ENCLOSURE

U.S. NUCLEAR REGULATORY COMMISSION

DIVISION OF WASTE MANAGEMENT REPORT NRC-VR-95-01

OF THE IN-FIELD VERIFICATION

OF THE U.S. DEPARTMENT OF ENERGY

OFFICE OF CIVILIAN RADIOACTIVE WASTE MANAGEMENT

AND ITS MANAGEMENT AND OPERATING CONTRACTOR

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1.0 INTRODUCTION

During April 3-6, 1995, members of the U.S. Nuclear Regulatory Commission Division of Waste Management staff conducted an in-field verification of the U.S Department of Energy (DOE), Office of Civilian Radioactive Waste Management and the DOE Management and Operating Contractor (M&O). The verification was conducted at the DOE and M&O offices in Las Vegas, Nevada and at Yucca Mountain, Nevada. The in-field verification evaluated the DOE/M&O compliance with commitments made in the DOE letter of November 14, 1994, to the NRC (Dreyfus to Bernero). This in-field verification, in conjunction with NRC staff observation of the operation of the tunnel boring machine and DOE audits YM-ARP-95-02 and HQ-ARC-95-04, completes Phase 2 of the NRC staff's effort to determine the acceptability of the information provided and the acceptability of implementation of DOE/M&O commitments made in DOE's November 14, 1994 letter.

The State of Nevada observed this in-field verification.

This is the report of the in-field verification. This report addresses the adequacy of implementation of DOE/M&O controls in the areas verified. NRC staff observations and conclusions are presented in this report.

2.0 OBJECTIVE

The objective of this in-field verification was to determine, in conjunction with NRC staff observation of the operation of the tunnel boring machine and of DOE audits YM-ARP-95-02 and HQ-ARC-95-04, the acceptability of implementation of DOE/M&O commitments made in DOE's November 14, 1994, letter.

3.0 SCOPE

The verification team evaluated the status, adequacy, and effectiveness of implementation of the actions committed to in the November 14, 1994, DOE letter to the NRC (Dreyfus to Bernero). The scope of this in-field verification included activities being performed at Yucca Mountain.

The commitments verified are in checklist NRC-VR-95-01, "In-Field Verification Checklist." The checklist was developed, in advance of the verification, based on the November 14, 1994, DOE letter to NRC (Dreyfus to Bernero).

4.0 MANAGEMENT SUMMARY AND CONCLUSIONS

The in-field verification team based its evaluation on discussions with DOE and M&O personnel and review of the Exploratory Studies Facility (ESF) design and pertinent DOE and M&O documents. There were effectively three recommendations resulting from the in-field verification. These were 1) that numerical modeling of rock bolts be expanded to include all pertinent types and applications, 2) that AP-6.14, currently being revised, be clarified regarding reportable conditions, and 3) that DOE/M&O re-evaluate the quality classification of pre-cast concrete inverts. Two other recommendations were acceptably resolved during the verification.

The verification team commended DOE/M&O for initiating a "Design Guidelines" document that appears to be a good addition to the M&O design system.

The NRC team finds that, within the scope of the in-field verification, DOE/M&O compliance with commitments is satisfactory. Open Items in the NRC letter of October 13, 1994, to DOE - Bernero to Dreyfus - have been reduced in scope based on the results of this in-field verification. The team's three recommendations will be followed-up as part of the Phase 3 activities described in the NRC letter of March 9, 1995, to DOE - Bernero to Dreyfus.

5.0 IN-FIELD VERIFICATION PARTICIPANTS

5.1 NRC Team

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5.2 State of Nevada Observers

James Grubb
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6.0 IN-FIELD VERIFICATION PROCEDURE

This NRC in-field verification of DOE/M&O was conducted in accordance with NRC's High-Level Waste Manual Draft Procedure 0330, "In-Field Verification Activities," March 23, 1995.

7.0 VERIFICATION OF NRC COMMENT (OPEN ITEM 1 IN THE NRC LETTER OF OCTOBER 13, 1994, TO DOE - BERNERO TO DREYFUS)

At the pre-verification meeting, DOE and M&O personnel made a comprehensive presentation of project status, personnel involvement, and DOE's position on design control of the ESF North Ramp Design Package 2C for the verification team and observers. This helped the NRC team complete its verification activities within the time allotted.

Verification of DOE/M&O commitments in response to the NRC Comment involved reviewing DOE/M&O actions identified in the M&O's "Management Plan for Resolving QA Issues Resulting from M&O and DOE Audits/Surveillances," (Management Plan) and reviewing and discussing selected design items and design documentation. NRC team reviews focused primarily on ESF North Ramp Design Package 2C. This design package was the only quality-affecting design package released before results of DOE and M&O QA audits and surveillances caused withdrawal of the package.

The NRC team verified that the DOE Yucca Mountain Site Characterization Office Engineering and Field Operations group, in conjunction with the DOE Office of Quality Assurance (OQA), had conducted a review of the Management Plan in October, 1994. Formal recommendations from OQA to the M&O regarding the

Management Plan were made in November, 1994, with a clarifying memo issued in December, 1994. The M&O responded in January, 1995, incorporating the DOE recommendations.

7.1 Corrective Action Request (CAR) Analysis

The first phase of the Management Plan was the DOE/M&O analysis of CARs to identify those affecting Design Package 2C and requiring remedial action before re-release of the package. Sixty-four open CARS, initiated by either the DOE or M&O QA organization, were open at the time of the DOE/M&O evaluation, and 35 of them were considered to impact Design Package 2C. The NRC team independently reviewed the 64 CARs and concurred with the assessments of the M&O and DOE QA groups. The NRC team verified that the M&O QA organization met with M&O line management weekly by reviewing Corrective Action Report Status Meeting memoranda issued during October and November, 1994. DOE surveillance report YMP-SR-95-019 and other M&O documents were provided that indicated completion of remedial actions of the 35 pertinent CARs prior to release of Design Package 2C products for construction.

The NRC team verified that the M&O review of open CARs only, as opposed to reviewing all CARs, was acceptable because none of the CARs related to the design process had been closed at the time of the review.

The 35 pertinent CARs (that is, those considered to impact Design Package 2C) were reviewed by the NRC team from both QA programmatic and technical perspectives. The NRC staff considered the appropriateness and adequacy of remedial actions, root cause determinations, and proposed action to prevent recurrence. At the time of the NRC verification, many of the CAR actions to prevent recurrence had not yet been completed and verified by DOE (or M&O) QA, and these actions will be examined during Phase 3 of NRC's actions to determine whether acceptable corrective actions have been effectively implemented. DOE and the M&O appeared to be appropriately following corrective action process requirements, but the effectiveness of corrective actions must be assessed in the longer term. These activities will be followed-up as part of the Phase 3 activities described in the NRC letter of March 9, 1995, to DOE - Bernero to Dreyfus.

7.2 Analysis of Items Corrected during the Recent Audits/Surveillances

The M&O QA organization, in addition to evaluating the 64 CARs, also evaluated items corrected during the recent audits and surveillances (that is, those items needing only remedial action). These items and the CARs were acceptably utilized in the design process reviews to identify trouble spots.

Based on these evaluations, the M&O concluded that the majority of the deficiencies resulted from procedural noncompliance (with a few procedural deficiencies) and that some CARs resulted from management deficiencies. The verification team did not disagree.

7.3 Design Process Reviews

The M&O staff described the design process using detailed process flow charts which associated design-related CARS and items corrected during audits/surveillances to the various phases of the design process. The process appeared to acceptably address the design-related CARS and items corrected during audits/surveillances.

In accordance with the Management Plan, an independent product checking organization, reporting to the Mined Geologic Disposal System Development Manager, has been established by the M&O with the responsibility of ensuring that all design products are developed in accordance with quality and technical requirements and that engineering personnel understand the requirements. This is so that errors that led to the Management Plan would not be repeated. The NRC team reviewed the Permanent Rockbolt and Temporary Channel Interactions Analysis that had undergone the checking process, and the checking process was found to be acceptable.

In addition to changes in the design process, M&O management recognized that the design staff did not embrace the discipline and rigor regarding documentation that is expected of a "nuclear-grade" organization. The M&O has attempted to locate personnel with nuclear experience to fill open design positions. The approach to training has also been upgraded, with new materials and training by peers rather than by a training organization. The independent product checking organization is preparing a "Design Guidelines" document which should aid engineers from various M&O organizations in performing their functions uniformly.

A product integrity organization, reporting to the Deputy Nevada Site Manager, has been established by the M&O to provide independent reviews and also provide M&O management with reliable assessments of the design process and of the product technical integrity, considering cost effective performance and acceptability for licensing. The product integrity organization complements the activities of M&O QA.

Finally, the M&O significantly revised the design process by replacing the "50% design review" and "90% design review" with "external review of inputs" and "external review of outputs," respectively. The "external review of inputs" will verify the design bases and preliminary analyses. The "external review of outputs" will verify the final designs and supporting analyses and the resultant specifications and drawings. As before, the results of the reviews will be submitted to DOE. This revision to the design process eliminates concurrent preparation of design bases, analyses, and products, which contributed to the cause of several CARs. The staff believes that the new design review process will enhance the past design process.

The analysis of the design process by the M&O was comprehensive, and the changes appear to address root causes.

7.4 Classification Process Review

The classification process is how the M&O identifies the activities and items subject to QA program requirements. Design Package 2C open CARs affecting the classification process were identified and associated with the appropriate steps on the process flow chart. Only a few design-related CARs impacted the classification process (most were compliance issues), and no revisions to the process were made due to the CARs. However, to streamline the classification process, in early March, 1995, controls previously in three procedures were consolidated into a single procedure (Nevada Line Procedure NLP-2-0). Waste isolation evaluations (WIEs) and test interference evaluations (TIEs) are now part of the overall determination of importance evaluation (DIE), whereas before these evaluations were made under separate procedures and provided as inputs to the DIE. Training was conducted to prepare the M&O staff for implementing the streamlined process. The NRC staff concurs that the CARs did not suggest that process changes were necessary and agrees that the changes made by the M&O should enhance the process.

The NRC also verified that no construction work has been initiated until the work has been through the DIE process. Additional confidence in the DIE process was gained by verifying implementation of Section 5.3 of Quality Assurance Procedure (QAP) 3-0, "Design Inputs Development and Review." This procedure recognizes DIEs as design input documents. The NRC team verified that DIE comments were resolved before design products were released for construction.

7.5 Product Quality Review

After withdrawing Design Package 2C, the M&O took measures to provide for its re-release so that ESF construction could continue. Design Package 2C drawings and specifications were reviewed by M&O sub-surface design personnel other than those who originally reviewed them. In addition, reviews were also performed by M&O surface design personnel for procedural compliance. The comments from these two reviews were combined, and appropriate revisions to design documents were drafted. The drafts were reviewed and finalized in accordance with M&O procedures and submitted to DOE for its review and acceptance. All reviews were completed prior to releasing the drawings and specifications for construction.

The NRC team reviewed a sample of Design Package 2C output documents as well as revised analyses supporting the output documents. The reviews committed to in the Management Plan plus the design reviews by the M&O and DOE required for the revised documents appear to have been effective in addressing the earlier concerns with the quality of Design Package 2C.

To verify that all mandatory review comments from design reviews were resolved before design products were released for construction, the NRC team also reviewed the 90% design review comments on Design Packages 1C and 1D. Seven mandatory comments from Design Package 1C and four mandatory comments from Design Package 1D were selected to verify that resolution had occurred prior to construction. From the sample of 11 mandatory comments, 10 could be traced through to resolution in the final documents. Resolution of the other

comment, however, could not be verified. This comment, regarding the ESF Basis for Design (BFD), required the addition of criteria for concrete pads and for environmental protection including dusty environment. The revised BFD did not contain the criteria for environmental protection including dusty environment. The NRC staff recommended that the M&O revisit the portion of the comment dealing with environmental protection to provide objective evidence of acceptability. The M&O corrected this during the in-field verification.

7.6 Evaluation of the M&O Culture Review

The M&O convened a special group of experienced personnel and consultants, independent of the original Design Package 2C development, to utilize the various CAR analyses and broad-based interviews to develop problem statements and identify the root causes of the design process deficiencies. The problem statements reflected 1) the inability to identify and correct process problems, 2) the inability to identify and correct personnel performance problems, and 3) poor workload planning and management. The root causes were assessed to be 1) management expectations and standards not defined and not enforced; 2) personnel lack of relevant nuclear experience and training; 3) ineffective problem identification and correction processes; 4) ineffective management of quality, schedules, and resources for reactive and routine workloads; and 5) ineffective communications and team work. The results of the culture review have been compiled into a draft report and submitted to DOE.

The root causes appear to be well considered and comprehensive. They are consistent with observations that have been made by the NRC staff during observation audits and other interactions with DOE/M&O. Future M&O/DOE activities for the culture review are the identification and implementation of corrective measures that address the root causes. These activities will be followed-up as part of the Phase 3 activities described in the NRC letter of March 9, 1995, to DOE - Bernero to Dreyfus.

7.7 Management Plan Closure

A draft of the "Management Plan Closure" document has been submitted to DOE for its review. This document compiles objective evidence supporting the reviews and actions called out in the Management Plan, including Product Quality Reviews of Design Packages 2C and 1D. Design Package 1D, which has been classified as not quality-affecting, was reviewed as well as Design Package 2C to determine the extent of earlier design deficiencies.

The M&O has drafted a revision to the Management Plan that has also been submitted to DOE for review. The revision upgrades the Management Plan based on the results of the various reviews. M&O management personnel indicated that they intend to utilize the Management Plan in the future to follow-through with the corrective measures and to continue improvements to the M&O processes.

DOE established Quality and Design Improvement Teams to perform independent reviews of CARs and nonconformance reports related to design and construction

activities to identify adverse trends that may warrant further actions. Recommendations for improvements were made to both the DOE and M&O in a report dated March, 1995. In addition, by July, 1995, DOE is to establish a program-wide quality trend program.

The NRC team concluded that the M&O's use of the Management Plan is appropriate.

7.8 NRC Review of Technical Activities and Products

DOE had stated that the design packages released for construction addressed all of the NRC comments generated during the 90% design review of Design Package 2C. The NRC team reviewed selected portions of the design package to verify the resolution of NRC comments with the following observations:

7.8.1 Seismic Response Spectra and Seismic Design of Utility Supports

Two design documents - "ESF Subsurface Design Piping Support Calculations (Design Package 2C)" (BABEAC000-01717-0200-00002, rev. 01) and "ESF Subsurface Design Cable Tray Supports" (BABEAC000-01717-0200-00005, rev. 00) - were selected as samples to determine if the seismic design of utility supports for Design Package 2C is acceptable. The review focused on the correctness of the seismic design input (including the seismic response spectrum used for determining the coefficient of amplification) and the seismic design calculations. During the 90% design review of Design Package 2C, an NRC observer had identified a misinterpretation of response spectrum used for utility supports. As a result, an incorrect coefficient of amplification was initially used to calculate maximum base shear, a basic input for seismic design of subsurface utility supports. The NRC team verified that the coefficient of amplification for seismic design has been corrected from 0.48 to 2.36. In addition, several selected calculations were checked by the NRC team and no errors were found. The NRC team concludes that the seismic design of utility supports for Design Package 2C is acceptable.

7.8.2 Data Used for Ground Support Design and Analysis for Design Package 2C

In order to determine if the data used for ground support design and analysis for the Design Package 2C are site specific, design documents "TS (Topapah Spring) North Ramp Ground Support Scoping Analysis" and "TS North Ramp Stability Analysis" were reviewed.

The TS North Ramp Ground Support Scoping Analysis indicated that eleven north ramp geologic (NRG) boreholes were drilled to collect rock structural core logging data to support implementation of the Drift Design Methodology (Hardy and Bauer, 1991) developed specifically for the underground facility of the proposed repository. As indicated in the report, core log data from eight NRG boreholes were used in the design. Therefore, the data are site specific. The data from the other three NRG boreholes were not available at the time of design.

Most of the data input used for the stability analysis was derived from the eight NRG borehole log data. Consequently, the data used for the stability

analysis are also site specific. The rock joint properties (such as joint cohesion and friction angle) used in the stability analyses are not site specific since the NRG boreholes do not provide such information. These data were extracted from a report prepared by Lin, et al (1993). The joint data analyzed in that report were from the Reference Information Base. The NRC team judged that the use of these data is acceptable since they are either site-specific or the best available.

References:

(1) Hardy, M.P., and S.J. Bauer. 1991. Drift Design Methodology and Preliminary Application for the Yucca Mountain Site Characterization Project. SAND89-0837, Sandia National Laboratories, Albuquerque, New Mexico.

(2) Lin, M., M.P. Hardy, and S.J. Bauer. 1993. Rock Mass Mechanical Property Estimations for the Yucca Mountain Site Characterization Project. SAND92-0450, Sandia National Laboratories, Albuquerque, New Mexico.

7.8.3 Ground Support Design Process

The ground support design approach used in the Design Package 2C followed the Drift Design Methodology (Hardy and Bauer, 1991). Personnel from J.F.T. Agapito & Associates, Inc. and the M&O explained the derivation of selected parameters used in the ground support scoping analysis, tracing the site characterization data through to the parameters used in the design. The ground support design process is, in general, traceable. However, the basis for the original stress reduction factor (SRF) of 1.0 had not been adequately explained in the calculations. The designers acceptably explained to the NRC team the basis for selecting 1.0 as the SRF. Also, an error involving calculation of modified rock quality, or "Q" values of the Paintbrush Tuff nonwelded (PTn) thermo-mechanical unit was identified. However, this error was found to have negligible impact on the analysis results.

The staff attended detailed briefings by M&O managers, designers, and other construction and testing personnel both at their offices and at the site. The construction specification that specifies the five categories of roof support systems was reviewed. The specification clearly says that the selection of a particular category of roof support system is left to the tunnel shift superintendent, based on his geotechnical expertise and field observations. Based on extensive discussions, it became evident to the NRC team that, while there are generic design recommendations of roof support for a given thermo-mechanical unit based on the limited number of boreholes, there is no location-specific design. The construction organization has the flexibility to choose one of the five roof support systems when the ground conditions change, subject to approval by the Architect/Engineer. Other than the limited observation of rock visible through the windows on either side of the tunnel boring machine (TBM) above the gripper pads, no measurements of any rock parameters are made. The work done by the geologic mappers and the scan-lines prepared by testing organizations are all contributors to "after-the-fact" verification of the roof support design. However, it appears that the construction organization has consistently chosen a conservative roof support category based on personnel safety considerations.

Reference:

Hardy, M.P., and S.J. Bauer. 1991. Drift Design Methodology and Preliminary Application for the Yucca Mountain Site Characterization Project. SAND89-0837, Sandia National Laboratories, Albuquerque, New Mexico.

7.8.4 North Ramp Stability Analysis

Based on discussions with the M&O analyst, the NRC team found that the "TS North Ramp Stability Analysis" is preliminary. The analysis did not take into consideration all aspects of the design. Nor did it consider some phenomena that may have impact on interpretation of the analysis results related to the evaluation of the effectiveness of rock bolts. Examples that had been noted in a CAR include: (1) not all the rock bolt types listed in design drawing BABEAB000-01717-2100-40157-01, "TS North Ramp Rockbolts and Accessories Details," have been numerically modelled; (2) the conditions of the rock mass that encompass the rock bolts to be evaluated were not factored into the assessment of effectiveness of the rock bolts; (3) rock support analysis was not performed using the model that was used to assess opening stability without rock bolts; and (4) the duration (0.25 seconds) of the seismic input signal used in the dynamic analysis is very short and may not be representative or conservative. The M&O designer explained that the use of longer seismic duration for dynamic analysis was not practical due to the longer time required to complete one analysis (several days of computer time). The final analysis, currently in progress, will be presented in the revised Design Package 2C that is expected to address ground support of the entire underground portion of the ESF. The NRC team recommended that numerical modeling of rock bolts be expanded to include all pertinent types and applications. Verification of the final numerical analyses of the stability of the openings will be followed-up in Phase 3.

7.8.5 ESF and Geologic Repository Operations Area Interface Drawings

Six controlled drawings representing the interfaces between the ESF and the Geologic Repository Operations Area (GROA) were checked and verified as containing sufficient information describing those interfaces. The NRC team understands that the design of the GROA is evolving and that the drawings are to be revised as the GROA design evolves. While the interface control process appears to be acceptable, the staff will continue to monitor the ESF-GROA interface as the design of the GROA is finalized. (See also Section 8.3 of this report.)

7.8.6 "G" Values Used in the ESF Design

The "G" values used in Design Package 2C for seismic design were from the "Exploratory Studies Facility Design Requirements" document (ESFDR). They had been found earlier to be inconsistent with the values in the "Controlled Design Assumption" document. M&O personnel stressed that they were following the ESFDR. The consistency of the "G" values in the ESFDR with those for the repository cannot be evaluated because the repository seismic design parameters are not yet finalized. The "G" values have a "To Be Verified"

(TBV) status and will be re-evaluated when the repository seismic design parameters are finalized.

7.8.7 Impact of Drill and Blast Operation on Testing in Alcoves

The TIE for Construction of North Ramp of the ESF (BABFA0000-01717-2200-00001, rev. 07) was reviewed. The NRC team verified that the impact of drill and blast on testing in alcoves had been acceptably considered in the evaluation of potential test interference. The impact was evaluated primarily in terms of blasting damages. The M&O explained that, in the process of conducting the TIE, individuals responsible for testing were asked to provide their input.

7.8.8 ESF Ventilation System Design

Review of the ESF Ventilation Flexibility Analysis (BABFAD000-01717-0200-00004, rev. 0) by the NRC team verified that the ventilation system was evaluated for the entire ESF and that the evaluation was acceptable.

7.8.9 Design Package 1C

Mandatory comments related to Design Package 1C were reviewed for their technical content, and two mandatory comments from the 90% design review were selected as samples for examining the technical adequacy of their resolution. The originator of the comments and the individual responsible for resolving the comments were interviewed. The two comments deal with the DIE conclusions related to fire protection and standby power system for the ventilation fans. The comments were acceptably resolved by providing additional explanation and clarification, and no change to the design or to the DIE resulted.

7.8.10 TBV/TBD Status

An issue examined was how "To Be Verified" and "To Be Determined" (TBD) items and activities are cleared of that classification. Nevada Line Procedure (NLP) 3-15, "To Be Verified (TBV) and To Be Determined (TBD) Monitoring System," was reviewed. Some confusion exists in the implementation of the procedure because draft versions of some documents are classified as TBV or TBD simply because they are draft versions and not because something really needs to be "verified" or "determined." Once the documents are finalized and approved, the TBV and TBD status is removed. Interviews with involved individuals convinced the NRC team that an effort is being made to avoid this confusion in the future.

7.8.11 On-site Verification

The NRC team raised a number of questions related to "reportable geologic condition" and the related DOE Administrative Procedure (AP) 6.14 (being revised to be issued as 30.27). This procedure provides only qualitative and somewhat confusing criteria to describe what is "significant," and it requires only "unexpected" conditions to be reported. One could argue that almost any geologic condition is not "unexpected" because of the extensive geologic information that exists for the site and that, hence, nothing is reportable. Using this line of argument, one can question the need for such a procedure.

The example of "voids" encountered by the TBM as a result of loose and blocky ground conditions at the site was discussed. Based on the AP-6.14, it was difficult to conclude without ambiguity whether such "voids" should be considered reportable geologic conditions. It was clear there were no procedures on hand to deal with these conditions when first encountered, nor were there contingency plans available to the field personnel. Most of the field conditions/problems were being attacked using a "learn as you go" approach. While this might be standard practice at some underground construction sites, the site characterization program for a geologic radioactive waste repository is governed by requirements that dictate the development of clear plans and procedures.

The NRC team verified that objective evidence existed (an internal M&O memorandum dated February 7, 1995, a DIE, and alternate excavation procedures with M&O concurrence dated February 14, 1995) that supported timely action by the concerned organizations/personnel after encountering difficult construction conditions.

Based on field observations and discussions with the involved personnel, the NRC team was convinced that the M&O has a mechanism in place to identify potential test-to-test and construction-to-test interference and waste isolation impacts. However, the NRC team recommended that AP-6.14 be clarified regarding reportable conditions.

7.9 Recommendation

Based on the results of this portion of the in-field verification and other Phase 2 activities, the NRC team recommends that Open Item 1 (The Comment in the NRC letter of October 13, 1994, to DOE - Bernero to Dreyfus) remain open for follow-up in Phase 3. Open Item 1 should be revised to reflect the above.

8.0 VERIFICATION OF NRC QUESTION 2 (OPEN ITEM 3 IN THE NRC LETTER OF OCTOBER 13, 1994, TO DOE - BERNERO TO DREYFUS)

8.1 Design Package 2C DIEs

The DIE documentation of Design Packages 1C, 1D, and 2C was reviewed by the NRC team and discussed with cognizant M&O personnel. Several designs were examined for WIEs and TIEs as well as for the general QA applicability evaluations of the DIE. The NRC team verified that potential test interferences were considered for the drill and blast operations for test alcove designs.

The DIE process was upgraded into one procedure in early March of 1995. TIEs and WIEs were formerly performed to separate procedures, and their results served as inputs into the DIE. The revised process includes TIEs and WIEs as sections of the DIE, and one procedure addresses the entire process.

As a part of the verification, definitions of "temporary" and "permanent" components of the potential repository were reviewed. The definition given in QAP-2-3 indicates that any component that has a function in the GROA is

considered "permanent." The steel sets and the lagging that are used as parts of the roof support are considered to be permanent as are the roof bolts. However, the pre-cast concrete inverts that are used as the base for the railroad track and as supports for the steel sets are classified as temporary. Therefore, the pre-cast concrete inverts are not subject to the same degree of QA controls as these other items and the inverts may have to be removed and replaced if the site becomes acceptable to host a geologic repository (if they can not be qualified in-place.) The removal of thousands of pre-cast concrete inverts and the attendant problems of temporarily transferring the steel set loads to some other mechanical load bearing device could potentially impact worker safety; long term waste isolation; and, in some cases, the ability to gather data. Therefore the NRC team recommended that DOE/M&O re-evaluate the quality classification of the pre-cast concrete inverts.

8.2 Hold on TBM Operation Beyond Upper PTn Contact

A "hold point" question had been raised partly on the possibility of the TBM reaching the PTn-Tiva Canyon welded contact before sufficient data could be gathered to address the pneumatic pathway issue. DOE has asserted that all of the data required to address the pneumatic pathway issue have been collected and plans to lift the self-imposed hold point soon. The NRC question relating to the "margin" with respect to the schedule appears to be moot at this point. The NRC team did not investigate further. The technical issue related to pneumatic pathways is currently under review by the NRC staff.

8.3 Drawing Revision

Six controlled drawings describing the ESF/GROA interface were reviewed and discussed with the involved M&O design and systems engineering personnel. The NRC team noted that some of the drawings still described a "main test area," associated with an outdated concept of two shafts for the ESF. This concept was from an earlier ESF and Site Characterization Plan, and it has been replaced with the current plan of site characterization tests being conducted in a number of different ESF test alcoves. The M&O systems engineering personnel indicated that these drawings were scheduled for revision during Fiscal Year 1995. The revision process and the revised drawings will be reviewed during Phase 3 activities described in the NRC letter of March 9, 1995, to DOE - Bernero to Dreyfus.

8.4 Recommendation

Based on the results of this portion of the in-field verification and other Phase 2 activities, the NRC team recommends that Open Item 3 (Question 2 in the NRC letter of October 13, 1994, to DOE - Bernero to Dreyfus) remain open for follow-up in Phase 3. Open Item 3 should be revised to reflect the above.

9.0 VERIFICATION OF NRC QUESTION 3 (OPEN ITEM 4 IN THE NRC LETTER OF OCTOBER 13, 1994, TO DOE - BERNERO TO DREYFUS)

Open Item 4 deals primarily with the design of the ESF and its integration into the GROA. For the M&O commitments that could be evaluated during this

in-field verification, the NRC team has verified that the M&O has acceptably met its commitments. The following discussion identifies the individual M&O commitments and the staffs evaluations.

9.1 Restrictions on Construction

To verify that requirements and restrictions imposed on construction by DIEs flowed-down properly to the design output documents, the following ESF-related DIEs were selected and examined: 1) ESF North Portal Pad, 2) Starter Tunnel Drill & Blast, 3) ESF Storm Water System, 4) Starter Tunnel Steel Arch Section, and 5) ESF Rock Storage Area.

The DIEs were reviewed for content to assure that the necessary information was contained within and that the DIEs were technically reasonable. Two design requirements from the DIE for Evaluation of ESF Starter Tunnel Drill & Blast Section, and one design requirement from the DIE for ESF Storm Water System were selected for tracing to design drawings and specifications. In each case the DIE requirement could adequately be traced to a specific design drawing or specification. Therefore, the NRC team believes that the DIE process is acceptable.

9.2 Personnel Qualification

Personnel packages for four M&O technical staff members responsible for mining engineering or geotechnical engineering were examined to determine if personnel implementing plans and procedures were sufficiently trained and qualified to adequately carry them out. Personnel qualifications and training records were reviewed for sufficiency. The personnel qualifications and training records examined were found to be acceptable. Based on the results of this examination of personnel records and interface with M&O personnel during the course of the in-field verification, the NRC team concludes that the M&O is meeting it's commitments in this area.

9.3 Procedures and Activities

The NRC team reviewed and evaluated numerous M&O procedures. Since the team effort focused on the design process, this checklist item was verified further by specifically examining NLP-2-0, "Determination of Importance Evaluations," QAP-3-10, "Engineering Drawings," and QAP-3-12 "Transmittal of Design Input." In general, these procedures were found to be clear and easy to follow. The M&O technical personnel implementing these procedures were familiar with the content of the procedures, and implementation was adequate. However the NRC team recommended that procedure AP-6.14 regarding reportable conditions be clarified. (See Section 7.8 of this report.)

The NRC staff observed during the site visit portion of the in-field verification that procedures are being developed/modified at the site, as appropriate, to suit the ground conditions being encountered. Design drawings and specifications are only specific to thermo-mechanical units and decisions to install a particular ground support category are made based on in situ conditions and personnel safety considerations. The Tunnel Shift Superintendent at the site has the final authority to make decisions regarding

roof supports. No field measurements of any rock parameters are available other than limited visual observations and an extrapolation of ground conditions encountered earlier in making these in-field decisions. Based on the obsevation that the roof support category selection had been consistently conservative, the NRC team had no concerns on the construction or the implementation of field procedures.

The Technical Data Preparation Plan (TDPP) for "Plans for Continuing TBM Advance" was released during the week of the in-field verification. The NRC team verified that this TDPP provides details of how field procedures are developed and modified. Lines of authority and responsibility of various organizations involved are acceptably delineated in the TDPP.

Technical Control Procedures that deal with criteria and reporting requirements for inputs to the as-built drawings and reports were reviewed by the NRC team. These provided objective evidence for demonstrating the acceptability of the design implementation process.

As a part of the verification, the following documents/activities which are underway were briefly reviewed: (1) Technical Document Preparation Plan for the "Recommended Layout Concepts Report," (2) "Repository Layout Options Analyses Report," and (3) "Draft SCP Progress Report # 12," and its reference, "Definition of the Potential Repository Block." There was sufficient objective evidence to conclude that work underway was in accordance with the commitments made by DOE/M&O.

9.4 Site Characterization Program Baseline

The staff reviewed the outline of the new Site Characterization Program Baseline (SCPB) and the schedule for its development. Actions underway to document linkages/revisions/transitions presented by M&O were also reviewed. Change requests and schedules for SCPB revision work were also provided by the M&O.

The SCPB issue is a subset of the bigger and more important issue of document hierarchy which is a part of Phase 3. Although the NRC team is satisfied that there is objective evidence that SCPB revision work is underway, how the SCPB fits into the overall document hierarchy will be examined during Phase 3.

9.5 Recommendation

Based on the results of this portion of the in-field verification and other Phase 2 activities, the NRC team recommends that Open Item 4 (Question 3 in the NRC letter of October 13, 1994, to DOE - Bernero to Dreyfus) remain open for follow-up in Phase 3. Open Item 4 should be revised to reflect the above.

10.0 MEETINGS WITH DOE/M&O MANAGEMENT

A meeting of the NRC Team Leader and DOE/M&O management (with a State of Nevada observer present) was held each morning to discuss the in-field verification status and preliminary findings. At the daily meetings and during the daily interfaces between the NRC team and DOE/M&O personnel,

potential findings generally appeared to be viewed as a means of improving the program.

11.0 SUMMARY OF NRC FINDINGS

At the end of the in-field verification, the NRC team concluded that, within the scope of the verification, DOE/M&O compliance with the commitments made in the DOE letter of November 14, 1994, to the NRC (Dreyfus to Bernero) is generally satisfactory.