Department of Energy
Washington, DC 20585

JAN 02 1992

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Repository Licensing and Quality Assurance
Project Directorate
Division of High-Level Waste Management
Office of Nuclear Material Safety
and Safeguards
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Dear Mr. Holonich:

The enclosed Yucca Mountain Site Characterization Project participant monthly status reports are forwarded for your information. If you have any questions on the enclosed reports, please contact Priscilla Bunton at (202) 586-8365.

Priscilla Bunton for
Linda J. Desell, Chief
Regulatory Integration Branch
Office of Civilian Radioactive
Waste Management

Enclosures: ltr encl rec'd
(1) Lawrence Livermore National Laboratory Monthly Status Report, November 1991
(2) Sandia National Laboratories Monthly Status Report, November 1991

102.8
WM-11
NH03

cc: w/o enclosure:
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cc: w/enclosure
R. Loux, State of Nevada
K. Whipple, Lincoln County, NV
M. Baughman, Lincoln County, NV
J. Bingham, Clark County, NV
D. Bechtel, Clark County, NV
S. Bradhurst, Nye County, NV
B. Raper, Nye County, NV
P. Niedzielski-Eichner, Nye County, NV
R. Campbell, Inyo County, CA
R. Michener, Inyo County, CA
G. Derby, Lander County, NV
P. Goicoechea, Eureka, NV
C. Schank, Churchill County, NV
C. Jackson, Mineral County, NV
F. Sperry, White Pine County, NV
L. Vaughan, Esmeralda County, NV
K. Hooks, NRC

Record WSK letter dtd

LAWRENCE LIVERMORE NATIONAL LABORATORY YUCCA MOUNTAIN PROJECT
NOVEMBER 1991 TECHNICAL HIGHLIGHTS AND STATUS REPORT 1/2/92

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ENCLOSURE 1

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

NOVEMBER 1991

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

1) An EBS source term model was provided to SNL for the initial Total Systems Performance Assessment discussed at the November 18-20 PA review meeting. The source term model sums over the waste packages, after assigning a distribution of local waste package environments correlated with the total system hydrology parameters. The model includes summary treatment of waste package responses as guided by earlier PANDORA analyses, and includes consideration of container breaches, borehole hydrology and geomechanical conditions, and spent fuel dissolution and waste transport into the nearby host rock. The model is isothermal, except for a range of waste package rewetting times, to be compatible with the total system geohydrology modeling.

2) L. Jardine (LLNL) and M. Cloninger (YMPO) represented YMP at the International Workshop on Engineered Barrier Systems (EBS) in Strasbourg, France on November 2-3. Belgium, Canada, Finland, Sweden, Switzerland, and the U.S. participated in the workshop which was convened jointly by the U.S. NWTRB and the Swedish National Board for Nuclear Fuel (SKN). The workshop established that the U.S. is the only country that emphasizes the natural barrier system characterization while not having an explicit EBS development program. In response to the DOE presentation, international participants made the following points:

The regulatory limit of 10,000 years in the U.S. is artificial, and designs and analyses should not use it as a solid limit.

Inspection and monitoring commitments should be carefully evaluated; public pressure may prevent scheduled cessation of these activities.

The impact of the thermal excursion on fractures and hydrology needs to be studied.

The properties of the unsaturated units at elevated temperatures need to be studied.

Dr. Langmuir of the NWTRB also made the point that the incoming (to the EBS) groundwater chemistry is largely determined by the thermally modified host rock while the exiting chemistry is determined by aqueous interaction with the EBS materials. The exiting chemistry will have a significant effect on the transport characteristics of the radionuclides.

1.2.1 SYSTEMS

1.2.1.1 Management and Integration

A. Van Luik of Intera (M&O) and A. Brandstetter (SAIC) visited LLNL on November 6. LLNL staff presented an overview of performance assessment activities and an update on performance assessment codes.

1.2.1.2.4 Systems Engineering Implementation

No significant activities.

1.2.1.2.6 YMP Support to Management Systems Improvement Strategy

No significant activities.

1.2.1.3.5 Technical Database Input

Work continued on the document "DBAPP: A FORTRAN-Equel Program that Facilitates Review and Modification of the GEMBOCHS Thermodynamic Database". This document will be submitted for review as a UCRL publication upon completion.

Extensive restructuring and modification of DBAPP continued. This update will expand the capabilities of the software to facilitate interactive review of all data in the database, tighten access controls on user modification of data, and broaden the range of information that can be included in the database.

Work continued on the final revision of "CNGBOCHS: An Automated Ingres-Email-Interleaf Filing System for Change Requests Associated with the GEMBOCHS Thermodynamic Database". This document will be submitted for review as a UCRL publication upon completion.

1.2.1.4.2 Waste Package Performance Assessment

W. Halsey, W. O'Connell. A. Lamont, L. Lewis and J. Blink attended the Systems Analysis meeting in Las Vegas, November 18-20. W. Halsey and A. Lamont gave a presentation entitled "Overview and Discussion of LLNL System Model". W. O'Connell gave a presentation on the "Simplified Source Term for Total Systems Performance Assessment".

The PACS networks for performance assessment were updated including detailed budget and activity planning for FY92 within the allocated budget.

Internal QA grading was completed for Activity I-20-22, "Extend PANDORA-1, the Deterministic Single Waste Package Systems Model, to PANDORA-1.1". An Individual Software Plan (ISP) was drafted for this activity. The subroutine source files of PANDORA-1.0 were copied to be used or adapted in Version 1.1 into an UNIX Source Code Control System (SCCS) file to establish a change control record.

1.2.1.4.5 Geochemical Modeling and Database Development

The EQ6 Theoretical Manual and User Guide was completed this month. This manual is the third of the four part set of documentation for EQ3/6. Work is now focussing on completing the EQPT User Guide, which will be the last piece of the code documentation for the EQ3/6 package. EQPT is a database preprocessor.

1.2.1.4.7 Supporting Calculations for Postclosure Performance Analyses

This WBS element has not been funded in FY92.

1.2.2 WASTE PACKAGE

1.2.2.1 Management and Integration

L. Jardine (LLNL) and M. Cloninger (YMPO) represented YMP at the International Workshop on Engineered Barrier Systems (EBS) in Strasbourg, France on November 2-3. Belgium, Canada, Finland, Sweden, Switzerland, and the U.S. participated in the workshop which was convened jointly by the U.S. NWTRB and the Swedish National Board for Nuclear Fuel (SKN). The workshop established that the U.S. is the only country that emphasizes the natural barrier system characterization while not having an explicit EBS development program. In response to the DOE presentation, international participants made the following points:

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The impact of the thermal excursion on fractures and hydrology needs to be studied.

The properties of the unsaturated units at elevated temperatures need to be studied.

Dr. Langmuir of the NWTRB also made the point that the incoming (to the EBS) groundwater chemistry is largely determined by the thermally modified host rock while the exiting chemistry is determined by aqueous interaction with the EBS materials. The exiting chemistry will have a significant effect on the transport characteristics of the radionuclides.

1.2.2.2 Waste Package Environment

1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

B. Viani participated in the YMP Geochemistry Integration Team (GIT) teleconference on November 25.

1.2.2.2.2 Hydrologic Properties of the Waste Package Environment

D. Wilder and S. Larsen attended the FRAC-Man class in Seattle, WA on November 18-21. This course covered discrete fracture analysis. It has a wide range of applications in site characterization and performance assessment, including analysis of fracture data, geological conceptual modeling, pathways analysis, exploration program planning, and flow and transport modeling.

The paper by T. Buscheck, J. Nitao and D. Chesnut entitled "The Impact of Episodic Nonequilibrium Fracture-Matrix Flow on Repository Performance at the Potential Yucca Mountain Site" was approved by YMPO on October 28 and was presented at

the XV International Symposium on the Scientific Basis for Nuclear Waste Management in Strasbourg, France, November 4-7, 1991.

The chemical testing of the high pressure and high temperature system using deionized water at room temperature was completed. The system is ready for testing of hydrologic properties of rock.

The first draft of the SIP for the laboratory study of the hydrologic properties of the near field environment is 90% complete.

A feasibility study was started of using a resonant cavity to measure the relative humidity in rock samples in the laboratory. In order to serve the purpose, a resonant cavity has to be as small as can be possibly made. A prototype resonant cavity of about 1.0 cm in diameter and 2.54 cm in length is under construction. Theoretical analyses have indicated that a resonant cavity that small may work. The calibration measurements will begin next month. If it works, the resonant cavity will be used in the determination of suction potential vs saturation in rock samples as function of temperature.

W. Lin attended the Sample Overview Committee meeting in the Sample Management Facility at NTS on November 5.

1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

S. Blair has assisted with the preparation of the review comment responses on the Early Site Suitability Evaluation (ESSE) Post Closure Rock Characteristics Guideline.

1.2.2.2.4 EBS Field Tests/ESF Test Design

The LLNL-YMP Scientific Investigation Plan for Initial Engineered Barrier System Field Tests, NF-1, Rev. 1 was transmitted to YMPO for approval.

1.2.2.2.5 Man-Made Materials

This WBS element has not been funded in FY92.

1.2.2.3 Waste Form and Materials Testing

1.2.2.3.1.1 Waste Form Testing - Spent Fuel

Spent Fuel Dissolution

Flow-Through Dissolution Tests on Unirradiated UO_2

The first subset in the matrix of tests on UO_2 and schoepite samples were completed. The difference in dissolution data for replication tests performed at PNL and LLNL are being analyzed in detail. These tests were on powdered samples which for flow-through testing can form flow channels, and thereby do not wet the total measured surface area of the sample. This type of error, which is still being assessed at PNL

and LLNL, would lead to an inferred dissolution rate that is less than the true dissolution rate. Resolution of the differences for powder data may result in a slight modification in the flow-cell design for the flow-through tests.

The paper by S. Nguyen, H. Weed, H. Leider and R. Stout entitled "Dissolution Kinetics of UO_2 Flow-Through Tests on $UO_{2.00}$ Pellets and Polycrystalline Schoepite Samples in Oxygenated, Carbonate/Bicarbonate Buffer Solutions at 25°C" was presented at the XV International Symposium on the Scientific Basis for Nuclear Waste Management in Strasbourg, France, November 4-7, 1991.

Flow-Through Dissolution Tests on Spent Fuel and Unirradiated UO_2

A paper by D. Wronkiewicz, J. Bates, T. Gerding, E. Veleckis and B. Tani at ANL entitled "Leaching Patterns and Secondary Phase Formation During Unsaturated Leaching of UO_2 at 90°C" was submitted to LLNL for technical review.

A paper by W. Gray, D. Strachan and C. Wilson of PNL entitled "Inventories and Dissolution Rates of Soluble Radionuclides from the Grain Inventories of Spent LWR Fuel" was presented at the XV International Symposium on the Scientific Basis for Nuclear Waste Management in Strasbourg, France, November 4-7, 1991.

Spent Fuel Characterization

A paper by W. Gray, D. Strachan and C. Wilson of PNL entitled "Gap and Grain-Boundary Inventories of Cs, Tc and Sr in Spent LWR Fuel" was presented at the XV International Symposium on the Scientific Basis for Nuclear Waste Management in Strasbourg, France, November 4-7. 1991.

1.2.2.3.1.2 Waste Form Testing - Glass

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

1.2.2.3.2 Metal Barriers

No significant activities due to reduced funding.

1.2.2.3.4.1 Integrated Radionuclide Release

Planning was started on FY93-94 workscope and budget requirements.

C-20-2 Determination of elemental profiles in rocks, minerals, and glasses using the Ion Microscope

Effort continued in the calibration of the ion microscope so that absolute concentration values can be determined to within 10-20% for actinides and trace metals in tuff, waste glass, and fuel pellets. A better signal to noise ratio was provided by improvements in the performance of the electron multiplier (gain changes, dead time, raster effects) which disclosed nonlinear behavior in the Faraday

cup preamplifier. Optimal operating conditions for this preamplifier were identified, and programs to correct for the nonlinearity were generated.

Instrumental Neutron Activation (INA) data were received as part of the intercalibration for determining sensitivity factors for rare earth element analysis.

G-20-3 Interactions of actinide-bearing solutions with rock core samples

Room temperature flow testing was completed of the flow-through system which is designed to study the adsorption and hydrology of water with radionuclide tracers. Testing at elevated temperatures will start soon.

Satisfactory flow was achieved with the completed fluid lines and an artificially fractured tuff sample. The volume of the sample lines was reduced to minimize the amount of solution necessary for running experiments. Work continued on preparing the heating jackets for installation.

G-20-5 Interaction of materials under repository conditions
Data were analyzed pertaining to the concentration, size and composition of naturally occurring colloids in J-13 and nearby waters from the NTS.

G-20-6 Source term model development
Work continued on the determination of the effect of temperature on U sorption (J. Leckie, Stanford) which included fabrication of goethite, calibration of temperature and pH measurement systems, and initiation of titrations to determine acidity constants and binding constants.

1.2.2.3.4.2 Thermodynamic Data Determination

This WBS element has not been funded in FY92.

1.2.2.4. Design, Fabrication, and Prototype Testing

1.2.2.4.1 Waste Package Design

This WBS element has not been funded in FY92.

1.2.2.4.2 Container Fabrication and Closure Development

This WBS element has not been funded in FY92.

1.2.2.4.3 Container/Waste Package Interface Analysis

D. Ruffner (LLNL) and T. Doering (B&W) made a presentation about EBS design to the MRS-MGDS Design Integration Group. The meeting was held in Aiken, SC on November 14-15 and was hosted by Duke Engineering. The information exchange was informative and resulted in a better understanding of the organizational interactions and design activities.

1.2.5 REGULATORY AND INSTITUTIONAL

1.2.5.2.1 NRC Interaction Support

No significant activities.

1.2.5.2.2 Site Characterization Program

Peer Review comments on the Early Site Suitability Evaluation (ESSE) Post Closure Rock Characteristics Guideline were received at LLNL and the comment resolution process was initiated. M. Revelli participated in an ESSE Telecon on November 15 to determine the overall status of comment review and to identify review topics which might impact several geotechnical guidelines.

M. Revelli participated in the ESSE Working Session in Las Vegas on November 20-22 (including the Core Team Meeting on November 21) to determine how overlapping comments might be resolved and to propose a course of action to the Core Team for closing the comments on each guideline. This approach was presented to the reviewer for the Rock Characteristics Guidelines, W. Paviseau, on November 27, and a mutually acceptable closure to these comments was verbally agreed upon.

1.2.5.2.4 Technical Support Documentation

No significant activities.

1.2.5.2.5 Study Plan Coordination

J. Blink (LLNL) and R. Crawley (YMPO) reconciled the list of study plans under review at LLNL. Several reviews were completed or closed, and the only outstanding review (8.3.1.2.2.9) is scheduled to be completed by mid-January.

1.2.5.2.6 Semi-Annual Progress Reports

The draft Progress Report (PR) covering the reporting period April 1 through September 30, 1991 was sent to LLNL for review. Several minor changes were made and transmitted to SAIC on November 18.

1.2.9 PROJECT MANAGEMENT

1.2.9.1.1 Management

J. Blink attended three ESF meetings: Criteria for sequencing ESF construction (November 5), ESF north ramp route (November 19), and ESF test planning (November 26).

LLNL prepared a detailed request for carryover funding and presented it to E. Petrie, R. Dyer, and (at E. Petrie's request) four staff members of the M&O.

J. Blink was appointed to the Interface Control Working Group (ICWG), replacing D. Short.

J. Blink met with C. Rekhop (YMPO) and R. McCarthy (SAIC) to discuss dual training records for LLNL personnel serving on YMPO and SAIC led activities such as the Field Change Control Board (FCCB) and the Early Site Suitability Evaluation (ESSE) task. LLNL is concerned that training will be unnecessarily duplicated and that records may become fragmented. The following training records are currently kept:

The organization providing training is required to keep a record of the training and who attended.

The home organization of each staff member is required to keep a record, organized by individual, of all training of that organization's staff members.

In addition, the lead organization for an activity (such as SAIC for the ESSE task) can also require records to be kept by name for each participating individual.

Once an individual has received indoctrination, that indoctrination serves for all YMP activities and should not have to be repeated if the individual serves on an activity led by another organization.

J. Blink served as a bus guide for the November 16 Yucca Mountain Tour. He also presented information on atomic energy and YMP to three eighth grade science classes at Roy Martin Jr. High School on November 14.

J. Blink attended the Project Update meeting on November 25 and transmitted a copy of Carl Gertz's briefing to LLNL.

1.2.9.1.4 Records

Document Control issued six Change Notices and twelve new issues under controlled distribution. Routine follow-up for receipt acknowledgements continues.

A total of 170 items were logged into the LLNL-YMP tracking system. This includes 42 records/records packages that were processed through to the CRF. Five action items were closed.

Two LLNL procedures were changed as a result of the issue of the Records Management Plan, Rev. 3, and an Affective Document Noted (ADN) was submitted to the CCB. LLNL also responded to the YMPO analysis of its records procedures, providing citations of the procedures containing the eight requirements thought by YMPO to be unincorporated.

1.2.9.2 Project Control

The October FTE report was submitted to YMPO.

Due to problems with the Laboratory's internal financial computer systems, the October cost data were not released to LLNL-YMP until the end of November. Therefore, LLNL-YMP was not able to submit an October Cost Plan to YMPO. A Cost Plan covering October and November will be submitted in December.

Reviews continued with the responsible TALs for the PACS planning for FY92 and FY93. The Summary Accounts were submitted to YMPO with workscope and schedules.

J. Podobnik attended the PACS Steering Committee meeting in Las Vegas on November 26. Modifications to the current PACS system were discussed. He also attended a subcommittee meeting on procedures. J. Blink attended the PACS training subcommittee meeting on November 21; topics included the proposed training video, formal project management training, and the proposed PACS handbook.

An audit was conducted by the auditing firm of Peat, Marwick on November 9-22. The audit focussed on internal controls, account balances of fixed assets, compliance with laws and regulations, and audited financial statements.

The GAO auditors continue to ask for new information for their audit. Some of their requests now span FY88 and FY89 as well as the original period of the audit, FY90 and FY91.

1.2.9.3 Quality Assurance

LLNL Audit 92-01, LLNL-YMP Instrument Calibration Program, was conducted on November 21-22.

LLNL Surveillance S92-01 was conducted on November 22 to verify the corrective action to correct deficiencies identified in AFRs 001 through 005.

R. Constable (DOE) visited LLNL on November 12-13. Corrective action was verified, and CARs-YM-91-055, -057, -058, -059, -060, -061, and -062 were closed.

The QA Surveillance Schedule for the surveillances planned for Fiscal Year 1992 was transmitted to YMPO.

The following two grading reports were finalized and forwarded to Document Control for distribution:

L-045 (Activity H-20-01), and
L-044 (Activity H-20-02).

A response was prepared to YMPO's request for review and comments on the Quality Assurance Requirement and Description document (QARD).

R. Monks met with YMPO Quality Assurance personnel in Las Vegas on November 21-22.

LLNL PROJECT STATUS REPORT DISTRIBUTION

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