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

Reply to:
301 E. Stewart Ave., #203
Las Vegas, NV 89101

Tel: (702) 388-6125

TO: Joseph Holonich, Director, HLPD, M/S 4 H 3

FROM: Sr. On-Site Licensing Representatives Office, Las Vegas

DATE: APRIL 20, 1993

SUBJECT: OFFICE OF GEOLOGIC DISPOSAL (OGD) WEEKLY HIGHLIGHTS FOR THE WEEK ENDING APRIL 9, 1993 and YUCCA MOUNTAIN SITE OFFICE (YMSO) FIELD ACTIVITY REPORT FOR THE WEEK ENDING APRIL 2, 1993

Please find enclosed the above-referenced reports.

There is nothing requiring specific management attention in the reports.

cc: w/enc.: Charlotte Abrams, M/S 4 H 3
Rosetta Virgilio, M/S 3 D 23
Dean Kunihiro, Region 5

JSP:nan
Enclosures as stated

NOTE TO CHARLOTTE: Also enclosed please find a REECo Status Report (March '93) and the March Project Status Report for LLNL's participation in the YMP

102
WM-11
NH03

9304260112 930420
PDR WASTE
WM-11 PDR

**Department of Energy**
Yucca Mountain Site Characterization
Project Office
P. O. Box 98608
Las Vegas, NV 89193-8608

WBS 1.2.9.2
QA: N/A

APR 1 4 1993

Lake H. Barrett, Acting Director, Civilian Radioactive Waste Management, HQ (RW-1) FORS

OFFICE OF GEOLOGIC DISPOSAL (OGD) WEEKLY HIGHLIGHTS FOR THE WEEK ENDING APRIL 9, 1993

I. CRITICAL ITEM STATUS - YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP)

A. Site Characterization Planning

Field Operations

The Site Manager and Field Operations Center staff participated in and provided logistical support for four major tours this reporting period.

On April 6, 1993, the Site Manager issued the job package (JP) authorization letter for JP 92-17, which is drilling for Borehole UZ-14. It is planned for Reynolds Electrical & Engineering Co., Inc. (REECo), to commence drilling operations using the LM-300 drill rig on or about April 8, 1993.

The Site Manager issued a work authorization letter on April 6, 1993, for REECo to perform work at Borehole UZW WT-7. This is for the removal of a steel tape stuck in the borehole.

On JP 92-20, Exploratory Studies Facility (ESF) North Portal Pad and Facilities, REECo is mobilizing to start drilling and blasting operations on or about April 7, 1993. REECo is continuing the grouting and surveying. As of April 3, 1993, they had drilled one periphery hole with several more to go.

Sample Management Facility

Processing of core and cuttings from UZN-61, UZN-62, and NRG-3 has been completed.

One box of core samples from UZ-16 was shipped to Los Alamos National Laboratory (Los Alamos).

A total of 81.4 feet of core drilled in UE25 NRG-3 was logged and sampled. The total depth is 330 feet.

Reconnaissance was performed by the drilling support geologist to locate large blocks of densely-welded Topopah Springs Tuff for Colorado School of Mines drill bit testing.

A draft ESF Consolidated Sampling Plan is being prepared.

Work continued on the geophysical cross section including USW UZ-14 to determine subsurface geological conditions.

A total of 120 boxes of core from UZ-16, NRG-2, and NRG-6 was laid out for examination by the U.S. Geological Survey (USGS) and Sandia National Laboratories (SNL).

The staff is preparing for the upcoming U.S. Department of Energy (DOE) Quality Assurance (QA) audit.

Regulatory Interactions

Issue Resolution

The next meeting of the Issue Resolution Steering Group is scheduled for May 4, 1993, from 8 a.m. to 10 a.m. Topics for discussion will include information gained from the U.S. Nuclear Regulatory Commission (NRC)/DOE management meeting on May 3, 1993. The meeting will be a videoconference between the Yucca Mountain Site Characterization Project Office (YMPO) and Civilian Radioactive Waste Management System Management and Operating Contractor's (CRWMS M&O) facilities in Vienna, Virginia.

Mined Geologic Disposal System (MGDS) Annotated Outline (AO)

Revision 2 of the MGDS AO was transmitted to DOE/Headquarters (HQ) and YMPO via InfoSTREAMS for review and comment. YMPO comments are due April 7, 1993.

Site Characterization Progress Report (PR)

Input for PR 8 has been received by YMPO; and CRWMS M&O is compiling the initial draft, which is due to YMPO for preliminary review on April 30, 1993. The final draft PR 8 will be submitted for review by DOE/HQ and the participants on May 7, 1993.

Technical Analysis

The Technical Analysis Branch personnel participated in a "dry run" for the Nuclear Waste Technical Review Board (NWTRB) Full Board Meeting to be held in Reno, Nevada, April 21-22, 1993.

The performance assessment management team met to discuss budget and schedule issues in Las Vegas, Nevada.

ESF Task Force Activities

A milestone was met on April 2, 1993, when excavation of the Tunnel Boring Machine (TBM) Launch Chamber began. The following milestones represent the near-term plan for ESF activities:

| | |
|---|---|
| Award TBM Contract | April 1993 |
| Award Subcontract for Underground Construction | June 1993 |

The 50 percent management and technical reviews are scheduled to begin on April 12, 1993, for Package 1B, and on April 19, 1993, for Package 2.

Site Characterization Plan (SCP)/Study Plan (SP) Status

No new SPs were approved this week.

STUDY PLAN BREAKDOWN

| | |
|---|---|
| In Screening Review | 0 |
| In YMPO Review | 3 |
| Awaiting Comment Resolution | 12 |
| Awaiting Author Revision | 4 |
| In YMPO Verification Audit | 4 |
| Preparing to Submit or Awaiting YMPO Approval | 1 |
| Awaiting Submission to the NRC | 1 |
| NRC Phase 1 Review | 16 |
| NRC Acceptance | 40 |
| Total | 81 |

SCP/SP Status:

| | |
|---|---|
| Total SPs Assigned to Cover 106 Studies | 104 |
| SPs Not Yet Submitted for Review | 36 |
| SPs Submitted for Initial Review | 68 |
| Revised SPs Submitted for Review | 6 |
| Revised ESF SPs Submitted for Review | 7 |
| Total SPs Submitted for Review | 81 |

State of Nevada Comments Status:

| | |
|---|---|
| Received Comments from the State of Nevada ..... | 19 |
| Responses Transmitted to the State of Nevada ..... | 12 |

NRC Comments Status:

| | |
|---|---|
| Received Comments from NRC ..... | 19 |
| Responses Transmitted from OGD to DOE/HQ ..... | 18 |

B. Project Planning and Control

A Cost/Schedule Change Request (C/SCR) was prepared adding carryover capital equipment funding to the fiscal year 1993 Cost/Schedule Baseline.

A letter from Vincent Iorii, YMPO, to participant Technical Project Officers was prepared regarding the importance of accurate reporting of accrued costs on the monthly Cost/Full-Time Equivalent Report. This data is extremely important to the analysis of funding requirements.

Changes were made to the work breakdown structure in the Planning and Control System (PACS) as required by approved C/SCRs and new Planning & Scheduling accounts were created.

The schedule for the revision of the PACS System Description has been completed to include the determination of writing assignments and their required completion date.

C. QA Implementation

YMPO Audit YMP-93-09 was performed April 5-9, 1993, covering QA Program Elements 1, 2, 5, 6, 8, 12, 13, and 17. The audit was conducted by four auditors, including the audit team leader. Seven observers from NRC, Office of QA, State of Nevada, and county were present.

The Yucca Mountain Quality Assurance Division (YMQAD) staff provided general review comments to the Office of Civilian Radioactive Waste Management (OCRWM) for Quality Assurance Procedure (QAP) 5.1, "Quality Assurance Program Procedure," and QAP 6.2, "Document Review."

The YMQAD staff performed an applicability review of the Quality Assurance and Requirements Description versus YMPO Work Scope and updated the QA Requirements Matrix.

During the week, 15 Technical Directives were reviewed.

Quality (Q) List and Q-List Procedure Development

Implementation

The Deputy Project Manager continues review of the Early Classification of Natural Barriers (ECNB) evaluation package. Pending approval, a revision to the Q-List will be initiated. Revision of the Assessment Team (AT) Controlled List to incorporate references used in the ECNB effort continues.

Given approval of the evaluation package developed by the AT for the ESF Starter Tunnel (Drill and Blast Section) Determination of Importance (DIE), the AT is now working on a revision of the Q-List. The AT continues review of the Starter Tunnel Steel Arch DIE.

The AT is reviewing two Raytheon Services Nevada classification analyses on surface-based testing construction activities.

Pending approval of the Document Action Request to revise the AT Classification of Items Management Plan, the plan will be submitted to the Plans and Procedures Department for processing/review.

D. Public Outreach and Institutional Activities

On April 4, 1993, a "Family Day" was held at the Las Vegas Yucca Mountain Information Office. Todd Kaish, CRWMS M&O, provided a nuclear energy presentation and several external speakers gave various presentations and answered questions about fossil fuels, gas, hydro, nuclear, geothermal and wind power. The day was designed to provide learning and fun activities for students and their families. Approximately 70 people attended.

A general project overview presentation was given by Doug Bradford, Technical and Management Support Services (T&MSS), to 25 members of the Lion's Club on April 8, 1993, in Las Vegas.

Willis Clarke, Larry Ramspott, and Thomas Buscheck, all from Lawrence Livermore National Laboratory (LLNL), gave various presentations to 15 students and two professors at the Nuclear Engineering Department of the University of California, Berkeley, April 6-8, 1993. Also, Willis Clarke briefed the Danville, California, Kiwanis Club on the YMP.

Two tours to Yucca Mountain, Nevada, were conducted on April 6, 1993: one for 40 guests of Desert Newcomers, including some media from Japan; and one for Barry Gale and Andrew Gray of DOE/HQ. Another tour was conducted on April 7, 1993, for 10 guests from Mineral County. The IEA staff accompanied the guests from Mineral County.

The IEA staff attended meetings with Lincoln County staff in Caliente, Nevada, and Pioche, Nevada, on April 6, 1993.

## II. ANALYSIS & VERIFICATION DIVISION

Review of the MGDS AO was completed and the review comments were submitted to RW-30 on April 7, 1993.

The staff participated in the "dry run" April 5-6, 1993, in Las Vegas in preparation for the upcoming NWTRB Full Board Meeting. They participated in the Implementation Integration Meeting at DOE in Washington, D.C., on April 6, 1993.

### MGDS

The staff reviewed Predecisional Draft II-A of the Civilian Radioactive Waste Management System Interface Specification and provided comments to RW-22. They also reviewed Draft 5A of QAP 5.1 and provided comments to YMPO for RW-20 consolidation.

The Implementing Line Procedure 1.4/YMPO-Q was reviewed and comments were forwarded to Robert Barton, YMPO.

The draft Repository Program Convergence paper has been completed.

### Occurrence Reporting Processing System (ORPS)

The staff attended the March 31, 1993, ORPS Overview Presentation to key YMP personnel for ESF construction.

## III. GENERAL INFORMATION ITEMS

### LLNL

The V-TOUGH input files were forwarded to other participants who will run code-to-code benchmark calculations as a means of partially validating LLNL's extended dry calculations.

Los Alamos

June Fabryka-Martin reported that Purdue University performed chlorine-36 analyses that were within two standard deviations of those obtained by LLNL and the University of Rochester, providing confidence in the reliability and reproducibility of the analyses over a wide range of concentrations. All five samples on which background levels were monitored showed acceptable and reproducible chlorine-36 results.

June Fabryka-Martin obtained chlorine-36 analyses for 14 rock samples from neutron access boreholes UZN-11, UZN-37, and UZN-53 in the Paintbrush nonwelded unit. The chlorine-36 levels varied from about half the meteoric value to bomb-pulse levels. These results are being confirmed. Chlorine-36 analyses were obtained for two shallow rock samples from UZN-55 to ascertain if shallow samples were as contaminated as those located at a depth of 165 to 265 feet. The results were well above meteoric background levels, although not as high as for deeper samples, probably because of dilution of the high signal by the higher in-situ chloride content of these near-surface samples.

SNL

An SNL surveillance on the construction monitoring activities in the North Ramp Starter Tunnel was completed. Controls required for initiating site work activities were examined and the readiness to begin work was assessed.

USGS

Calibration of the magnetic susceptibility and magnetometer logging tools was carried out at the Denver Federal Center. The logging truck was moved to Las Vegas in preparation for logging of Borehole UZ-16. Repair of the Jake brake was required in Las Vegas.

Site preparation for hydraulic testing has been completed at the Raymond, California, quarry site. An area was leveled, road and culvert construction was completed, and office trailers were moved in and set up. This site, if funded under the DOE International Program, will be used to test equipment and techniques that will be used in C-well testing at Yucca Mountain.

IV. UPCOMING EVENTS CALENDAR

Please note that the usage of "(P)" in the calendar indicates that the event is open to the public. Educational presentations and State and Public Interactions are coordinated by the Speakers Bureau; contact Jacqueline Brandt at (702) 794-7896 or Theresa Hirsch at (702) 794-7759 for additional information. Exhibits and Public Update Meetings are coordinated by Joanna Magruder at (702) 794-7056, and Tours are coordinated by Carleen Hill at (702) 794-7375.

| Date | Event | Location | YMPO Contact |
|---|---|---|---|
| A. DOE/HQ Meetings | | | |
| Friday, April 16 | Followup to Quarterly for CRWMS M&O and OCRWM | Vienna, VA Televideo | C. Gertz |
| B. CRWMS M&O/DOE Meetings | | | |
| Friday, April 30 | CWRMS M&O Program Review | Las Vegas, NV | C. Gertz |
| C. Internal and DOE Nevada Field Office (DOE/NV) Meetings | | | |
| Wednesday, April 21 | DOE/NV Monthly Program Review | Las Vegas, NV | C. Gertz |
| D. NRC Interactions | | | |
| Monday, May 3 | Management Meeting on Topical Report (P) | Las Vegas, NV | T. Bjerstedt |
| Monday, May 17 | Technical Exchange - Program Planning and Integration (P) | Video-Conference | L. Desell T. Bjerstedt |
| Tuesday, May 18 | Technical Exchange - OCRWM Technical Baseline Documents (P) | Video-Conference | L. Desell T. Bjerstedt |
| Tuesday-Wednesday, May 25-26 | NRC Site Visit (P) | Las Vegas, NV | T. Bjerstedt |
| Monday, June 7 | NRC Management Meeting for Interactions Scheduling (P) | Las Vegas, NV | T. Bjerstedt |

| Date | Event | Location | YMPO Contact |
|---|---|---|---|
| D. NRC Interactions (Continued) | | | |
| Tuesday, June 8 | Technical Exchange - Geophysics Integration (P) | Las Vegas, NV | T. Bjerstedt |
| Wednesday, June 9 | Technical Exchange - Volcanism (P) | Las Vegas, NV | T. Bjerstedt |
| Wednesday, July 28 | Technical Exchange - ESF Title II Design (P) | TBD | T. Bjerstedt |
| E. NWTRB Interactions | | | |
| Monday April 19 | NWTRB Environment and Public Health Panel - Site Tour (P) | Las Vegas, NV | J. Cooper |
| Wednesday-Thursday, April 21-22 | NWTRB Full Board Meeting (P) | Reno, NV | J. Cooper |
| May TBD | NWTRB Environment and Public Health Panel (P) | Las Vegas, NV | J. Cooper |
| Tuesday-Saturday, June 1-12 | NWTRB International Trip | TBD | J. Cooper |
| Monday-Thursday, July 12-15 | NWTRB Full Board Meeting (P) | Denver, CO | J. Cooper |
| Tuesday-Friday, October 19-22 | NWTRB Full Board Meeting (P) | Las Vegas, NV | J. Cooper |
| F. Advisory Committee on Nuclear Waste (ACNW) Interactions | | | |
| Wednesday-Thursday, May 19-20 | ACNW 54th Meeting (P) | Bethesda, MD | A. Gil |

| Date | Event | Location | YMPO Contact |
|---|---|---|---|
| F. ACNW Interactions (Continued) | | | |
| Wednesday-Thursday, July 21-22 | ACNW 56th Meeting (P) | TBD | A. Gil |
| Wednesday-Thursday, August 25-26 | ACNW 57th Meeting (P) | TBD | A. Gil |
| Wednesday-Thursday, September 22-23 | ACNW 58th Meeting (P) | TBD | A. Gil |
| Wednesday-Thursday, October 27-28 | ACNW 59th Meeting (P) | Las Vegas, NV | A. Gil |
| Monday-Tuesday, November 22-23 | ACNW 60th Meeting (P) | TBD | A. Gil |
| Wednesday-Thursday, December 15-16 | ACNW 61st Meeting (P) | TBD | A. Gil |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions | | | |
| Saturday, April 10 | Girl Scouts Geology Workshop | Las Vegas, NV | E. Harle |
| Monday, April 12 | Cactus Water & Energy Conservation Society | Las Vegas, NV | P. Standish |
| Monday, April 12 | Valley High School | Las Vegas, NV | J. Blink |
| Monday, April 12 | REECo Teacher Partnership Workshop | Las Vegas, NV | J. Hartley |
| Tuesday, April 13 | Media Day Event | Las Vegas, NV | C. Gertz |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions (Continued) | | | |
| Tuesday, April 13 | Burkholder Middle School | Henderson, NV | J. Blink |
| Wednesday, April 14 | Sandy Valley Elementary | Sandy Valley, NV | A. Gil |
| Thursday, April 15 | Centel Managers Group | Las Vegas, NV | P. Standish |
| Thursday, April 15 | Teamsters Local 14 | Las Vegas, NV | K. Beall |
| Thursday, April 15 | Sandy Valley Elementary | Sandy Valley, NV | J. Blink |
| Thursday, April 15 | American Nuclear Society(ANS)/ American Society of Mechanical Engineers | New York, NY | C. Gertz |
| Thursday, April 15 | Fay Herron Elementary | North Las Vegas, NV | J. Hartley |
| Thursday, April 15 | George Harris Elementary | Las Vegas, NV | T. Kaish |
| Friday, April 16 | Mt. Charleston Elementary | Mt. Charleston, NV | J. Cooper |
| Friday, April 16 | Tonopah Elementary | Tonopah, NV | J. Blink |
| Monday, April 19 | Charlotte Hill Elementary School | Las Vegas, NV | J. Blink |
| Monday, April 19 | Orr Junior High School | Las Vegas, NV | A. Gil |
| Tuesday, April 20 | Burkholder Middle School | Henderson, NV | K. Olsson<br>T. Pysto |
| Wednesday, April 21 | Pahrump Lion's Club | Pahrump, NV | P. Carmack |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions (Continued) | | | |
| Thursday, April 22 | DOE 20th Annual Science Now | Las Vegas, NV | A. Robison |
| Saturday, April 24 | Boy Scouts Atomic Energy Merit Badge Workshop | Las Vegas, NV | E. Harle |
| Sunday, April 25 | Yucca Mountain Lecture Series (P) | Pahrump, NV | R. Arnold |
| Monday, April 26 | OCRWM Fellowship Student Conference | Las Vegas, NV | C. Gertz |
| Monday, April 26 | U.S./Canada Bilateral Conference | Las Vegas, NV | C. Gertz |
| Monday, April 26 | REECo Teacher Partnership Workshop | Las Vegas, NV | R. Arnold<br>M. Pendleton |
| Tuesday, April 27 | Yucca Mountain Lecture Series (P) | Las Vegas, NV | R. Arnold |
| Tuesday, April 27 | Little Skull Mountain Plenary Session | Las Vegas, NV | C. Gertz |
| Wednesday, April 28 | Ruthe Deskin Elementary | North Las Vegas, NV | R. Arnold |
| Thursday, April 29 | Orr Junior High School | Las Vegas, NV | R. Arnold |
| Thursday, April 29 | High-Level Waste (HLW) Conference | Las Vegas, NV | C. Gertz |
| Friday, April 30 | Twin Lakes Elementary | Las Vegas, NV | T. Kaish |
| Friday, April 30 | Mt. Charleston Elementary | Mt. Charleston, NV | T. Geer |
| Friday, April 30 | Child Haven | Las Vegas, NV | R. Arnold |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions (Continued) | | | |
| Tuesday, May 4 | Underground Structures, Colorado School of Mines | Golden, CO | C. Gertz |
| Wednesday, May 5 | University of Washington | Seattle, WA | P. Standish |
| Thursday, May 6 | Nevada Power Company | Las Vegas, NV | C. Gertz |
| Thursday-Friday, May 6-7 | Roy Martin Middle School | Las Vegas, NV | A. Gil |
| Saturday, May 8 | Girl Scouts | Las Vegas, NV | T. Pysto |
| Saturday, May 8 | Boy Scouts Atomic Energy Merit Badge Workshop | Las Vegas, NV | E. Harle |
| Monday, May 10 | Mt. Charleston Elementary | Mt. Charleston, NV | A. Gil |
| Tuesday, May 11 | Lomie Heard Elementary | Las Vegas, NV | R. Arnold |
| Friday, May 14 | Orr Junior High School | Las Vegas, NV | A. King |
| Monday, May 17 | Green Valley Kiwanis Club | Henderson, NV | A. Robison |
| Monday, May 17 | Conference of Radiation Control Program Directors | San Francisco, CA | C. Gertz |
| Wednesday, May 19 | International Right of Way Association | Las Vegas, NV | G. Fasano |
| Wednesday, May 19 | Sunrise Acres | Las Vegas, NV | K. Grassmeier |
| Friday, May 21 | Burkholder Junior High School | Las Vegas, NV | J. Blink |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions (Continued) | | | |
| Saturday, May 22 | President's Tea of the Sunrise Council (PTA) | Henderson, NV | E. Harle<br>A. Gil |
| Sunday, May 23 | Yucca Mountain Lecture Series (P) | Beatty, NV | J. Weigand |
| Tuesday, May 25 | Yucca Mountain Lecture Series (P) | Las Vegas, NV | J. Weigand |
| Wednesday, May 26 | Sandy Valley Elementary | Sandy Valley, NV | J. Cooper |
| Thursday, May 27 | American Business Women's Association | Las Vegas, NV | J. Younker<br>B. Reilly |
| Monday, June 14 | Rapid Excavation & Tunneling Conference | Boston, MA | C. Gertz |
| Wednesday, June 16 | Palo Verde Generating Station | Phoenix, AZ | G. Fasano<br>E. Harle |
| Sunday, June 20 | Vanishing Desert Greater Opportunity Group | Las Vegas, NV | A. Gil |
| Sunday, June 20 | Yucca Mountain Lecture Series (P) | Pahrump, NV | W. Dixon |
| Tuesday, June 22 | Yucca Mountain Lecture Series (P) | Las Vegas, NV | W. Dixon |
| Wednesday, July 7 | University of California, Santa Barbara | TBD | C. Gertz |
| Monday, August 2 | U.S. Council on Energy Awareness Energy Information Centers | Chicago, IL | C. Gertz |

| Date | Event | Location | Speaker |
|---|---|---|---|
| G. State and Public Interactions (Continued) | | | |
| Tuesday, August 17 | 1993 American Institute of Chemical Engineers Summer National Meeting | Seattle, WA | C. Gertz |
| Tuesday-Friday, August 17-20 | Second International Mixed Waste Symposium | Baltimore, MD | C. Gertz |
| Friday, September 10 | Public Gas Service Gas Company | TBD | C. Gertz |
| Sunday, September 26 | Children's Discovery Museum | Las Vegas, NV | R. Arnold |
| Monday-Wednesday, September 27-29 | Industrial & Engineering Chemistry Division Symposium | Atlanta, GA | C. Gertz |
| Monday-Friday, November 15-19 | ANS | San Francisco, CA | C. Gertz |

| Date | Event | Location |
|---|---|---|
| H. Exhibits Scheduled | | |
| Thursday-Sunday, April 15-18 | Clark County Fair (P) | Logandale, NV |
| Sunday-Wednesday, April 18-21 | B&W Fuel Company Industry Conference | Williamsburg, VA |
| Saturday, April 24 | Public Open House (P) | Las Vegas, NV |
| Saturday, April 24 | Earth Day/Earth Fair | Las Vegas, NV |

| Date | Event | Location |
|---|---|---|
| H. Exhibits Scheduled (Continued) | | |
| Sunday-Wednesday, April 25-28 | American Association of Petroleum Geologists | New Orleans, LA |
| Monday-Friday, April 26-30 | International High-Level Radioactive Waste Management Conference | Las Vegas, NV |
| Tuesday, May 4 | American Nuclear Energy Council (ANEC) | Washington, DC |
| Monday, May 10 | Public Update Meeting (P) | Beatty, NV |
| Tuesday, May 11 | Public Update Meeting (P) | Las Vegas, NV |
| Thursday, May 13 | Public Update Meeting (P) | Reno, NV |
| Wednesday, May 19 | Public Open House (P) | Las Vegas, NV |
| Wednesday-Friday, May 19-21 | Geological Society of America 1993 Combined Cordilleran & Rocky Mountain Section Meeting | Reno, NV |
| Saturday, June 19 | Public Open House (P) | Las Vegas, NV |
| Saturday, July 24 | Public Open House (P) | Las Vegas, NV |
| Saturday, August 21 | Public Open House (P) | Las Vegas, NV |
| Saturday, September 25 | Public Open House (P) | Las Vegas, NV |

| Date | Event | Escorts |
|---|---|---|
| I. Tours Scheduled | | |
| Tuesday, April 13 | Kenny Guinn Junior High School | TBD |

| | Date | Event | Escorts |
|---|---|---|---|
| I. | Tours Scheduled | (Continued) | |
| | Wednesday, April 14 | Orr Junior High School | TBD |
| | Thursday, April 15 | Project Property Administrators | P. Rodgers |
| | Friday, April 16 | Our Lady of Las Vegas | TBD |
| | Friday, April 16 | University of Nevada, Reno-Mackey School of Mines | M. Powell |
| | Monday, April 19 | NWTRB | TBD |
| | Tuesday, April 20 | Round Mountain High School | TBD |
| | Friday, April 23 | OCRWM Field Test Teachers | TBD |
| | Saturday, April 24 | Public Open House (P) | Various Escorts |
| | Monday, April 26 | HLW Conference | TBD |
| | Monday, April 26 | Hydrology Field Trip | A. Flint |
| | Tuesday, April 27 | HLW Conference Spouses | TBD |
| | Thursday, April 29 | Lander County | C. Binzer |
| | Saturday, May 1 | Teacher Workshop and Occidental College | M. Powell<br>A. Gil |
| | Monday May 3 | Institute of Shaft Drilling Technology | TBD |
| | Wednesday, May 5 | USGS Headquarters | B. Craig |

| | Date | Event | Escorts |
|---|---|---|---|
| I. | Tours Scheduled | (Continued) | |
| | Thursday, May 6 | Pahrump Junior High | TBD |
| | Monday, May 10 | Los Alamos | TBD |
| | Monday, May 10 | DOE Contractor Classification Officers Meeting | TBD |
| | Friday, May 14 | National Association of Regulatory Utility Commissioners | TBD |
| | Wednesday, May 19 | Public Open House (P) | Various Escorts |
| | Saturday, June 19 | Public Open House (P) | Various Escorts |
| | Monday, June 21 | Girl Scouts Wider Opportunity Program | TBD |
| | Saturday, July 24 | Public Open House (P) | Various Escorts |
| | Tuesday, August 17 | Senior Tripsters | TBD |
| | Saturday, August 21 | Public Open House (P) | Various Escorts |
| | Saturday, September 25 | Public Open House (P) | Various Escorts |

for Carl P. Gertz
Project Manager

YMP:VFI-3628

**Department of Energy**
Yucca Mountain Site Characterization
Project Office
P. O. Box 98608
Las Vegas, NV 89193-8608

APR 13 1993

WBS: 1.2.7.3
QA: N/A

Carl P. Gertz, Project Manager, YMP, NV

YUCCA MOUNTAIN SITE OFFICE (YMSO) FIELD ACTIVITY REPORT

The following are the significant field activities for the week ending April 2, 1993:

1. <u>Field Operations Center, (YMSO)</u>

   A. <u>Management and Administration</u>

      a. The Site Manager and FOC staff participated in and provided operational and logistical support to several tours conducted during this period. These were: Eureka/White Pine Counties; Local Talk Show Hosts and French Rad Waste Regulatory Agency Representatives.

      b. The Site Manager prepared and issued the JP Authorization Letter for JP 93-03, Construction of Access Road and Drill Pad for Borehole UE25 NRG-5.

      c. Provided operations, administrative, and security support to the Yucca Mountain Site Manager and his DOE staff.

      d. Provided operational and administrative support for site characterization activities in the field.

      e. Provided administrative support for issuing vehicles, first aid kits, fire extinguisher, and other necessary equipment to personnel performing field duty.

      f. Provided administrative, staffing, and logistical support for five (5) tours of YMP facilities.

      g. Prepared and transmitted daily operations reports to NORSOC, and the biweekly reports to HQ OCRWM.

      h. Staff Member attended ORPS Train-the-Trainer Course.

      i. Rewrote FOI 4705, "YMP Work Site and Area Access and Controls" to incorporate issuance of permits for temporary structures.

j. Issued Field Operating Permit for JP 92-17, Borehole USW UZ-14 Drilling and Testing.

k. Processed seven (7) Work Order Requests.

l. Initiated planing of office moves in the FOC, floor plan reviewed and area assignments made.

m. Directed taking of video and stills of LM300 drill rig move.

n. Completed camera stand/platform to support construction progress photography.

o. Completed final script for YMSO Monthly Activity Video report.

p. The Bullfrog Planning Commission continuing with development of data base for Facilities Management Program.

q. Attended Site Development Plan Committee meeting and discussed RSN's Trade Paper on common facility sitting.

B. Project Safety and Health, (DOE/SAIC)

a. Checked on Satellite Accumulation Area for Bldg 4522.

b. Began draft of S&H portion of Self-Assessment Implementation Plan, required by RW-1.

c. Continued to work on draft implementing line procedure "DOE Employee Safety and Health Program."

d. Continued REECo Safety & Health functional appraisal.

e. Attended monthly S&H Advisory Committee Meeting.

f. Prepared letter for Site Manager clarifying requirements for Mine Rescue team in Area 25.

g. Completed five surveillance: anti-whip connections on air and water hoses at ESF; 2 on USGS trailer complex top of Yucca Mountain; New worker locker facility; and collected dust samples at NRG-3.

h. Supported ongoing tours.

i. Occurrence Reports - two waiting for FM Signature.
   1. REECo - 10 outstanding: 2 awaiting FM Signature; 4 rejected (09/22/92, 03/18/93 and 2 on 03/22/93); and 4 10 day notification (12/28/92; 2/16/93/ 03/15/93; and 03/18/93.)
   2. SAIC - 2 outstanding; 2 awaiting PM Signature.

2. <u>Raytheon Services Nevada, (RSN)</u>

A. <u>Field Support</u>

a. Geologic mapping survey of Ghost Dance Fault, Phase II is scheduled for April 1993.

b. GSF test pits surveyed. Calaculations and plotting remain. Survey and calculations of percolation test boreholes are completed. MTL scheduled 4/5.

c. Survey for Geologic Mapping of North Portal Box Cut, Phase II and IV are complete, calculations remain.

d. Re-survey of trenches CF1 and T8 complete. Calculations remain.

e. Field alignment of LM-300 rig scheduled 4/1.

f. Survey of NRG-5 scheduled 4/1.

g. Survey NRG-2a borehole and grid north stake complete.

h. Issued six (6) Work Initiations in support of ongoing and upcoming job packages.

i. Field Engineering continues to check Trench 14, JP: 91-9 Rev. 3; 92-2; 92-5; 92-8; 92-12; 92-19; 93-01 and 92-20.

j. Field Engineering continues to check Trench 14, JP 91-2, daily to insure suitability for operations.

k. Survey crew continuing work on the Area 25 Survey Control Net.

B. <u>Quality Control</u>

a. Completed verification activities on NRG-3 borehole coring and reaming utilizing the CME-850 drill rig.

b. Completed verification activities on USW H-5 borehole cleanout and packer replacement.

c. Performed surveillance on Trenches in Stagecoach Road (SCR-T1; T2; T3) and in Crater Flats (SCF-T1; CF2; Trench 8).

d. Closed the following "Field Verification Plans" document packages and sent to RSN Records Coordinator:
   1. 92-015.0, Video Camera Surveying, UZ-16 Borehole.
   2. 92-014.0, Directional Surveying, UZ-16 Borehole.
   3. 92-028.0, Directional Surveying, NRG-6 Borehole.
   4. 92-029.0, Video Camera & Caliper Survey, NRG-6 Borehole.
   5. 92-029.0, Video Camera & Caliper Survey, NRG-2 Borehole.
   6. 92-013.0, Neutron Borehole Drilling, UZN-62.

3. <u>Sample Management Facility, (SMF/SAIC)</u>

a. Completed prognoses on SRG-1 and NRG-2a.

b. Completed processing core and cuttings from NRG-3, UZN-61 and UZN-62.

c. Continued work on geophysical cross section including UZ-14 to determine subsurface geological conditions.

d. Shipped 1 box of UZ-16 core samples to Los Alamos.

e. Prepared draft of ESF Consolidated Sampling Plan.

f. Laid out 120 boxes of core from UZ-16, NRG-2 and NRG-6 for examination by USGS and Sandia.

g. Reconnaissance to locate large blocks of Topopah Spring Tuff for Colorado School of Mines drill bit testing.

h. Preparing for upcoming QA audit.

4. <u>YMP Hydrologic Research Facility, (USGS)</u>

a. No report submitted.

5. <u>Reynolds Electrical and Engineering Co., Inc., (REECo)</u>

A. <u>Drilling</u>

a. JP 92-3, UZ-16, rigged, moved to UZ-14.

b. JP 93-11, work completed, rigged down and moved.

c. JP 93-01, UE 25 NRG-3, cored to 330 feet (total depth); capped and locked casing, set Cal-Seal plug on outside of 5 1/2" casing, rigging down.

B. Logistics

a. Continued requisitioning supplies, materials, and services for YMP Field Operations Center.

b. Supported tours during the week, and Open House Tour, 03/27.

c. Supported construction efforts in Area 25.

C. Construction

a. JP 92-20, ESF North Portal Pad and Facilities....REECo continued hauling sand to rock storage pad; continued grade work at ESF North pad; continued screening and placing rip rap at north drainage channel; continued installing portal support rock bolts and continued temporary water, air and electrical hook-ups at portal.

b. JP 93-03, Access Road and Drill Pad for NRG-5....REECo began topsoil removal from pad area and access road.

6. **Los Alamos National Laboratory, (LANL)**

a. Continued monitoring construction activities at the north portal box cut.

b. Attended briefing on mapping observation on North Portal given by USBR, to NRC personnel.

c. Escorted SNL; and JFT Agapito Assoc. to ESF North Portal Pad to obtain information to complete calculations that estimate particle velocity for blast monitoring instrument.

7. **Document and Records Center, (CRWMS M&O)**

a. Received and Issued the following Controlled Documents:

Job Packages

YMP/JP 93-03, Rev. 0, "Construction of Access Road and Drill Pad for Borehole UE25 NRG-5."

Test Planning Packages

TPP T-92-16, Rev. 0, "Borehole USW UZ-14 Drilling and Testing."

Specifications

YMP-025-9-SP08, Rev. 0, "Drill Pad and Access Road for NRG-5 Borehole."

Drawings

YMP-025-9-MING-MG211, Rev. 0, "Standard Drill Pad and Road Test Blast Layout."
YMP-025-9-CIVL-PL104, Rev. 0, "NRG-5 Borehole Site Plan."
YMP-025-9-CIVL-GP104, Rev. 0, "NRG-5 Borehole Grading Plan."
YMP-025-9-CIVL-PR104, Rev. 0, "NRG-5 Borehole Profile & Cross-sections.

Work Programs

YMP/WP/93-13, Rev. 0, "USW WT-7 Additional Work Activities."

FCRs

FCR 93/245, Rev. 0, "Switchgear Building Tenant Improvements."
FCR 93/246, Rev. 0, "Switchgear Building Tenant Improvements."
FCR 93/247, Rev. 0, "Switchgear Building Tenant Improvements."
FCR 93/258, Rev. 0, "Switchgear Building Tenant Improvements."
FCR 93/208, Rev. 0, "Revise ASTM Standard."
FCR 93/209, Rev. 0, "ASTM Method for Bulk Density of Riprap."
FCR 93/210, Rev. 0, "Revise ASTM Standard."
FCR 93/211, Rev. 0, "Revise ASTM Standard."
FCR 93/212, Rev. 0, "Modification of Paragraph 2.03, Common Fill, Section 02210."
FCR 93/228, Rev. 0, "Addition of Compaction Requirements to Specs."
FCR 93/215, Rev. 0, "Modification of Paragraph 2.03, Common Fill, Section 02210."
FCR 93/216, Rev. 0, "Addition of Compaction Requirements to Specs."
FCR 93/217, Rev. 0, "Additional Pipe Bedding Controls."

FCR 93/218, Rev. 0, "Modification of Paragraph 2.03, Common Fill, Section 02210."
FCR 93/219, Rev. 0, "Addition of Compaction Requirements to Specs."
FCR 93/220, Rev. 0, "Additional Pipe Bedding Controls."
FCR 93/221, Rev. 0, "Additional Pipe Bedding Controls."
FCR 93/222, Rev. 0, "Modification of Paragraph 2.03, Common Fill, Section 02210."
FCR 93/223, Rev. 0, "Modification of Paragraph 2.03, Common Fill, Section 02210."
FCR 93/265, Rev. 0, "Correction of Drawing and Spec Number Within JP 93-03."

b. Reproduction

17,220 pages copied.
720 drawings copied.

c. Documents Issued

1,737 controlled documents.
1,502 FCR's
100 DWG's
25 SPEC's
37 WP's
37 TPP's
36 JP's
1,150 information copies

d. DTAR Logoffs

227

8. . **Field Training, (SAIC)**

a. GET 1.1. (GERT) training was conducted. A total of 42 people attended.

b. GET 1.2, 1.3, and 1.4 training was conducted. A total of 9 people attended.

c. 30 GET 1.5 exams were administered. All examines passed.

d. Radiological Control Technician Testing was conducted for 10 personnel.

Winfred A. Wilson
Winfred A. Wilson
Site Manager

YMP:WAW-101

cc:
R. M. Cameron, CRWMS M&O/YMSO, Mercury, NV
M. D. Voegele, SAIC, Las Vegas, NV
R. R. Schneider, SAIC/YMSO, Mercury, NV
G. K. Beall, SAIC, Las Vegas, NV
C. L. Lugo, SAIC, Las Vegas, NV
C. J. Cotten, SAIC, Las Vegas, NV
I. R. Cottle, SAIC, Las Vegas, NV
G. D. Milligan, SAIC/YMSO, Mercury, NV
M. B. Blanchard, YMP, Las Vegas, NV
R. V. Barton, YMP, Las Vegas, NV
J. R. Dyer, YMP, Las Vegas, NV
S. B. Jones, YMP, Las Vegas, NV
D. R. Williams, YMP, Las Vegas, NV
J. T. Sullivan, YMP, Las Vegas, NV
R. B. Baumeister, YMP/YMSO, Mercury, NV
W. R. Tunnell, YMP/YMSO, Mercury, NV
R. J. White, YMP/YMSO, Mercury, NV
Phil Justus, NRC, Las Vegas, NV

bcc:
A. C. Bonk, REECo, Las Vegas, NV

**Reynolds Electrical & Engineering Co., Inc.**

Post Office Box 98521 • Las Vegas, NV 89193-8521

IN REPLY REFER TO:
580-01-355

WBS 1.2.9.1
QA: N/A

April 8, 1993

Carl P. Gertz, Project Manager
Yucca Mountain Site Characterization
Project Office
U.S. Department of Energy
Post Office Box 98608
Las Vegas, NV 89193-8608

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP) STATUS REPORT (SCP: N/A)

Attached is the March YMP Status Report for Reynolds Electrical & Engineering Co., Inc.'s participation in the YMP.

If further information is required, please contact Rene' R. Knott at 794-7193.

R. F. Pritchett, Manager
Yucca Mountain Project Division
YMP Technical Project Officer

RFP:RRK:mab

Enclosure
Status Report (3 pages)

cy: See page 2

**REYNOLDS ELECTRICAL & ENGINEERING CO., INC.**
**(REECo)**

**YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP)**

**MARCH 1993 - STATUS REPORT**

Reeco has no reportable Level 0 or Level 1 Milestones.

**SITE (1.2.3)**
WBS 1.2.3.2
Task: USGS Integrated Data Acquisition System (IDAS)

Continued support of IDAS to include technical support, equipment testing, maintenance and repairs.

WBS 1.2.3.5
Task: Capital Equipment to Support Drilling Programs

Additional Fiscal Year 1993 equipment consisting of an Area 25 Subdock Breakout Table, Dust Collector, Tubing Tongs and backup unit, and power spinners was requested in the Capital Equipment Requirement Plan.

Task: USW UZ-N62 Neutron Access Borehole (Job Package 91-9)

Completed drilling/coring operations at a total depth of 60 feet on March 10, 1993. Rigged down and returned equipment to the Area 25 Subdock.

Task: UE-25 UZ-16 Vertical Seismic Profile (VSP-2) (Job Package 92-3)

Completed drilling/coring operations at a total depth of 1686.16 feet on March 11, 1993. Rigged down the LM-300 rig and began mobilizing to UZ-14.

Task: NRG-6 North Portal Ramp Hole (Job Package 92-11)

Completed drilling/coring operations at a total depth of 1100 feet on March 4, 1993. Laid down tools and secured rig awaiting logging operations.

Task: UE-25 NRG-3 North Portal Ramp Borehole (Job Package 93-01)

Completed drilling/coring operations at a total depth of 330 feet on March 30, 1993. Laid down tools and secured rig.

Task: USW H-5 Additional Work Activities (Work Program 93-11)

Completed March 25, 1993. Moved rig and equipment to Area 25 Subdock.

Task: Procurement Actions
Awarded the following Request for Proposals (RFP): RFP 8-DH-93, Technical Support for Fishing Services; and RFP 9-DH-93, Technical Support Services for the LM-300.

**REGULATORY (1.2.5)**
WBS 1.2.5.2.4
Task: Site Characterization Plan (SCP) Reference Library and Database

Continued distribution and database maintenance for the SCP and Progress Reports. Distributed one SCP set during this reporting period.

**EXPLORATORY STUDIES (1.2.6)**
WBS 1.2.6.1
Task: Exploratory Studies Facility (ESF)

Continued administrative support for ESF activities to include planning, scheduling and management. Prepared and issued ten Technical Control Procedures, participated in the Environmental Compliance Audit, and participated in the CRWMS/M&O Underground Safety and Health Assessment.

Awarded the following RFPs: 6-DH-93, Trailers, 06/30/93 delivery; 10-DH-93, Tunnel Gate; 93-DH-93, Tunnel Girders, first delivery 4/9/93, the remainder to be shipped during the week of April 19, 1993. A vendor visit is scheduled April 2, 1993 to emphasize the importance of meeting the delivery schedule.

Issued the following RFPs: 7-DH-93, Tunnel Arch Structure, reissued March 29, 1993 with a April 9, 1993 closing date; and 11-DH-93, Concrete Aggregate issued March 23, 1993 with a April 1, 1993 closing date.

Closed RFP 12-VP-93, Rebar, on March 29, 1993; award is expected by April 2, 1993.

Task: Technical Support and Underground Excavation for the ESF (RFP 1-DH-92)

Contractor selected for the RFP is undergoing Government audit.

Task: Procurement of a Tunnel Boring Machine (RFP 2-DH-93)

This task is proceeding on schedule. The Technical Evaluation Team completed the technical evaluation and issued the final report ahead of schedule. Letters requesting revised proposals were sent to all Offerors with a suspense date of April 6, 1993. A letter was sent to DOE/NV concerning the use of progress payments as requested by all Offerors.

Task: ESF North Portal Pad & Facilities (Job Package 92-20)

Continued fill work at North ESF Portal Pad; completed Phase III and Phase IV at North ESF Boxcut including excavation, installation of rock bolts and wire mesh, and washdown at face and sides of boxcut for mapping; built temporary ramp to reach face of Starter Tunnel; began grouting rockbolts for the portal protection; completed temporary water, power, and air systems for starter tunnel utility support; continued excavating North ESF Drainage Channel; completed fine grading, installation of PVC liner, and hauling sand for liner protection at the Rock Storage Pad.

**TEST FACILITIES (1.2.7)**
Task: Field Operations Support

Continued logistical and tour support for DOE Yucca Mountain Site (YMSO) staff. Seventeen tours were held during this period with 784 people attending. Support included but was not limited to arrangements

for buses, registration of guests, coordination of lunches/beverages, medical service, furniture, and mechanical service. Continued preparations for upcoming tours.

Continued support services to participants; and maintenance of YMP utilized facilities, utilities, equipment and roads in Area 25. Commenced installation of new chiller unit and auxiliary units for Building 4015, Area 25 Field Operations Center.

**PROJECT MANAGEMENT (1.2.9)**
WBS 1.2.9
Task: Technical Project Office Management/Project Control

Continued normal administrative level of effort support. Continued status and update of Planning and Control System (PACS); supported ESF Construction activities, drilling activities and completed cost estimates as required.

**QUALITY ASSURANCE (1.2.11)**
WBS 1.2.11
Task: Quality Assurance

Continued normal administrative level of effort support. An internal QA audit was conducted of YMP Quality Control inspection activities. The audit resulted in two Corrective Action Reports regarding (1) training, qualification and certification, and (2) inspection documentation deficiencies.

**ENVIRONMENT, SAFETY & HEALTH (1.2.13)**
WBS 1.2.13
Task: Safety & Occupational Health

Provided medical, occupational safety, industrial hygiene and fire protection support.

Completed development of underground safety and health training program to be provided to any persons accessing the underground facility, including experienced and inexperienced workers, and visitors. Of the REECo inexperienced and experienced workers requiring training, 50% had completed training at period end. Training for the remainder of REECo personnel is on schedule for completion by April 9, 1993.

Provided support to Subcontractor, Environmental Technologies Inc. (ET), for the removal of oil stained soil. Completed backfill of excavation, stabilized and graded pad, graded and shaped access road. The subcontract was completed with ET removing 1884 tons of stained soil for remediation.

**SUPPORT SERVICES (1.2.15)**
WBS 1.2.15
Task: Administrative Support and Training

Continued to provide procurement, logistical, and information management administrative level of effort support; continued support services to various YMP participants. Staffed the Technical Information Display at the Waste Management '93 Symposium at Tucson, Arizona.

Lawrence Livermore National Laboratory

LLYMP9304035
April 8, 1993

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 1993
SCP: N/A

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 510-422-7854 or Jim Blink in Las Vegas at 702-794-7157.

Sincerely,

W. L. Clarke
LLNL Technical Project Officer
for YMP

WC/EC

cc:
Distribution

DISCLAIMER

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

Recycled

LAWRENCE LIVERMORE NATIONAL LABORATORY YUCCA MOUNTAIN PROJECT
MARCH 1993 TECHNICAL HIGHLIGHTS AND STATUS REPORT
TABLE OF CONTENTS


**1.2.1 Systems**

| | |
|---|---|
| WBS 1.2.1.1 | Systems Engineering Coordination and Planning |
| WBS 1.2.1.5 | Special Studies |
| WBS 1.2.1.6 | Configuration Management (Blink) |

**1.2.2 Waste Package**

| | |
|---|---|
| WBS 1.2.2.1 | Waste Package Coordination and Planning (Wilder) |
| WBS 1.2.2.2 | Waste Package Environment (Wilder) |
| WBS 1.2.2.2.1 | Chemical & Mineralogical Properties of the Waste Package Environment (Glassley) |
| 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 | Engineered Barrier System (EBS) Field Tests (Lin) |
| WBS 1.2.2.2.5 | Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment (Meike) |
| WBS 1.2.2.3 | Waste Form & Materials Testing (Stout/McCright) |
| WBS 1.2.2.3.1.1 | Waste Form Testing - Spent Fuel (Steward) |
| WBS 1.2.2.3.1.2 | Waste Form Testing - Glass (Bourcier) |
| WBS 1.2.2.3.2 | Metal Barriers (McCright) |
| WBS 1.2.2.3.3 | Other Materials (McCright) |
| WBS 1.2.2.3.4 | Integrated Testing (Viani) |
| WBS 1.2.2.3.4.1 | Integrated Radionuclide Release: Tests and Models (Viani) |
| WBS 1.2.2.3.4.2 | Thermodynamic Data Determination (Silva) |
| WBS 1.2.2.3.5 | Nonmetallic Barrier Concepts (McCright) |
| WBS 1.2.2.4 | Design, Fabrication, and Prototype Testing |
| WBS 1.2.2.4.3 | Container/Waste Package Interface Analysis |
| WBS 1.2.2.5 | Waste Package - Special Studies |

**1.2.3 Site Investigations**

| | |
|---|---|
| WBS 1.2.3.2 | Geology |
| WBS 1.2.3.2.1.2.1 | Natural Analogue of Hydrothermal Systems in Tuff (Glassley) |
| WBS 1.2.3.4 | Geochemistry (Glassley) |
| WBS 1.2.3.4.2 | Geochemical Modeling (Wolery) |
| WBS 1.2.3.10 | Altered Zone Characterization |

**1.2.5 Regulatory**

| | |
|---|---|
| WBS 1.2.5.2.2 | Site Characterization Program (Blink) |
| WBS 1.2.5.3.4 | Geologic and Engineering Materials Bibliography of Chemical Species (GEMBOCHS) (Johnson) |
| WBS 1.2.5.3.5 | Technical Data Base Input (Revelli) |
| WBS 1.2.5.4 | Performance Assessment (Halsey) |
| WBS 1.2.5.4.2 | Waste Package Performance Assessment (O'Connell/MacIntyre) |

**1.2.9 Project Management**

| | |
|---|---|
| WBS 1.2.9.1 | Management and Coordination (Clarke) |
| WBS 1.2.9.1.2 | Technical Project Office Management (Clarke) |
| WBS 1.2.9.2 | Project Control (Podobnik) |
| WBS 1.2.9.2.2 | Technical Project Office Management (Podobnik) |

**1.2.11 Quality Assurance**

| | |
|---|---|
| WBS 1.2.11.1 | Quality Assurance Coordination and Planning |
| WBS 1.2.11.2 | Quality Assurance Program Development |
| WBS 1.2.11.3 | Quality Assurance Verification |
| WBS 1.2.11.3.1 | Quality Assurance Verification - Audits |
| WBS 1.2.11.3.2 | Quality Assurance Verification - Surveillance |
| WBS 1.2.11.5 | Quality Assurance - Quality Engineering |

**1.2.12 Information Management**

| | |
|---|---|
| WBS 1.2.12.2.2 | Local Records Center Operation (LRC) (Bryan) |
| WBS 1.2.12.2.5 | Document Control (Bryan) |

**1.2.13 Environment, Safety and Health**

| | |
|---|---|
| WBS 1.2.13.1 | Environment, Safety and Health Coordination and Planning (Blink) |

**1.2.15 Support Services**

| | |
|---|---|
| WBS 1.2.15.2 | Administrative Support (Campbell) |
| WBS 1.2.15.3 | YMSCP Support for the Training Mission (Bryan) |

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

MARCH 1993

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

1) **1.2.2.2 (Waste Package Environment).** The Preliminary Near Field Environment Report, Vol. I and II, was approved by YMPO and will soon be available as an LLNL report. This completes Milestone T359.

2) **1.2.2.3.1.1 (Waste Form Testing - Spent Fuel).** An analysis of the test matrix from PNL's spent fuel dissolution tests shows a uranium dissolution dependence primarily on temperature and oxygen concentration. Carbonate concentration is less important. Existing data from LLNL's $UO_2$ dissolution tests show a similar relationship. The data from PNL and LLNL show pH as an insignificant factor under the alkaline conditions of these test matrices. Dissolution data under acidic conditions should be different, if only because of solubility differences.

3) **1.2.5.3.4 (Geologic and Engineering Materials Bibliography of Chemical Species - GEMBOCHS).** Three organic acids (formic, propanoic, and butanoic) were transferred to the auxiliary basis set of aqueous species in the SUPCRT92 and composite data subsets of GEMBOCHS. This transfer permits specification of the concentrations of these acids as input parameters for EQ3/6 calculations. A revised suite of thermodynamic datafiles (R19) was generated by D0OUT incorporating the aqueous-acid transfers.

4) **1.2.2.2.2 (Hydrologic Properties of the Waste Package Environment).** Work continued measuring electrical resistivity as a function of moisture content of Topopah Spring Tuff samples from U3hg-1 and GU-3 holes at room temperature, using J-13 water as pore fluid. The electrical impedance and high frequency electromagnetic tomography used in the laboratory and the field to monitor the distribution of moisture content in the tuffaceous rock depend on accurate laboratory measurements for their calibration. The electrical conductivity of partially saturated rocks is largely dependent on saturation level, fluid conductivity, and temperature. Thus far, electrical conductivity as a function of moisture content has been determined during both imbibition and drying cycles at 20°C on tuff samples for Area 3 and Area 25 NTS, Nevada using distilled water. Results indicate an exponential dependence of conductivity on water content (Sw) for both imbibition and drying cases. Hysteresis between the imbibition and drying cycles is observed for both rock types. The imbibition curve is more conductive than the drying curve between 20 and 70% Sw. Possible explanations of the hysteresis are changing ionic concentration or conducting mechanism in the pore fluid with changing saturation levels. Additional experiments using J-13 well water as the saturating fluid do not show any departure from the curves determined with distilled water during the imbibition cycle up to 30% saturation. The established

curves have successfully been used to determine saturation levels of a core sample used in a flow test.

5) **1.2.2.2.2 (Hydrologic Properties of the Waste Package Environment).** Calculations show that extending the model to more than 1 km below the water table does not affect the unsaturated zone (UZ) temperature on saturation distributions. Since the model assumes a perfect heat sink at its lower edge, a fast moving aquifer deeper than 1 km below the water table would not affect the UZ thermo-hydrological performance.

6) **1.2.2.2.5 (Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment).** Investigation activities into the stability and reactivity of organic materials have been initiated:

1) Planning of the initial experimental phases has been completed.
2) Lab facilities are in the final stages of completion.
3) The first phase of database evaluation for organic compounds that are liable to be introduced into the ESF and the potential radioactive waste repository and for which the thermodynamic and kinetic properties are not well established has been completed.

7) **1.2.2.2.2 (Hydrologic Properties of the Waste Package Environment).** Analytical and model calculations have been conducted for areal mass loadings (AMLs) of 27.1, 49.2 (the SCP-CDR) value, and 154.7 metrics tons of uranium per acre (MTU/acre) and for a range of bulk permeabilities, $k_b$, between $10^{-18}m^2$ (1 microdarcy) and $8 \times 10^{-10}m^2$ (840 darcy). The threshold for large-scale, buoyant, gas-phase convection dominance of the hydrological performance is in the 10-20 darcy range for 27.1 MTU/acre, and in the 1-5 darcy range for 49.2 MTU/acre. For 154.7 MTU/acre thermal buoyancy influences, but does not dominate, hydrological performance for $k_b$ <5 darcy. The signature for hydrological influence is a vertical asymmetry of the temperature profile. Thermal performance is significantly affected by buoyancy-driven flow for $k_b$ values 5 to 10 times higher than the threshold stated above. Convection effects are a balance between buoyancy-driven flow and boiling-induced pressures. Because the SCP-CDR design is marginally boiling, it is more affected by convection than are the lower and higher AMLs.

## 1.2.1 SYSTEMS ENGINEERING

### 1.2.1.1 Systems Engineering Coordination and Planning

No significant activities.

### 1.2.1.5 Special Studies

W. Clarke, J. Blink, D. Wilder, W. Halsey and W. Lin attended a Thermal Goals meeting in Denver, CO on March 24. Six LLNL staff members will participate in the ongoing exercise to review thermal goals as part of the thermal loading system study.

### 1.2.1.6 Configuration Management

Affected document notices (ADNs) were completed for CRs 92/110 and 92/149. No LLNL-controlled documents are affected.

## 1.2.2 WASTE PACKAGE

### 1.2.2.1 Waste Package Coordination and Planning

W. Lin attended the (SOC) Sample Overview Committee meeting at NTS on March 3.

B. Viani participated in the March Geochemistry Integration Task (GIT) teleconference meeting which focused primarily on the upcoming colloid workshop at LANL.

### 1.2.2.2 Waste Package Environment

The Preliminary Near Field Environment Report, Vol. I and II, was approved by YMPO and will soon be available as an LLNL report. This completes Milestone T359.

W. Clarke, D. Wilder, W. Halsey, T. Buscheck, W. Lin, W. Glassley, J. Blink, S. Blair, J. Nitao and D. Chesnut participated in the Committee for the Advancement of Science at Yucca Mountain (Casy) meeting hosted by USGS in Denver, CO on March 24-25. The topic of discussion was the extended dry concept. T. Buscheck gave a presentation entitled "The Impact of Repository Thermal Load on Hydrothermal Flow". W. Glassley gave a presentation concerning geochemical processes in the altered zone; the emphasis of the presentation was on the nature of processes that can be expected and that these processes will occur regardless of thermal load. An important conclusion from that meeting is that in situ heater testing is critically needed in assessing the ability of the Yucca Mountain site to safely contain and isolate spent nuclear fuel (SNF).

D. Wilder and D. Chesnut met with R. Levich (YMPO), G. Gustafson (Sweden) and several Swedish students on March 2 at NTS to discuss the construction and grouting meeting to be held in Sweden on March 30-April 1.

D. Wilder and W. Glassley attended the Loma Prieta earthquake seminar in San Francisco, CA on March 22-23.

#### 1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

Work on the New Zealand natural analog site continued, with a visit there the last week of March and the first week of April by two LLNL scientists to evaluate potential sites for conducting validation activities using EQ3/6.

Models of mineral evolution in the vicinity of waste packages were further developed. Consideration is being given to the development of a baseline set of

computations that will be used as a comparison for calculations involving flow and transport. The current calculations do not consider the role of moving water. Computations are also underway to further evaluate the effects of flow on the extent to which equilibrium may be achieved in the vicinity of waste packages.

A discussion was held to more fully coordinate activities between various project participants regarding coupling of geochemical and hydrological processes. A plan for experimental studies was developed that will address specific questions that relate to alteration associated with two-phase systems.

**1.2.2.2.2 Hydrologic Properties of the Waste Package Environment**

Study Plan 8.3.4.2.4.2, Rev. 0, "Laboratory Study of Hydrological Properties of the Near Field Environment" was reviewed at LLNL. The comment resolution is about 70% complete.

T. Quinn will be leaving her LLNL-YMP position as lead software engineer for V-TOUGH to accept a position as Division Leader in the Computations Department.

Model Calculations

T. Buscheck with the support of S. Daveler and T. Quinn continued analyzing the preliminary scoping calculations of the hydrothermal performance of the repository, using the new model which represents hydrothermal flow in the upper 1000 m of the saturated zone (SZ) as well as within the unsaturated zone (UZ). Calculations have addressed four general effects:

1) large-scale, buoyant, gas-phase convection,
2) the distance to the lower boundary in the UZ-SZ-repository-scale model,
3) binary gas-phase diffusion, and
4) the initialization of the model.

With respect to bulk permeability, $k_b$, and the impact that large-scale, buoyancy-driven gas-phase convection has on thermal performance and moisture redistribution, a wide range of $k_b$ have been considered; from $1.9 \times 10^{-18} m^2$ (1.9 microdarcy) to $8.3 \times 10^{-10} m^2$ (840 darcy). This wide range was considered in order to examine when convective effects dominate repository-driven heat flow. Hydrothermal performance for the $k_b$ values month were examined in the transition from intermediate to large values (1 to 40 darcy), particularly for low- to intermediate-areal mass loadings (AML) cases for which rock dry-out primarily occurs under sub-boiling conditions, including AMLs of 27.1 and 49.2 MTU/acre. Also considered were $k_b$s values of 1 and 5 darcy for a high AML (154.7 MTU/acre). The purpose was to identify the threshold $k_b$ where large-scale, buoyant, gas-phase convection begins to dominate hydrological performance and the threshold $k_b$ where this convection begins to dominate the thermal performance. J. Nitao also developed analytical expressions which determine these $k_b$ thresholds.

For 27.1 MTU/acre (30-yr-old SNF) and an areal power density (APD) of 20 kW/acre), $k_b$ values of $2.8 \times 10^{-13} m^2$ (280 millidarcy), $1.0 \times 10^{-11} m^2$ (10 darcy), $2.0 \times 10^{-11} m^2$ s (20 darcy), and $4.0 \times 10^{-11} m^2$ (40 Darcy) were considered. These values are well within the range of unpublished $k_b$ values estimated by E. Weeks for the UZ.

Depending on the number of SNF assemblies per waste package (WP), local boiling conditions may persist for some time even though average temperatures are well below boiling condensate (~60°C). For $k_b < 10$ darcy, large-scale, buoyant, gas-phase convection does not significantly redistribute liquid saturations; however, significant refluxing occurs with buoyant vapor flow being balanced by condensate drainage. For a $k_b$ of 10 darcy, condensate drainage cannot keep up with buoyant vapor flow, and regions of net dry-out and condensate buildup develop and persist for tens of thousands of years. With the use of the Equivalent Continuum Model (ECM) it cannot be determined whether this condensate flux results in nonequilibrium fracture flow down to the repository horizon. However, the potential for nonequilibrium condensate drainage exists even for situations which do not result in a noticeably redistribution of liquid saturation.

J. Nitao recently developed analytical expressions for repository-heat-driven hydrothermal flow. These expressions were used to determine the threshold $k_b$ at which large-scale, buoyant, gas-phase convection begins to dominate hydrological performance for a range of AMLs. For an AML of 27.1 MTU/acre, the threshold $k_b$ lies is in the range of 10 to 20 darcy. For an AML of 27.1 MTU/acre and a $k_b$ of 20 darcy, model calculations show a persistent condensate buildup above the repository horizon for tens of thousands of years. Therefore, the analytical determination of the threshold $k_b$ for repository-heat-dominated hydrological flow is corroborated by the model calculations.

With the analytical expressions, J. Nitao found that for a $k_b$ which is approximately 5 to 10 times the threshold for repository-heat-dominated hydrological flow, convective effects begin to dominate the temperature distribution. For an AML of 27.1 MTU/acre and a $k_b$ of 84 darcy, it was found that buoyant vapor flow has little effect on temperatures at the repository center but it begins to have a noticeable effect on far-field temperatures and repository edge temperatures. In general, convection on repository temperatures are first observed at the outer edge of the repository. For a $k_b$ of 168 darcy, it was found that the far-field temperatures are significantly perturbed by convection effects; however temperatures at the repository center are very similar to those of conduction-dominated heat flow. For a $k_b$ between 168 and 410 darcy, temperatures at the repository center depart significantly from conduction-dominated heat flow.

The analytical determination of the threshold $k_b$ at which temperatures are significantly affected by convective effects is corroborated by the model calculations. The factor of 5 to 10 difference between the two different threshold $k_b$ values indicates that in order for the hydrological (buoyant gas-phase) flow system to dominate heat flow generated by the repository, the repository-generated heat flow must have had a dominant impact on the hydrological flow system, including both liquid-phase and gas-phase flow. In general, more will be known about the repository temperatures than any other aspect of the thermo-hydrological system. Moreover, the magnitude of buoyant convective effects required to dominate the thermal performance at the repository horizon will be associated with a dramatic increase in liquid saturation above the repository and resultant condensate drainage and episodic infiltration flow at the repository horizon.

For the reference SCP-CDR thermal loading case 49.2 MTU/acre AML, (10-yr-old SNF and an APD of 57 kW/acre), $k_b$s of 2.8 x $10^{-13}m^2$ (280 millidarcy), $10^{-12}m^2$ (1 darcy), 5.0 x $10^{-12}m^2$ (5 darcy), $10^{-11}m^2$ (10 darcy), and 4.0 x $10^{-11}m^2$ (40 darcy) were considered. The large-scale buoyant gas-phase convection occurring in the 1 darcy case reduces the duration of the boiling period, $t_{bp}$, from 666 yr to 618 yr, relative to the 280 millidarcy case. The peak temperature at the center of the repository, $T_{peak}$, is only reduced from 100.3 to 100.0°C and t = 1000 yr, the temperature at the center of the repository is not affected. For the 5 darcy case, the effect of buoyant convection is to reduce $t_{bp}$ to 565, $T_{peak}$ is only reduced to 99.4°C, and t = 1000 yr, the temperature at the center of the repository is not affected. For the 10 darcy case, $t_{bp}$ is reduced to 417 yr, $T_{peak}$ is only reduced by 1.1°C, and t = 1000 yr, the temperature at the center of the repository is only reduced by 0.2°C. The large-scale buoyant gas-phase convection becomes more pronounced for the 40 darcy case, reducing $t_{bp}$ to only 173 yr, reducing $T_{peak}$ to 98.2°C, and t = 1000 yr, the temperature at the center of the repository is reduced by 5.1°C. B. Ross has conducted a calculation for a case with nearly the same AML (47.5 MTU/acre), with the primary differences being that he assumes 30-yr-old SNF, an APD of 35 kW/acre, and a $k_b$ of 50 darcy. At t = 1000 yr, Ross found that buoyant gas-phase convection reduced the temperature at the center of the repository by approximately 9.5°C, relative to the conduction-only calculation. When one takes into account that the Rayleigh number for the Ross calculation is approximately 25% greater than that applicable to the LLNL calculation, the two models are seen to be in reasonably good agreement. Moreover, the shape of the temperature curves predicted by the two different models are very similar.

For an AML of 154.7 MTU/acre, increasing $k_b$ from 280 millidarcy to 1 darcy does not affect $t_{bp}$ (11,446 yr). The effect of large-scale, buoyant gas-phase convection has a minor effect on the 5 darcy case, reducing $t_{bp}$ by 3.3% to 11,067 yr relative to the 280 millidarcy case. In contrast for the SCP-CDR thermal load, increasing $k_b$ from 280 millidarcy to 5 darcy has the effect of decreasing $t_b$ by 15.2%. The greater sensitivity of the SCP-CDR case to this range in $k_b$ is due to two effects. Because temperatures never significantly exceed boiling, small changes in temperature result in larger changes in $t_{bp}$. In general, thermal buoyancy occurs because elevated temperatures lighten the column of gas which is within the footprint of the repository. The cooler column of gas outside of the repository footprint is denser and therefore has a larger pressure at a given depth below the repository horizon. Consequently, cooler denser gas moves in, displacing the warmer less dense gas column. In addition to this thermal buoyancy effect, boiling raises pressures in the dry-out zone. This boiling-generated gas-phase pressure buildup increases with AML. This boiling-generated pressure buildup opposes the thermal buoyancy for some period of time. For the SCP-CDR, thermal loading boiling effects are somewhat limited in space and time, resulting in less suppression of thermal buoyancy than for a thermal loading with a thick, persistent boiling zone. Both analytical analyses and model calculations show that the hydrological impact of buoyant vapor flow is maximized for the SCP-CDR thermal load.

J. Nitao's analysis showed that for the SCP-CDR thermal load, the threshold $k_b$ at which repository heat dominates long-term hydrological performance is in the range of 1 to 5 darcy. Below this range of $k_b$, model calculations also show that $t_{bp}$ is not affected by large-scale, buoyant, gas-phase convection. The ECM model

calculations also show in the 1 to 5 darcy range that large-scale, buoyant vapor flow will result in a very large buildup in liquid saturation above the repository horizon persisting for 100,000 yr. (The ECM cannot model non-equilibrium drainage of this fluid). Persistent buoyant vapor flow and condensate drainage may result in nonequilibrium fracture flow at the repository horizon for tens of thousands of years. This repository-heat-driven condensate flux is potentially orders of magnitude greater than the infiltration of meteoric water. Using the ECM and the unpublished UZ $k_b$ data of E. Weeks, the condensate flux is orders of magnitude greater than infiltration fluxes that would be associated with pluvial conditions. It is possible that the rate limiting consideration for buoyant vapor flow may be the size of the rock matrix blocks and the gas-phase permeability of those blocks. LLNL is developing a dual porosity approach which will enable examination of the sensitivity of buoyant vapor flow to the matrix properties and condensate drainage.

The large-block test will provide critically important data of two-phase flow effects between fractures and matrix blocks. It is also critically important that in situ heater tests be conducted under sub-boiling conditions to determine the potential for nonequilibrium condensate drainage under low to medium AMLs and to better understand the post-boiling-period thermo-hydrological performance for high AMLs. Because of the magnitude of these potential repository-heat-driven effects and the impact of these effects on thermal loading decisions, it is imperative that the in situ heater tests be conducted as soon as possible.

LLNL's UZ-SZ-repository-scale calculations have assumed a constant temperature and constant pressure boundary 1 km below the water table. Calculations were repeated for AMLs of 27.1, 49.2, and 154.7 MTU/acre with a model in which the fixed temperature and pressure boundary is 7 km below the water table. Both models (1-km-thick and 7-km-thick SZs) yielded exactly the same thermo-hydrological performance in the UZ. It has been speculated that the lower paleozoic carbonate aquifer may have a very large lateral component of flow which would result in it acting as a temperature sink. The model results indicate that if this aquifer is located 1 km or more below the water table then it will have no effect on thermo-hydrological performance in the UZ. Further calculations will be investigated at what depth below the water table an aquifer which acts as a heat sink, would have an effect on the thermo-hydrological performance of the UZ.

In order to look at the effect of what is called "enhanced" binary vapor diffusion, several model calculations were repeated with different values of the tortuosity factor, t, for binary gas diffusion. Most of LLNL's previous calculations assumed a t of 0.2. Recently calculations considered a t of 1.0 for AMLs of 27.1, 49.2, and 154.7 MTU/acre and found that it had a negligible effect on temperatures at the repository edge and center. At the repository center, re-wetting back to ambient saturation was slightly enhanced, but re-wetting at the repository edge was somewhat retarded. In general, increasing t has a minor effect on stabilizing large-scale, buoyant vapor flow.

Most of LLNL's UZ-SZ-repository-scale calculations utilized a model which was based on a one-dimensional initialization. These calculations were repeated in which two-dimensional (R-Z) initialization for 10,000 yr before the introduction of

repository heat was tested. No difference was found in thermo-hydrological performance between the one- and two-dimensional initializations.

Laboratory Experiments

Work continued measuring electrical resistivity as a function of moisture content of Topopah Spring Tuff samples from U3hg-1 and GU-3 holes at room temperature, using J-13 water as pore fluid. The electrical impedance and high frequency electromagnetic tomography used in the laboratory and the field to monitor the distribution of moisture content in the tuffaceous rock depend on accurate laboratory measurements for their calibration. The electrical conductivity of partially saturated rocks is largely dependent on saturation level, fluid conductivity, and temperature. Thus far, electrical conductivity as a function of moisture content has been determined during both imbibition and drying cycles at 20°C on tuff samples for Area 3 and Area 25 NTS, Nevada using distilled water. Results indicate an exponential dependence of conductivity on water content (Sw) for both imbibition and drying cases. Hysteresis between the imbibition and drying cycles is observed for both rock types. The imbibition curve is more conductive than the drying curve between 20 and 70% Sw. Possible explanations of the hysteresis are changing ionic concentration or conducting mechanism in the pore fluid with changing saturation levels. Additional experiments using J-13 well water as the saturating fluid do not show any departure from the curves determined with distilled water during the imbibition cycle up to 30% saturation. The established curves have successfully been used to determine saturation levels of a core sample used in a flow test.

Work continued to investigate the different imbibition rates of water into a rock sample when the sample is either in a vapor environment or in liquid water. It was found that nucleation has no effect on the moisture retention in a capillary tube.

Work continued on an experiment to determine the effect of fracture surface coatings on the imbibition of water into the matrix. Eight Topopah Spring Tuff samples machined from outcrops from Busted Butte were prepared for this purpose. The determination of the mineralogy of the coating material, the pore-size distribution in the coating layers, and the porosity of the samples are in process.

Sample preparation for determining the moisture retention curve and one-dimensional imbibition at high temperatures continued. Work will soon start to prepare a fractured Topopah Spring Tuff sample from G-4 hole for a fracture healing study.

Meetings and Publications

The paper by T. Buscheck entitled "Repository-Heat-Driven Hydrothermal Flow at Yucca Mountain: Analysis and Testing" is in internal and YMPO review. After YMPO approval, it will be submitted to the Radioactive Waste Management and Nuclear Fuel Cycle Journal.

The abstract by J. Roberts and W. Lin entitled "The Effects of Water Saturation and Water Chemistry on the Electrical Conductivity of Topopah Spring Tuff" was approved by YMPO and will be presented at the American Geophysical Union meeting in Baltimore, MD on May 24-28.

### 1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

Initial scoping calculations were performed for the Large Block Test (LBT) using two different codes, FLAC a finite difference code and FRACROCK a boundary element code. A third code was acquired: HEFF, a boundary element, thermomechanical code.

Work started on the procurement and calibration of laboratory equipment for laboratory testing of fracture properties and rock damage analysis and for calibration of the LBT.

### 1.2.2.2.4 Engineered Barrier System (EBS) Field Tests

Study Plan 8.3.4.2.4.4, "Engineered Barrier System Field Tests" has completed internal technical review, and will be sent to YMPO next month.

S. Blair, J, Blink, W. Lin, and D. Wilder attended an ESF test consolidation meeting in Las Vegas with LANL, the M&O, YMPO and SNL on March 17.

Large Block Test (LBT)

The Scientific Investigation Plan for Large Block Testing of Coupled Thermal-Mechanical-Hydrological-Chemical Processes, SIP-NF-2, Rev. 0, completed internal review and was submitted to YMPO for approval. Internal QA grading for the LBT has been completed. W. Simecka (YMPO) signed the initiation form for the Test Planning Package. R. Oliver (LANL TCO) initiated contacts with SAIC and REECo to obtain environmental clearance and site clearing necessary to finalize the location of the LBT.

The preliminary moisture content of some small pieces of Topopah Spring Tuff from the Fran Ridge outcrop has been determined to be about 20 and 50%, with the smallest samples having the lowest moisture content. Work will continue to refine the moisture content determination. This information will be used in the design of the Large Block Tests.

The design of the loading frame has been finalized. Mechanical Engineering Department personnel are preparing fabrication drawings. A SANL has been issued for the procurement of SNL's service for cutting the block(s).

J. Blink, W. Lin, and D. Wilder met with the M&O at NTS on March 16 to discuss issues related to the LBT.

### 1.2.2.2.5 Characterization of the Effects of Man-Made Materials on Chemical & Mineralogical Changes in the Post-Emplacement Environment

Investigation activities into the stability and reactivity of organic materials have been initiated:

1) Planning of the initial experimental phases has been completed.
2) Lab facilities are in the final stages of completion.
3) The first phase of database evaluation for organic compounds that are liable to be introduced into the ESF and the potential radioactive waste repository and for which the thermodynamic and kinetic properties are not well established has been completed.

The white paper entitled "Chemical and Mineralogical Concerns For The Use Of Man-Made Materials In The Post-Emplacement Environment", by A. Meike, has been released as an LLNL report.

A letter has been sent to J. Younker (M&O) describing the man-made materials task in order to open a dialogue to pursue potential interfaces with activities being conducted by M&O.

Revision of the draft Man-made Materials Study Plan 8.3.4.2.4.5, continues.

## 1.2.2.3 Waste Form and Materials Testing

### 1.2.2.3.1 Waste Form

#### 1.2.2.3.1.1 Waste Form Testing - Spent Fuel

Revision 7 of the PNL QA plan was sent to LLNL for review and concurrence.

R. Fish (M&O) visited LLNL on March 23.

<u>Spent Fuel Dissolution</u>

The low-oxygen $UO_2$ dissolution experiments that are a part of the LLNL test matrix are continuing at LLNL. The very-low (0.2%) oxygen, room-temperature runs were finished this month. The equipment for the remaining low-oxygen runs has been installed in another laboratory and experiments will begin shortly.

An analysis of the test matrix from PNL's spent fuel dissolution tests shows a uranium dissolution dependence primarily on temperature and oxygen concentration. Carbonate concentration is less important. Existing data from LLNL's $UO_2$ dissolution tests show a similar relationship. The data from PNL and LLNL show pH as an insignificant factor under the alkaline conditions of these test matrices. Dissolution data under acidic conditions should be different, if only because of solubility differences.

The flow-through dissolution tests at PNL on ATM-106 fuel (PWR fuel with burnup ~48 MWd/kgM and fission gas release ~18%) in both oxidized (O/M ~2.4) and

unoxidized forms are in progress. Another specimen of ATM-106 fuel was converted to $U_3O_8$ by heating in air overnight at 425°C. Flow-through dissolution tests on this material will be started as soon as characterization work has been completed using x-ray diffraction (XRD), scanning electron microscopy (SEM) and surface area measurement.

W. Gray gave a presentation on spent fuel dissolution for the EBS meeting held March 31-April 1 at PNL.

Spent Fuel Oxidation

R. Einziger gave a presentation on spent fuel cladding and fuel oxidation for the EBS meeting held March 31-April 1 at PNL. R. Stout and W. Halsey (LLNL) attended the meeting. A preliminary model is being formulated to relate cladding failure with the rate of oxidation front propagation, with the time to clad splitting initiation, and with the amount of fuel oxidized to $U_3O_8$ as a function of container atmosphere and temperature. Results of the calculations will be reported next month.

Dry Bath Testing

Test instructions were prepared for initiation of the 255°C drybath test at PNL. A number of the samples of fuel at 130°C in bath 5 will be examined by ceramography and XRD to make sure there are no unanticipated results. Some of the samples from the drybath will be removed into drybath 7 running at the same temperature; other samples will be removed from the test completely and saved in stainless steel pipes for possible future use. After drybath 5 is completely empty, it will be operated at 255°C for a few weeks to determine its temperature stability. If the bath proves stable, it will be loaded with samples per the test plan addendum which was approved by LLNL and incorporated into Activity Plan D-20-45.

Thermogravimetric Apparatus (TGA)

B. Hanson, an OCRWM fellow from UC Berkeley, has joined the program to conduct fuel oxidation studies on the TGA and complete his Ph.D. dissertation. He is currently reviewing the oxidation literature, reading QA procedures and completing his required safety training. His first lab work will be to get the mothballed TGA's back into calibrated working condition and install the new data acquisition system. His first milestone is to prepare a test plan addendum for the TGA.

Materials Characterization Center (MCC) Hot Cell Activities

A meeting was held to brief DOE-RL on the status of disposal of the excess spent nuclear fuels currently occupying space in the PNL Bldg. 324 hot cells. PNL is currently identifying which fuel samples will be needed for OCRWM research activities.

### 1.2.2.3.1.2 Waste Form Testing - Glass

D-20-27 Unsaturated Testing of WVDP and DWPF Glass

The N2 tests (SRL actinide-doped glass) continue with no sampling period occurring this month. These tests have been in progress for 364 weeks. The N3 tests (ATM-10, a West Valley actinide-doped glass) continue and have been in progress for 282 weeks.

A validated model for predicting borosilicate glass dissolution rates must successfully simulate results from a variety of test types. This is being done for the SRL-202 glass using results from closed system tests with surface area to volume (SA/V) ratios from 10 to 20,000/m and from flow-through tests with varying flow rates. Results from measurements of surface charge, atomic electron microscopy (AEM) of reacted surface layers, and nuclear magnetic resonance (NMR) spectra of reacted and unreacted glasses also help constrain the model. The kinetic model has been modified to relate the surface charge rather than pH using data from the surface titrations. The form of the affinity term in the rate equation has been modified to better predict long-term reaction rates in high SA/V tests.

The abstract by W. Bourcier, S. Carroll, B. Phillips (LLNL), J. Bates and W. Ebert, (ANL) entitled "Modeling 202-SRL Glass Dissolution: Combined Constraints from Varying SA/V, Flow-Through, Surface Titration, AEM, and NMR Experiments" was approved by YMPO and will be presented at the American Ceramic Society meeting in Cincinnati, OH, April 18-22 .

### 1.2.2.3.2 Metal Barriers

D. McCright met with R. Fish and K. McCoy from the M&O on March 23-24 to discuss the status of the Metal Barrier work. Technical activities, schedules, and projected budgets were discussed. At the meeting, it was agreed that the present Scientific Investigation Plan (SIP) for this task is out-of-date. The present SIP dates from 1989 and reflects the interest of the YMP at that time to focus on a thin-walled container fabricated from a single material, which is the YMP Conceptual Design (CD). Since that time, other design concepts have been introduced, and these other designs involve materials not currently being considered for the YMP-CD. The SIP therefore needs revision to incorporate activities to support designs that will be considered during the Advanced Conceptual Design (ACD) phase. A draft of the revised SIP is planned for submission to YMPO in August 1993.

D. McCright has been in contact with D. Diercks and J. Bates from ANL to restart work on crack propagation under YMP sponsorship. The work had been sponsored by the YMP during the 1998-91 period, but budget reductions in 1991 forced curtailment of YMP sponsorship. The work at ANL originally included slow strain rate tests and crack propagation tests on the conceptual design candidate materials to determine their relative stress corrosion cracking resistance under repository-relevant conditions. The resistance of Alloy 825 tested under creviced conditions by the slow strain technique in simulated J-13 well water was an important reason why this material was recommended for additional study during ACD. It was felt that

this combination of conditions represented a very aggressive environment for the alloy. In the course of running the crack propagation tests, Alloy 825 did not show any indication of crack growth (the specimens were pre-cracked) after more than two years of exposure. Resumption of support for these tests is important for determining the long term resistance of corrosion resistant materials, used as single containment barriers or as part of a multiple barrier design. A statement of work was received from ANL and is being evaluated. Funding for the ANL subcontract work will be in a separate PACS account. It is anticipated that formal resumption of this work will occur in May.

Installation of crack growth measurement equipment in a new laboratory at LLNL is proceeding. Mechanical installation is complete and electrical installation will be completed during April. Procurement of the thermogravimetric system, placed on the YMP capital equipment purchase list for FY93, is still held up pending release of the funds.

Work on the degradation modes of iron and steel under YMP repository relevant conditions is continuing.

J. Mitchell is writing a "position paper" on the degradation of nuclear waste containers under "wet" and "dry" scenarios for the potential Yucca Mountain repository. R. Van Konynenburg is providing assistance. This paper will help support decisions on thermal loads for waste package designs.

R. Van Konynenburg is organizing the fall Materials Research Society (MRS) symposium on the Scientific Basis of Nuclear Waste Management to be held in Boston, MA in late November 1993. The call for papers has been mailed to 2500 scientists world-wide and funding requests have been submitted to DOE and NRC.

#### 1.2.2.3.3 Other Materials

This WBS element has not been funded in FY93.

#### 1.2.2.3.4 Integrated Testing

##### 1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models

<u>Determination of Elemental Profiles in Rocks, Minerals, and Glasses using the Ion Microscope</u>

Initial secondary ion mass spectroscopy (SIMS) analysis of clinoptilolite samples was completed. Additional samples are currently being treated with chloride salts for subsequent SIMS analysis. Natural (untreated) samples of clinoptilolite were mounted in epoxy and examined by scanning electron microscopy (SEM). These samples will be used to provide base line composition data using the electron microprobe and SIMS.

X-ray analysis of various size fractions of clinoptilolite samples to be used in cation exchange experiments was completed. A protocol for separation of relatively pure clinoptilolite is being developed.

Interactions of Actinide-bearing Solutions with Rock Core Samples

Flow tests on the saw-cut fractured rock were begun using filtered Milli-Q deionized water. The automated balance and data collection system is operational. Changes to the data collection program will be made to facilitate tracking instantaneous flow rates.

**1.2.2.3.4.2 Thermodynamic Data Determination**

The status of NEA activities was reviewed, an update was provided to A. Simmons (YMPO), and plans were made for FY94-95 activities.

**1.2.2.3.5 Nonmetallic Barrier Concepts**

This WBS element has not been funded in FY93.

**1.2.2.4 Design, Fabrication, and Prototype Testing**

**1.2.2.4.3 Container/Waste Package Interface Analysis**

This WBS element has not been funded in FY93.

**1.2.3 SITE INVESTIGATIONS**

**1.2.3.1 Site Investigations Coordination and Planning**

This WBS element has not been funded in FY93. LLNL should be added to the list of participants for this WBS element in the WBS Dictionary.

**1.2.3.2 Geology**

**1.2.3.2.1.2.1 Natural Analogue of Hydrothermal Systems in Tuff**

This WBS element has not been funded in FY93.

**1.2.3.4 Geochemistry**

**1.2.3.4.2 Geochemical Modeling**

At the direction of R. Dyer (YMPO), Version 7.1 of EQ3/6 was provided to Dr. H. Nitsche at LBL.

Preparation was begun of a Version 7.2 package. Version 7.2 is designed to be compatible with both SPARC workstations and 486 PCs. This version incorporates changes required to allow EQ3/6 to run on the 486 PC. One bug in EQ6 was found

using the Lahey PC Fortran compiler. A local tolerance parameter in the pre-Newton-Raphson optimization model had the same name as a global tolerance parameter. The much tighter global value was being used in this module, causing a small loss of overall computing efficiency. Version 7.2 also addresses the few other bugs that have been reported in Version 7.1. One problem was that it was assumed that species names would be unique through the first 18 characters. This is not sufficient to discriminate among the end-members of the hydrated clinoptilolite solid solution, causing related calculations to be incorrect. The independent software verification effort found a discrepancy between the equations given in the EQ3NR manual for certain Jacobian matrix elements and the corresponding programming, which was found to be not up-to-date. Testing with the test library shows a very slight improvement in convergence properties with the programming corrected. A write format error in the EQ6 pickup file (reported by W. Murphy of CNWRA) was fixed. This affected the fixed fugacity option, causing the possible loss of a minus sign when this file is read as an input file. Some minor port-related problems (reported by T. Scandora of ANL) were also fixed. Work on the major codes was essentially completed this month. Version 7.2 will be available for distribution in April on floppy disks in both UNIX and DOS formats.

The review of Rev. 0 of the "Software Design Documentation for EQ3/6, Version 8" was completed, and this document was approved. Hands-on development of Version 8.0 will commence immediately upon the completion of the Version 7.2 package.

#### 1.2.3.10 Altered Zone Characterization

YMPO has notified LLNL of its decision to fund this WBS element with FY92 underrun funds. These funds were furnished to LLNL in an Approved Financial Plan (AFP) in early April.

### 1.2.5 REGULATORY

#### 1.2.5.1 Regulatory Coordination and Planning

This WBS element has not been funded in FY93. LLNL should be added to the list of participants for this WBS element in the WBS Dictionary.

#### 1.2.5.2 Licensing

#### 1.2.5.2.2 Site Characterization Program

Two Study Plans were sent to LLNL for review, and reviewers were assigned.

Rev. 1 of LLNL Study Plan 8.3.4.2.4.3, containing minor typographic and reference list changes were issued by YMPO.

### 1.2.5.3 Technical Data Management

#### 1.2.5.3.4 Geologic and Engineering Materials Bibliography of Chemical Species (GEMBOCHS)

Development continued of a WINDOWS/4GL (mouse-driven) version of D0OUT. This program facilitates interactive point-and-click generation of thermodynamic datafiles for EQ3/6, GT, and other geochemical modeling packages. Beta testing of the prototype version of this code led to the conception of several significant enhancements; these are now being incorporated.

At the request of T. Wolery, three organic acids [formic acid(aq), propanoic acid(aq), and butanoic acid(aq)were transferred from the non-basis to the auxiliary basis set of aqueous species in the SUPCRT92 and composite data subsets of GEMBOCHS. This transfer permits specification of the concentrations of these acids as input parameters for EQ3/6 calculations.

D0OUT was used to generate a revised suite of thermodynamic datafiles (DATA0 suite R19) that support the EQ3/6 geochemical software package. These new datafiles incorporate the aqueous-acid transfer noted above. The new files were piped through EQPT to generate the corresponding DATA1 suite, which was then transferred to s60:/dberror/data0, where it can be accessed by local users of EQ3/6.

Fine tuning continued on the CNGBOCHS package.

J. Blink attended the Technical Data Working Group meeting in Las Vegas on March 4.

#### 1.2.5.3.5 Technical Data Base Input

YMPO transferred an additional $60K into this WBS element. $10K will be used to fund R. Silva's participation in the Solubility Working Group. The remainder will be used to input backlogged data.

### 1.2.5.4 Performance Assessment

#### 1.2.5.4.2 Waste Package Performance Assessment

W. Halsey and J. Blink met with J. Younker, A. Van Luik, R. Andrews, S. Trimishra (M&O) and J. Boak (YMPO) in Las Vegas on March 9 to discuss LLNL and M&O workscopes in PA. The meeting continued via conference call on March 15.

## 1.2.9 PROJECT MANAGEMENT

### 1.2.9.1 Management and Coordination

#### 1.2.9.1.2 Technical Project Office Management

J. Blink attended the Quarterly Project Management meeting dry run in Las Vegas on March 4. W. Clarke and J. Blink attended the TPO meeting in Las Vegas on March 10. W. Clarke, J. Blink, D. Wilder and W. Lin attended a meeting with T. Sullivan, C. Newbury and A. Simmons in Las Vegas on March 16 to discuss the interface between LLNL's workscopes in WBS elements 1.2.2 and 1.2.3. J. Blink attended the Infrastructure Reduction Analysis Team (IRAT) meeting in Las Vegas on March 5.

S. Lundeen was appointed as LLNL's member on the Software Advisory Group (SAG), replacing T. Quinn who has accepted another LLNL assignment.

W. Clarke presented an overview on the Yucca Mountain Project to the Kiwanis Club of Danville, CA on March 4.

J. Blink judged the science fair at Armagosa Valley School (K-8) on March 2. He presented a hands-on science program to a kindergarten class at Griffith Day School and a fourth grade class at Crestwood Elementary School in Las Vegas on March 12. He also presented a hands-on demonstration of nuclear science to two fifth grade classes from Charlotte Hill Elementary School at the Yucca Mountain information office on March 18. In the first half of the fiscal year, he has provided hands-on science programs for over 2400 students and over 120 adults.

J. Blink was a tour guide to Yucca Mountain for eighteen members of the LLNL College Intern Program on March 3 and ten people from the University of Colorado on March 8.

J. Blink attended a meeting in Las Vegas on March 16 chaired by T. Kaish (M&O) to plan Boy Scout Merit Badge Workshops sponsored by YMPO.

### 1.2.9.2 Project Control

#### 1.2.9.2.2 Participant Project Control

The February FTE/cost report was submitted to YMPO. The February actual schedule progress and costs were submitted via PACS workstation. Variance analysis explanations were developed for several P&S accounts for activity undertaken in February. The Cost Plan was updated to include February actuals. This is an internal report.

The FY95 Field Work Proposal (FWP) was completed. This annual planning document is a DOE requirement placed on the entire laboratory and is submitted directly to DOE through the San Francisco Field Office (SAN). YMPO is not directly

involved. This year's submission covered FY94-95. Total budget requirements by year are:

1) FY94 - $12 million, and
2) FY95 - $15 million.

Little progress has been achieved in the effort to automate transfer of data between laboratory financial systems and the PACS workstation. The FTE calculation module is 80% complete. The remaining modules are labor dollars and other direct charges.

A SANL was prepared for a Technical Services Agreement with SNL for the Large Block Test specimen preparation. An additional SANL is being prepared for ANL to perform crack growth studies.

A Change Control Notice was prepared to increase the FY93 Metal Barriers P&S account by $100,000 provided by FY92 carryover funds.

D. Rainey (SAIC) has accepted a position with the M&O and will be leaving LLNL on April 2. Her position will be covered temporarily by a Project Control technician.

Two positions were posted:

1) A Project Control Coordinator to assist in the development and maintenance of the PACS database; and
2) an Engineering/Scientific Coordinator to provide planning and programmatic/ technical support for the Technical Area Leaders.

It is anticipated that both positions will be filled by May 1.

J. Blink contacted members of the M&O and YMPO to determine FY94 initial budget estimates.

## 1.2.11 QUALITY ASSURANCE

### 1.2.11.1 Quality Assurance Coordination and Planning

Several applicants were interviewed for the LLNL-YMP QA Manager position. A candidate has been selected, and an offer is in preparation.

LLNL provided input to T. Statton (M&O) for the FY94 Annual Plan for Site Characterization. WBS elements 1.2.2.1, 1.2.2.2, 1.2.2.3.4, 1.2.3, 1.2.5.1, 1.2.5.2 and 1.2.5.3 were included in the submission. A courtesy copy was provided to H. Benton (M&O). Similar input is being prepared for H. Benton for the remaining elements of WBS 1.2.2.3 and 1.2.2.4.

The PNL Quality Assurance Plan (PNL-MA-70) (WTC-018, Rev. 7) for the Geologic Disposal Support Project for the YMP was reviewed, and comments were forwarded to the PNL Project Manager.

Grading reports for the five activities (LBT-01 through -05) of the Large Block Testing of Coupled Thermal-Mechanical-Hydrological-Chemical Processes were

reviewed, and the resulting grading determinations were submitted to the LLNL-YMP Leader for approval.

### 1.2.11.2 Quality Assurance Program Development

Work continues at LLNL to develop those changes to internal procedures that have been identified as necessary to fully implement the QARD.

### 1.2.11.3 Quality Assurance Verification

Actions have been prepared to close CARs YM-92-064, YM-92-065 and YM-93-017. The first two, dealing with M&TE, will be treated together, while the third, dealing with Grading Reports, is separate. YMQAD verification of the corrective actions is scheduled for early April.

#### 1.2.11.3.1 Quality Assurance Verification - Audits

No significant activities.

#### 1.2.11.3.2 Quality Assurance Verification - Surveillance

Surveillance S93-04 (Training and Qualification of Personnel currently assigned to the LLNL-YMP) was conducted. The Surveillance Report was issued on March 18.

### 1.2.11.4 Field Quality Assurance/Quality Control

This WBS element has not been funded in FY93.

### 1.2.11.5 Quality Assurance - Quality Engineering

No significant activities.

## 1.2.12 INFORMATION MANAGEMENT

### 1.2.12.2 Records Management

#### 1.2.12.2.2 Local Records Center Operation (LRC)

Two new revisions and one change notice were issued by Document Control.

#### 1.2.12.2.3 Participant Records Management

A total of 139 items were logged into the LLNL-YMP tracking system. This includes nine records/records packages that were processed through to the CRF. Ten action items were closed.

### 1.2.12.2.5 Document Control

LLNL received no funding under this WBS. Work performed to complete LLNL's obligation in this WBS is funded under WBS 1.2.12.2.2.

## 1.2.13 ENVIRONMENT, SAFETY AND HEALTH

### 1.2.13.1 Environment, Safety and Health Coordination and Planning

Changes were submitted to the PEARL directory; these changes update LLNL-YMP personnel and phone entries.

## 1.2.15 SUPPORT SERVICES

### 1.2.15.2 Administrative Support

The guidance letter for input to PR 8, Site Characterization Progress Report: Yucca Mountain, Nevada, was received by LLNL on March 3. LLNL's input to PR 8 was sent to YMPO on March 25.

### 1.2.15.3 Yucca Mountain Site Characterization Project (YMP) Support for the Training Mission

Sixteen different self-study assignments were issued, and 53 people were trained to these assignments. Currently, there are 69 participants on the project who are to be trained and/or tracked.

# LLNL PROJECT STATUS REPORT DISTRIBUTION

## EXTERNAL

PRELIMINARY STAMP
Dr. J. Bates
Chemical Technology Division
Argonne National Laboratory
9700 S. Cass Avenue
Argonne, Illinois 60439

H. Benton/D. Stahl
Ste P110
101 Convention Center Drive
Las Vegas, Nevada 89109

A. Berusch (RW-20)
OCRWM
Forrestal Building
Washington, DC 20585

M. Blanchard
Yucca Mountain Project Office
U.S. Department of Energy
P. O. Box 98518
Las Vegas, Nevada 89193-8518

T. Blejwas
Sandia National Laboratories
P.O. Box 5800
Albuquerque, NM 87185

J. Blink
LLNL/Las Vegas
101 Convention Center Drive,
Suite 820
Las Vegas, NV 89109

J. Boak
Yucca Mountain Project Office
U.S. Department of Energy
P. O. Box 98518
Las Vegas, Nevada 89193-8518

S. Bodnar
TRW, Mail Stop 423
101 Convention Center Drive
Las Vegas, Nevada 89109-2005

M. Brodeur
Science Applications Int'l Corp
101 Convention Center Dr. # 407
Las Vegas, NV 89109-2005

J. Canepa
Los Alamos National Laboratory
P.O. Box 1663/N-5, MS J521
Los Alamos, NM 87545

P. Cloke
Science Applications Int'l Corp
101 Convention Center Dr. # 407
Las Vegas, NV 89109-2005

W. Dixon
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

J. Dyer
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

PRELIMINARY STAMP
R. Einziger
Battelle-Pacific Northwest
P.O. Box 999/MS P714
Richland, WA 99352

R. Fish
Ste P110
101 Convention Center Drive
Las Vegas, Nevada 89109

L. D. Foust
Technical Project Officer
CRWMS M&O
101 Convention Center Drive
Phase II, Suite P110
Las Vegas, NV 89109

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

D. Harrison
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

L. Hayes
U.S. Geological Survey
Box 25046/MS 425
Denver Federal Center
Denver, Colorado 80225

R. Hughey
Nuclear Energy Division
USDOE/SAN
1333 Broadway
Oakland, CA 94612

V. Iorri
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

C. Johnson
M&O
101 Convention Center Drive
Phase II, Suite P110
Las Vegas, NV 89109

P. Justus
Nuclear Regulatory Commission
301 E. Stewart Ave. #203
Las Vegas, NV 89101

H. Kalia
LANL/LV
101 Convention Center Drive #1024
Las Vegas, NV 89109-2005

PRELIMINARY STAMP
S. Marschman, P7-14
Battelle, Pacific Northwest
P.O. Box 999
Richland, WA 99352

M. Martin
TRW, Mail Stop 423
101 Convention Center Drive
Las Vegas, Nevada 89109-2005

J. Nelson
Science Applications Int'l Corp
101 Convention Center Dr. # 407
Las Vegas, NV 89109-2005

P. Osborne
Science Applications Int'l Corp
101 Convention Center Dr. # 407
Las Vegas, NV 89109-2005

R. L. Robertson
TRW-Metro Place
2650 Park Tower Dr.
Suite 800
Vienna, VA 22180

W. Simecka
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

A. Simmons
Yucca Mountain Project Office
U.S. Department of Energy
P.O. Box 98518
Las Vegas, Nevada 89193-8518

E. Smistad
Yucca Mountain Project Office
U.S. Department of Energy
P. O. Box 98518
Las Vegas, Nevada 89193-8518

L. Snow
Roy F. Weston, Inc.
955 L'Enfant Plaza, S.W.
Washington, DC 20024