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

November 1993

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

1) **WBS 1.2.2.2.1 (Chemical and Mineralogical Properties of the Waste Package Environment).** LLNL work on the New Zealand natural process analog site focused on resolving uncertainties in gas analyses and mineral constraints on water chemistry. Modeling of the equilibrium state of the system requires consistent means for back calculating downhole water chemistries from chemistries of separate gas and water analyses collected at the well head. Differences between various reported water chemistries focused attention on the approach to these calculations.

2) **WBS 1.2.2.2.2 (Hydrologic Properties of the Waste Package Environment)** LLNL thermal-hydrological calculations considered cases in which the distribution of bulk permeability (k_b) varies vertically, which results in a layered distribution. For the low AML, low k_b in the PTn reduces both the magnitude of gas-phase flow and the extent of liquid saturation buildup above the repository. For high AML, low k_b in the PTn reduces the magnitude of gas-phase flow, but has the effect of slightly increasing the saturation buildup above the repository. For both AMLs, low k_b in the CHnv and CHnz reduces both the magnitude of the gas-phase flow velocities and the extent of liquid saturation buildup above the repository.

3) **WBS 1.2.2.2.2 (Hydrologic Properties of the Waste Package Environment)** LLNL thermal-hydrological calculations focused on the impact of buoyant, gas-phase convection on reducing the duration of the boiling period, and bulk moisture movement in the UZ. The area-weighted boiling period duration, ($t_{bp,av}$) for several above-boiling cases was calculated. The cooling effect that mountain-scale, buoyant, gas-phase convection has on $t_{bp,av}$ increases with decreasing Areal Mass Loading. For example, the 110.5 MTU/acre, 40-darcy case has $t_{bp,av}$ reduced by 29% relative to a 280 millidarcy case, while for the 83.4 and 55.3 MTU/acre cases, the reduction is 39 and 74%, respectively.

4) **WBS 1.2.2.2.3 (Mechanical Attributes of the Waste Package Environment)** Assessment of instrumentation for the laboratory and field block tests continued. LLNL staff visited a potential vendor evaluate a frequency modulated (FM) laser ranging system for use in the measurement of displacements in laboratory and field tests. The FM system is promising and could be used with components of conventional multiple point borehole extensometers (MPBX) that are currently available. The laser system would circumvent many of the limitations of the conventional MPBX systems, however, it currently does not provide the required precision and needs more development.

5) **WBS 1.2.2.2.4 (Engineered Barrier System Field Tests)** Leveling and surface fracture mapping of the site has been completed. The location of the block was determined based on the distribution and orientation of fractures on the surface. Vertical hole drilling has begun. Air permeability measurements were conducted in the first vertical NX hole (7.6 cm diameter). The permeability at the potential heater horizon in the block ranges between 5 and 10 millidarcy. Scoping calculations indicate that this permeability level is suitable for creating a dry-out zone and a condensate zone in the block by heating from internal heaters, as planned.

6) **WBS 1.2.2.3.1.1 (Waste Form Testing - Spent Fuel)** Spent Fuel Dissolution LLNL started two repeat experiments at 20% oxygen and 75°C. The original data seemed unusually high when compared to the other experiments in the test plan. The new data will be included in the paper submitted for the IHLWM meeting in Las Vegas this coming May that combines and compares the UO_2 dissolution data obtained at LLNL and the similar spent fuel dissolution data obtained at Pacific Northwest Laboratories.

7) **WBS 1.2.2.3.1.1 (Waste Form Testing - Spent Fuel)** Thermogravimetric Apparatus (TGA) tests of spent fuel oxidation are in progress at 255°C to obtain the initial rise-to-plateau part of the oxidation curve and at 270°C to obtain a full oxidation curve. A very flat plateau of >400 hours formed at 270°C. Based on previous data, the next phase transition should occur shortly. Samples from the scoping tests are being prepared for transmission electron microscope and scanning electron microscope analyses.

8) **WBS 1.2.2.3.2 (Metal Barriers)** R. Van Konynenburg served as the general chairman for this year's symposium on the Scientific Basis for Nuclear Waste Management which was held at the Fall Materials Research Society meeting. He presented one of the keynote papers entitled "Science and Licensing: Let's Get Off the Collision Course". The paper examined the inherent factors and limitations in making long-term predictions using the scientific method and discussed the criteria for admissibility of scientific evidence in the legal arena. The paper concluded that the prospects were doubtful for successful licensing of a repository under regulations that were binding until recently. However, changes are occurring in these regulations, and the paper suggests solutions to the situation. Presentation of the paper produced a lively discussion at the meeting.

9) **WBS 1.2.2.3.2 (Metal Barriers)** G. Henshall has returned to the YMP as Principal Investigator for performance tests and model development. Experimental and code development efforts that are needed to continue this research have been identified, including:

1) Determining the distribution of pit depths as a function of time, environment, and alloy composition for austenitic candidate alloys.
2) Measuring the electrochemical noise during the initiation of pits.

3) Exploring the mechanisms of stochastic stable pit growth based on results from the above experiments.

Efforts needed for code development include:

1) Explore the effects of not having a constant stable pit growth probability. constant.
2) Improve the equations simulating the environmental dependence of the stochastic pitting parameters.
3) Explore numerical methods to determine the stochastic model parameters from the experimental data.

10) **WBS 1.2.2.3.5 (Non-metallic Barrier Concepts)** K. Wilfinger began his assignment as Principal Investigator for LLNL Non-metallic Barrier Concepts. He has a Ph.D. from Rutgers University in ceramic engineering and has been at LLNL since 1987. The major piece of work planned for this task in FY-94 is the preparation of a survey of 1) possible ceramic materials that could be used in a multiple barrier design, 2) the state of technology in fabricating ceramic materials in dimensions suitable for a waste package barrier, and 3) possible degradation modes affecting ceramics for long-term disposal.

11) **WBS 1.2.3.10 (Altered Zone Characterization)** Plans for reaction precipitation studies are being developed. An evaluation of existing equipment for suitability has been completed. The existing equipment is suitable. The first efforts will focus on silica precipitation kinetics.

12) **WBS 1.2.5.3.4 (Geologic and Engineering Materials Bibliography of Chemical Species)** A reconnaissance and review of recently published thermodynamic data for Neptunium, Americium, Plutonium, and Technetium species has been initiated. As needed and where appropriate, these data will be used to augment those already in GEMBOCHS until publication of the NEA-TDB critical reviews of the chemical thermodynamics of these species. These reviews, to be published as separate volumes in the series, began with the Uranium compilation (Grenthe et al., 1992), and will be available in the next few years.

LLNL DELIVERABLES MET

(October and November 1993)

Milestone	WBS	Planned Date	Actual Date	Description	Comment
MOL07	1.2.2.3.1.1		10/22/93	Submit report SF/UO_2	Completes an FY93 action
MOL08	1.2.2.3.1.1		11/09/93	Submit hi temp perform. of SF in Oxid. Env.	Completes an FY93 action
MOL20	1.2.2.2.2		11/30/93	Submit SP 8.3.4.2.4.2 (Lab)	Completes an FY93 action
MOL21	1.2.2.2.5		11/30/93	Submit SP 8.3.4.2.4.5	Completes an FY93 action

LLNL DELIVERABLES NOT MET

None

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 30-NOV-93

PARTICIPANT: LLNL PEM: SMITH WBS: 1.2.2.1

WBS TITLE: WASTE PACKAGE COORDINATION AND PLANNING

P&S ACCOUNT: 0L21

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
66	66	88	0	0.0	100.0	-22	-33.3	75.0	400	422	-22	-5.5	533	100.0

Analysis

Cumulative Cost Variance:
Cost variance caused by charges by senior LLNL management for developing and modifying FY94 plans. Initial high level of costs will be diminished as the planning and integrating function for FY94 is essentially complete. For succeeding months, LLNL anticipates a "maintenance" level management cost/effort.

Cumulative Schedule Variance:

Variance At Complete:

P&S ACCOUNT MANAGER 12/14/93 DATE

TPO for W. Clarke 12/14/93 DATE

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 30-NOV-93

PARTICIPANT: LLNL PEM: SMITH WBS: 1.2.2.3.1.1

WBS TITLE: WASTE FORM TESTING - SPENT FUEL

P&S ACCOUNT: 0L2311

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
296	429	273	133	44.9	144.9	156	36.4	157.1	1785	1762	23	1.3	1136	91.1

Analysis

Cumulative Cost Variance:
The cost variance in Spent Fuel is due to two FY93 summary accounts being carried over into FY94 awaiting completion of two milestones. Two reports from PNL arrived at LLNL and have been submitted to YMPO to complete the milestone requirements. No actual costs occured but earned value was calculated upon closing of these summary accounts. The cost variance will remain in these accounts and will continue to appear in PACS unless removed during the FY93 close-out exercise.

Cumulative Schedule Variance:
The same situation as above applies for the schedule variance. FY94 activities are progressing as scheduled.

Variance At Complete:
The variance at completion is an accurate summation of actuals in FY94. This will correct itself as effort increases in dissolution tests and models.

Ray B. Stout Dec 19, 93
P&S ACCOUNT MANAGER DATE

John C. Chen for W. Clarke 12/14/93
TPO DATE

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 30-NOV-93

PARTICIPANT: LLNL PEM: SMITH WBS: 1.2.2.2.4

WBS TITLE: ENGINEERED BARRIER SYSTEM (EBS) FIELD TESTS

P&S ACCOUNT: 0L224

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
301	1229	411	928	308.3	408.3	818	66.6	299.0	1650	2621	-971	-58.8	552	19.0

Analysis

Cumulative Cost Variance:
The cost variance in Large Block is due to two FY93 carryover activities. Work on quarrying blocks and frame construction contracts have not been completed nor have funds been expended. The work and budget have been included in the FY94 totals, which are presenting and inaccurate summation of the progress in this P&S account. LLNL is waiting for DOE direction to resolve these discrepancies.

Cumulative Schedule Variance:
The schedule variance in Large Block is due to two FY93 carryover activities and erroneous changes made to the PACS baseline dates associated with these activities. LLNL is waiting for direction from DOE to correct this data.

Variance At Complete:
The variance at completion is due to three FY93 carryover summary accounts. The variance will remain until direction from DOE is received by LLNL. The capital plan that was submitted for FY93 is no longer valid and the amount ($264k) that was carried over into FY94 will be cleared in December.

12/14/93 12/10/93

P&S ACCOUNT MANAGER DATE TPO DATE

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 30-NOV-93

PARTICIPANT: LLNL PEM: LONG WBS: 1.2.3.5.2.2

WBS TITLE: ENGINEERING, DESIGN AND DRILLING SUPPORT

P&S ACCOUNT: 0L3522

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
5	5	27	0	0.0	100.0	-22	-440.0	18.5	25	47	-22	-88.0	135	100.0

Analysis

Cumulative Cost Variance:
The DOE WBS Manager decided to only fund this LOE account at the $25k level for FY94, with a contingency to increase funding if demand warranted. In mid-November, the WBS Manager was informed that about 1/2 of the FY funding had been used in the first month; it was recommended that funding be increase to $75k. In mid-December, the recommendation was reviewed and accepted, with action to be completed in time for the January YMPO AFP submission to DOE HQ. In the meantime, calls for support in this WBS will be met because the third level (1.2.3) WBS has enough funds to temporarily meet the overall 1.2.3 demand.

Cumulative Schedule Variance:

Variance At Complete:

This is an LOE account; its funding is determined by the demand for support services. Additional funding has been requested to meet requirements.

P&S ACCOUNT MANAGER — DATE 12/14/93

TPO — DATE 12/14/93

Yucca Mountain Site Characterization Project
Variance Analysis Report
Status Thru: 30-NOV-93

PARTICIPANT: LLNL PEM: GIL WBS: 1.2.5.2.2

WBS TITLE: SITE CHARACTERIZATION PROGRAM

P&S ACCOUNT: 0L522

FY 1994 Cumulative to Date									FY 1994 at Completion					
BCWS	BCWP	ACWP	SV	SV%	SPI	CV	CV%	CPI	BAC	EAC	VAC	VAC%	IEAC	TCPI
40	40	93	0	0.0	100.0	-53	-132.5	43.0	240	293	-53	-22.1	558	100.0

Analysis

Cumulative Cost Variance:
Cost variance was produced by unforseen level of activity required to support NWTRB actions. LLNL does not control the frequency or requirements of activities covered by this WBS. Costs are incurred as a result of ad hoc support requirements requested by NRC, NWTRB, and DOE.

Cumulative Schedule Variance:

Variance At Complete:
Variance at completion is a trend indication only. LLNL will continue to respond to requests by the above organizations until BAC has been expended.

John C. Robertson for W. Clarke 12/14/93
P&S ACCOUNT MANAGER DATE

John C. Robertson for W. Clarke 12/14/93
TPO DATE

Prepared - 12/14/93:08:07:59 | WBS Status Sheet (WBS02) | Inc. Dollars in Thousands

WBS No. - 1.2 | WBS Manager -

WBS Title - YUCCA MOUNTAIN PROJECT

Parent WBS No. - | Parent WBS Manager -

Parent WBS Title -

Statement of Work

See the current WBS Dictionary

Cost/Schedule Performance

		Current Period					FY1994 Cumulative to Date					FY1994 at Completion		
Id	Description	BCWS	BCWP	ACWP	SV	CV	BCWS	BCWP	ACWP	SV	CV	BAC	EAC	VAC
1.2.1	SYSTEMS ENGINEERING	13	13	0	0	13	26	26	13	0	13	160	147	13
1.2.2	WASTE PACKAGE	623	499	709	-124	-210	1221	2248	1299	1027	949	7663	8422	-759
1.2.3	SITE INVESTIGATIONS	103	72	61	-31	11	211	179	169	-32	10	1101	1067	34
1.2.5	REGULATORY	113	82	157	-31	-75	222	198	266	-24	-68	1470	1483	-13
1.2.9	PROJECT MANAGEMENT	102	102	99	0	3	202	202	199	0	3	1220	1217	3
1.2.11	QUALITY ASSURANCE	54	54	48	0	6	108	108	102	0	6	650	644	6
1.2.12	INFORMATION MANAGEMENT	21	21	7	0	14	41	41	27	0	14	250	236	14
1.2.13	ENVIRONMENT, SAFETY, & HEA	2	2	0	0	2	5	5	3	0	2	25	23	2
1.2.15	SUPPORT SERVICES	32	32	20	0	12	63	63	51	0	12	382	370	12
Total		1063	877	1101	-186	-224	2099	3070	2129	971	941	12921	13609	-688

Resource Distributions by Element of Cost

Fiscal Year 1994
Budgeted Cost of Work Scheduled

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	8369	8300	8336	8448	8356	8127	8055	7746	8046	7894	7904	7572	97153
LABOR	769	778	769	805	770	768	741	729	736	743	722	721	9051
SUBS	114	116	176	143	114	179	139	117	201	117	114	205	1735
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	153	169	173	195	172	179	166	177	160	160	134	156	1994
CAPITAL	0	0	0	0	141	0	0	0	0	0	0	0	141
Total BCWS	1036	1063	1118	1143	1197	1126	1046	1023	1097	1020	970	1082	12921

Inc. Dollars in Thousands

WBS No. - 1.2 -YUCCA MOUNTAIN PROJECT

Resource Distributions by Element of Cost

Fiscal Year 1994
Actual Cost of Work Performed

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
LBRHRS	8301	6113	0	0	0	0	0	0	0	0	0	0	14414
LABOR	762	413	0	0	0	0	0	0	0	0	0	0	1175
SUBS	114	303	0	0	0	0	0	0	0	0	0	0	417
TRAVEL	0	0	0	0	0	0	0	0	0	0	0	0	0
PM&E	0	0	0	0	0	0	0	0	0	0	0	0	0
OTHER	152	385	0	0	0	0	0	0	0	0	0	0	537
CAPITAL	0	0	0	0	0	0	0	0	0	0	0	0	0
Total ACWP	1028	1101	0	0	0	0	0	0	0	0	0	0	2129

Resource Distributions

Fiscal Year 1994	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
BCWS	1036	1063	1118	1143	1197	1126	1046	1023	1097	1020	970	1082	12921
BCWP	2193	877	0	0	0	0	0	0	0	0	0	0	3070
ACWP	1028	1101	0	0	0	0	0	0	0	0	0	0	2129
ETC	0	0	1141	1206	1560	1212	1082	1090	1139	1078	943	1029	11480

Fiscal Year Distribution

	Prior	FY1994	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001	FY2002	FY2003	Future	At Complete
BCWS	11926	12921	43026	40634	35287	24735	16377	10420	6461	750	0	0	202537
BCWP	10466	3070	0	0	0	0	0	0	0	0	0	0	
ACWP	10846	2129	0	0	0	0	0	0	0	0	0	0	
ETC	0	11480	41445	39309	34926	25815	17751	10826	7122	781	0	0	202430

MONTHLY COST/FTE REPORT

PARTICIPANT: LLNL
DATE PREPARED: Dec. 13, 1993
FISCAL MONTH/YEAR: NOV.1993

WBS ELEMENT	CURRENT MONTH END								FISCAL YEAR		
	ACTUAL COSTS	PARTICIPANT FTES	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS#	CAP EQPT ACCURAL	APPROVED BUDGET	CURRENT FY94 AFP	CUMULATIVE COSTS
1.2.1.5	5,602	0.30	48		0.00				160,000		11,664
SUBT 1.2.1	5,602	0.30	48	0	0.00	0	0	0	160,000	40,000	11,664
1.2.2.1	54,636	3.40	428		58.00				400,000		118,064
1.2.2.2.1	51,290	1.70	364		3,436.00	176,000			550,000		83,607
1.2.2.2.2	52,245	1.40	256		4,201.00				850,000		97,493
1.2.2.2.3	6,380	0.30	88		15.00				230,000		12,881
1.2.2.2.4	134,563	5.40	1,061		650.00	698,713			1,650,000		125,598
1.2.2.2.5	25,707	0.70	152		20.00				248,000		43,258
1.2.2.3.1.1	18,389	1.00	84		0.00	411,919			1,785,000		-240,162
1.2.2.3.1.2	16,176	0.60	124		2,852.00	24,231			280,000		-2,366
1.2.2.3.2	33,511	4.10	392		619.00	82,000	2,000		880,000		7,454
1.2.2.3.4.1	27,809	1.20	244		1,682.00				390,000		49,897
1.2.2.3.4.2	7,874	0.80	69		2.00				300,000		30,343
1.2.2.3.5	2,342	0.00	24		0.00				100,000		2,342
CAPITAL EQUIP.									••••		
SUBT 1.2.2	430,922	20.60	3,286	0	13,535	1,392,863	2,000	0	7,663,000	1,928,250	328,409
1.2.3.1	3,729	0.00	28		0.00				245,000		3,729
1.2.3.4.2	24,702	0.60	156		122.00				381,000		45,340
1.2.3.5.2.2	13,449	1.00	146		0.00				25,000		27,136
1.2.3.10.1	9,112	0.70	72		0.00				125,000		23,463
1.2.3.10.2	13,186	0.00	124		41,774.00				125,000		19,336
1.2.3.11.3	0	0.00	0		0.00				200,000		0
CAPITAL EQUIP.									•••		
SUBT 1.2.3	64,178	2	526	0	41,896	0	0	0	1,101,000	225,250	119,004
1.2.5.1	153	0.00	0		0.00				150,000		96
1.2.5.2.2	30,020	2.90	224		0.00				240,000		92,472
1.2.5.3.4	18,248	1.00	183		6,419.00				350,000		37,844
1.2.5.3.5	3,895	0.00	40		0.00				50,000		3,895
1.2.5.4.2	50,332	3.00	836		547.00				660,000		92,875
1.2.5.5.2	234	0.10	0		0.00				20,000		2,000
CAPITAL EQUIP.									••		
SUBT 1.2.5	102,882	7.00	1,283	0	6,966.00	0	0	0	1,470,000	367,500	229,182

MONTHLY COST/FTE REPORT

PARTICIPANT: LLNL
DATE PREPARED: Dec. 13, 1993
FISCAL MONTH/YEAR: NOV.1993

WBS ELEMENT	CURRENT MONTH END								FISCAL YEAR		
	ACTUAL COSTS	PARTICIPANT FTES	PARTICIPANT HOURS	SUBCONTRACT HOURS	PURCHASE COMMITMENTS	SUBCONTRACT COMMITMENTS	ACCRUED COSTS#	CAP EQPT ACCURAL	APPROVED BUDGET	CURRENT FY94 AFP	CUMULATIVE COSTS
1.2.9.1.2	43,161	3.10	428		193.00				620,000		93,155
1.2.9.2.2	52,646	3.90	571		768.00				600,000		108,708
SUBT 1.2.9	95,807	7.00	999	0	961.00	0	0	0	1,220,000	305,000	201,863
1.2.11.1	43,453	2.00	371		6.00				650,000		102,060
SUBT 1.2.11	43,453	2.00	371	0	6.00	0	0	0	650,000	162,500	102,060
										(FUNDED UNDER 1.2.16)	
1.2.12.2.2	5,525	0.20	36		0.00				116,000		10,399
1.2.12.2.3	7,651	0.30	40		950.00				134,000		17,419
SUBT 1.2.12	13,176	0.50	76	0	950.00	0	0		250,000	62,500	27,818
										(FUNDED UNDER 1.2.17)	
1.2.13.2.5	0	0.00	0		0.00				25,000		0
SUBT 1.2.13	0	0.00	0	0	0.00	0	0	0	25,000	0	0
1.2.15.2	17,910	2.60	357		99.00				290,000		39,888
1.2.15.3	5,865	0.00	0		0.00				92,000		10,538
SUBT 1.2.15	23,775	2.60	357	0	99.00	0	0	0	382,000	95,500	50,426
TOTAL LLNL	779,795	42.30	6,946	0	64,413	1,392,863	2,000	0	12,921,000	3,186,500	1,070,426

**** Capital equipment budgets are included in the individual WBS Elements.
Per instructions letter dated 4/27/93 V.F. Iorii to W. L. Clarke

Issues and Concerns

None at this time.

TECHNICAL SUMMARY

1.2.1. SYSTEMS ENGINEERING

1.2.1.1 Systems Engineering Coordination and Planning

No significant activities.

1.2.1.5 Special Studies

T. Buscheck continued to support the thermal loading systems study with a suite of repository-UZ-SZ-scale models for repository areas of 570, 744, 1139, 1755, and 2598 acres. For 63,000 MTU of Spent Nuclear Fuel (SNF), these repository areas correspond to Areal Mass Loadings (AMLs) of 110.5, 83.4, 55.3, 35.9, and 24.4 MTU/acre. A Youngest Fuel First SNF receipt scenario is assumed with a 10 yr cut-off for the youngest fuel, referred to as YFF(10). The scenario accounts for (in yearly increments) the emplaced inventory of BWR Waste Packages (WPs) containing 40 assemblies per WP, and PWR WPs containing 21 assemblies per WP. The waste receipt schedule was supplied by J. King of M&O. Seven values of k_b between 1 millidarcy and 84 darcy (1 darcy ~ io $^{-12}m^2$) were considered.

1.2.1.6 Configuration Management

Affected document notices (ADN's) were completed for CRs 94/013 and 94/019. No LLNL controlled documents were affected.

1.2.2. WASTE PACKAGE

1.2.2.1 Waste Package Coordination and Planning

W. Lin attended an SOC meeting on November 3, 1993.

1.2.2.2 Waste Package Environment

1.2.2.2.1 Chemical and Mineralogical Properties of the Waste Package Environment

Work on the New Zealand natural process analog site focused on resolving uncertainties in gas analyses and mineral constraints on water chemistry. Modeling of the equilibrium state of the system requires consistent means for back calculating downhole water chemistries from chemistries of separate gas and water analyses collected at the well head. Differences between various reported water chemistries

focused attention on the approach to these calculations. LLNL is in communication with the New Zealand collaborators to resolve these questions.

Use of affinity-temperature diagrams has pointed out particular areas of interest where minerals that control or strongly influence water chemistry can be identified. Current work is addressing apparent discrepancies between the results of this type of analysis and observed mineral assemblages. Specific questions are being formulated to determine how best to identify the equilibrium mineral assemblages.

The results of these efforts were presented at the Materials Research Society Meeting held in Boston, Nov. 29 - Dec. 3. Further discussions are underway to refine the work plan for the New Zealand collaborators, in light of the results to date.

The revised study plan for Waste Package Geochemistry and Mineralogy has completed internal review. It is currently being revised to address the review comments, and will be submitted to YMPO by December 31.

Data sets for use in the three-dimensional representation of mineralogical and chemical changes associated with various waste loading scenarios and repository geometries are being obtained. Requests have been sent to organizations that have the data sets, and we await their response.

Installation of software for converting graphical displays to video images has been delayed until December due to other programmatic demands of a higher priority.

1.2.2.2.2 Hydrologic Properties of the Waste Package Environment

<u>The Impact of Layered Heterogeneity on Mountain-Scale, Buoyant Gas-Phase Convection</u>

This month, we considered cases in which the distribution of bulk permeability (k_b) varies vertically, which results in a layered distribution. This was done in consideration of the unpublished k_b data of E. Weeks, USGS, which indicates considerable layering. In particular, it appears that k_b may be far smaller in the nonwelded vitric units (PTn and CHnv) and the nonwelded zeolitized CHnz than in the welded units (TCw, TSw1, TSw2, and TSw3). We considered two suites of cases where k_b is high throughout the welded units. In order to analyze these cases, S. Daveler developed a post-processor (called MASSB) for V-TOUGH that calculates the mass balance as a function of time over specified regions. MASSB calculates the total volume of water removed from the dry-out zone and water added to the zone of saturation buildup as well as the net saturation change. MASSB also calculates the normalized volumes of dry-out, saturation buildup, and net saturation change.

For an areal mass loading (AML) of 27.1 MTU/acre, we considered three cases with a layered k_b distribution:

1) k_b = 84 darcy everywhere in the UZ except in the PTn, where k_b = 320 millidarcy
2) k_b = 84 darcy everywhere in the UZ except in the CHnv and CHnz, where k_b = 307 and 280 millidarcy, respectively
3) k_b = 84 darcy everywhere in the UZ except in the PTn, CHnv, and CHnz, where k_b = 320, 307, and 280 millidarcy, respectively. The layered-k_b sub cases were compared to the uniform-k_b case in which k_b is 84 darcy throughout the unsaturated zone (UZ).

For an AML of 154.7 MTU/acre, we considered three cases with a layered k_b distribution:

1) k_b = 5 darcy everywhere in the UZ except in the PTn, where k_b = 320 millidarcy
2) k_b = 5 darcy everywhere in the UZ except in the CHnv and CHnz, where k_b = 307 and 280 millidarcy, respectively.
3) k_b = 5 darcy everywhere in the UZ except in the PTn, CHnv, and CHnz, where k_b = 320, 307, and 280 millidarcy, respectively.

These layered-k_b cases were compared to the uniform-k_b case in which k_b is 5 darcy throughout the UZ.

For the uniform-k_b cases, mountain-scale, buoyant, gas-phase convection behaves as though it is in an "open" system with respect to the ground surface. In this open system, the gas-phase velocity vectors are orthogonal to the ground surface in the vicinity of the ground surface. Buoyant vapor flow results in a substantial increase in liquid saturation from the repository horizon all the way to the ground surface. In the case in which the PTn has low permeability, this unit functions as a gas-phase flow barrier or "vapor cap." Consequently, the direction of gas-phase flow below the PTn/TSw1 contact becomes tangential to this contact rather than crossing the PTn. The PTn effectively isolates the buoyant, gas-phase, convection cells from the ground surface, thereby causing the convective system be "closed" with respect to the ground surface. The magnitude of gas-phase flow velocities in the "closed" convective system is nearly three times less than in the "open" convective system. In the case in which the CHnv and CHnz have low permeability, the direction of gas-phase flow above the TSw3/CHnv contact becomes tangential to this contact rather than crossing it. Consequently, the magnitude of gas-phase flow in the TSw3 and TSw2 is substantially less than in the uniform-k_b case.

For the low AML, low k_b in the PTn reduces both the magnitude of gas-phase flow and the extent of liquid saturation buildup above the repository. For high AML, low k_b in the PTn reduces the magnitude of gas-phase flow, but has the effect of slightly increasing the saturation buildup above the repository. For both AMLs, low k_b in the CHnv and CHnz reduces both the magnitude of the gas-phase flow velocities and the extent of liquid saturation buildup above the repository.

T. Buscheck continued to support the thermal loading systems study with a suite of repository-UZ-SZ-scale models for repository areas of 570, 744, 1139, 1755, and 2598 acres. For 63,000 MTU of Spent Nuclear Fuel (SNF), these repository areas correspond to Areal Mass Loadings (AMLs) of 110.5, 83.4, 55.3, 35.9, and 24.4 MTU/acre. A Youngest Fuel First SNF receipt scenario is assumed with a 10 yr cut-off for the youngest fuel, referred to as YFF(10). The scenario accounts for (in yearly increments) the emplaced inventory of BWR Waste Packages (WPs) containing 40 assemblies per WP, and PWR WPs containing 21 assemblies per WP. The waste receipt schedule was supplied by J. King of M&O. Seven values of k_b between 1 millidarcy and 84 darcy (1 darcy ~ io $^{-12}m^2$) were considered.

This month, focus was on the impact of buoyant, gas-phase convection on reducing the duration of the boiling period, and bulk moisture movement in the UZ. The area-weighted boiling period duration, ($t_{bp,av}$) for the above-boiling cases was calculated.

	Area weighted boiling duration, yr						
AML	k_b (darcy)						
MTU/acre	0.001	0.01	0.28	1	10	40	84
110.5	5466	5515	5446	5286	4990	3891	3227
83.4			3391	3056	2402	2056	1592
55.3			1424	1349	928	375	164

The cooling effect that mountain-scale, buoyant, gas-phase convection has on $t_{bp,av}$ increases with decreasing AML. For example, the 110.5 MTU/acre, 40-darcy case has $t_{bp,av}$ reduced by 29% relative to the 280 millidarcy case, while for the 83.4 and 55.3 MTU/acre cases, the reduction is 39 and 74%, respectively.

A comparison of the net total liquid saturation buildup (ignoring shedding) above the repository for all of the thermal loads and k_b cases was performed. For the high-k_b, high-AML cases (10, 40, and 84 darcy; 83.4 and 110.5 MTU/acre), there is an early peak in total saturation buildup that occurs at about 500 to 800 yr, coinciding with the maximum vertical extent of boiling conditions. After the initial peak, the total saturation buildup quickly declines, with a trough occurring at around 3000 yr, coinciding with the maximum vertical extent of dry-out. For the 110.5 MTU/acre case, the total saturation buildup declines to nearly zero. For the 83.4 MTU/acre case, the trough is less pronounced and the total saturation buildup stays well above zero. For the 55.3 MTU/acre case there is no trough and the saturation buildup continues uninterrupted. After the trough occurs in the 83.4 and 110.5 MTU/acre cases, the saturation buildup resumes until a second peak in total saturation buildup occurs at around 20,000 to 30,000 yr. For 10, 40, and 84 darcy, the 55.3, 83.4, and 110.5 MTU/acre cases experience the same initial rate of increase in total saturation buildup until 500 yr when the 110.5 MTU/acre case

reaches its initial peak and 800 yr when the 83.4 MTU/acre case reaches its initial peak. This initial peak is related to the interaction of the heat-pipe effect and mountain-scale, buoyant, gas-phase convection.

It is extremely important to note that the net total saturation buildup is greater in the 55.3 MTU/acre case than in 83.4 MTU/acre case which is greater than in the 110.5 MTU/acre case. For the 83.4 MTU/acre case, the maximum net total saturation buildup is 1.5, 1.7, 1.4, 1.4, and 1.5 times greater than in the 110.5 MTU/acre case for 280 millidarcy, 1, 10, 40, and 84 darcy, respectively. For the 55.3 MTU/acre case, the maximum net total saturation buildup is 1.5, 1.3, 2.4, 2.6, and 2.5 times greater than in the 110.5 MTU/acre case for 280 millidarcy, 1, 10, 40, and 84 darcy, respectively. To the first order, for the above-boiling cases, the maximum total net saturation buildup is proportional to the repository area. Therefore, the total amount of saturation buildup above the repository decreases with increasing AML. For the 110.5 MTU/acre case and $k_b \leq 10$ millidarcy, the net saturation buildup above the repository is always negative (i.e., a net decrease in liquid saturation). Consequently, if the large-scale connected k_b is small enough, mountain-scale, buoyant, gas-phase convection does not result in a saturation buildup above the repository.

For 280 millidarcy, the maximum net total saturation buildup for the 24.4 and 35.9 MTU/acre cases is 26 and 34% of the buildup for the 110.5 MTU/acre case; however, the saturation buildup for the latter case is relatively small to begin with. For 10 darcy, the maximum net saturation buildup for the 24.4 and 35.9 MTU/acre cases is 50 and 105% of the buildup for the 110.5 MTU/acre case. For 40 darcy, the maximum net saturation buildup for the 24.4 and 35.9 MTU/acre cases is 1.7 and 2.9 times greater than in the 110.5 MTU/acre case. For 84 darcy, the maximum net saturation buildup for the 24.4 and 35.9 MTU/acre cases is 2.8 and 3.4 times greater than in the 110.5 MTU/acre case. Therefore, for low k_b, the sub-boiling cases result in less net saturation buildup than the 110.5 MTU/acre. However, for high k_b, the sub-boiling cases result in substantially greater net saturation buildup than the 110.5 MTU/acre case. To the first order, for high k_b, the maximum total net saturation buildup is proportional to the repository area. Therefore, the total amount of saturation buildup above the repository decreases with increasing AML.

T. Buscheck attended the Two-Phase Flow in Fractures Workshop in Berkeley on November 3 and 4 and helped write the report produced by the workshop participants.

The draft of the study plan 8.3.4.2.4.2, "Hydrological Properties of the Near-Field Environment" has been reviewed by the LLNL QA Manager and was submitted to YMPO for review on November 30. The internal technical review will be completed in parallel with the YMPO review. Submission of the draft study plan for YMPO review completes milestone MOL20.

See WBS 1.2.1.5 for further hydrological calculations.

Laboratory Experiments

Measurement of electrical resistivity as a function of moisture content of Topopah Spring tuff samples from the G-4 and GU-3 holes continued. Distilled and J-13 water are being used as pore fluids. Measurements of the G-4 samples at 40°C are complete; measurements included wetting and drying cycles and the use of both J-13 and distilled waters. The samples are now in the wetting phase at 65° C and up to 65% saturation.

The experiment to determine the moisture retention curve and one-dimensional imbibition using G-4 core continues. The data from this experiment will be used to calculate relative permeability as a function of water saturation. Moisture retention experiments at high temperatures have been initiated. Some samples are at 95°C and 50% relative humidity. Data analysis of the one-dimensional imbibition experiment is proceeding. Evaluation of the use of the four-electrode method on a rectangular sample continues.

The saturated water permeability measurement on an intact sample from G-4 is ongoing. The sample is under a confining pressure of about 5 MPa and a pore-water pressure of about 2.4 MPa. Permeability measurements at a pore pressure gradient of 0.14 MPa/cm were conducted. The data will be reduced next month.

1.2.2.2.3 Mechanical Attributes of the Waste Package Environment

Assessment of instrumentation for the laboratory and field block tests continued. LLNL staff visited a vendor in Phoenix, AZ. to evaluate a frequency modulated (FM) laser ranging system for use in the measurement of displacements in laboratory and field tests. The FM system is promising and could be used with components of conventional multiple point borehole extensometers (MPBX) that are currently available. The laser system would circumvent many of the limitations of the conventional MPBX systems, however, it currently does not provide the required precision and needs more development. Follow-on discussions are underway with Phase Laser to assess the possibility for improved performance of this technology.

P. Berge and B. Bonner continued design and planning of the acoustic measurements to be made on the laboratory and main large block tests. These include assessment of acoustic sources and receivers, design of experiment geometry, and interfaces with other experiments on the LBT.

Progress was made on the fabrication of a pressure control system for the laboratory block tests and purchase of a conventional MPBX for the LBT.

Training for the PACS and to several new QPs was also completed.

1.2.2.2.4 Engineered Barrier System (EBS) Field Tests

Study Plan 8.3.4.2.4.4, entitled "Engineered Barrier System Field Tests," has been reviewed by the YMPO. Comment resolution by the PI is about 50% complete.

Large Block Test (LBT)

The first draft of the Activity Plan for the LBT has been completed. The LLNL internal review began in November. The activity plan, according to LLNL QA procedures, does not require external review. However, J. Blink has circulated copies externally for informal review and is providing any comments received to the PI; these comments need not be resolved but will be considered.

Preparation for laboratory tests on smaller blocks and for supporting the quarrying of the large block continue.

Leveling and surface fracture mapping of the site has been completed. The location of the block was determined based on the distribution and orientation of fractures on the surface. Vertical hole drilling has begun. Air permeability measurements were conducted in the first vertical NX hole (7.6 cm diameter). The permeability at the potential heater horizon in the block ranges between 5 and 10 md. Scoping calculations indicate that this permeability level is suitable for creating a dry-out zone and a condensate zone in the block by heating from internal heaters, as planned.

Geomechanical instrumentation for the LBT is discussed in the WBS 1.2.2.2.3 section.

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

Three papers have been prepared for presentation at the Fall Materials Research Society Meeting in Boston next month: "Chemical Implications for the Presence of Introduced Materials in the Post-Emplacement Environment" by A. Meike, "Introduced Materials and Colloid Formation: A Report on the Current State of Knowledge" by A. Meike and C. Wittwer, "Experimental Investigation of Hydrous Pyrolysis of Diesel Fuel and the Effect of Pyrolysis Products on Performance of the Candidate Nuclear Waste Repository at Yucca Mountain" by K. Jackson and S. Carroll.

New Zealand

Work continues to set up a contract with Biodegradation Systems, Inc. for biodegradation work during FY94.

Diesel Fuel Stability Experiments

A three month experiment was initiated to investigate diesel fuel stability in water at elevated temperature.

Diesel Exhaust

Dialogue continues with J. Younker, M&O, regarding the possible chemical ramifications of the presence of diesel exhaust in the ESF and a potential repository at Yucca Mountain. A proposal for the study of these effects through both historical analog and experiment has been submitted by A. Meike, S. Carroll and K. Jackson.

A. Meike has provided a draft response to reviewer's comments for the white paper "Chemical and Mineralogical Concerns for the use of Man-Made Materials in the Post-Emplacement Environment" and is awaiting a reply in order to provide a formal response.

The draft study plan "Characterization of the Effects of Man-Made Materials on Chemical and Mineralogical Changes in the Post-Emplacement Environment" (8.3.4.2.4.5) was been submitted to YMPO for review on November 30. This complete milestone MOL21.

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

Spent Fuel Dissolution

LLNL started two repeat experiments at 20% oxygen and 75°C. The original data seemed unusually high when compared to the other experiments in the test plan. The new data will be included in the paper submitted for the IHLWM meeting in Las Vegas this coming May that combines and compares the UO_2 dissolution data obtained at LLNL and the similar spent fuel dissolution data obtained at Pacific Northwest Laboratories.

Specimens of ATM-104 (PWR) and ATM-105 (BWR) spent fuel continue to be prepared for use in dissolution tests with oxidized fuel. Part of the preparation involves exposing short sections (about 20 mm long) of the fuel and its associated cladding to deionized water for one week. These waters will be analyzed to determine the so-called gap inventories of Cs-137, I-129, and other radionuclides. Following the water exposure, portions of each fuel will be oxidized to U_3O_8 for use in flow-through dissolution tests. Other portions are ground and screened to produce specimens consisting of individual grains. These will be subjected to short-

term dissolution tests designed to measure the grain-boundary inventories of Cs-137, I-129, and other radionuclides. The specimens will then be used in flow-through dissolution tests where the results will be compared with test results from other specimens of ATM-104 and ATM-105 fuels that were oxidized to U_4O_{9+x}. It is anticipated that they will be completed and the specimens transferred to the Pacific Northwest Laboratories building 325 hot cells in early December.

A paper describing the UO_2 dissolution work at LLNL was presented at the 1993 Fall Materials Research Society Meeting in Boston. A manuscript will be published in the proceedings of the symposium entitled "Scientific Basis for Nuclear Waste Management XVII."

Spent Fuel Oxidation

Dry Bath Testing

Drybath testing continued without incident. The next interim examination is scheduled in December.

Thermogravimetric Apparatus (TGA)

A TGA Test Plan Addendum has been completed. Corrections and revisions are currently being incorporated.

TGA tests are in progress at 255°C to obtain the initial rise-to-plateau part of the oxidation curve and at 270°C to obtain a full oxidation curve. A very flat plateau of >400 hours formed at 270°C. Based on previous data, the next phase transition should occur shortly. Samples from the scoping TGA tests are being prepared for transmission electron microscope (TEM) and scanning electron microscope (SEM) analyses.

Materials Characterization Center (MCC) Hot Cell Activities

Old and unusable spent fuel samples are in the process of being packaged and consolidated for storage. Consolidation will simplify accountability of special nuclear materials. These samples are unusable due to contamination in the hot cells and have presented inventory problems.

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 91 months. Enough liquid should have collected since the last sampling period to allow for some useful

additional testing in support of EBS design to be done. Sampling will occur in December.

The N3 tests (ATM-10, a West Valley actinide-doped glass) continue and have been in progress for 72 months. Sampling of these tests will also be done in December as input to the Topical Report for the N3 tests.

A QAC surveillance has been scheduled for December as part of sampling of the N2 and N3 tests.

Due to continued low funding, no work was done in the following areas:

1) Static Leach Testing of WVDP and DWPF Glass
2) Parametric Studies of WVDP and DWPF Glasses Based on the Unsaturated Test
3) Parametric Studies of WVDP and DWPF Glass
4) Studies of Glass Surface Layers and Precipitation
5) Development of Licensing Database for Glass Waste Form Materials Interactions

1.2.2.3.2 Metal Barriers

Task Management and Quality Assurance (PACS OL232JCD)

D. McCright was contacted by R. Moeller representing the Nickel Development Institute (NiDI) on the status of YMP work on candidate barrier materials. NiDI is an association of nickel producers and was formed to promote the use of that metal and its alloys. A packet of recent YMP publications on metal barriers was prepared for Mr. Moeller.

During November, a considerable amount of time was spent on interviewing and recruiting principal investigators to work on the Metal Barrier Task and related Non-Metallic Barrier Task (WBS 1.2.2.3.5). We were able to find PIs, some of whom have previously worked on this project. Where necessary, position descriptions were written and training requirements were established. These new participants have begun QA training.

R. Van Konynenburg attended the MRS meeting, November 29 - December 3 in Boston, MA. He served as the general chairman for this year's symposium on the Scientific Basis for Nuclear Waste Management. In addition, he presented one of the keynote papers entitled "Science and Licensing: Let's Get Off the Collision Course". The paper examined the inherent factors and limitations in making long-term predictions using the scientific method. The paper also discussed the criteria for admissibility of scientific evidence in the legal arena. The paper concluded that the prospects were doubtful for successful licensing of a repository under regulations that were binding until recently. However, changes are occurring in these regulations, and the paper goes on to suggest how the situation can be remedied. Presentation of the paper produced a lively discussion at the meeting.

The paper, along with all the others, will be published in the symposium proceedings.

On a related project, D. McCright participated in a DOE Waste Acceptance Technical Review Group November 3-4 meeting in Buffalo, NY. The group also toured the West Valley Demonstration Project site. There is considerable construction proceeding on the full-scale waste handling, melting, and pouring operations planned at this site. Production of the first canisters of high-level glass is expected in mid-1995.

Prepare Planning Documents (PACS OL232LFF)

No significant activities.

Degradation Mode Surveys (PACS OL232LFF)

Metal Barrier SIP Activity E-20-13: A proposal was received from D. Bullen at Iowa State University to complete the degradation mode survey on carbon steels and other iron-base materials. The proposal would cover a wider range of materials and environments than the initial draft of this survey. Because of the need to complete this survey in a short time and the previous experience of the principal investigator, a non-competitive procurement was prepared. It is expected that the procurement action can be completed in December.

Performance Tests and Model Development (PACS OL232LFB)

Metal Barrier SIP Activity E-20-16: G. Henshall has returned to the YMP as Principal Investigator for this activity. His efforts this month have focused on QA training and a review of his previous efforts in modeling pitting corrosion, using codes developed in previous years. Experimental and code development efforts that are needed to continue this research have been identified. Experimental efforts needed include:

1) Determining the distribution of pit depths as a function of time, environment, and alloy composition for austenitic candidate alloys. This information will be used to determine values for the model parameters for model validation and for further model development. J. Farmer will contribute to this aspect of the planned work.
2) Measuring the electrochemical noise during the initiation of pits. This information will be used to determine the pit birth and pit death parameters in the model. These experiments need to be performed as a function of the environmental variables, e.g. temperature, potential, electrolyte chemistry, etc.
3) Exploring the mechanisms of stochastic stable pit growth based on results from the above experiments. The question to be addressed is how stable pits grow, whether monotonically with time, in a start/stop/start sequence, or some pits grow continuously while others permanently stop growing after various exposure times.

Efforts needed for code development include:

1) Explore the effects of not having the stable pit growth probability, *r*, be a constant. This includes exploring stochastic variations in *r*, a monotonic decay in *r* with time, and having *r* be a function of pit depth. The goal is to simulate pit depth distributions that are "skewed" toward small depths with a long "tail" at large depths, in agreement with a variety of previously published data.
2) Improve the equations simulating the environmental dependence of the stochastic pitting parameters. This will be achieved by combining reviews of the literature with the results of the experiments described above.
3) Explore numerical methods to determine the stochastic model parameters from the experimental data.

Parameter Tests and Metal Degradation (PACS OL232LFC)

Metal Barrier SIP Activity E-20-17: G. Gdowski has rejoined the YMP as a Principal Investigator for this activity. He is also undergoing QA training and review of previous work. Currently, there are two separate areas to the work in this activity:

1) Thermogravimetric analysis (TGA) system to measure corrosion and oxidation rates under controlled humidity levels.
2) Reversing dc crack growth data acquisition system for monitoring crack propagation in candidate materials. This last area is similar to the apparatus used at Argonne National Laboratory for activity E-20-18f discussed in the next section.

The Cahn TG-131 TGA unit arrived in October and was installed in the laboratory. J. Peterson of Cahn Instruments visited the laboratory on November 11 and 15 to complete installation and perform the initial calibration, using a calcium oxalate standard. J. Estill is running some scoping tests of high-purity copper (CDA 102) in dry air at 100, 175, 250, and 325°C. The TGA unit, as received, was not designed as a hot vapor delivery system. Therefore, it was necessary to build a remote vapor delivery system outside the confines of the TGA system box to eliminate the possibility of condensation problems in the existing system. At the same time, we are able to maintain the sophisticated gas switching system of the TGA controller. The remote electronic hook-up was completed.

In December the fabrication of the vapor delivery system will be completed. A level switch is being added to the saturator system that will transmit a signal to a solenoid valve that closes the flow from a distilled water reservoir. This system will maintain a constant volume of water in the saturator, thus requiring maintenance of the critical temperature in only one saturator, rather than in all three as previously designed. The reservoir will provide a sufficient volume of water to allow us to run tests for 2-3 weeks unattended.

G. Stevens of General Electric visited on November 18 to solve some of the problems with the crack growth data acquisition system. He found some errors associated with the test start-up. The program was modified in two ways to handle the existing problems. He optimized the program to use as much RAM as was

available on the viper board and also modified the program so that it would not allow test set-up entries that produced conflicts with the print interval input. He graciously provided us with the code for future reference to such errors. During December, J. Estill and S. Gordon will run several different test parameters to eliminate future problems.

Crack Growth Tests (PACS OL232LFD)

Metal Barrier SIP Activity E-20-18f: D. McCright visited Argonne National Laboratory (ANL) on November 6 to discuss progress being made on stress corrosion crack growth measurements. He met with D. Diercks, J-Y. Park, and J. Bates. ANL submitted a year-end status report on the work completed through FY-93. This report will be reviewed and submitted as a deliverable for this activity. We submitted the necessary paper work to continue the funding for this activity through an Integrated Contractor Order (ICO). The ICO should be in place by early December. As indicated in last month's report, the ANL work will focus on the stress corrosion cracking resistance of highly corrosion resistant materials. In addition to the work on Alloy 825, specimens of Hastelloy C-4, Hastelloy C-22, and Titanium Grade 12 will be added to the test matrix. We will continue to test Types 304L and 316L stainless steel as points of reference because of the abundant data and mechanistic studies available on these materials.

Materials Characterization Report (PACS OL232LFE)

No sigificant activities.

1.2.2.3.3 Other Materials

This WBS element has not been funded in FY94.

1.2.2.3.4 Integrated Testing

1.2.2.3.4.1 Integrated Radionuclide Release: Tests and Models

Determination of Elemental Profiles in Rocks, Minerals, and Glasses using the Ion Microscope

The flow through apparatus test phase is nearly finished and the milestone MOL06 will be completed in December.

Due to continued low funding, no work was performed in the following areas:

1) Modeling Actinide Distribution in Tuff
2) Interaction of Materials under Repository Conditions
3) Source Term Model Development
4) Source Term Model Validation

1.2.2.3.4.2 Thermodynamic Data Determination

A total of $400k has been allocated to this task in FY94. $200k of YMPO funds will support experimental work. A total of $200k (half from the International Program) will support NEA data reviews. PACS accounts were established for these activities.

1.2.2.3.5 Non-metallic Barrier Concepts

(PACS OL235JGD and OL235KKA)

K. Wilfinger began his assignment as Principal Investigator for this task. He has a Ph.D. from Rutgers University in ceramic engineering and has been at LLNL since 1987. The major piece of work planned for this task in FY-94 is the preparation of a survey on possible ceramic materials that could be used in a multiple barrier design, the state of technology in fabricating ceramic materials in dimensions suitable for a waste package barrier, and possible degradation modes affecting ceramics for long-term disposal.

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 FY94.

1.2.3 SITE INVESTIGATIONS

1.2.3.1 Site Investigations Coordination and Planning

No significant activities.

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 FY94. Funding has been requested from the YMPO WBS manager (A. Simmons) in order to write the Study Plan required by the RSED Director in FY94.

1.2.3.4 Geochemistry

1.2.3.4.2 Geochemical Modeling

A preliminary version of the software for EQ3/6 Version 7.2a was ported onto a Silicon Graphics (SG) machine. Testing revealed a few problems in the UNIX interface software which were due to the fact that SG now uses a slightly different

flavor of UNIX. These were quickly resolved. The EQPT preprocessor was modified to process the Chemval data file, which uses e^- as the redox species in place of $O_{2(g)}$. This data file will be included in the Version 7.2a distribution package. The expected distribution date has been pushed into December due to continued work by the Data Base Group on the other data files.

The Independent Software Validation activity for EQ3/6 Version 7 is continuing. Focus on EQ3NR is complete and is now on EQ6.

Work is continuing on EQ3/6 Version 8.0. In FY93, we completed a major re-write of the software, incorporating major changes in the data structure in order to accommodate improvements in numerical methods and the addition of new functional capabilities. This included modifying the EQ6 code to utilize the auxiliary basis concept, thus allowing it to make reaction path calculations incorporating specified redox disequilibria. This capability is important in treating the metastable persistence of dissolved components such as sulfate, nitrate, and organics in laboratory and field settings. In FY94, we are adding two additional capabilities to EQ3/6:

1) a generic ion-exchange model
2) correction of supporting data, mostly thermodynamic, to pressures off the 1.013 bar-steam saturation curve.

Work is currently being done to incorporate the necessary new data structures and the related I/O.

1.2.3.5 Drilling

1.2.3.5.2.2 Engineering, Design, and Drilling Support

Two logging sessions were conducted at UZ-14. The runs were conducted on November 3 and 4. Both runs were to monitor water movement.

Two logging sessions were conducted at UE 25 NRG-2A. On November 8 one run was conducted to inspect the hole. On November 9, fifteen runs were made to inspect the hole and one run was made to conduct a hole depth measurement.

Two logging sessions were conducted at UE 25 NRG-2B. Hole inspection runs were made on November 10 and 12.

The line marking procedure utilized in Technical Implementing Procedure NV-01 was field tested on truck #80004 on November 15.

A CAR was written by YMPO because TIP-NV-01 was not yet approved and distributed as a controlled document. To date, activities have been controlled by the scientific notebook procedure and by Weapons Program procedures. In response to the CAR, review of TIP-NV-01 was accelerated.

Funding for this WBS element has been exhausted. Additional funds have been requested from the DOE WBS Manager, these are expected in the YMPO January AFP submission to DOE-HQ.

1.2.3.10 Altered Zone Characterization

Preliminary activites to begin experiments to evaluate the effect of relative humidity on reaction products and rates in vitric material continued. The sample material was prepared for initial characterization prior to loading into reaction vessels. Unexpected changes in the schedule of technical support prevented completion of characterization projected for November and experimental runs that were to begin in December. Characterization is now expected to be completed in mid-January, and the experimental runs started in late January. The reaction products will be provided to Los Alamos National Laboratory (LANL) for use in studies of dehydration/ rehydration effects in single phases.

Plans for reaction precipitation studies are being developed. An evaluation of existing equipment for suitability has been completed. The existing equipment is suitable. The first efforts will focus on silica precipitation kinetics.

LLNL consulted with LANL concerning coordination of activities regarding the stablity of mineral assemblages. A meeting took place in Albuquerque, and discussion of study design occurred. The results of that meeting are being documented.

Additional existing codes that couple hydrological and geochemical processes were obtained. Installation of the codes is now in progress and they will be in place by late January. Test cases will be run by late January. Design of experiments to test the codes, as well as general test cases for use in all of the codes will be started at that time.

The study plan for this WBS is now being written. Projected completion is May 1994.

1.2.3.11 Integrated Geophysical Testing for Site Characterization

1.2.3.11.3 Geophysics - ESF Support, Subsurface Geophysical Testing

PACS planning was completed for this new WBS element.

1.2.5 REGULATORY

1.2.5.1 Regulatory Coordination and Planning

No significant activities.

1.2.5.2 Licensing

1.2.5.2.2 Site Characterization Program

J. Blink attended a NWTRB meeting in Dallas on November 12.

J. Blink briefed nine members of the Nuclear Regulatory Commission on a tour of the Fran Ridge Large Block Test (LBT) site on November 17.

J. Blink briefed nine members of the Edison Electric Institute on a tour of the LBT site on November 30.

1.2.5.3 Technical Data Management

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

Development of a Windows/4GL (mouse-driven) version of JEWEL is continuing. This program facilitates interactive point-and-click generation of customized thermodynamic data files for EQ3/6, GT, and other geochemical modeling packages.

A reconnaissance and review of recently published thermodynamic data for Neptunium, Americium, Plutonium, and Technitius species has been initiated. As needed and where appropriate, these data will be used to augment those already in GEMBOCHS until publication of the NEA-TDB critical reviews of the chemical thermodynamics of these species. These reviews, to be published as separate volumes in the series, began with the Uranium compilation (Grenthe et al., 1992), and will be available in the next few years.

1.2.5.3.5 Technical Data Base Input

Technical data submissions were included in PACS milestones for data generating activities.

1.2.5.4 Performance Assessment

1.2.5.4.2 Waste Package Performance Assessment

W. Halsey attended a Total System Performance Assessment Workshop for FY-93 on November 22 in Albuquerque, New Mexico.

1.2.5.5. Special Projects

1.2.5.5.1 Integrated Test Evaluation (ITE)

This activity has not been funded in FY94.

1.2.5.5.2 Energy Policy Act Support

No significant activities.

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 Infrastructure Reduction Assessment Team and Cost Reduction Steering Committee meetings in Las Vegas on November 10. J. Blink attended Infrastructure Reduction Assessment Team meetings in Albuquerque, New Mexico on November 16 and Las Vegas, Nevada on November 18.

J. Blink and C. Passos attended the LESSON-NV committee meeting on November 17.

1.2.9.2 Project Control

1.2.9.2.2 Participant Project Control

The PACS Monthly Status Report, Variance Explanations, Cost/FTE Equivalent Report and WBS Report have been submitted to YMPO for the month of November.

1.2.11 QUALITY ASSURANCE

1.2.11.1 Quality Assurance Coordination and Planning

R. Monks attended training on procedure YAP-15.1Q in Las Vegas on November 30.

1.2.11.2 Quality Assurance Program Development

T. Wolery completed new drafts of QP 3.2 and TIP-YM-17, these are currently undergoing internal review.

Revision 1 to Internal Grading Reports LLNL-QAG-003, 004, and 007 for new activities D-20-49.6, D-20-54.1, and D-20-54.2 were completed and distributed on November 3.

LLNL is continuing to work on the revision of procedures to comply with the new QARD and matricing requirements against LLNL-YMP procedures. In that respect, the following procedures or Change Notices to procedures were issued during November:

1) CN2.5-1-1 to procedure 033-YMP-QP 2.5, "Acceptance of Data Not Generated Under the Control of the QARD".

2) CN 5.0-3-1 to procedure 033-YMP-QP 5.0, "Technical Implementing Procedures".
3) CN 15.0-3-1 to procedure 033-YMP-QP 15.0, "Nonconforming Items".
4) CN 16.0-5-1 to procedure 033-YMP-QP 16.0, "Corrective Action".
5) CN 17.0-5-2 to procedure 033-YMP-QP 17.0, "Quality Assurance Records".
6) CN 18.2-3-1 to procedure 033-YMP-QP 18.2, "Qualification of Quality Assurance Audit Personnel".
7) CN 1.0-4-1 to procedure 033-YMP-QP 1.0, "Organization".
8) CN 2.1-5-1 to procedure 033-YMP-QP 2.1, "Preparation, Approval, & Revision of Procedures, Requirements, Plans, and the Quality Assurance Program Description".
9) CN 2.3-1-1 to procedure 033-YMP-QP 2.3, "Management Assessments".
10) B, Rev. 1, "Preface".
11) 033-YMP-QP 2.10, Rev. 5, "Qualification of Personnel".
12) 033-YMP-QP 2.0, Rev. 2, "Assurance".
13) 033-YMP-QP 2.2, Rev. 1, "Peer Review".
14) 033-YMP-QP 2.9, Rev. 5, "Indoctrination & Training".
15) 033-YMP-QP 3.4, Rev. 3, "Scientific Notebooks".
16) 033-YMP-QP 4.0, Rev. 4, "Procurement Document Control".
17) 033-YMP-QP 7.0, Rev. 1, "Control of Purchased Items".
18) 033-YMP-QP 8.0, Rev. 2, "Identification & Control of Items, Samples, & Data
19) 033-YMP-QP 12.0, Rev. 6, "Control of Measuring & Test Equipment".

1.2.11.3 Quality Assurance Verification

1.2.11.3.1 Quality Assurance Verification - Audits

The YMQAD staff has verified the corrective action to Corrective Action Report (CAR) YM-93-085, resulting from audit YMP-93-14, and determined the results to be satisfactory. As a result, the CAR is closed.

1.2.11.3.2 Quality Assurance Verification - Surveillance

No significant activities.

1.2.11.4 Field Quality Assurance/Quality Control

This WBS element has not been funded in FY94.

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 Operations (LRC)

LLNL-YMP Document Control issued nine revisions and 10 change notices in November.

1.2.12.2.3 Participant Records Management

A total of 178 items were logged into the LLNL-YMP tracking system. This includes 5 records/records packages that were processed through to the CRF. Eleven action items were closed.

1.2.12.2.5 Document Control

LLNL received no funding under this WBS for FY94. Work performed to complete LLNL's obligation in this WBS is funded under WBS 1.2.12.2.2.

1.2.13.2 SAFETY AND OCCUPATIONAL HEALTH

1.2.13.2.5 Occupational Safety and Health

Preparations for neutron logging at the Large Block Test site continue.

1.2.15 SUPPORT SERVICES

1.2.15.2 Administrative Support

No significant activities.

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

Currently there are 81 participants on the project who are to be trained and/or tracked.

PACS training for LLNL-YMP Account Managers was held on November 11.

LLNL-YMP added three new participants and re-activated one participant. The training office distributed 368 self study assignments. The self study assignments included 9 revisions and 10 changes notices to quality procedures.

LLNL PROJECT STATUS REPORT DISTRIBUTION

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DEC 20 9 05 AM '93

I-351042

IN REPLY REFER TO:
580-01-146

WBS 1.2.9.1
QA: N/A

December 14, 1993

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Acting Project Manager
Yucca Mountain Site Characterization
Project Office
U.S. Department of Energy
Post Office Box 98608
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YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP) PROGRESS REPORT (SCP: N/A)

Attached is the November YMP Progress 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.

RF Pritchett

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

RFP:RRK:mab

Enclosures
1. Progress Report (6 pages)
2. Cost/Full-Time Equivalent Report (1 page)
3. Variance Analysis Report (19 pages)

cy w/encl: See page 2

820 DIVISION
cc: Bechtel K-W-Lay
cc: Bilup L Carter
cc: Williams D/Stucker
cc: Lake J/Nelson, K-W%
cc: Sinecka J/Sev Dist Post(7)
cc: Boyer
cc: Bradshaw
cc: RIB-BC

REC'D IN YMP
12/17/93

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Information Services Center, M/S 408
M. M. Martin, M&O, M/S 423

cy w/encl 1.
L. M. Smith, DOE/NV, M/S 505
M. B. Blanchard, DOE/YMP, M/S 523
W. R. Dixon, DOE/YMP, M/S 523
J. R. Dyer, DOE/YMP, M/S 523
C. E. Hampton, DOE/YMP, M/S 523
B. D. Hutchinson, DOE/YMP, M/S 523
V. F. Iorii, DOE/YMP, M/S 523
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E. H. Petrie, DOE/YMP, M/S 523
W. B. Simecka, DOE/YMP, M/S 523
D. R. Williams, DOE/YMP, M/S 523
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P. Justus, NRC/Las Vegas, NV
R. C. Furtek, REECo, M/S 706
B. R. Gardella, REECo, M/S 408
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J. L. Henze, REECo, M/S 751
S. L. Hughes, REECo, M/S 408
D. L. Knight, REECo, M/S 408
D. L. Koss, REECo, M/S 408
R. B. Land, REECo, M/S 585
T. M. Leonard, REECo, M/S 751
K. L. Limon, REECo, M/S 408
C. J. Mason, REECo, M/S 751
S. O. Straub, REECo, M/S 408
J. R. Trujillo, REECo, M/S 590
M. Brodeur, SAIC, M/S 517/T-23
J. J. Brogan, SAIC, M/S 517/T-12
R. D. Hutton, SAIC, M/S 517
S. C. Smith, SAIC, M/S 517/T-10
J. W. Teak, SAIC, M/S 517
J. E. Therien, SAIC, M/S 517

cy w/encl 2.
R. M. Spiro, SAIC, M/S 517

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

YUCCA MOUNTAIN SITE CHARACTERIZATION PROJECT (YMP)

NOVEMBER 1993 - PROGRESS REPORT

Reeco has no reportable Level 0 or Level 1 Milestones.

WASTE PACKAGE (1.2.2)
PROGRESS DURING REPORTING PERIOD:

WBS 1.2.2.2.4
Task: Fran Ridge Prototype Saw Support (Job Package 93-10)

Completed drilling, blasting, and excavating of rock in support of Large Block Test; completed setting up the core drill and drilled 120 feet and supported testing as needed.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.

SITE (1.2.3)
PROGRESS DURING REPORTING PERIOD:

WBS 1.2.3.5
Task: USW UZ-14 Drilling (Job Package 92-17)

Advanced core hole from 1422 feet to 1442 feet and 12 1/4-inch reamed hole depth is 1422 feet. Drilling/coring progress has been minimal due to perched water encountered in the borehole. Efforts to cement off water inflow at 1280 feet to 1282 feet were unsuccessful. Continued to bail water out of hole and monitored fluid levels. Received direction from DOE/YMP on November 29, 1993, to prepare to set cement plug at 1422 feet. Calculated top of cement at 1285 feet. Plans are to run a protection string of casing with external casing packer set below water producing zone. Demobilized the LM-300 drill rig and mobilized on USW SD-12. A smaller core rig will be mobilized on UZ-14 at a later date to continue coring.

Task: Work Program YMP/WP/93-21, Additional Work Activities, UE-25 NRG-2A and NRG-2B

Utilizing a portion of the LM-300 crew from UZ-14 and the CME-850 Drill Rig, completed work scope as directed in Work Program 93-21.

Task: UE-25 NRG-3 (Job Package 93-01)

Utilizing a portion of the LM-300 crew from UZ-14 and the CME-850 drill rig, cleaned out borehole to total depth in support of geophysical logging.

Task: SD-12 Drill Pad/Access Road (Job Package 93-13)

Completed drilling and blasting at SD-12 and completed rough grading of drill pad and access road; began placing and compacting plating materials on drill pad and access road.

Task: USW NRG-7/7A, North Portal Ramp Borehole (Job Package 93-15)

Cored from 120 feet to 554 feet. Reamed hole and drove 6 5/8 inch odex casing from 81 feet to 302 feet. Ran directional surveys at 350 feet, 4 degrees - 30 minutes, S-20-W; 400 feet, 4 degrees - 40 minutes, S-20-W; 455 feet, 4 degrees - 45 minutes, S-21-W; and 505 feet, 4 degrees - 55 minutes, S-20-W.

Work Program YMP/WP/93-10, UE-25 C-Hole Complex Testing - Phase 1

Mobilized the Failing Stratmaster 100 drill rig on C-Hole #3 and completed Work Program for C-Hole #3.

Mobilized the Failing Stratmaster 100 Drill Rig on C-Hole #2. Recovered water sample for USGS. Ran simulated packer mandrel on 2 7/8-inch tubing to 3001 feet. Operations continuing.

DELIVERABLES:

Deliverable	Due Date	Expected Date	Completed Date	Comments
SD-12 Borehole	-	-	-	Access road and site prep 90% complete. Expected completion date December 8, 1993. Expect to begin drilling operations in January 1994.
Ghost Dance Fault	-	-	-	90% complete; expected completion date December 8, 1993.
NRG-7 Drilling	-	-	-	Operations ongoing; expected completion March 1994.
UZ-7A Drilling	-	-	-	No activity at this time; no funding identified.

Deliverable	Due Date	Expected Date	Completed Date	Comments
Boreholes NRG-8A, 8B, 8C	-	-	-	No activity at this time.
Borehole SD-9	-	-	-	No activity.
Support testing and completion on UZ-16 & UZ-14		-	-	Ongoing test support on UZ-16; UZ-14 delayed due to borehole conditions.
Support pump testing activities at the C-Hole Complex.		-	-	Support ongoing - Phase 1.

ISSUES AND CONCERNS:
None.

EXPLORATORY STUDIES (1.2.6)
PROGRESS DURING REPORTING PERIOD:

WBS 1.2.6.1
Task: Exploratory Studies Facility (ESF)

Continued administrative support for ESF activities to include planning, scheduling and management.

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

Waterline - J-13 to Booster: Continued excavating trench for waterline and placement and compaction of bedding sand; hauled soil from trench back to borrow pit; began receiving and stockpiling additional bedding sand material.

Starter Tunnel Rockbolts/Shotcrete: Completed grouting pattern rockbolts. Pumped 6.6 cubic meters (234 cubic feet) of HLN(cc). Experienced a grout return from two rockbolts; and plugged eight rockbolts. Pull tested 159 pattern rockbolts with six rockbolts failing.

Test Alcove #1 Excavation: Drilled for and installed 88 10-foot split set rockbolts in the Test Alcove. Hung 6-inch welded wire in the Test Alcove as required. Blasted and mucked round NP-TA-007. Drilled, blasted and mucked rounds NP-TA-008 through NP-TA-015. Advanced the Test Alcove to CS 0+27 Meters (0+90 ft).

Area 25 Batch Plant Setup: Continued installation of power at batch plant site. Batch plant has been awarded and is expected in mid-January.

Construction Monitoring Test Support: Completed core drilling the vertical and the horizontal MPBx holes at CS 0+58 meters (1+90 ft). Core drilled a total of 15 meters (50 ft.) Set up and drilled 15 meters (50 ft.) on three Pressure Cell holes. Supported installation of load cells and convergence pins for the investigators.

ESF Underground Electrical Duct Banks: Began excavation of trenches for electrical duct banks and manholes at the ESF North Portal Pad.

Procurement Actions
Continued work with Kiewit/PB Construction Company in the development of a mini-purchasing system; expected completion in late December. Met with Construction Tunneling Services Company during this period to review TBM progress. Resumed delivery of aggregate to Area 25 after successful inspection of two delivery trucks.

DELIVERABLES:

ISSUES AND CONCERNS:

TEST FACILITIES (1.2.7)
PROGRESS DURING REPORTING PERIOD:

Task: Field Operations Support

Continued support services to participants and maintenance of YMP utilized facilities, utilities, equipment and roads in Area 25.

Continued logistical and tour support for DOE Yucca Mountain Site (YMSO) staff. Ten tours and one Open House were held during this period. 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.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.

PROJECT MANAGEMENT (1.2.9)
PROGRESS DURING REPORTING PERIOD:

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 and drilling activities; and completed cost estimates as required.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.

QUALITY ASSURANCE (1.2.11)

PROGRESS DURING REPORTING PERIOD:

WBS 1.2.11
Task: Quality Assurance (QA)

Continued normal administrative level of effort support. Conducted a presentation to the Nuclear Regulatory Commission (NRC) in Rockville, Maryland, on the subject of First Line Quality Control. The presentation informed NRC representatives of REECo's planning and inspection methods to ensure that requirements are met.

Conducted REECo Audit No. REECo-001-94 of Procurement/Material Control activities on the YMP. One Corrective Action Report (CAR) was closed and four Deficiency Notices (DNs) were issued as a result of the audit.

Closed CAR CA-93-004 during audit REECo-001-094. The CAR documented a variety of material control deficiencies and its closure represents a significant effort on the part of the Control and Quality Assurance Departments.

Combined effort with Construction personnel to complete Construction and Inspection Plan (CIP) package 93-0004, Rock Storage Pad Geomembrane Liner, for turnover to the Project Document Records Center. CIP 93-0004 is the first CIP package completed for turnover in support of Job Package 1A.

Revised the Approved Suppliers List to clarify Kiewit/PB work scope, conditions and restrictions.

Submitted review comments on Kiewit/PB Phase I QA implementing procedures for resolution by Kiewit/PB.

Submitted written responses to each Yucca Mountain Quality Assurance Division comment on the QARD Implementation Matrix.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.

ENVIRONMENT, SAFETY & HEALTH (1.2.13)

PROGRESS DURING REPORTING PERIOD:

WBS 1.2.13
Task: Safety & Occupational Health

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

Industrial Hygiene personnel supported the following project activities: conducted air quality and relative humidity measurements in the North Portal Starter Tunnel and Test Alcove; collected five air bag samples at the face (CS 1+97) and CS 1+70 of the North Portal Starter Tunnel for gassy/nongassy laboratory analyses. Preliminary lab results indicate nongassy; conducted noise level

measurements at UE-25 C-2 Well and affixed hearing protection required decals to equipment; continued follow-up accident investigation interviews of cement alkali burns experienced at UZ-14.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.

SUPPORT SERVICES (1.2.15)
PROGRESS DURING REPORTING PERIOD:

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 YMP Technical Information Display at the annual fall conference of the American Nuclear Society in San Francisco, California.

Task: Site Characterization Plan (SCP) Reference Library and Database

Received 700 copies of Progress Report No. 8; sent one SCP without progress reports, nine copies of Progress Report No. 7, and 59 copies of Progress Report No. 8.

DELIVERABLES:
None.

ISSUES AND CONCERNS:
None.