U.S. NUCLEAR REGULATORY COMMISSION

ON-SITE LICENSING REPRESENTATIVE'S REPORT

NUMBER OR-99-03

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REPORT DETAILS

1.0 INTRODUCTION

The principal purpose of the On-Site Licensing Representative (OR) report is to alert U.S. Nuclear Regulatory Commission (NRC) staff, managers and contractors to information on the U.S. Department of Energy (DOE) programs for site characterization, repository design, performance assessment, and environmental studies that may be of use in fulfilling NRC's role during pre-licensing consultation. The principal focus of this and future OR reports will be on DOE's programs for the Exploratory Studies Facility (ESF), surface-based testing, performance assessment, data management systems and environmental studies. Relevant information includes new technical data, DOE's plans and schedules, and the status of activities to pursue site suitability and ESF development. The ORs also participate in activities associated with resolving NRC Key Technical Issues (KTI). In addition to communication of this information, any potential licensing concerns, or opinions raised in this report represent the views of the ORs. The reporting period for this report covers April 1, 1999, through May 31, 1999.

2.0 OBJECTIVES

The function of the OR mission is to principally serve as a point of prompt informational exchange and consultation and to preliminarily identify concerns about site investigations relating to potential licensing issues. The ORs accomplish this function by communicating, consulting and identifying concerns. Communication is accomplished by exchanging information on data, plans, schedules, documents, activities and pending actions, and resolution of issues. The ORs consult with the DOE scientists, engineers, or managers with input from NRC Headquarters management on NRC policy, philosophy, and regulations. The ORs focus on such issues as quality assurance (QA), design controls, data management systems, performance assessment, and KTI resolution. A principle OR role is to identify areas in site characterization and related studies, activities, or procedures that may be of interest or concern to the NRC staff.

3.0 QUALITY ASSURANCE, ENGINEERING AND NRC KEY TECHNICAL ISSUES

- The current listing of the NRC QA Open Items is provided in the updated status is listed below. Most of these issues are discussed bi-weekly at the DOE/M&O Senior staff meeting. The OR attends these bi-weekly meetings as an observer to monitor the actions and progress associated with the DOE Management Plan and Response to Corrective Action Requests as delineated in the January 25, 1999, letter from R. Dyer to J. Greeves. These items were also discussed at an Appendix 7 meeting held at the OR office on February 16-17, 1999. A DOE interim verification team was formed to confirm the real time status of the commitments specified in the Management Plan delineated in the January 25, 1999, letter to NRC from R. Dyer. The results of this verification were documented in an April 27, 1999, letter from R. Clark to D. Wilkins and subsequently responded to in a May 17, 1999, letter from C. Heath to R. Clark. The verification and response letter indicate that several of the commitment dates in the January 25, 1999, Management Plan may have to be revised. Further discussions between DOE and the M&O indicate that the M&O will meet the due dates specified in the January 25, 1999, letter.

96-2 VOLCANISM SYNTHESIS REPORT

(Ref: DOE Deficiency Report (DR) YM-96-D-107)

As a result of the DOE audit of Los Alamos National Laboratory conducted in September 16-23, 1996, four DRs were issued. Proposed corrective actions to resolve these DRs were originally scheduled for completion in August 1997, and verification for full closeout was scheduled for late 1997. On June 15, 1998, the OR was informed that the requested volcanism studies would be available before the end of FY 98. On September 1, 1998, the OR was informed that the implementing procedure YAP-SIII.1Q, "Qualification of Unqualified Data" was being revised and that a technical assessment would be authorized to review the synthesis studies material in question to close this open item. The procedure was issued November 13, 1998, with an effective date of November 18, 1998. Because of the importance of the subject matter in this procedure, the OR provided the final procedure to the NRC technical staff for review and any comments. The results of this review revealed no comments from the NRC technical staff on YAP-SIII.1Q. At the January 26, 1999, NRC/DOE QA meeting, DOE indicated that the final reports are now projected for completion for February 20, 1999, with the closure for corrective action completion scheduled for May 14, 1999. The last DR, YM-96-D-107 was verified and closed by DOE on May 27, 1999. This DR and the affected volcanism report was sent to NRC Headquarters Technical staff for review. The NRC found the corrective action to be reasonable; therefore, this open item is considered closed.

97-2 PROCUREMENT/DATA QUALIFICATION

(Ref: DOE Corrective Action Requests (CARs) LVMO-98-C-002 (Data Qualification), and VAMO-98-C-005 (Procurement)

As a result of the OR observation of increased deficiencies surfacing during DOE audits/surveillances of its suppliers, the OR questioned whether the data/products produced by these suppliers will be acceptable and appropriately qualified for licensing. For CAR LVMO-98-C- 002, all data obtained by the M&O and US Geological Survey (USGS) suppliers were identified and subject to future evaluation. The impact on data produced by the applicable suppliers is also being evaluated by DOE. A determination on whether this data needs to be qualified for either Site Recommendation (SR) or License Application (LA) will be taken into consideration. The procedure for processing of technical data (YAP SIII.3Q) is currently being revised. When completed, the results will be furnished to the OR and forwarded to NRC Management. The scheduled completion for this CAR-002 is October 29, 1999.

Part of the corrective action to assure more effective procurement control in response to CAR-005 was to reorganize and centralize the procurement process for consistency. The reorganization effort was initiated in October 1998. Previously, the National Laboratories conducted procurements in accordance with their own set of procedural requirements. As of February 1999, the M&O has responsibility for all procurements which are conducted in accordance with two procurement procedures, (QAP 7-3 and QAP 7-5). Dedicated full-time QA and technical personnel review procurement documents to assure that applicable regulatory requirements, design bases, and other requirements are referenced or stated in procurement documents. All open procurements from October 1998 to the present have been reviewed. All prior procurements will need to be reviewed to determine whether the data or product produced is acceptable. CAR-005 is scheduled for completion October 29, 1999.

98-1 LENGTH OF TIME TO CLOSE DEFICIENCIES

The OR review of the open and closed deficiency documents indicated many deficiencies have remained open in excess of one year. This was originally reported in the OR Report for January/February 1998 dated March 17, 1998. This does not meet the full intent of Criterion XVI of Appendix B to 10 CFR Part 50 for prompt identification and closeout of deficiencies. The matter of timely closeout of deficiencies also appears to be somewhat of a repetitive occurrence of CAR-LVMO-94-C-010. This CAR, originated in December 16, 1993, noted that 30% of CARs required an extension. Fifty-five percent (55%) of the CARs were open for more than 90 days indicating an adverse trend that CARs were not being completed in a timely manner.

DOE has categorized the open deficiencies in their order of priority and then initiated efforts to close these deficiencies in a more timely manner in their respective order of priority. The performance/deficiency reporting procedure (AP16.1Q) and the corrective action and stop work procedure (AP16.2Q) have been revised and consolidated whereby deficiencies open in excess of one year will be elevated to the DOE OCRWM Director. AP16.1Q has been issued and is effective June 1, 1999. The NRC Director of the Division of Waste Management has requested to be informed by DOE for those cases the DOE OCRWM Director receives such notification. Preliminary observations from the OR perspective appeared to indicate some improvement in this area due to electronic communication and processing of deficiencies and responses. Also, there has been some noticeable improvement in this area due to the newly established Corrective Action Board actions.

98-2 SCIENTIFIC NOTEBOOKS

OR observations of DOE audits and surveillances indicated an increased pattern or trend in scientific notebook (SN) deficiencies. The deficiencies pertaining to SNs were evaluated to determine the extent of the appropriate corrective action and extent of required training. Originally it was planned to develop a consolidated SN procedure to be used by all participants for control of scientific investigations. Upon further investigation, DOE determined that existing scientific investigation procedures met the requirements of the Quality Assurance Requirements and Description document and therefore decided that implementation of the procedures was the problem. However, as part of the Process Validation and Reengineering effort, a single procedure (Administrative Procedure AP-SIII.1Q) has been drafted and is now in the final review process.

In lieu of initiating a CAR, a plan was established and customized to train each participant organization in the use and control of SNs. Also, a compliance criteria checklist was prepared to review all active SNs (approximately 500). These actions were completed by March 31, 1999. In conjunction with CAR LVMO-98-C-002, "closed" SNs to be used for SR or LA will be reviewed in accordance with the above checklist. The DOE Acting QA Director has indicated that the review of active or open SNs have been completed. Inactive or completed SNs will be reviewed to determine the extent of further reviews if necessary.

Visits to all the National Laboratories and the U.S. Geological Survey by personnel independent of the QA organization were scheduled and completed during the months of April-May 1999. The results of these visits are noted below.

LAWRENCE LIVERMORE (LLNL) AND LAWRENCE BERKELEY (LBNL) NATIONAL LABORATORIES

To assess the progress of the SN review and comment resolution process, the DOE Project Management Division established a team to visit the involved National Laboratories and the US Geological Survey. The team consisted of representatives from DOE OQA and the Civilian Radioactive Waste Management System Management and Operation Contractor (CRWM M&O). From April 13-15, 1999, this team visited LLNL and LBNL. A representative sample of six SNs were selected that had been previously reviewed and obtained satisfactory comment resolution. The team's review found that certain basic compliance issues had not been addressed and also not noted on the checklist. Examples of the deficiencies included incomplete calibration information, improper strike outs, entries not signed and dated, blank pages, unauthorized signatures on entries, and lack of name/signature/initial information in the beginning of the SN. One of the LLNL leads was unaware that the identification of the name/signature/initial was a procedural requirement. It was discovered that the LLNL did not use the preferred checklist but rather three separate checklists they believed accomplished the same purpose. The separate checklists did not contain sufficient information from these reviews to provide sufficient traceability of the reviewer's work and nature of the discrepancies found and how corrected. In another review of two SNs, the review team found significant measuring and testing equipment and calibration issues which had not been properly addressed or corrected by the review.

The results and recommendations were that LLNL management and technical staff should have assistance from the Project in QA compliance. The team felt that the appointment of the Office of Quality Assurance/On-Site Representative (OQA/OR) replacement for the recently departed OQA/OR would assist in the review and resolution of SN problems. Lastly, the team recommended a select task force be established to explain to the users, managers, and Engineering Assurance staff, on how to properly implement and comply with the procedural requirements for the control of SNs. A special DOE team has been formed and is now working closely with LLNL personnel to improve SN reviews.

On the last part of this April 13-15, 1999, visit to LBNL, the team looked at eight SNs that had gone through the complete review process and all comments had been resolved. The team uncovered two minor comments which were resolved during the team's review. In general the LBNL SN review was found to be well conducted and effective in bringing the SNs into compliance.

SANDIA (SNL) AND LOS ALAMOS NATIONAL LABORATORIES (LANL)

For the second effort of the team, from April 28-29, 1999, SNL and LANL were visited to assess their efforts in the review of SNs. Eight SNs that had been reviewed and corrected were selected for a representative sample. It was discovered that one of the SNs consisted of six Volumes generated at SNL and 9 generated at the University of New Mexico. The table of contents for the SNL SN indicated five Volumes; however, the team was presented with six Volumes to examine. It was also discovered that the identification on the looseleaf binders was different than the table of contents due to the information intended for Volume one did not fit into Volume one and therefore, the

Volume was split into Volumes one and two without changing the table of contents. There was no pagination until the notebook is ready to be closed and therefore, there is no way to track when the data is entered into the notebook. It appeared to the team, that the data is gathered for several sections of the SN, sorted, and then entered into several sections of the SN. Measuring and Test Equipment (M&TE) information was lacking on several of the sample preparation data sheets. Several of the Volumes were identified that needed reconciliation but LANL reported that due to lack of funding, reconciliation of these items, work was stopped. The checklist appeared to be a comprehensive delineation of the corrective action to bring the SN into compliance, but many of the identified items had not been addressed or inadequately addressed.

Two closed SNs were examined and one was found to be non-compliant. SNL personnel indicated that this SN was declared to be "non-Q." The team requested the basis for declaring this SN "non-Q" and the rationale was unable to be explained.

The team's verification to a closed DR for another SN indicated the review to be closed. Further examination revealed numerous compliance issues still had not been addressed, although the verification documentation stated these issues were addressed and verified.

The team could not accurately assess the commitment of the SNL management and staff due to limited contact and having to meet at a non-Sandia building. Meeting at a non-Sandia building caused a delay in retrieving the SNs from the SNL records system, as well as ready access to SNL personnel because of travel involved from the SNL building to the non-SNL building. Consequently, the team could not review the nine Volumes of SNs initiated by the University of New Mexico.

Interviews with SNL personnel revealed that the review of the SNs were not conducted with the compliance checklist specifically developed for these reviews. Further interviews revealed that several years ago, SNL staff had become frustrated with the efforts to conduct work using procedures and abandoned this process in favor of using SNs. SNs, they felt, could not be constructed chronologically and data was accumulated until there was complete datasets and then entered into the SNs. Nothing was paginated until the SN was ready to be closed. The team believed this process was contrary to utilizing the SN to accurately depict and document ongoing work in order it can be followed, understood, and completed by equivalent expertise should the originator be unavailable for any reason. The team felt this type of process is aimed at building a final records process and not accurately track the work.

The team, as with the recommendations for LLNL above, recommends the use of a task force to be sent to SNL to review the SNs, explain their findings and recommended solutions and verify the implementation of the solutions. As of May 31, 1999, no such team has been initiated to assist SNL in improving the quality of SN reviews.

A representative sample of 10 LANL SN's were reviewed with only minor oversights identified. These minor oversights were quickly corrected during the team's review. The team found the compliance checklists to be well documented, what the reviewer had found, and that the SNS had been brought into compliance. It was also noted that

all LANL staff interviewed were dedicated and worked as a team to meet project requirements.

US GEOLOGICAL SURVEY

On May 26-27, 1999, the OR observed the DOE assessment of the progress of the SN process at USGS. A random number of open SNs were selected to determine compliance with Section 5 of USGS Quality Management Procedure QMP-5.05, "Scientific Notebooks" and the DOE Compliance Review Worksheet checklist. With a few minor observations, the USGS process for SN review is being implemented in an exceptional manner. A master tracking record lists all USGS SNs, both open and closed, the review status, and any pertinent review comments. USGS review personnel were knowledgeable, aware of problem areas, and thorough in their reviews. USGS modified the checklist to be more narrative and "user friendly." Once completed, the checklist is attached inside the SN. On a positive aspect, USGS requires all open SNs to receive a documented management review every six months. The OR recommends that DOE look at this modified checklist and consider incorporating pertinent parts into the current DOE checklist.

Presently, USGS has in excess of 50 closed SNs that will potentially have to be reviewed. There does not appear to be any definitive guidance to determine whether all closed notebooks will need to be reviewed or just a select few. From a Site Recommendation, License, and resource perspective, it would appear that guidance would be developed to preclude the review of non-Q SN's. Likewise, there does not appear to be any schedule or completion date for the review of all applicable SN's (both open and closed).

Based on the OR's observation of this evaluation of USGS, the process for SN review is being properly implemented. This implementation should lead to decreased deficiencies in the area of SN review. The OR recommends DOE look at this process for possible consideration for project-wide application.

Although the NRC OR did not observe the above team reviews and findings for LLNL, LANL, LBNL, and SNL, the NRC OR is familiar with the team member's professionalism, expertise, and credibility. At USGS, the DOE team performed a thorough review and should be commended. The OR is disappointed however, since the NRC Division of Waste Management Director at several NRC/DOE meetings has expressed concern with the amount of deficiencies that keep surfacing for scientific notebooks. Likewise, the January/February 1998, and subsequent OR Reports have constantly made NRC/DOE staff aware of this trend. DOE Management has also visited the various National Laboratories and USGS to stress the importance of correcting this adverse trend for SNs. However, in view of the various concerns expressed by NRC, DOE, and most recently the review team, findings continue to surface. This issue is of great concern to the NRC OR in that the QA program requirements and corrective action program is ineffective.

98-3 MODEL DEFICIENCIES

(Ref: CAR-LVMO-98-C-010)

The M&O line organization performed two vertical slice reviews late 1997 and early 1998. Conclusions documented in the M&O's reports from the review of the Site-Scale

Unsaturated Zone Flow Model and the Total System Performance -1995 for Waste Form Degradation and Solubility Limits indicate that procedures used to develop and document these models do not generally meet accepted nuclear QA standards. The findings from these reports were perceived by NRC to be of significance and necessary to track the corrective action through NRC Open Item 98-3. DOE has indicated that the associated processes and work products relative to the vertical slice findings will be generally sufficient to support the Viability Assessment. The NRC OR has not seen the supporting documentation for this determination and in view of the various deficiencies that have surfaced, does not necessarily agree with this conclusion.

An implementation action plan has been developed by the line organization resulting from the issuance of CAR LVMO-98-C-010. The intent of this plan will be to identify the models being developed or are in use, and the pertinent output of the data in these models. This will initiate the development of a proceduralized process for analyses and models (AP-3-10Q). The extent of this determination will result from the "Tiger Team" investigation. The ORs will monitor the progress/improvements resulting from this action plan which is scheduled for completion in October 29, 1999.

98-4 TRACEABILITY
(Ref: CAR LVMO-99-C-001)
As a result of the October 1998, DOE performance based audit of the M&O, a significant condition adverse to quality was documented on CAR LVMO-99-C-001. This CAR was issued for technical data referenced in Viability Assessment technical documents was not traceable to the origin, and the qualification status of referenced data could not always be determined.

The corrective action established a multi-step checking process to review and evaluate a given list of documents to be used to support of SR/LA. Those documents identified will be corrected or replaced as applicable. Documents identified that will not support LA will have no remedial action taken and justification for this decision will be documented. This CAR is scheduled for completion on December 30, 1999.

- The recently established Process Validation and Reengineering initiative was established to review and validate processes that support reaching a verifiable and defensible Environmental Impact Statement, SR, and LA. As a result, twenty-seven new APs were developed and apply project wide for quality-affecting processes. The completed procedural process flow effort by the M&O resulted in the consolidation of almost fifty procedures and a streamlined document hierarchy. These documents are currently due for completion and implementation by late June 1999.

- During the week of May 3-7, 1999, the OR observed a performance based audit of the M&O processes and activities related to Total-System Performance Assessment. The results of this observation will be documented separately in NRC Audit Observation Report OAR-99-03.

4.0 EXPLORATORY STUDIES FACILITY AND NRC KEY TECHNICAL ISSUES

Enhanced Characterization of the Repository Block (ECRB)

The excavation of the ECRB or "cross-drift", completed on October 13, 1998, allows the collection of scientific and engineering data in the potential repository block to support the characterization of Yucca Mountain. Temperature, relative humidity, air velocity, rock mass moisture, and construction monitoring data continue to be collected in the cross-drift. In May 1999, scientists completed installing the final series of 2 meter deep moisture monitoring boreholes from approximately 25+50 to 26+50 (including eight boreholes across Solitario Canyon Fault). These boreholes are instrumented with heat dissipation probes to measure the in-situ moisture potential of the rock mass. According to DOE scientists, preliminary measurements indicate that the rock mass is wetter (0.8 to 1.5 bars), and moisture more uniformly distributed then expected. Over this reporting period, scientists also measured (via neutron logging) the water content of the rock mass beyond station 17+63. Two bulkheads are presently under construction at stations 17+63 and 25+03. These two bulkheads will isolate the section of the cross-drift underlying that portion of proposed repository block believed to have the highest infiltration rate, as well as an exposure of the Solitario Canyon Fault. Ventilation will be shut off beyond 17+63 to allow moisture levels in the rock mass to return to pre-construction levels.

Geologic mapping of the cross-drift was completed in December 1998. A final report (Milestone SPG42GM3) describing the geology of the cross-drift is expected to be submitted to DOE in August 1999. Geologic mapping continues on a small-scale fracture study to map features down to a cutoff of four centimeters (previous underground mapping cutoff was one meter). For this study, six 6 meter long traverses will be mapped in the cross-drift using this finer cutoff. This data will be compared to previous mapping to determine if the four centimeter cutoff has any significant effect on the fracture characterization of rock mass. Cross-drift stations and Topopah Spring Tuff stratigraphic units selected for this study include the following: 11+15 to 11+21, and 13+00 to 13+06 (Middle nonlithophysal zone); 15+25 to 15+31, 17+35 to 17+41, and 22+15 to 22+21 (Lower lithophysal zone);and 24+25 to 24+31 (Lower nonlithophysal zone). The results of this study are expected to be submitted to DOE in September 1999.

Niche #5 (16+20):
This niche will be constructed at station 16+20 to conduct seepage testing in the Topopah Spring lower lithophysal zone. In May 1999, constructors completed drilling three 20 meter deep boreholes pararell and adjacent to the planned niche location. These boreholes will be used to conduct air permeability testing to monitor pre- and post-excavation effects. Borehole air permeability testing is expected to start in June 1999. An access drift (10 meters long X 5 meters wide) will be constructed using drill and blast excavation and limited mechanical excavation. After the construction of the access drift, additional boreholes (approximately seven 15 meter deep boreholes) will be drilled for air permeability and liquid release testing for pre- and post-excavation effects testing. After this testing, constructors will extend the excavation an additional 15 meters. A final series of six 7 meter deep boreholes will be drilled radially from this niche. Niche walls and boreholes will be instrumented with moisture monitoring

equipment, and a bulkhead will be constructed at the entrance of this niche. The excavation of this niche is expected to begin in the Fall 1999 time frame.

Alcove 8 (7+73):
This alcove will be constructed to conduct seepage testing in the Topopah Spring Upper lithophysal zone. This alcove will be excavated to a depth of approximately 30 meters using drill and blast excavation, with limited mechanical excavation. After this alcove is excavated, six 10-13 meter deep boreholes will be drilled in the invert and lower rib section of this alcove for moisture monitoring. Niche #3, previously constructed in the Topopah Spring Middle nonlithophysal zone is situated below this alcove and will be used in conjunction with this infiltration test. Four 10 meter deep boreholes will be drilled upward from the crown in Niche #3. An infiltration system will be constructed and confined to a 3X3 meter section of invert in Alcove 8. A well-sorted sand will be spread over the infiltration plot and traced water applied to the invert at a measured rate (1 to 2 centimeters/day). Instrumented boreholes in Alcove 8 and Niche #3 will monitor changes in moisture content of the rock mass. Excavation of this alcove is currently expected to start in June 1999. After excavation, a bulkhead will be constructed at the entrance of this alcove.

Exploratory Studies Facility (ESF) Testing

Moisture and construction monitoring continue in the ESF. DOE scientists continue a study to validate the presence of bomb-pulse chlorine-36 at two locations in the ESF. Approximately 50 samples will be collected in the vicinity of the Drill Hole Wash Fault and the Sundance Fault where anomalously high concentrations of chlorine-36 were detected in a previous study. These samples will be analyzed for chlorine-36, tritium, technetium-99, and supplemented by analyses of uranium, thorium, and radium isotopes. Over this reporting period, DOE scientists completed coring 14 shallow boreholes in the vicinity of the Sundance Fault. This sampling activity is expected to be completed by August 1999. A final report on the results of this study is presently scheduled to be submitted to DOE in January 2000.

Alcove 1:
The second phase of the artificial infiltration test continued over this reporting period. In this second phase of testing, scientists continue to vary the surface application rate of traced construction water. Since the start of this phase of testing on February 19, 1999, through May 19, 1999, approximately 104,882 liters (29,250 gallons) of water have been applied at the surface and approximately 9,918 liters (2,620 gallons) collected in Alcove 1. Initial breakthrough of traced water occurred on March 6, 1999. According to DOE scientists, the total surface application rate of traced water is 23 times greater than the current annual precipitation rate at Yucca Mountain. The following preliminary results show how seepage rates vary with surface application rates in a saturated fracture system at Alcove 1.

Period	Surface Application Rate	Alcove 1 Seepage Rate
2/19 to 3/20	~ 420 gallons per day	~ 40 gallons per day
3/20 to 4/12	~ 150 gallons per day	~ 8 gallons per day
4/12 to 4/28	~ 660 gallons per day	~ 100 gallons per day
4/28 to 5/18	~ 270 gallons per day	~ 10 gallons per day

According to DOE scientists, these results indicate that for a given surface application rate there is a corresponding seepage rate. These scientists further suggest that preliminary results indicate that there is a threshold value of infiltration that must be exceeded in order to get seepage into this drift. DOE scientists hope to estimate this threshold infiltration value through ongoing testing. A report describing the overall results of this test is expected to be submitted to DOE in the Fall 1999 time frame. On May 18, 1999, the concentration of Lithium Bromide (LiBr) tracer water applied at the surface was increased from approximately 20 to 500 parts per million to determine the travel time required for this tracer to seep into Alcove 1. The surface application rate of this tracer was also adjusted to approximately 180 gallons per day on this date. A figure showing the test plot is provided in Enclosure 1.

Alcove 2:
This alcove serves as a Yucca Mountain display center for ESF visitors. Therefore, there is no further testing conducted in this alcove.

Alcoves 3 and 4:
Over this reporting period, there were no new activities conducted in Alcoves 3 and 4.

Alcove 5 (Thermal Testing Facility Access/Observation Drift, Connecting Drift, and Heated Drift):
DOE initiated the heating phase of this test on December 3, 1997. The four year heat-up phase will be followed by a four year cool-down phase. Heat generated by 9 electrical floor heaters and 50 wing electrical heaters will simulate heat from empaled waste. This test is designed to heat approximately 15,000 cubic meters of rock in the proposed repository horizon to 100° Centigrade (212° Fahrenheit) or greater to investigate coupled thermal-hydrologic-mechanical-chemical processes. These processes are monitored by approximately 4000 sensors positioned in 147 radial boreholes around the heated drift. A data collection system records measurements from these sensors. On May 27, 1999, sensors in the heated drift recorded the following preliminary temperatures: canister temperature of 176.1° Centigrade (349° Fahrenheit), rock-mass surface temperature of 168.3° Centigrade (335° Fahrenheit), and air temperature of 172.2° Centigrade (342° Fahrenheit).

In an effort to reduce heat and mass flux through the bulkhead of the Drift Scale Test (DST), DOE re-enforced insulation around the edges of the DST bulkhead, improved seals, and applied a sealant at the cable bundles where they pass through the bulkhead. DOE is presently exploring approaches to measure heat and mass flux across the bulkhead.

On March 30, 1999, a draft water sample collection procedure was tested in the field. This procedure is currently documented in Scientific Notebook #SN-LANL-SCI-088-VI. DOE believes this draft procedure clarifies the water sampling protocol, and will help to ensure the accuracy of water chemistry analyses. A field chemistry kit is now being used to provide additional time-sensitive information in the field when water samples are collected. This kit can be used to measure temperature, pH, alkalinity, (e.g., hydroxide, carbonate and bicarbonate), electrical conductivity, total dissolved solids, and major cationic and anionic concentration measurements in the field. All these measurements except temperature, pH, and anionic/cationic concentrations are new field capabilities.

These field measurements are designed to compliment the water analysis perform in the laboratory. Water samples are normally collected from the hydrology holes every 2-3 months. The frequency of water sampling from hydrology hole 60-3 has been increased from once in more than a month to twice a month to determine any changes in water quality or quantity produced. Two chemistry (Seamiest) holes will be converted to hydrology type set-ups. Each chamber in these hydrology holes will have a positive displacement pump for sampling water. Finally, a small scale colloid study is being conducted to observe whether any colloids are present in the DST water samples. If the test confirms the presence of colloidal particles, then this study may generate further information on colloids (e.g., concentration, size distribution, and composition).

Thermomechanical Alcove:
The Single Heater Test started on August 26, 1996. This test was designed to heat approximately 25 cubic meters of rock to 100° Centigrade (212° Fahrenheit) or greater to investigate the thermomechanical properties of rock in the potential repository horizon. The thermal objective for the heat-up phase of this test was met, and the heater was turned off on May 28, 1997, to begin the cool-down phase of this test. In late December 1997, the cool-down phase of the test was completed. After the completion of the cool-down phase, the heater hole and other instrumentation holes were over cored to evaluate the thermal effects on the rock mass. A final report (Milestone SP3120M3) on the results of the Single Heater Test was submitted for DOE review on May 28,1999.

Alcove 6 (Northern Ghost Dance Fault Alcove):
Over this reporting period, there was no new testing conducted in this alcove. Testing in this alcove was designed to investigate the hydro chemical and pneumatic properties of the Ghost Dance Fault. Excavation of this alcove cut the fault at station 1+52. At this location, the fault is approximately 1 meter wide with a vertical offset of 6 meters. Scientists completed their field investigations in December 1998 and documented the results of this testing in a report (Milestone SP3515M3) that was submitted for DOE review on May 28, 1999.

Alcove 7 (Southern Ghost Dance Fault Alcove):
Excavation of this alcove cut the Ghost Dance Fault at station 1+67. At this location, the fault is approximately one meter wide with a vertical offset of approximately 25 meters. Two steel bulkheads have been constructed in this alcove to isolate and test two different zones (a non-faulted zone from 0+64 to 1+34, and a faulted zone from 1+34 to 2+00). Since November 1997, data has been collected from moisture monitoring instrumentation installed at the surface, above this alcove, and in the alcove. This instrumentation is designed to measure natural infiltration at the surface and changes in temperature, pressure, and moisture conditions in the alcove. DOE scientists report no significant hyrdrologic changes from baseline conditions; however, moisture monitoring instrumentation indicates that the rock mass continues to slowly rewet approaching preconstruction conditions.

Niche #1 (35+66):
The steel bulkhead for this niche was closed in January 1998, to monitor in-situ moisture conditions. Data continues to be collected from instruments that monitor humidity, moisture, and rewetting of niche walls.

Niche #2 (36+50):
There was no new activity conducted in this niche over this reporting period. In 1998, investigators completed drift seepage threshold testing. DOE investigators continue to collect moisture monitoring data in this niche.

Niche #3 (31+07) and Niche #4 (47+87):
These Niches have been excavated and bulkheads constructed at the entrance of each niche. Air permeability testing have been completed at these niche locations. In April 1999, DOE investigators initiated water release tests at Niche #3 to quantify seepage into this niche. Similar seepage tests are panned for Niche #4.

Fluid Inclusion Study:
University of Las Vegas (UNLV) scientists are proceeding with a study to date the age of fluid inclusions found in calcite at Yucca Mountain. Over this reporting period, UNLV started collecting rock samples throughout the ESF and cross-drift in support of this study. Microscopic fluid inclusions in calcite are targeted for sampling because they can yield information about minimum fluid temperatures at the time of their formation. In addition to obtaining this information, it is also important to date the age of the calcite sample containing the fluid inclusion. Therefore, calcite deposits containing opal are preferentially selected for sampling, because opal can contain small concentrations of uranium that can be used to date the rock samples. Ultraviolet light is used in the field to help detect the presence of opal, since this mineral may fluoresce under this light source.

The UNLV principal investigator collecting the samples is usually accompanied by a representative from DOE and USGS; however, representatives from other organizations have also participated in this activity. To date, approximately 135 samples have been collected at Yucca Mountain. Portions of all stratigraphic units exposed in the ESF and cross-drift have been sampled. Samples are taken from faults, fractures, vapor phase partings and lithophysical cavities. All sampling is expected to be completed by July 1999. The next UNLV status meeting on this study is scheduled for June 14-17, 1999.

Surface-Based Testing

SD-6:
This borehole is intended to assist in characterizing the geology and hydrology in the western portion of the proposed repository. SD-6 was drilled to a depth of 775 meters (2,541 feet) when drilling difficulties forced a shut-down of drilling activity. DOE recently completed this borehole to a depth of 2806.8 feet. Over this reporting period, a submersible pump was installed in this borehole for hydrologic sampling and for conducting an aquifer pump test. Investigators plan on conducting a series of aquifer pump tests through July 1999. The water level in boreholes H-4, H-5, H-6, and WT-2 will be monitored during pump testing.

Nye County Drilling and Testing:
Nye County initiated their Early Warning Drilling Program (EWDP) in December 1998. This multi-year drilling program is aimed at reducing uncertainty associated with the characteristics of the saturated zone south of the proposed high-level nuclear waste repository. The program includes the drilling, completion, sampling, testing, and

monitoring of some 20 planned wells down gradient from Yucca Mountain. Nye County completed eight wells in their first year of drilling and issued a report containing information collected from the drilling of these wells. In May 1999, Nye County collected water samples in a number of these wells. A summary of this testing is provided in Enclosure 2.

Pneumatic Testing:
Pneumatic data recording and gas sampling continue at UZ-4/5, NRG-7a, and SD-7. Nye County is also recording data at ONC-1.

Busted Butte UZ Transport Test:
The planned hydrologic and tracer testing at Busted Butte is designed to provide data to help model the travel of radionuclides in the unsaturated zone under the proposed repository. This underground facility includes a 72.5 meter main drift and 19 meter test alcove. The test is fielded in the base of the Topopah Spring non-partly-welded vitric sub-zones and the top of the Calico Hills Formation. Tracer testing is designed to proceed in phases

Phase I tracer injection started in early 1998 and was completed by late 1998. Phase I included a total of eight 2 meter deep boreholes (six single point injection boreholes and two collection boreholes). A mixture of nonradioactive tracers were injected at rates of one and ten milliliter per hour (ml/hr) in an effort to bound potential infiltration rates of 30 and 380 millimeters per year (mm/yr). Investigators completed the mine back of a portion of the Phase I test-bed to determine tracer migration rates and pathways. According to DOE scientists, preliminary results of Phase I testing provide evidence for matrix diffusion and capillary flow in the geologic Calico Hills Formation, and indicate that lithologic contacts may also impede flow in this stratigraphic unit. If these results are substantiated, they may provide the basis for significantly longer travel times in the Calico Hills Formation.

The Phase II tracer injection continues in a separate 10 X 10 X 6 meter block of rock exposed on two sides in this underground facility. Tracer injection started on July 23, 1998, and is expected to continue through CY99. The Phase II test includes eight injection and twelve collection boreholes ranging from seven to 10 meters deep. Each injection borehole is equipped with 10 injection ports representing a significant scale up from the Phase I test. Nonradioactive tracers are injected at rates of 1, 10 and 50 ml/hr simulating infiltration rates of 30, 380, and 1550 mm/yr. Borehole geophysics and moisture collection pads are used to monitor the migration of tracers. Post test characterization will include over coring of selected boreholes and partial mine back to provide additional data on tracer migration rates and pathways. Results of this testing will be documented as AP-3.10Q reports supporting DOE's Unsaturated Zone Flow and Transport Process Model Report. The first AP-3.10Q report on this testing is expected to be completed in the August 1999 time frame.

A one-cubic foot block of the Calico Hills Formation cut from the Busted Butte test site was transported to Canada by Atomic Energy of Canada, LTD. (AECL) for use in testing radionuclide transport at the AECL laboratory. In the next several months, a one-cubic meter block will be removed from the Busted Butte facility for additional testing.

DOE's Multi-Year Scope:

In the OR view, it is not clear whether or not DOE's multi-year budget will address critical information needs that the Project has identified to support License Application. In the Viability Assessment of a Repository at Yucca Mountain, DOE has identified what it considers are the most important information needs for licensing. However, work to address these needs has yet to be fully incorporated into DOE's multi-year budget. The ORs have requested a copy of DOE's budget outlining their planned work scope. This topic is expected to be addressed in a June 22, 1999 meeting between NRC and DOE.

5.0 GENERAL

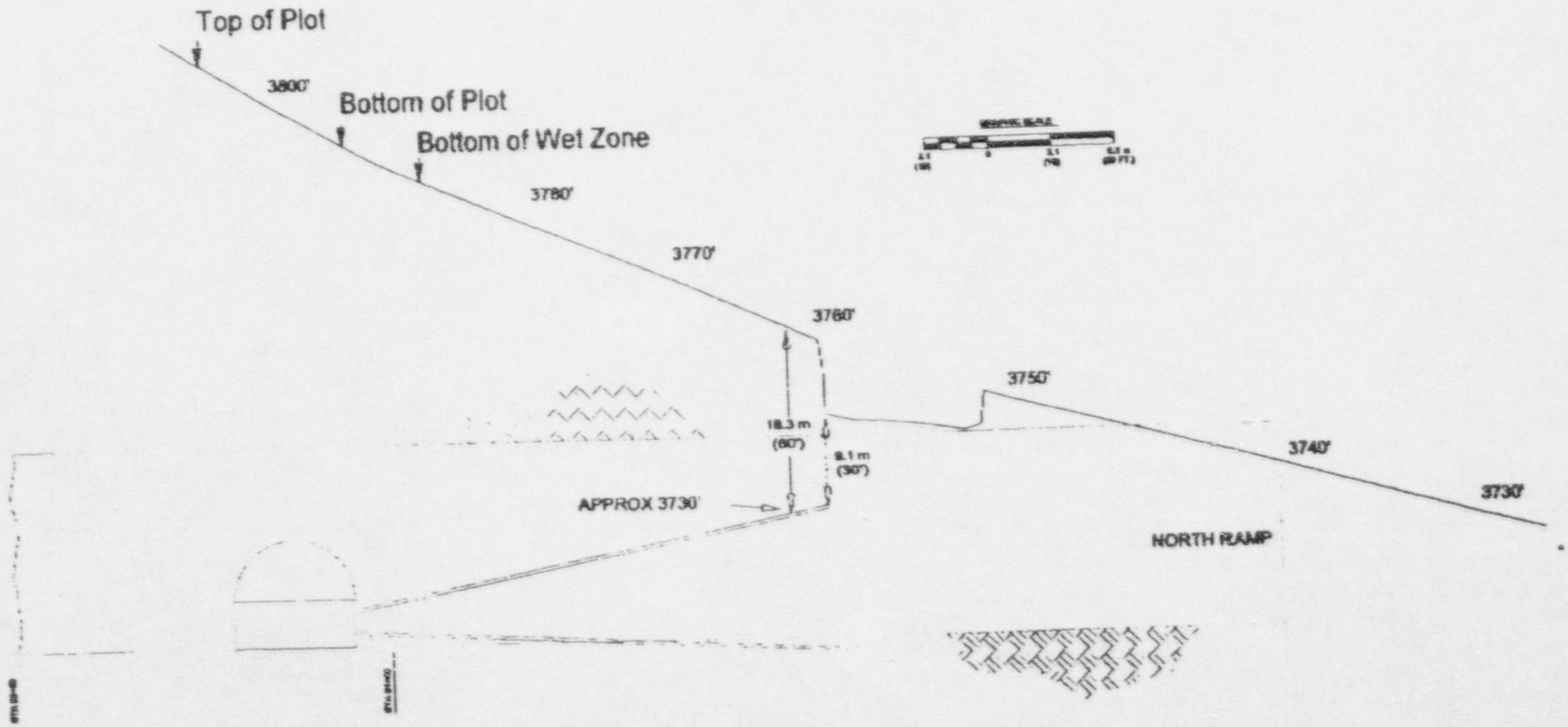
1. Appendix

April 5, 1999, several representations of the NRC Division of High-Level Waste Management met with DOE Yucca Mountain Project staff at the Nevada Test Site, to discuss saturated zone tracer testing at the C-Well complex.

April 28, 1999, representatives cf the NRC Division of High-Level Waste Management met with DOE Yucca Mountain Project staff in Las Vegas, NV to discuss the status of DOE's Thermal Testing Program.

2. Other

April 29, 1999, NRC Commissioner Greta Dicus and Commissioner Nils Diaz toured DOE facilities at Yucca Mountain. The Itinerary is provided in Enclosre 3.

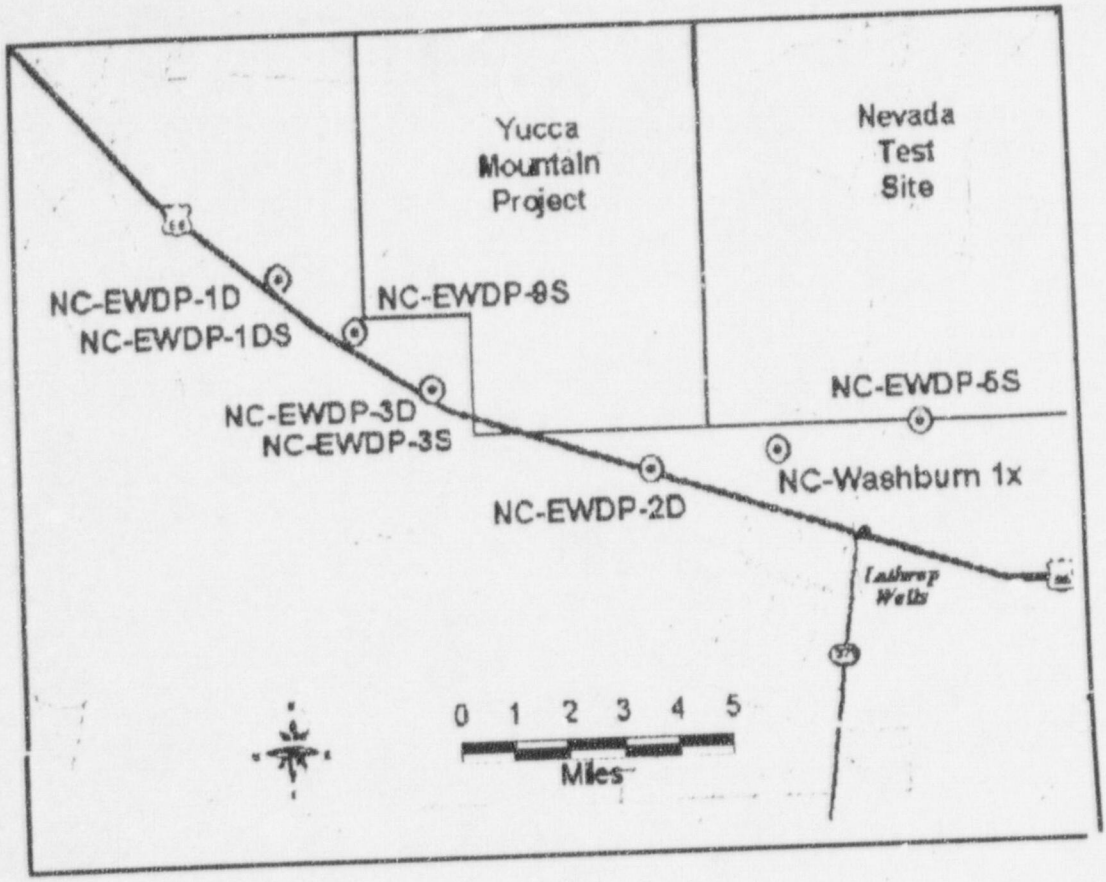


Enclosure 1a

NYE COUNTY

EARLY WARNING DRILLING PROGRAM

COMPLETED WELLS



ENCLOSURE 2a

Summary of Nye County NWRPO May Sampling Event at the EWDP Boreholes

The following is a brief summary of the water sampling event conducted by Nye County Nuclear Waste Repository Project Office (NWRPO) at the Nye County Early Warning Drilling Project (EWDP) Wells during May of 1999. The wells are located south of Yucca Mountain and North of State Hwy. 95, between the towns of Beatty and Lathrop Wells.

The purpose of the EWDP is to establish a groundwater monitoring system to protect the residents of Nye County in Amargosa and Pahrump Valley against potential radionuclide contamination. Specifically, the water sampling of EWDP wells is being conducted to provide hydrogeologic information that is needed and has been missing from the DOE's program at the Yucca Mountain Project site. Analysis of water samples collected at the EWDP boreholes will aid us in our investigations of the origin of spring deposits, the geology of the area, and the recharge and groundwater flow patterns.

Water sampling was conducted from May 17th through May 24th, 1999. Monitoring wells were pumped using a Bennett Sample Pump, Model 1800-6. An air compressor was used as a source of compressed air to operate the pump motor. Water was pumped at between 0.5 and 1.5 gallons per minute. Pumping rates were dependent on the characteristics of the specific monitoring zone of interest. Calculations were made prior to pumping to ensure that each zone was pumped for a sufficient amount of time before sampling was performed. In the case of the Westbay instrumented wells (EWDP-1S, -3S and –9S), pumping time was arrived at based on calculating how long it would take to evacuate the saturated volume of the Westbay casing above the sampling port, plus the volume of water between the packers at the monitoring zone, plus the volume of water in the sand pack at the monitoring zone. In the case of EWDP-1DX, approximately three tubing string volumes were pumped before sampling commenced.
Four EWDP wells were pumped during this sampling event and a total of 10 monitoring zones were sampled. Samples from each monitoring zone were collected by Nye County for geochemical and radiological analysis. In addition to Nye County, several other organizations were present and collected samples at each of the monitoring wells. These organizations included: the USGS, LANL, UNLV, the Nevada State Health Department, and the Southwest Research Institute. Nye County plans to sample these, and additional wells, in the future, possibly within the next six months, and will again make these wells available to interested parties for sampling purposes.

Chronology follows:

May 17,1999

Sampling was conducted at EWDP-1S. This well is located on paleospring deposits near the boundary between the Crater Flat and the Amargosa Desert hydrographic basins. The borehole is approximately 340 feet deep. This well was completed using Westbay PVC casing and has been instrumented with Westbay pressure and temperature probes. These probes are located at two monitoring zones within the well and monitor pressure and temperature continuously. The upper zone, located approximately between 160 and 180 feet below ground surface, is in the upper Tertiary volcanics. The lower zone, between approximately 210 and 270 feet, is located in the underlying Tertiary sedimentary rocks. Both of these zones were sampled during the water sampling event.

May 18, 1999

Sampling continued at EWDP-1S in the morning and then moved to EWDP-9S in the afternoon. EWDP-9S is located on paleospring deposits adjacent to the wash that drains the southwest flank of Yucca Mountain.

The site is located down-gradient of fractured volcanic rocks that provide a pathway for groundwater flow from the Yucca Mountain area. The borehole is approximately 397 feet deep. This borehole was completed with Westbay casing and four screened intervals have been instrumented with Westbay temperature and pressure probes. Samples were collected from all four zones at EWDP-9S. Zones 1, 2 and 3 are located in the Valley-fill deposits and Zone 4 is located in Tertiary volcanic rock.

May 19,1999

Continued sampling at EWDP-9S.

May 20, 1999

Sampling was conducted at EWDP-3S. This borehole is located along a key groundwater pathway between Crater Flat and the Amargosa Desert. The borehole is approximately 550 feet deep. It has been completed with Westbay casing and three monitoring zones are instrumented with Westbay probes. The upper zone is in the upper Tertiary volcanic rock in a fractured, bedded tuff. The middle zone is completed deeper in the same unit and the lower zone is completed in a thick sequence of reworked ash fall tuffs. Water samples were collected at all three zones.

May 21, 1999

Sampling continued at EWDP-3S.

May 24, 1999

Sampling was conducted at EWDP-1DX. This well is located on paleospring deposits near the boundary between the Crater Flat and Amargosa Desert hydrographic basins. Two zones, one in the upper Tertiary volcanics and one in the underlying Tertiary sedimentary rocks, were selected for long-term monitoring. A satellite well (EWDP-1S) is located nearby and was sampled the previous week. At present, this borehole has been completed with three tubing strings of shallow, intermediate and deeper depths. At the time of the sampling event only the deepest tubing string was available for pumping. This deeper string is approximately 2300 feet in length and has been perforated between 2160 and 2240 feet. This string was pumped and samples were collected by all interested parties. Nye County plans to perforate the intermediate string and will hopefully have it available for sampling during the next sampling round.

ITINERARY
YUCCA MOUNTAIN TOUR
NUCLEAR REGULATORY COMMISSION
APRIL 29, 1999

6:25am	Guests meet escorts Lake Barrett, Acting Manager OCRWM, DOE and Russ Dyer, Project Manager, DOE at the Fiesta Hotel, 2400 North Rancho Dr., old valet entrance facing Rancho Dr.
6:25 - 6:30	Board bus
6:30 - 7:20	Depart the Fiesta Hotel and travel to the Mercury Badge Office
7:20 - 7:30	Badging
7:30 - 7:40	Travel to Mercury Housing, dorm 529, pick up Commissioner Diaz group and proceed to the Mercury Cafeteria to pick up box lunches
7:40 - 8:05	Travel to the Field Operations Center (FOC)
8:05 - 8:30	Tunnel training / pick up safety equipment
8:30 - 9:00	Travel to the Exploratory Studies Facility (ESF), Change House
9:00 - 10:55	View underground
10:55 - 11:00	Walk to the Change House
11:00 - 11:30	Lunch
11:30 - 11:40	Travel to the south portal
11:40 - 11:50	View TBM
11:50 - 12:00pm	Travel to the base of Yucca Mountain and transfer to vans
12:00 - 12:20	Travel to Yucca Mountain Crest
12:20 - 12:30	Yucca Mountain Crest - General overview of geology, hydrology, faulting and volcanism.
12:30 - 1:10	Travel to Busted Butte
1:10 - 1:40	Briefing on activities

ENCLOSURE 3a

1:40 - 2:15	Travel to the FOC
2:15 - 2:30	Break / return safety equipment
2:30 - 3:00	Travel to Mercury Cafeteria, drop off lunch coolers and proceed to dorm 529 to drop off Chad Glenn, NRC
3:00 - 3:10	Travel to Gate 100 for badge collection
3:10 - 4:00	Travel to the Santa Fe Hotel and drop off Commissioner Diaz group
4:00 - 4:15pm	Return to the Fiesta Hotel and drop off Commissioner Dicus group

CAMERAS AND RECORDING EQUIPMENT HAVE BEEN AUTHORIZED FOR AREA 25 ONLY. THE ESCORT WILL BE JAMES R. DYER, DOE, Q

Special Notes:
Escorts: Lake Barrett and Russ Dyer
Group Size: 20