization Program (Ballou)

WBS 1.2.5.2.4 Technical Support Documentation (Blink)

WBS 1.2.5.2.5 Study Plan Coordination (Ballou)

WBS 1.2.5.2.6 Semi-Annual Progress Reports (Blink)

1.2.9 Project Management

WBS 1.2.9.1.1 Management (Jardine)

WBS 1.2.9.1.4 Records Management (Bryan)

WBS 1.2.9.2 Project Control (Podobnik)

WBS 1.2.9.3 Quality Assurance (Dann)

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

FEBRUARY 1991

1.2.1 SYSTEMS

1.2.1.1 Management and Integration

Staff attended a software QA workshop in Las Vegas on February 4-7 which provided an open forum to identify problems with the present SQA system and to initiate development of recommendations for improvement.

1.2.1.2.4 Systems Engineering Implementation

Staff participated in the Physical System Functional Analysis and the start-up of the MSIS ESF Mission and Functional Analysis activity in Denver, February 4-8.

Staff participated in the Physical System Functional Analysis integration meeting in Las Vegas, February 19-21.

1.2.1.4.2 Waste Package Performance Assessment

Staff participated in a Partition and Transportation Meeting held in Pleasanton, CA on February 11. A telecon was held on February 13 to discuss the Performance Assessment role in this area.

Source term development is continuing.

Work continued on completing the PA problem definitions and work planning for PA support to the site suitability effort.

A conference abstract by T. Ueng and W. O'Connell entitled "Diffusive Barrier Simplified Applications" was prepared for the Focus '91, Nuclear Waste Packaging Conference to be held in Las Vegas, September 29-October 2, 1991.

Staff reviewed the draft System Functional Analysis for function 1.4, "Dispose of Waste", prepared by the Systems Engineering Working Group. Review effort focused on functions 1.4.2, Isolate Waste and 1.4.3, Evaluate System Performance.

Work continues on the SNL/LLNL MOU for the Near Field and Engineered Barrier System Scenario Determination Task.

1.2.1.4.5 Geochemical Modeling and Database Development

Updated the SUPCRT91 subset of GEMBOCHS to incorporate recently revised thermodynamic data and equation-of-state coefficients for 61 aqueous metal complexes.

Located and resolved a subtle D0OUT bug that resulted in the calculation of erroneous dissociation constants for six aqueous diphosphate complexes $[K, Na]P_2O_7$ and $[Na_2, Ca, Mg, Sr]P_2O_7$, as written to DAT0.com.R9. (The R10 suite of DATA0 files, to be generated in March, will include corrected dissociation constants for these species together with revised dissociation constants for the aforementioned SUPCRT91 aqueous metal complexes.

The document by J. Delany and S. Lundeen entitled "The LLNL Thermochemical Database and Revised Data and File Format for the EQ3/6 Package" will soon be submitted to YMPO for approval.

Viewgraphs were generated summarizing current and future modeling capabilities of the GEMBOCHS thermodynamic database for inclusion in a talk to be given at the Pittsburgh Conference in Chicago, March 4, by T. Wolery. The talk is entitled "EQ3/6 Software and Its Applications to Environmental Problems".

Generated WAS input for WBS 1.2.1.4.5, Geochemical Modeling, which encompasses maintenance and development of the GEMBOCHS database, associated software, and the EQ3/6 package. This input provides a summary of accomplishments in FY90-91 as well as projected accomplishments in FY92 and beyond.

Work continued on writing and revising EQ3/6 code documentation.

1.2.2 WASTE PACKAGE

1.2.2.1 Management and Integration

Staff attended a software QA workshop in Las Vegas on February 4-7 which provided an open forum to identify problems with the present SQA system and to initiate development of recommendations for improvement.

1.2.2.2 Waste Package Environment

Chemical and Mineralogical Properties of the Waste Package Environment

Revisions and additional contributions were submitted to the Near Field Environment Report.

Technical plans and background material for the joint AECL/DOE Fundamental Materials project were reviewed with A. Meike and W. Glassley in preparation for the Feb. 27-Mar. 1 meeting.

Staff repeated a series of EQ3/6 simulations to be described in the UCID entitled "Progress in Modeling Fluid-Rock Interaction at Yucca Mt, Nevada", currently in preparation. The original simulations had been made over the past year using a number of different versions of the codes and data base. To ensure consistency among the results, common versions of the code and database were used for the

calculations in the report. The calculations of the impact of water chemistry on rock-water interactions were also expanded to include Eh-pH conditions in equilibrium with the atmosphere, in addition to those Eh-pH conditions measured in waters from Yucca Mt.

Staff are developing a solid-solution model based on the Vanselow exchange convention. This model will allow simulation of precipitation/dissolution of clinoptilolite (and other exchangers) according to the Vanselow convention. LLNL has previously shown that adsorption of Cs and Sr on clinoptilolite is best modeled using this approach.

The HP HPLC (liquid chromatograph) was received. Also received were the Waters conductivity detector and an ADC (analog-to-digital converter) to allow ion chromatograph (IC) analyses as well as liquid chromatograph (LC) analyses with this instrument. Installation will be completed next month. These two instruments will allow study of the effects of organic aqueous species on the inorganic aqueous species and minerals of interest to not only the Geochemistry/Mineralogy Task, but also the Man-Made Materials Task. Inorganic aqueous anion analyses will now be possible and should significantly improve the electrical balance calculations, particularly for higher temperature runs. These electrical balance calculations are used as a measure to evaluate the analyses.

Man-Made Materials

A change request to add Man Made Materials as a separate WBS element 1.2.2.2.5 has been submitted to the Change Control Board.

Hydrologic Properties of the Waste Package Environment

Calculations have been conducted investigating fracture-matrix flow from the ground surface to the repository horizon and on to the water table. For example, for multiple, contiguous 100 μm fractures (assumed to penetrate the entire thickness below the repository) and ponded water at the repository horizon, the wetting front moves from the repository horizon to the water table in about 52 hours in roughly 50% of the area where nonwelded vitric CHnv is not present below the repository and in about 290 days in the area where CHnv is present. For similar assumed fracture morphology and ponded water at the surface, the wetting front moves from the surface to the repository horizon in about 56 years (70 to 10,000 times longer than the travel time below the repository). These calculations have two important implications. First, the calculations can be used to determine the combinations of idealized fracture morphology, matrix properties, and water ponding duration which appear to meet regulatory limits on release rates and ground water travel time, particularly as consequences of the PA human intrusion scenarios that directly inject water into the repository horizon. Second, the calculations show that quantifying both fracture and matrix properties in the rock above the repository horizon is required to calculate its effectiveness as a barrier limiting the amount of water reaching the engineered barrier system. The acceptable combinations of fracture morphology and ponding duration above the repository will probably be less stringent than for below the repository.

Work continued on the fracture healing study. The water samples that were collected from the steam-flow experiment in January were analyzed. The silica concentration in the water condensed from the steam that flowed through the sample ranged from 20 to 50 ppm compared to about 3 ppm in the water before entering the sample. A blind test has been run, using an Al sample to replace the rock sample, to verify that the source of the silica in the water condensed from the steam was actually from the rock sample. The water samples collected in the blind test are being analyzed. The rock sample is being prepared for SEM analysis of the fracture surfaces before and after the experiments.

A prototype enhanced version of V-TOUGH has been completed which produces efficient and very flexible time histories of all primary and secondary variables calculated by the code. This capability will enhance data extraction from V-TOUGH output and will reduce storage requirements for output. Enhancements have also been added to this prototype including the capability of accommodating time-dependent Dirichlet boundary conditions.

The first draft of the revised study plan for the Laboratory Near Field Hydrology Task is about 90% completed.

An abstract by W. Lin entitled "Role of Steam in Fracture Healing of Topopah Spring Tuff Sample" was submitted to the American Geophysical Union (AGU) Spring Meeting to be held in Baltimore, MD, May 28 - June 1, 1991.

Mechanical Attributes of the Waste Package Environment

Continued to revise the Study Plan for Characterization of Mechanical Attributes of the Waste Package Environment (Study Plan 8.3.4.2.4.3) incorporating the review comments received.

EBS Field Tests/ESF Test Design

Work continues on the first draft of the Near Field Environment Report.

The report by A. Ramirez, et al., entitled "Prototype Engineered Barrier System Field Tests (PEBSFT) - Final Report" was submitted to YMPO.

Staff reviewed the University of Nevada, Reno proposal by G. Danko entitled "Application of Long Horizontal Cooling Enhancement for a Nuclear Waste Repository" in Las Vegas on February 7.

1.2.2.3 Waste Form and Materials Testing

Waste Form Testing - Spent fuel

Work continues on the compilation of information for the Waste Form Characterization Report.

The December 1990 report from PNL described a need to improve the method of preparing spent fuel grains for subsequent flow-through dissolution testing so that the small subgrain particles (those smaller than about 2 μm) will be eliminated. Two methods have been tried:

- 1) wet screening using a screen with 5 μm openings, and
- 2) aqueous settling-rate segregation.

The latter simply involves ultrasonic agitation and stirring to produce an aqueous suspension of particles in a beaker. After a few seconds of settling, the aqueous solution is decanted along with the smaller particles while the larger particles settle to the bottom and remain in the beaker. The latter method seems to work somewhat better and is easier to perform in the hot cell. Different solutions (deionized water, dilute solutions of HCl or KOH, and a mixture of deionized water and glycerol) were tried with method 2, but little difference was observed. Therefore, in the future, deionized water (or, perhaps, dilute carbonate/bicarbonate solutions) will be used to prepare fuel-grain specimens for flow-through dissolution tests using this method.

Finished synthesizing another new batch of schoepite (≈ 13 g). X-ray diffraction (XRD) confirmed its purity. A sub-sample will be sent to the LLNL Chemistry Department for surface area measurement. Another sub-sample will be sent to PNL.

The draft bibliography by W. McKenzie entitled "UO₂ Dissolution Kinetics, Solubility, and Thermochemical Properties of Uranium: Selected References" was prepared and is being reviewed by the Waste Form Technical Area staff.

A Readiness Review was completed for Activity D-20-53a, Flow Through Dissolution Tests on UO₂ (LLNL).

A review of the PNL Test Plan for Activity D-20-53b, "Flow Through Dissolution Tests on Spent Fuel" was completed. W. Gray of PNL visited LLNL on February 11 and discussed the flow-through dissolution test plan.

The calibrations and operational testing of the uranium analyzer testing were completed in preparation for initiating the UO₂ Flow-through tests.

R. Einziger and L. Thomas of PNL met with R. Stout at LLNL to discuss oxidation of spent fuel and work plans for the current fiscal year. Test instructions for the altered scope of work were written. Samples will be loaded into the dry baths in February/early March depending upon the final negotiated schedule.

Waste Form Testing - Glass

Work continued on the preliminary Waste Form Characterization Report. A draft of the glass portion of the document includes the important glass-related information in the form of tables and figures. The ANL contribution to the Waste Form Characterization Report was received and incorporated into the draft document. The three areas examined by ANL include the effect of fracturing on glass reaction, the effect of radiation on glass reaction, and the estimation of glass

reaction rates under a variety of conditions. The glass reaction rates reported were based on long-term static leach tests to establish a "final" reaction rate, on vapor phase hydration reaction at repository-relevant temperatures, and on long-term application of the unsaturated test method. Reaction rates were presented for a range of potential glasses to be produced by the Defense Waste Processing Facility (DWPF).

The N2 tests (SRL actinide-doped glass) continued as scheduled with no sampling period occurring this month. These tests have now been in progress for over five years with the anniversary date being 2/3/91.

The N3 tests (ATM-10, a West Valley actinide-doped glass) continued as scheduled. The tests have been in progress for 182 weeks.

Work to characterize the distribution of actinides in solution has been completed at ANL, and a letter report describing the results was submitted to M. Buchholtz ten Brink at LLNL. Further exposure of the alpha-bearing filtered particles to nuclear emulsion has produced separate alpha tracks that can be vectored to discrete particles which are then examined using transmission electron microscopy (TEM). The alpha tracks are produced by the Ca-Th phosphate phase described previously. Additionally, many small particles of the clay substrate which contains the Ca-Th phosphate phase were mounted for X-ray diffraction analysis. This was a tedious procedure since the clay particles were on the order of 1 μ m diameter. A successful XRD pattern has been obtained at several focal lengths and the patterns are being compared to those produced using electron diffraction in the TEM. A draft journal article was submitted describing these results. The results are significant because they indicate that the ratio of Am/Pu suspended in solution to that actually dissolved in solution is greater than 1000:1. These findings may affect the application of solubility-limit based performance assessment models and could influence the design of the engineered barrier system for radionuclide containment.

YMPO was contacted by J. O'Keefe of NASA Goddard concerning information they have about the rates of tektite dissolution in natural environments. Tektites are natural glasses that have apparently survived for millions of years on or near the surface of the earth. Experimental dissolution studies of tektites have shown that the presence of magnesium in solution suppresses the rate of tektite dissolution (commonly by a factor of 100 or more) either by poisoning the surface or due to the formation of a magnesium-rich alteration layer that inhibits transport. Plans are to examine and quantify this effect for nuclear waste glasses by including magnesium in the buffer solutions of the flow-through tests. This is part of the reason for revising the test matrix in Activity D-20-31 as described below.

Work continued on developing a test plan matrix for dissolution tests of waste glasses. A reduced funding level makes it imperative that only a few key experiments be done in the remainder of this fiscal year. A reduced number of pHs, temperatures, and glass compositions will be used.

Container Materials Modeling and Testing

W. Love from RMI Titanium in Brea, CA visited LLNL and gave a presentation on various aspects of titanium and titanium alloys. J. Ratka from Brush-Wellman in Cleveland, OH visited LLNL and gave a presentation on various aspects of copper-beryllium alloys. Detailed presentations were given on all aspects of these metals as they would apply to a high level nuclear waste disposal container.

D. Macdonald, SRI International, visited LLNL on February 14 to discuss container life prediction modeling. He is developing models for the Canadian Repository Program which, with some modification, could also be applied to Yucca Mountain EBS design concepts.

Four staff members attended the Golden Gate Metals and Welding Conference held in San Mateo, CA on February 5-7. D. McCright was a session chairman and W. Halsey presented a paper on Container Materials.

W. Clarke attended the second planning meeting in Las Vegas on February 21 for the DOE EBS Concepts Workshop.

All five sections of the degradation mode survey on Ni-Cr-Mo alloys are completed. The sections have been reviewed for technical content. Reviewer's comments have been incorporated into the documents. The five sections are:

- 1) Introduction,
- 2) Phase stability,
- 3) Stress corrosion cracking and localized corrosion in chloride environments,
- 4) Corrosion in marine atmospheres and brines, and
- 5) Stress corrosion cracking in hydrogen environments.

The entire report (all five sections) will receive management and QA reviews as a single document. This is expected to occur in March.

Integrated Radionuclide Release

Discussions and document reviews were conducted for collaborations and work plans for sorption and transport work with LANL.

A review was completed for the Individual Software Plan for the ion microscope experiments. Began testing software developed for calibration of the ion microscope to measure concentrations of trace elements in YMP samples. Completed a depth profiling analysis of uranium and thorium ion implants as part of the calibration effort.

Continued construction of the flow-through chemical-hydrological system. Installation and safety testing are expected to be completed in March.

Drafts of the letter report and manuscript on identification of actinide-bearing colloids in waste glass were completed.

Reduced the inductively coupled plasma-mass spectrometer (ICP-MS) data for the Rare Earth Element standard intercalibration.

Thermodynamic Data Determination

A thin window Ge detector was set up and shielded. Calibration with NIST primary efficiency standards completed the validation of the gamma counting facility. The 75 keV transition in Am^{243} is used to determine the concentration of Americium in the solutions used for the spectroscopic determination of Americium complexation constants.

Experiments to determine the extent of americium hydrolysis at ambient temperature continued in preparation for measurements at elevated temperatures. Controlling the pH of the analyte solutions was found to be difficult. Analysis of the data afforded a value of $\log K(1,-1,0) = -7.53 \pm 0.59$ which compares well with the value presented in the NEA draft americium review.

The optical cell in the Guided Wave variable temperature spectrometer was reconstructed. The modification resulted in markedly improved data. Consequently, the first LLNL high-temperature spectroscopy experiments were conducted. Spectroscopic complexation data were collected at 25, 50, 75, and 95°C for the americium hydrolysis system. The high temperature data are important for performance assessment calculations that will be made at elevated temperature near-field conditions.

In response to an OCRWM request, three contracts were initiated with U.S. scientists to provide independent technical and peer reviews of the Nuclear Energy Agency's review of actinide thermodynamic data. These contracts are as follows:

- 1) D. Hildenbrand, SRI International, Peer Review on uranium
- 2) F. Pearson, Jr., Consultant, Peer Review, uranium
- 3) J. Sullivan, Argonne National Laboratory, Critical Technical Review, plutonium

1.2.2.4 Design, Fabrication, and Prototype Testing

Waste Package Design

No significant activities.

Container Fabrication and Closure Development

No significant activities.

Container/Waste Package Interface Analysis

A draft of the Waste Package Plan Milestone 1, the EBS Mission Statement, has been released to YMP for review.

The methodology for developing alternate design concepts has been internally reviewed and approved for implementation.

1.2.5 REGULATORY AND INSTITUTIONAL

NRC Interaction Support

No significant activities.

Site Characterization Program

No significant activities.

Technical Support Documentation

No significant activities.

Study Plan Coordination

Two study plans were received for review from USGS.

Semi-Annual Progress Reports

No significant activities.

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management

One presentation was given at an LLNL-YMP staff meeting:

B. Bryan discussed Records Management.

The Sample Overview Committee approved LLNL specimen removal requests for Integrated Testing and Geomechanics experiments.

L. Ballou participated in Early Site Suitability Evaluation meetings in Denver, February 7-8 and February 27 - March 1.

Staff attended a software QA workshop in Las Vegas on February 4-7 which provided an open forum to identify problems with the present SQA system and to initiate development of recommendations for improvement. D. Wilder, D. Short and other YMP staff briefed J. Bartlett in Las Vegas on February 8th on the YMP-QA Workshop.

Staff members discussed LLNL comments with D. Helton of YMPO on the YMP Information Management Systems Plan, Software Management Plan, Data Management Plan, and Computer Resources Management plan.

L. Jardine presented a paper entitled "Using a Systems Engineering Process to Develop Engineered Barrier Design Concepts" to the Waste Management '91 Conference in Tucson, AZ on February 25.

Two staff members attended the Records Coordinator Conference & Workshop in Las Vegas, February 5-6, which included a trip to the Yucca Mountain Records and Document Control Office.

J. Blink was appointed as the LLNL representative to the Technical/Quality/Management (T/Q/M) Group.

1.2.9.2 Project Control

Submitted the January FTE Report and Cost Plan to YMPO.

Initiated work on preparing the following planning documents:

- 1) FY93 WAS/FWP
- 2) FY93 LLNL FWP
- 3) YMP Performance Measurement Baseline covering the period of October 1, 1990 through October 1, 2001.

Reviewing and revising the PACS network and budget data. The FY91 budget, as compiled by the SAIC PACS system, totals approximately \$2 million more than approved LLNL FY91 budget.

1.2.9.3 Quality Assurance

Quality Procedures 033-YMP-QP 2.6, Readiness Review; 033-YMP-QP 2.9, Indoctrination and Training; and 033-YMP-QP 3.4 Scientific Notebooks, have been revised and distributed.

Draft charters for the Technical/Quality/Management Group and the Software Advisory Group were reviewed, and comments were forwarded to YMPO.

The Quality Assurance Requirements Specification for Instrument Calibration Services, QARS-003, was revised and distributed.

Work is continuing on the annual Trend Analyses Report.



LLYMP9103200
April 5, 1991

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 - March 1991

Attached is the March 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,

Leslie Jardine

Leslie Jardine
LLNL Technical Project Officer
for YMP

LJJ/EC/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
MARCH 1991 TECHNICAL HIGHLIGHTS AND STATUS REPORT

TABLE OF CONTENTS

1.2.1 Systems

- WBS 1.2.1.1 Management and Integration (Ballou)
- WBS 1.2.1.2.4 Systems Engineering Implementation (Revelli)
- WBS 1.2.1.2.6 YMP Support to MSIS (Ruffner)

Performance Analyses (Chesnut)

- WBS 1.2.1.4.2 Waste Package Performance Assessment (Chesnut)

Geochemical Modeling

- WBS 1.2.1.4.5 Geochemical Modeling & Database Development (Wolery/Johnson)
- WBS 1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses (Carrigan)

1.2.2 Waste Package

- WBS 1.2.2.1 Management and Integration (Ballou)

Waste Package Environment (Wilder)

- WBS 1.2.2.2.1 Chemical & Mineralogical Properties of the Waste Package (Wilder)
- WBS 1.2.2.2.2 Hydrologic Properties of Waste Package Environment (Chesnut)
- WBS 1.2.2.2.3 Mechanical Attributes of the Waste Package Environment (Blair)
- WBS 1.2.2.2.4 EBS Field Tests (Lin)

Waste Form & Materials Testing (Stout/Clarke)

- WBS 1.2.2.3.1.1 Waste Form Testing - Spent Fuel (Stout)
- WBS 1.2.2.3.1.2 Waste Form Testing - Glass (Bourcier)
- WBS 1.2.2.3.2 Metal Barriers (McCright)
- WBS 1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models (ten Brink)
- WBS 1.2.2.3.4.2 Thermodynamic Data Determination (Silva)

Engineering & Systems Analyses (Ruffner/Clarke)

- WBS 1.2.2.4.1 Waste Package Design
- WBS 1.2.2.4.2 Container Fabrication & Closure Development (Clarke)
- WBS 1.2.2.4.3 Container/Waste Package Interface Analysis (Ruffner)

1.2.5 Regulatory and Institutional

- WBS 1.2.5.2.1 NRC Interaction Support (Blink)
- WBS 1.2.5.2.2 Site Characterization Program (Ballou)
- WBS 1.2.5.2.4 Technical Support Documentation (Blink)
- WBS 1.2.5.2.5 Study Plan Coordination (Ballou)
- WBS 1.2.5.2.6 Semi-Annual Progress Reports (Blink)

1.2.9 Project Management

- WBS 1.2.9.1.1 Management (Jardine)
- WBS 1.2.9.1.4 Records Management (Bryan)
- WBS 1.2.9.2 Project Control (Podobnik)
- WBS 1.2.9.3 Quality Assurance (Dann)

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

MARCH 1991
EXECUTIVE SUMMARY
(Items Proposed for Reporting in YMPO or OGD Reports)

1.2.2.3 Waste Form and Materials Testing

D-20-3: Parametric Studies of WVDP and DWPF Glass

Four-year batch tests with ATM-1c and ATM-8 glasses were terminated as scheduled. While these glasses are not representative of any glass that will be produced by DWPF or WVDP, a considerable data base exists, and the results can be applied to model validation. These tests are part of the gamma radiation glass study, and were done without radiation to provide a comparative basis. The four-year period represents the longest time this glass has been reacted.

The tests were done with and without tuff wafers and with and without glass (EJ-13 water only); therefore, long-term results on rock/water/glass performance are now available. Additionally, since the ATM-8 glass contains ^{237}Np and ^{239}Pu , some information on radionuclide distribution is also available.

The solutions were analyzed for cations, radionuclides, and anions while the distribution of radionuclides was measured between the rock and the solution and as particulate material in solution. One additional test of each type is still ongoing and is scheduled for termination at eight years.

1.2.2.2 Waste Package Environment

Hydrologic Properties of the Waste Package Environment

The tuff fracture healing study is continuing. The silica concentration in the water condensed from the steam flowing through the aluminum sample is about the same as in the water before entering the sample. This indicates that the 20 to 50 ppm silica concentration in the water condensed from the steam that flowed through the fractured tuff sample was caused by the transportation of silica by the steam. Preliminary Scanning Electron Microscope (SEM) photos of the fracture surfaces of the tuff sample indicate that the fracture surfaces before and after the experiment are different. Further SEM studies will be conducted next month.

1.2.2.3 Waste Form and Materials Testing

D-20-37: Generate Models for Release Form Glass

The EQ3/6 database has been converted to a format that Gt, an alternate reaction path computer code, can use. Gt will be used both to perform verification studies of EQ3/6, and to model rock-centered flow-through experiments.

1.2.2.4 Design, Fabricatⁿ, and Prototype Testing

Container/Waste Package Interface Analysis

A core team of LLNL personnel is developing preliminary concept descriptions for alternate Engineered Barrier System (EBS) designs suitable for hot/dry, cold/dry, hot/wet, and cold/wet environments.

1.2.1 SYSTEMS

1.2.1.1 Management and Integration

Staff participated in the QA workshop follow-up meeting in Denver, March 14.

1.2.1.2.4 Systems Engineering Implementation

The tentative schedule of submission of data to the Technical Database was updated and the revised schedule was sent to YMPO for Division Director approval.

A Technical Data Information Form (TDIF) associated with the thermodynamic measurements discussed in the LLNL report, UCID-21658, "The LLNL Thermochemical Database - Revised Data and File Format for the EQ3/6 Package" by J. Delany and S. Lundeen, was submitted to YMPO. This document reports on the structure of the GEMBOCHS (EQ3/6) database which is one component of the YMP Technical database and lists the species in the current version.

1.2.1.2.6 YMP Support to MSIS

Staff participated in the MSIS ESF Mission and Functional Analysis activity in Denver, March 12-15 and in Los Alamos, March 26-29.

1.2.1.4.2 Waste Package Performance Assessment

Staff prepared input for the YMP Performance Assessment Review Meeting to be held in Las Vegas, April 2-3.

An abstract by D. Chesnut entitled "The Demands Placed on Waste Package Performance Testing and Modeling by Some General Results of Reliability Analysis" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

Staff participated in the ESF mission/Functional Analysis Meeting at Los Alamos, March 26-29.

1.2.1.4.5 Geochemical Modeling and Database Development

Software documentation continues with the 1983 EQ3NR User Guide being revised for consistency with the recent code release (EQ3/6, Version 3245.1090). A matching user guide is being prepared for the EQPT code, which is the database preprocessor for the EQ3NR and EQ6 codes. The draft EQ6 user guide is being revised to incorporate internal and external review comments.

1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

YMP approved C. Carrigan's proposal to study seismically induced movements of the water-table at and near Yucca Mountain. Internal QA grading was completed for this activity.

1.2.2 WASTE PACKAGE

1.2.2.1 Management and Integration

W. Clarke attended planning meetings on March 7 at LLNL and on March 14 in Las Vegas for the June 18-20 DOE EBS Concepts Workshop in Denver that was requested by the NWTRB.

1.2.2.2 Waste Package Environment

The Near Field Environment Report (NFER) was QA graded using the internal LLNL procedure. LLNL hosted YMPO staff on March 7 and 8 to discuss the organization of the NFER.

Chemical and Mineralogical Properties of the Waste Package Environment

Calculations have been started to estimate the effect of hydration water properties on the thermodynamic properties of clinoptilolite.

A prototype implementation has been started of the Vanselow solid-solution model in EQ3/6 using the numerical solver "zbrent".

Hydrologic Properties of the Waste Package Environment

The tuff fracture healing study is continuing. The silica concentration in the water condensed from the steam flowing through the aluminum sample is about the same as in the water before entering the sample. This indicates that the 20 to 50 ppm silica concentration in the water condensed from the steam that flowed through the fractured tuff sample was caused by the transportation of silica by the steam. Preliminary Scanning Electron Microscope (SEM) photos of the fracture surfaces of the tuff sample indicate that the fracture surfaces before and after the experiment are different. Further SEM studies will be conducted next month.

The first draft of the revised Study Plan for the Laboratory Near-field Hydrology Task is complete.

The first draft of the Near Field Environment Report Hydrology section was completed. Work continues on a summary of this section.

An abstract by T. Buscheck, J. Nitao, and D. Chesnut entitled "The Impact of Episodic Nonequilibrium Fracture-Matrix Flow on Geological Repository Performance" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

An abstract by W. Lin, A. Ramirez, and D. Watwood entitled "Temperature Measurements from a Horizontal Heater Test in G-Tunnel" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

Staff met with LANL staff on March 4 to discuss common issues.

Mechanical Attributes of the Waste Package Environment

Revised Section 3.0, Methodology, of the Study Plan for Characterization of Mechanical Attributes of the Waste Package Environment (Study Plan 8.3.4.2.4.3) incorporating the review comments received.

EBS Field Tests/ESF Test Design

W. Lin has been named Task Leader for the Engineered Barrier System Field Tests.

An abstract by K. Lee, and T. Ueng entitled "Field Air Injection Tests to Determine the Effect of a Heat Cycle on the Permeability of Welded Tuff" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

1.2.2.3 Waste Form and Materials Testing

Waste Form Testing - Spent fuel

Activity Plan D-20-53b "Flow Through Dissolution Tests on Spent Fuel" (at PNL) has been completed and is in final review at LLNL. Internal QA Grading was also completed for the LLNL portion of this activity. The method developed for removing small subgrain particles from fuel grain specimens prepared for flow-through dissolution testing was expanded to include use of dilute-carbonate/bicarbonate solutions.

The UO_2 dissolution tests (Activity D-20-53a) were initiated at LLNL. Buffer solutions were prepared. The solutions are a very weak carbonate/bicarbonate at pH 10 (total C = $2 \times 10^{-4}\text{M}$) and a very atmospheric-sensitive solution at pH 8 (Total C = $2 \times 10^{-2}\text{M}$).

LLNL approved modification of the test matrix for the dry bath oxidation tests at PNL. The revised loading diagram has been implemented. These tests will determine grain volume oxidation rate parameters for oxidation modeling.

K. Pedersen has joined the spent fuel task and will be working on the Waste Form Characterization Report.

Comments on the paper by L. Thomas, O. Slagle and R. Einzinger, entitled "Nonuniform Oxidation of LWR Spent Fuel in Air", were received from the editor of the Journal of Nuclear Materials and incorporated as needed. Permission to publish has been received from LLNL and YMPO.

An abstract by H. Leider entitled "Estimating the Time for Dissolution of Spent Fuel Under Unconstrained Conditions" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

An abstract by R. Einzinger entitled "Effects of an Oxidizing Atmosphere in a Spent Fuel Packaging Facility" was submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 -October 2.

Waste Form Testing - Glass

S. Steward of LLNL has joined the glass task and will be working on collecting and analyzing data on glass compositions and their dissolution response; as well as developing a statistically designed matrix to test effects of compositional variables by flow through controlled experiments.

New cells are being prepared for the expanded glass dissolution work. Orders have been placed for additional flow rate control pumps and connectors to perform these tests. As soon as the glassware is received, work will begin on Si- and Al-doped buffer solutions. Additional laboratory space has been obtained for the expanded matrix testing.

The N2 tests (SRL actinide-doped glass) have now been in progress for 268 weeks. The N3 tests (ATM-10, a West Valley actinide-doped glass) have been in progress for 186 weeks.

The report "Parametric Effects on Glass Reaction in the Unsaturated Test Method" was returned to ANL from LLNL with technical comments. These comments are currently being addressed.

Four-year batch tests with ATM-1c and ATM-8 glasses were terminated as scheduled. While these glasses are not representative of any glass that will be produced by DWPF or WVDP, a considerable database exists, and the results can be applied to model validation. These tests are part of the gamma radiation glass study, and were done without radiation to provide a comparative basis. The four-year period represents the longest time this glass has been reacted.

The tests were done with and without tuff wafers and with and without glass (J-13 water only); therefore, long-term results on rock/water/glass performance are now available. Additionally, since the ATM-8 glass contains ^{237}Np and ^{239}Pu , some information on radionuclide distribution is also available.

The solutions were analyzed for cations, radionuclides, and anions while the distribution of radionuclides was measured between the rock and the solution and as particulate material in solution. One additional test of each type is still ongoing and is scheduled for termination at eight years.

Work is underway to begin the next set of doped-buffer flow-through glass dissolution tests. Additional cells are being fabricated and more simple glass is being prepared. An operational safety plan (OSP) was written to govern sample preparation of uranium-containing glasses. The OSP must now be approved by LLNL management.

A draft of the glass ta_u input to the Waste Form Charac_uzation Report has been completed. Input from ANL on three aspects of glass performance (Effects of Radiation, Estimates of Glass Corrosion Rates, and Effects of Cracking) were received and incorporated into the report.

The EQ3/6 database has been converted to a format that Gt, an alternate reaction path computer code, can use. Gt will be used both to perform verification studies of EQ3/6, and to model rock-centered flow-through experiments.

The revised Test Plans for the LLNL Activity Plan and the N2 and N3 unsaturated tests were received from ANL and approved at LLNL. The Activity Plan and the QA grading report for the LLNL portion of this activity are completed and are awaiting signature by LLNL-YMP management and QA.

All QA activities for the ANL contract are up to date.

Container Materials Modeling and Testing

The following papers have been submitted to the Focus/91 Nuclear Waste Packaging Conference to be held in Las Vegas on September 29 - October 2.

- 1) "Candidate Container Materials for Yucca Mountain Waste Package Designs" by W. Clarke, W. Halsey and D. McCright.
- 2) "Selection Process and Quantitative Criteria for YMP Container Materials" by W. Halsey.
- 3) "Summary of Yucca Mountain Engineered System Concepts Workshop" by W. Clarke, D. Harrison-Giesler, R. Morissette, P. Childress and A. Berusch.
- 4) "Electrochemical Polarization Measurements on Pitting Corrosion Susceptibility of Nickel-Rich Alloy 825" by D. McCright and D. Fleming.
- 5) "Degradation Mode Surveys of Nickel-Chromium-Molybdenum Alloys and Titanium Alloys Considered for High-Level Radioactive Waste Container Materials" by G. Gdowski and D. McCright.
- 6) "Degradation Mode Surveys of YMP Site Characterization Plan Candidate Materials for High-Level Radioactive Waste Container Materials" by J. Farmer and G. Gdowski.
- 7) "Stochastic Models for Predicting Pitting Corrosion Damage of HLRW Containers" by G. Henshall.
- 8) "Predicting HLRW Container Failures Due to Pitting Corrosion Using a Deterministic Approach" by G. Henshall and D. Macdonald.
- 9) "Effects of Ionizing Radiation on the Anticipated Waste Package Environment at Yucca Mountain" by D. Reed and R. Van Konynenburg.
- 10) "Corrosion of Candidate HLW Container Metals in Irradiated Air-Steam Mixtures" by D. Reed and R. Van Konynenburg.
- 11) "Gaseous Release of Carbon-14 from Spent Fuel Waste Packages in a Potential High Level Waste Repository: Why the Regulations Should be Changed" by R. Van Konynenburg.

Integrated Radionuclide Release

Continued preparing the final technical data submission and records package for the tuff wafer experiments.

Continued testing of software developed for calibration of the CAMECA ion microscope to measure concentrations of trace elements in YMP samples. Features added recently include automation for acquisition and reduction of large volumes of data.

As part of the calibration effort, data reduction was completed for the depth profiling analysis of the U, Th ion implant.

Continued construction of the flow-through chemical-hydrological system. The pressure vessel was completed, solution delivery and collection systems were modified, and installation and safety testing begun.

Completed equipment set-up and received initial training for the auto-correlation photon spectrometer. Testing with standard particles and determination of the instrument's capabilities began.

Thermodynamic Data Determination

Experiments to determine the extent of americium hydrolysis at ambient temperature continued. To achieve better control of the analyte solution pH, hydroxylamine buffer solutions were prepared. These solutions are for use with the glovebox enclosed laser-induced photoacoustic spectrometer. The americium concentration of the solutions was $3 \times 10^{-7} \text{M}$ and the pH varied from 5.25 to 6.75 in 0.25 increments. The ionic strength of all solutions was 0.5M (NaClO_4). Remote spectral interrogation of both metal and reference solutions was completed for this initial study. Data reduction and analysis were initiated.

The manuscript by J. Smith, P. Zanonato, and G. Choppin entitled "An Elevated Temperature Titration Calorimeter" was reviewed and is being submitted for journal publication.

The following abstracts were submitted to the Third International Conference on Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere, Migration, '91 to be held in Jerez de la Frontera, Spain, October 21-25:

- 1) "Speciation Calculations of Pu, Np, Am and U in J-13 Well Water: Effects of Anion Concentration and pH" by C. Palmer, R. Silva and C. Miller.
- 2) "High Temperature Measurements of Americium Hydrolysis Using Absorption and Photoacoustic Spectroscopies" by R. Russo, P. Grant, G. Klunder, P. Robouch, J. Andrews, R. Torres, H. Hall, C. Palmer and R. Silva.
- 3) "Carbonate Complexation of Tetravalent Uranium" by R. Russo, R. Silva, J. Andrews, and P. Robouch.

1.2.2.4 Design, Fabrication, and Prototype Testing

Waste Package Design

No significant activities.

Container Fabrication and Closure Development

A Technical Data Information Form is being prepared for the B&W data.

Container/Waste Package Interface Analysis

A core team of LLNL personnel is developing preliminary concept descriptions for alternate (Engineered Barrier System) EBS designs suitable for hot/dry, cold/dry, hot/wet, and cold/wet environments.

1.2.5 REGULATORY AND INSTITUTIONAL

NRC Interaction Support

Staff prepared and gave presentations at the DOE-NRC Technical Exchange on Mineral Stability and Applicability of Laboratory Data to Repository Transport Calculations held in Los Alamos, NM on March 20-21, 1991.

D. Wilder participated in the QA Enhancement Workshop held in Dallas, TX, March 26-27 for the NWTRB.

Site Characterization Program

L. Ballou and M. Revelli continued to support the Early Site Suitability Evaluation (ESSE) activity. Both attended the meeting in Las Vegas on February 27 - March 1 and participated in conference calls on March 15 and 28. A preliminary guideline evaluation for Postclosure Rock Characteristics is nearly complete and will be distributed to the core team.

LLNL-YMP management signed the Interface Memorandum of Understanding (IMOU-330015) pertaining to LLNL's participation in the ESSE activity.

Technical Support Documentation

No significant activities.

Study Plan Coordination

Technical Review was completed for USGS YMP Study Plan 8.3.1.5.1.3, "Climatic Interpretations of Terrestrial Paleocology".

The USGS Study Plan 8.3.1.5.2.2. "Characterization of Future Hydrology Due to Climate Changes" was received for review.

Semi-Annual Progress Reports

Guidelines were received for assembling material for the Technical Status Report (TSR) covering October 1, 1990 to March 31, 1991.

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management

A Technical presentation was given at an LLNL-YMP staff meeting:

D. Short discussed Design Methodology for the EBS Alternatives Study.

L. Jardine presented a paper entitled "Quality Assurance Implementation Experience in the Yucca Mountain Project, Technical Activities at Lawrence Livermore National Laboratory" on March 18 in Las Vegas for the 2nd International Waste Management Conference of the American Society for Quality Control.

Staff briefed C. Gertz and YMPO staff in Las Vegas on March 22 on potential LLNL contributions to the Engineered Barrier Systems design basis and to Site Characterization.

J. Caldwell and C. Martin from Mactec visited LLNL to get input on the problem of data submittal.

L. Jardine, D. Emerson and S. Sprague participated as hosts for the YMP Open House held at NTS on March 2.

Consultants authorized by DOE/HQ visited LLNL on March 5-7 and conducted a detailed review of the LLNL backlog.

L. Zucconi resigned her position as Software Quality Manager (SQM) to accept a promotion within the LLNL Computations Department. Jim Blink assumed the responsibility of the SQM as an additional duty.

T. Quinn was appointed as the LLNL member of the YMP Software Advisory Group. She attended the Software Quality Workshop follow-up meeting in Las Vegas on March 21.

Jim Blink was appointed as the LLNL member of the Technical Integration Group.

1.2.9.2 Project Control

The February Cost Report and the February FTE Report were submitted to YMPO.

The FY91 Project Monthly Spend Plan was updated with new input for the spending plans from the TALs.

A third contract was established with an independent peer reviewer for review of the thermodynamic data on Uranium. This contract was established to fulfill the request made by OCRWM to support the NEA review of uranium thermodynamic data.

A new PACS account was established for work being done to evaluate the role of fractures in seismically induced movements of the water table at and near Yucca Mountain (WBS 1.2.1.4.7).

A new contract was established with Kaiser Engineering to provide QA support including surveillance, audit and QA Program and Quality Procedure reviews.

Completed work on the following planning documents:

- 1) FY93 WAS/FWP
- 2) FY93 LLNL FWP
- 3) YMP Performance Measurement Baseline covering the period of October 1, 1990 through October 1, 2001.

Staff members are reviewing the PACS network milestones and analyzing the impacts of constrained budgets for FY92 and FY93.

An update was submitted for the ITR Short Range Plan update.

1.2.9.3 Quality Assurance

Conducted Audit 91-12, LLNL Engineering Measurements and Analysis Section, ESD, on March 18-19.

Conducted Audit 91-13, LLNL Electronic Services Group, on March 27-28.

Conducted a surveillance, "Status Review of SIPs, Activity Plans, TIPs, and Quality Assurance Grading for Scheduled Audits".

Distributed TIP-YM-11, Software Configuration Management System.

Transmitted to YMPO for approval the QAPP Change Notice 3.0-4.

Conducted internal QA grading meetings for Activity J-20-8.5, Development of Methods and Instrumentation; Activity J-20-8.10, Technical Reviews/Peer Reviews in Support of NEA Database; and Near-Field Environment Report.

Transmitted to YMPO the revised QA Surveillance Schedule (Rev. 1) for the surveillances planned for the remainder of Fiscal Year 1991.

Transmitted to YMPO the revised QA Audit Schedules (Rev. 1) for both internal and external audits planned for the remainder of Fiscal Year 1991.

R. Dann attended the Quality Assurance Manager meeting in Albuquerque, NM on March 5.



Lawrence Livermore National Laboratory

LLYMP9105085
May 9, 1991

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 - April 1991

Attached is the April 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,

A handwritten signature in cursive script that reads "Leslie Jardine".

Leslie Jardine
LLNL Technical Project Officer
for YMP

LJJ/EC/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
APRIL 1991 TECHNICAL HIGHLIGHTS AND STATUS REPORT

TABLE OF CONTENTS

1.2.1 Systems

- WBS 1.2.1.1 Management and Integration (Ballou)
- WBS 1.2.1.2.4 Systems Engineering Implementation (Revelli)
- WBS 1.2.1.2.6 YMP Support to MSIS (Ruffner)

Performance Analyses (Chesnut)

- WBS 1.2.1.4.2 Waste Package Performance Assessment (Chesnut)

Geochemical Modeling

- WBS 1.2.1.4.5 Geochemical Modeling & Database Development (Wolery/Johnson)
- WBS 1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses (Carrigan)

1.2.2 Waste Package

- WBS 1.2.2.1 Management and Integration (Ballou)

Waste Package Environment (Wilder)

- WBS 1.2.2.2.1 Chemical & Mineralogical Properties of the Waste Package (Wilder)
- WBS 1.2.2.2.2 Hydrologic Properties of Waste Package Environment (Buscheck)
- WBS 1.2.2.2.3 Mechanical Attributes of the Waste Package Environment (Blair)
- WBS 1.2.2.2.4 EBS Field Tests (Lin)

Waste Form & Materials Testing (Stout/Clarke)

- WBS 1.2.2.3.1.1 Waste Form Testing - Spent Fuel (Stout)
- WBS 1.2.2.3.1.2 Waste Form Testing - Glass (Bourcier)
- WBS 1.2.2.3.2 Metal Barriers (McCright)
- WBS 1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models (ten Brink)
- WBS 1.2.2.3.4.2 Thermodynamic Data Determination (Silva)

Engineering & Systems Analyses (Ruffner/Clarke)

- WBS 1.2.2.4.1 Waste Package Design (Ruffner)
- WBS 1.2.2.4.2 Container Fabrication & Closure Development (Clarke)
- WBS 1.2.2.4.3 Container/Waste Package Interface Analysis (Ruffner)

1.2.5 Regulatory and Institutional

- WBS 1.2.5.2.1 NRC Interaction Support (Blink)
- WBS 1.2.5.2.2 Site Characterization Program (Ballou)
- WBS 1.2.5.2.4 Technical Support Documentation (Blink)
- WBS 1.2.5.2.5 Study Plan Coordination (Ballou)
- WBS 1.2.5.2.6 Semi-Annual Progress Reports (Blink)

1.2.9 Project Management

- WBS 1.2.9.1.1 Management (Jardine)
- WBS 1.2.9.1.4 Records Management (Bryan)
- WBS 1.2.9.2 Project Control (Podobnik)
- WBS 1.2.9.3 Quality Assurance (Dann)

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

APRIL 1991

EXECUTIVE SUMMARY

(Items Proposed for Reporting in YMPO or OGD Reports)

1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

Water table response calculations were completed to support a manuscript to be submitted to a refereed journal. This effort involved rewriting and carrying out additional supporting calculations of water table response to earthquakes. These calculations also support the paper by C. Carrigan entitled "Models of Water Table Excursions Induced by Seismic and Volcanic Events at Yucca Mountain, Nevada" that will be presented at the Spring American Geophysical Union Meeting on May 29 in Baltimore, MD. Work continued on the organization of the special session at AGU entitled "The Potential of Tectonism and Volcanism for Producing Significant Excursions of the Water Table". The AGU and the American Institute of Physics have expressed a desire to have a press conference on the topic of this session during the meeting.

1.2.2.2 Waste Package Environment

Hydrologic Properties of the Waste Package Environment

Work was done on integrating the various hydrological modeling studies into a comprehensive conceptual and theoretical framework of the thermo-hydrological features and processes which are critical to repository performance. This theoretical framework has been developed into a graphical presentation. Requests for copies of this presentation have come from YMPO, Golder Associates, and the NRC.

1.2.2.3 Waste Form and Materials Testing

Waste Form Testing - Spent fuel

The drybath oxidation tests at PNL continue to operate without a problem. Four samples at 195°C have been continuously monitored to determine delta (O/M). At selected O/M values, ~100 mg samples have been removed for future examination. As of April 19, the tests have been operating for ~430 hours. Other spent fuel samples are running at 175°C in concurrent tests to determine the activation energy of oxidizing front propagation. Ceramographic sample preparation may start as early as next week.

Waste Form Testing - Glass

A sample of vapor hydrated WV 50 glass was analyzed using Analytic Electron Microscopy (AEM). The purpose of this examination was to characterize the Ca, Th, phosphate phase formed in the reacted layer and compare the phase with that found in the material filtered from the liquid in the N3 tests. The phase that formed in the hydrated layer matched well with brockite. This matches the phase found on the filter, which suggests that the material in solution is a result of degradation of the reacted layer rather than reprecipitation from solution. The importance of this finding is that brockite is an americium sink, and is the source of americium detected in the N3 test solutions.

1.2.1 SYSTEMS

1.2.1.1 Management and Integration

Technical and management staff prepared for the June 1991 YMPO audit of LLNL-YMP.

1.2.1.2.4 Systems Engineering Implementation

Two draft Change Requests are in preparation:

- 1) to create a separate WBS element to support the development/maintenance of the thermochemical (GEMBOCHS) database and
- 2) to add LLNL to WBS 1.2.1.3.4 for the associated technical database management computer support.

A data dictionary for the LLNL thermochemical database was prepared and submitted to YMPO for consideration in developing the Project's Parameter Dictionary.

M. Revelli represented LLNL at the Technical Database Handbook meeting at SAIC on April 16 and participated in the Technical Data Advisory Group meeting in Las Vegas on April 17-18.

1.2.1.2.6 YMP Support to Management Systems Improvement Strategy

LLNL staff continued to support the MSIS ESF Mission and Functional Analysis activity. On April 8-12, staff attended the MSIS meeting in Las Vegas where the issue logic diagrams and ESF test descriptions were completed. On April 16-19, staff participated in the Phase II "kickoff" meeting of the ESF Functional Analysis group in Washington, D.C.

1.2.1.4.2 Waste Package Performance Assessment

Staff participated in the YMP Performance Assessment Review Meeting held in Las Vegas, April 2-3. The purpose was to present FY91 progress to date and to summarize plans for the remainder of the year. T. Buscheck presented the paper entitled "Nonequilibrium Fracture-Matrix Flow, Part I: Implications for Radionuclide Transport". J. Nitao presented the paper entitled "Nonequilibrium Fracture-Matrix Flow, Part II: Impact on Radionuclide Transport". The radionuclide transport calculations covered in J. Nitao's talk have been recently conducted with the use of LLNL's flow and transport simulator. W. Bourcier presented a summary of the LLNL glass performance model.

The following paper was presented at the International High Level Radioactive Waste (IHLRW) Conference in Las Vegas, April 29-May 2:

"Preliminary Calculations of Release Rates from Spent Fuel in a Tuff Repository" by W. O'Connell.

1.2.1.4.5 Geochemical Modeling and Database Development

A user guide to satisfy the documentation requirements of NUREG-0856 is being prepared for each of the three codes in the EQ3/6 package: the EQPT data file preprocessor, the EQ3NR speciation-solubility code, and the EQ6 reaction-path code. These will correspond to the software as released in Version 3245.1090. The EQPT manual is completely new, and the EQ3NR manual is a major revision of a version published in 1983. The EQ6 manual has been previously reviewed using LLNL procedures, and it is being revised in response to reviewer comments and code changes made after the document was submitted for review.

Continued development of a software interface between GEMBOCHS and the GT geochemical modeling code. This project involves collaboration with the Glass Waste Form Testing Task.

Continued restructuring of GEMBOCHS and DOOUT that will facilitate generation of composite databases for the EQ3/6 package based on alternate suites of basis and auxiliary basis aqueous species.

Began modification of the LLNL local filing system for controlling and tracking the evolution of database software products to achieve conformance with guidelines described in TIP-YM-11 (Software Configuration Management System), which was approved during March.

1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

Water table response calculations were completed to support a manuscript to be submitted to a refereed journal. This effort involved rewriting and carrying out additional supporting calculations of water table response to earthquakes. These calculations also support the paper by C. Carrigan entitled "Models of Water Table Excursions Induced by Seismic and Volcanic Events at Yucca Mountain, Nevada" that will be presented at the Spring American Geophysical Union Meeting on May 29 in Baltimore, MD. Work continued on the organization of the special session at AGU entitled "The Potential of Tectonism and Volcanism for Producing Significant Excursions of the Water Table". The AGU and the American Institute of Physics have expressed a desire to have a press conference on the topic of this session during the meeting.

1.2.2 WASTE PACKAGE

1.2.2.1 Management and Integration

Revised FY91 workscopes for the PNL tasks were submitted by PNL to LLNL. Comments received from LLNL were incorporated and the revised Statement of Work (SOW) was submitted to LLNL. The SOW contains an expanded workscope for each of the three tasks corresponding to direction received from LLNL in January. The revised program deliverables, cost, and schedule will be incorporated into these tasks when funding arrives at PNL in May.

Technical and management staff prepared for the June 1991 YMPO audit of LLNL-YMP.

W. Clarke participated in the DOE EBS Workshop planning meeting held in Las Vegas on April 25.

1.2.2.2 Waste Package Environment

Chemical and Mineralogical Properties of the Waste Package Environment

The new heat capacity, entropy and standard chemical potential for end member components of clinoptilolite have been given to the database group to generate a new DATA0 and DATA1. The effects of accounting explicitly for water of hydration will be judged by comparing EQ3/6 results using the new data with runs made using the current data.

Hydrologic Properties of the Waste Package Environment

The revised version of the Hydrology Chapter of the Near Field Environment Report was completed. The original version of this chapter has been modified and the first draft is about to be released as a paper by T. Buscheck, J. Nitao and D. Chesnut entitled "The Impact of Hydrology on the Engineered Barrier System of the Potential Yucca Mountain Repository Site".

Work was done on integrating the various hydrological modeling studies into a comprehensive conceptual and theoretical framework of the thermo-hydrological features and processes which are critical to repository performance. This theoretical framework has been developed into a graphical presentation. Requests for copies of this presentation have come from YMPO, Golder Associates, and the NRC.

T. Buscheck is reviewing the paper entitled "T&MSS Implementation Plan for Developing and Implementing a Method for Early Evaluation of Site Suitability". T. Buscheck and J. Nitao are developing a modeling and site characterization strategy to support the repository license application which will be presented to the M&O contractor next month.

T. Quinn and J. Nitao ported LLNL's flow and transport simulator to the Open Computing Facility (OCF). Performance timing tests were run on this simulator on both the OCF version as well as the version on the National Energy Research Supercomputing Center (NERSC). The performance of the OCF and NERSC versions were found to be similar. Because this simulator heavily utilizes the C programming language, the superior C programming environment of the OCF prompted us to set up OCF accounts for J. Nitao, T. Quinn and T. Buscheck.

The following four papers were presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Laboratory Determined Suction Potential of Topopah Spring Tuff at High Temperatures" by W. Daily.

"Microwave Measurements of the Water Content of Bentonite" by V. Latorre.

"Theory of Matrix and Fracture Flow Regimes in Unsaturated, Fractured Porous Media" by J. Nitao.

"Variation of Permeability with Temperature in Fractured Topopah Spring Tuff Samples" by W. Lin.

W. Lin attended the Sample Overview Committee (SOC) meeting in Chicago on April 9.

Mechanical Attributes of the Waste Package Environment

Completed a revised draft of Study Plan 8.3.4.2.4.3 and circulated it for internal review.

EBS Field Tests/ESF Test Design

The following paper was presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Yucca Mountain Near Field Environment Considerations for Engineered Barrier System Design and Performance" by D. Wilder.

W. Lin attended ESF meetings in Las Vegas on April 18 (site selection), April 23 (test planning package) and at NTS (Yucca Mountain) on April 11.

1.2.2.3 Waste Form and Materials Testing

Waste Form Testing - Spent fuel

Work continued on the Waste Form Characterization Report.

The drybath oxidation tests at PNL continue to operate without a problem. Four samples at 195°C have been continuously monitored to determine delta (O/M). At selected O/M values, ~100 mg samples have been removed for future examination. As of April 19, the tests have been operating for ~430 hours. Other spent fuel samples are running at 175°C in concurrent tests to determine the activation energy of oxidizing front propagation. Ceramographic sample preparation may start as early as next week.

Following approval of the test plan and two technical procedures in March, a Readiness Review at PNL was completed, and experimental work on Flow Through Dissolution of Spent Fuel was started in April. Spent fuel samples of ATM-103 were obtained from the Materials Characterization Center at PNL and used to load three flow through columns for room temperature dissolution testing. One of the columns was loaded with fuel fragments 1 - 3 mm in size; the other two columns were loaded with individual fuel grains (10 to 30 μm in size) prepared by crushing and screening the fuel followed by washing to remove the very fine subgrain

particles. Dilute carbonate/bicarbonate solutions are being pumped through the columns at flow rates of about 0.2 mL/min. Samples of column effluent are collected periodically and analyzed for uranium. Some of the effluent samples will also be analyzed for fission products such as ^{137}Cs and ^{90}Sr .

In addition to the spent fuel testing, unirradiated UO_2 pellets supplied by LLNL were crushed, screened, and washed (to remove the fine powder) at PNL to produce particles in the 44 to 105 μm size range for flow through testing. A portion of this material was returned to LLNL. The purpose is to provide identical test material for comparison of the slightly different flow through testing methods being employed for the spent fuel tests at PNL and the UO_2 tests at LLNL.

Several flow through cells have been loaded at LLNL with UO_2 and schoepite and preliminary rates of dissolution are being obtained. A common UO_2 sample is being shared between PNL and LLNL to ensure that measurements at both laboratories are comparable.

Initial difficulties in stabilizing the dissolution solutions containing carbonate have been resolved with the help of calculations by C. Bruton. An atmosphere containing specific concentration of CO_2 (depending on the particular solution composition) will be used hereafter.

The following two papers were presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Spent Fuel Waste Form Characteristics: Grain and Fragment Size Statistical Dependence for Oxidation Response" by R. Stout.

"Spent Fuel Waste Form Characteristics: Grain and Fragment Size Statistical Dependence for Dissolution Response" by R. Stout.

Completed peer review of ORNL report "Characteristics of Potential Repository Wastes", DOE/RW-0184 Rev. I, Vol. 1.

The paper by H. Leider, S. Nguyen, R. and H. Weed entitled "Estimation of the Time for Total Dissolution of Spent Fuel Under Unconstrained Conditions" is in internal review.

Waste Form Testing - Glass

The N2 tests (SRL actinide-doped glass) continued as scheduled with no sampling period occurring this month. These tests have now been in progress for 272 weeks. The N3 tests (ATM-10, a West Valley actinide-doped glass) continued as scheduled. The tests have been in progress for 190 weeks. The approved Activity Plan controlling both sets of tests was received at ANL and is being implemented.

A sample of vapor hydrated WV 50 glass was analyzed using Analytic Electron Microscopy (AEM). The purpose of this examination was to characterize the Ca, Th, phosphate phase formed in the reacted layer and compare the phase with that found in the material filtered from the liquid in the N3 tests. The phase that formed in the hydrated layer matched well with brockite. This matches the phase found on the

filter, which suggests that the material in solution is a result of degradation of the reacted layer rather than reprecipitation from solution. The importance of this finding is that brockite is an americium sink, and is the source of americium detected in the N3 test solutions.

W. Bourcier attended the Program Review for High-Level Waste Technology Development Activities in Washington, D.C. on April 10-11. On April 9, he met with ANL personnel to discuss plans for glass model development and related glass testing.

W. Bourcier met with A. Barkatt (Catholic Univ. of America), J. O'Keefe and S. Alterescu (NASA Goddard) on April 19 to discuss their experimental work on tektite dissolution behavior. Their work showed the strong effect of magnesium in slowing down the rate of dissolution of both tektite and nuclear waste glasses. More work will be performed to determine the mechanism for the reduction in reaction rate. Some work to characterize the reacted glass surfaces from future tests may be performed at LLNL and ANL.

The following two papers were presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Disposal of Vitriified Waste in an Unsaturated Environment" by J. Bates.

"Mechanistic Interpretation of Glass Reaction: Input to Kinetic Model Development" by W. Ebert:

Abstracts were submitted to two upcoming professional meetings. The paper "Prediction of Long-Term Release Rates of Radionuclides from Nuclear Waste Glass" was submitted to Chemistry and Migration Behavior of Actinides and Fission Products in the Geosphere at the Migration '91 meeting to be held in Jerez, Spain, October 28-30; the paper "Recent Progress in Model Development for Nuclear Waste Glass Dissolution" was submitted to the Focus 91 meeting on Nuclear Waste Packaging to be held in Las Vegas on September 29-October 2.

Container Materials Modeling and Testing

A combined meeting was held on April 26 with the Performance Analyses Technical Area to discuss modeling and modeling needs.

The following three papers were presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"An Electrochemical Approach to Predicting Corrosion Performance of Container Materials" by D. McCright.

"Degradation Mode Surveys of High Performance Candidate Container Materials" by G. Gdowski.

"Gaseous Release of Carbon-14: Why the High Level Waste Regulations Should be Changed" by R. Van Konynenburg.

Integrated Radionuclide Release

Data reduction of depth profiling analysis of U, Th ion implant continued as part of the calibration effort. Discrepancies in the results were resolved when discussions

with the laboratory that provided the implants indicated that differing implant procedures were used in some of the samples.

Received the final report "Residence Times of Radium, Thorium and Lead in J-13 Well at the Nevada Test Site" by S. Copenhaver, S. Krishnaswami, K. Turekian, and H. Shaw and closed the subcontract with Yale University.

The following paper was presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Effects of Heterogeneity on Actinide Distribution Rates in Tuff Rock" by M. Buchholtz ten Brink, D. Phinney, and D. Smith.

Thermodynamic Data Determination.

The americium (III) hydrolysis measurements have been completed.

A paper on the high temperature Guided Wave spectrometer and the results from the investigation of the praesodymium acetate system was presented at the ANS International Topical Conference on Methods and Applications of Radioanalytical Chemistry II. An article in The Journal of Radioanalytical and Nuclear Chemistry will result from this meeting. Praesodymium, a non-radioactive stand-in for americium, was used in the development stages of the high temperature spectrometer.

J. Rard submitted the selected technetium data for review by the NEA.

1.2.2.4 Design, Fabrication, and Prototype Testing

Waste Package Design

No significant activities.

Container Fabrication and Closure Development

No significant activities.

Container/Waste Package Interface Analysis

Work continued on alternate EBS design concept descriptions in preparation for the DOE EBS workshop in Denver, June 16-18.

1.2.5 REGULATORY AND INSTITUTIONAL

NRC Interaction Support

Staff members prepared for and gave a presentation on Natural Hydrothermal Analogs at the Nuclear Waste Technical Review Board meeting on Natural and Archaeological Analogs held in Reno, NV on April 16-17, 1991. The presentation reviewed the need to carry out a natural analog study, the approach to the study, and an overview of potential analog sites in the Taupo Volcanic Zone in New Zealand.

Site Characterization Program

Staff addressed comments made by the State of Nevada on the SCP.

LLNL continued to support the Early Site Suitability Evaluation task, participated in the April 17-18 meeting in Las Vegas, and prepared for the May 1 "Methodology Review".

Technical Support Documentation

No significant activities.

Study Plan Coordination

Received LANL Study Plan 8.3.1.3.1.1 "Groundwater Chemistry Model of Yucca Mountain" for review.

Semi-Annual Progress Reports

The Progress Report (PR) covering October 1, 1990 to March 31, 1991 was submitted to YMPO on April 15. Clarification responses were submitted to YMPO on April 29.

1.2.9 PROJECT MANAGEMENT

1.2.9.1 Management

Technical presentations were given at a LLNL-YMP staff meeting:

- 1) Ray Stout gave a talk on the Waste Form Characterization Report.

LLNL-YMP staff made formal presentations to the M&O staff on April 8-9.

L. Jardine and L. Younker presented a proposed FY92 work scope to C. Gertz and other senior YMPO staff members on March 22. The presentation emphasized the importance of the disturbed zone to MGDS performance and a strategy to develop a successful license application.

L. Jardine discussed disposal of naval reactor spent fuel with INEL staff in a meeting at YMPO on April 12.

L. Jardine participated in the Strategic Principles Workshop on April 3-4 in Denver, CO.

L. Jardine participated in the OGD Information Exchange with Edison Electric Institute (EEI)/U-Waste in Las Vegas on April 10-11.

L. Jardine, D. Emerson and S. Sprague participated as hosts for the YMP Open House Tour held at NTS on April 20.

T. Quinn attended the first meeting of the Software Advisory Group for YMP in Las Vegas. This group, which was initiated by a YMP Software Quality Assurance Workshop recommendation earlier this year, completed its charter and prioritized its assigned tasks. Its immediate goal is to review Section 19 of the QARD and to recommend any changes which could have an immediate impact on improving the Software Quality Assurance Plans of the Participants.

J. Blink participated in the QA Grading Workshop on April 2-3 and 16-19 in Las Vegas. He acted as Master of Ceremonies for the presentation of workshop results to M. Blanchard and D. Horton. He also participated in the action-plan follow-up meetings during the last week of April.

The following two papers were presented at the IHLRW Conference in Las Vegas, April 29-May 2:

"Yucca Mountain Site Characterization Project Waste Package Plan" by D. Harrison-Geisler, L. Jardine and R. Morissette.

"Uncertainty Analysis of Preclosure Accident Doses for the Yucca Mountain Repository" by C. Ma, D. Miller, S. Zavoshy and L. Jardine.

1.2.9.2 Project Control

Submitted the April FTE Report and the Cost Plan to YMPO. The Worker Data Report for January through March 1991 was also submitted to YMPO.

Submitted the 1993 LLNL Institutional Plan.

Reviewing PACS network milestones and analyzing impacts of constrained budgets for FY92 and FY93.

Analyzing YMPO Performance Measurement Baseline and LLNL PACs database to determine differences and make modifications as required.

Expanding workscope descriptions of summary accounts in outyears.

1.2.9.3 Quality Assurance

Conducted Internal Audit 91-09, "Performance Analyses", on April 25-26.

Transmitted to YMPO the revised LLNL-YMP Qualified Suppliers List dated April 9.

Completed and distributed:

- 1) QP 033-YMP-QP 3.0, Rev. 2, "Scientific Investigation Control",
- 2) Change Notices QP 2.8-1-2, "Quality Assurance Grading",
- 3) QP 2.1-2-3, "Preparation, Approval & Revision of Procedures, Requirements, Plans, Quality Assurance Program Description"
- 4) QP 3.4-2-1, "Scientific Notebooks".

QAPP Change Notice 033-YMP-R 1.0-0-4, "Organization", was forwarded to YMPO for approval.

Transmitted to YMPO external Audit Report LLNL-YMP 91-12 "LLNL Engineering Measurements and Analysis Section" and LLNL-YMP 91-13 "LLNL Electronic Services Group".

DOE conducted a surveillance at LLNL on April 8 - 10.

DOE conducted an Audit Scoping Meeting at LLNL on April 10-11 for a scheduled June 1991 audit. On April 22, staff members provided M. Mitchell of YMPO with information on the status of technical activities (in-house vs. contractor, QA vs. preliminary, ongoing vs. planned). This information will be used to determine the scope of the technical portion of the June 3-7 YMPO audit of LLNL-YMP.

R. Dann attended the ASME Code Meeting in Washington on April 22-25.