



**UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
WASHINGTON, D.C. 20555-0001**

August 16, 2001

**MEMORANDUM TO:** C. William Reamer, Chief  
High-Level Waste Branch  
Division of Waste Management  
Office of Nuclear Material Safety and Safeguards

**FROM:** William L. Belke, Sr. On-Site Licensing Representative  
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Office of Nuclear Material Safety and Safeguards

**SUBJECT:** U. S. NUCLEAR REGULATORY COMMISSION ON-SITE  
LICENSING REPRESENTATIVES' REPORT ON YUCCA  
MOUNTAIN PROJECT FOR MAY 1, 2001 THROUGH  
JUNE 30, 2001

The purpose of this letter is to transmit the U.S. Nuclear Regulatory Commission (NRC) On-Site Representative's (OR's) report for the period of May 1, 2001, through June 30, 2001.

This report highlights a number of Yucca Mountain Project activities of potential interest to NRC staff. The OR's continue to respond to requests from NRC Headquarters staff to provide various documentation and feedback related to Key Technical Issues (KTI's) and their resolution. During this reporting period, the OR's continued to observe activities associated with Yucca Mountain Site Characterization, KTI's, and auditing. The OR's also attended a number of meetings and accompanied NRC staff on visits to Yucca Mountain.

If you have any questions on this report or its enclosures, please call William L. Belke on (702) 794-5047, Chad J. Glenn on (702) 794-5046, or Robert Latta on (702) 794-5048.

**Enclosures:** U.S. Nuclear Regulatory Commission On-Site Licensing Representatives Report  
ESF/ECRB Plan View Alcove, Niche and Borehole Test Locations  
Nye County Early Warning Drilling Program Drillhole Locations  
ATC Site Layout/ATC Cross-hole Configuration

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ADAMS ACCESSION NUMBER:  
ADAMS DOCUMENT TITLE:

ML012340377  
U.S. Nuclear Regulatory Commission On-Site  
Licensing Representatives' Report on Yucca  
Mountain Project for May 1, 2001, through  
June 30, 2001

Publicly Available     Non-Publicly Available     Sensitive     Non-Sensitive

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DATE:	08/02/2001	08/02/2001	08/02/2001	08/16/2001

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NUMBER OR-01-01

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## 1.0 EXECUTIVE SUMMARY

### **SURVEILLANCE OF CONDITION IDENTIFICATION AND REPORTING SYSTEM (CIRS)**

During the week of June 24, 2001, the OR observed a portion of a DOE surveillance of the CIRS system. One DR was issued for not properly using the corrective action procedure process to manage quality-related issues. Also, eight recommendations were issued with responses requested.

### **DEFICIENCIES DATA BASE**

In the last On-Site Representative's (OR) report, the OR review of the data base used for tracking deficiencies adverse to quality revealed that there may be areas where there may be repetitive recurrences of deficiencies previously identified and closed. One area of a suspected trend was the recurrence of scientific notebook (S/N) deficiencies. These increased deficiencies prompted the DOE Office of Quality Assurance (OQA) to issue a Suspected Trend Investigation Report (STIR). The STIR resulted in an OQA surveillance which concluded that Bechtel SAIC Company, LLC is pro-active in the control of S/Ns and that no adverse quality trend exists. Also, the review did not indicate there was a significant condition adverse to quality. However, upon further consideration, the OQA initiated an effort to review subsequent documentation generated on deficiencies associated with S/Ns. Based on the results of this review, a decision will be made whether or not, to initiate a Deficiency Report (DR) or a CAR.

### **MODEL VALIDATION**

During this reporting period two issues involving significant conditions adverse to quality were identified by the U.S. Department of Energy (DOE) concerning model validation and inadequate software controls. Specifically, on May 3, 2001, a Corrective Action Request (CAR), was issued identifying that project personnel did not consistently implement applicable procedure requirements for model validation of the analysis model reports associated with the Total System Performance Assessment Model for Site Recommendation (TSPA-SR). On June 12, 2001, DOE issued another CAR, which documented software configuration management deficiencies related to; inadequate procedural compliance, lack of supplemental procedures and ineffective training for software development. These issues along with the staff's identification of technical errors and inconsistencies in the TSPA-SR were discussed during the publically available U.S. Nuclear Regulatory Commission (NRC)/DOE Quarterly QA Breakout Session and Management Meetings, held in Rockville, Maryland on June 13, 2001.

### **EXPLORATORY STUDIES FACILITY (ESF) & NRC KEY TECHNICAL ISSUES (KTIs)** **Seepage Testing**

DOE is conducting water release and seepage testing at several locations in the Topopah Spring Tuff. Passive hydrologic testing continues where sealed bulkheads isolate sections of the Enhanced Characterization of the Repository Block (ECRB) from the effects of ventilation to allow drifts to return to ambient conditions in an effort to observe natural seepage. To date, DOE scientists have not observed natural seepage. DOE has not yet developed a detailed test plan for the passive hydrologic test, but DOE scientists state that one is being developed and is expected to be completed by August 2001. DOE is also developing a procedure that would require documentation of pre-test predictions and other relevant information before conducting future testing.

### **Cl-36 Validation Study**

Testing to verify the presence of bomb pulse Chlorine-36 in the vicinity of the Sundance and Drill Hole Wash Faults continues. DOE reports that preliminary Tritium and Chlorine-36 analyses completed to date, have not confirmed the presence of bomb pulse Chlorine-36. Additional analyses await completion. DOE is proceeding with steps to determine if differences in sample preparation techniques might explain differences in analytical results from two laboratories. Two laboratories completed separate leaching experiments of reference samples to determine what effect different leaching procedures may have on Chlorine-36 analyses. According to DOE, preliminary results of these experiments show that these analyses are sensitive to sample leach time. The laboratories have agreed to establish a standard protocol that will provide guidance for crushing samples to a uniform size and reduce leaching time to 24 hours or less. This protocol will be used to complete Chlorine-36 analyses on the remaining samples for this study.

### **Thermal Testing**

DOE continues to maintain drift wall-rock temperatures below 200° Centigrade (392° Fahrenheit) in the Alcove 5 thermal test. In January 2002, DOE plans to begin the four-year cool-down phase for this test. DOE previously reported evidence of rock scaling at several locations in the Heated Drift. DOE issued a report documenting these observations and continues to evaluate this condition. DOE continues to drill boreholes in the Topopah Spring lower lithophysal unit to collect in-situ thermal conductivity data.

### **Fluid Inclusion Study**

University of Nevada Las Vegas (UNLV) scientists are proceeding with a study to determine the origin and age of fluid inclusions in calcite at Yucca Mountain. UNLV scientists plan to submit a final report on this study to DOE before the end of FY2001.

### **Surface-Based Testing**

Waste Handling Building Geotechnical Investigation - DOE completed the field work supporting a geotechnical investigation at the Yucca Mountain North Portal area to collect rock property and geophysical data for input to the design of a waste handling building for a potential repository at Yucca Mountain. A final report is expected to be completed by the end of FY 2001. Over this period, DOE initiated seismic work to characterize the near surface velocity structure at Yucca Mountain.

### **Nye County Early Warning Drilling Program**

Over this period, DOE completed single-well alluvial tracer testing at Nye County well NC-EWDP-19D/D1. In July 2001, Nye County plans to drill up to four additional shallow wells at this location for cross-hole alluvial tracer testing.

### **Busted Butte Unsaturated Zone Transport Test Facility**

Phase II post-test characterization continued over this period. This testing is scheduled to be completed by the end of FY2001. Atomic Energy of Canada, LTD., continues radionuclide tracer testing on blocks of tuff extracted from the Busted Butte Test Facility.

**Engineered Barrier System (EBS) Testing**

DOE continues EBS testing at their Pilot Scale Test Facility located in North Las Vegas. The DOE Phase II pre-closure ventilation test started in April 2001. To date, 6 of 14 Phase II tests have been completed. This phase of testing simulates the ability of ventilation inlet air, at different temperatures, to maintain sub-boiling temperature at the emplacement drift wall in a potential repository.

## REPORT DETAILS

### 2.0 INTRODUCTION

The principal purpose of the OR report is to inform NRC staff, managers, and contractors of information on the 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 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. The OR's also participate in activities associated with resolving NRC Key Technical Issues (KTI's). In addition to communication of this information, this report may raise potential licensing concerns, or express opinions; these items represent the views of the OR's. The reporting period for this report covers May 1, 2001 through June 30, 2001.

### 3.0 OBJECTIVES

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 OR's 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 OR's consult with DOE scientists, engineers, and managers, with input from NRC Headquarters management, on NRC policy, philosophy, and regulations. The OR's focus on such issues as Quality Assurance (QA), design controls, data management systems, performance assessment, and KTI's resolution. A principal 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.

### 4.0 QUALITY ASSURANCE, ENGINEERING, AND NRC KEY TECHNICAL ISSUES

#### **CIRS (Condition Identification and Reporting System)**

During the week of June 24, 2001, the OR observed (part time) a surveillance of the CIRS System. The purpose of this surveillance was to assess the adequacy and effectiveness of the CIRS system capability to track and resolve issues placed in the system. Surveillance personnel conducted interviews with various CIRS personnel, reviewed CIRS procedure AP-REG-004 to verify appropriate implementation, reviewed the CIRS trend report, and attended a CIRS screening team meeting to observe how CIRS entries are appropriately categorized.

One deficiency was issued for not using the AP-16-1(Procedure for Management of Conditions Adverse to Quality) process to manage quality-related issues. In addition, the surveillance team issued the following eight observations/recommendations:

1. Q. issues are not clearly traceable to the issued deficiency document.
2. CIRS reports do not provide management summaries or useful overviews.
3. CIRS reports do not always address all issues. Several issues were noted where no action had been assigned.
4. Except for the initial entry, CIRS data can only be updated by the CIRS Condition Coordinator. This sometimes leads to a reader not always understanding the full extent of the issue.
5. Initiators and assigned individuals are not always notified of the results of how an issue was or is being dispositioned.
6. There does not appear to be accountability for management or personnel to ensure that CIRS items action due dates are met or revised.
7. Actions assigned by the CIRS Screen Team are not summarized into a short summary that would be easy to track.
8. The CIRS trend report does not provide a comparison of performance from prior trends to indicate improved or decreased performance.

The surveillance team has requested responses to the eight recommendations. The surveillance team concluded that the CIRS system has the potential to be an effective management system to identify and resolve several types of project issues. However, the CIRS system currently does not provide management with a clear cumulative overview of all issues including scheduled closure dates, responsible manager, days open, disposition and a brief discussion of the issue. The OR agrees with this conclusion.

At the June 13, 2001, DOE/NRC quarterly QA meeting, a viewgraph was presented listing three items (CIR Identification Numbers 1577, 1580, and 1581) that had been entered into the CIRS system. These subject matter of these items pertained to the software and model issues identified in the May 17, 2001, NRC letter from W. Reamer to S. Brocoum. The CIRS items were reviewed after the completion of the DOE surveillance. The result was similar to the recommendations in the previous paragraph. For example:

1. It is not clear to whom the responsible manager is to refer any questions to regarding the status or progress of closing the respective CIRS item.
2. The original input to all three CIRS items classified them as Opportunity for Improvement (OI). Once reviewed by the CIRS Screening Team, CIRS item numbers 1580 and 1581 were documented as Deficiency Reports in lieu of an OI. However, the CIRS item presently reflects the OI status.
3. It would be more useful if the CIRS items provided a brief overview or summary in order for the user to more readily obtain a "snapshot" overview.
4. CIRS items 1580 and 1581 reflect an "Open" status and need to be tracked.

The OR will monitor the corrective action and responses to the recommendations initiated by the surveillance team and report on the status in future OR Reports.

## **DEFICIENCIES DATA BASE**

### ***Background***

In the previous OR Report, the OR had reviewed the DOE data base used for tracking and trending the deficiencies adverse to quality that have surfaced during the various audits, surveillances, self assessments, or observations. These deficiencies have been documented in CARs or in DRs and which indicate where there may be repetitive

recurrences of deficiencies that were previously identified and closed. One area where there appeared to be a trend pertained to deficiencies in developing and maintaining scientific notebooks (S/N).

There were several recurrences of various S/N deficiencies. Increased S/N deficiencies were noted as NRC OR Open Item 98-2 in the January-February 1998 NRC OR Report dated March 17, 1998. DOE initiated a custom training program for each participating organization in the use and control of S/Ns. Also, reviews of 656 ongoing or open S/Ns were conducted. Based on these results, the problems with S/Ns were corrected and NRC Open Item 98-2 was closed in the October-December 1999 OR Report. Until recently these efforts appeared to be effective. However, several recurrences of S/N deficiencies again surfaced. A STIR was initiated by DOE on March 6, 2001, to determine whether sufficient actions are being taken by the affected organizations to correct recent conditions adverse to quality relative to implementation and use of S/Ns. This resulted in DOE Surveillance Report BSC-SR-01-014 concluding "... BSC's management is proactive in the control of S/Ns and that no adverse quality trend exists nor did the review indicate a significant condition adverse to quality."

The OR agreed that the S/N deficiencies that surfaced were mostly of a minor nature. However, the OR does not agree with the DOE conclusion that a trend does not now exist. This is of special concern in that DOE undertook a significant effort to correct the previous trend.

#### ***Current Status***

OQA has initiated an effort to review the recent documented information pertaining to S/N deficiencies and concerns. This information consists of deficiencies that have surfaced through recent audits, surveillances, self assessments, and from the information entered into the CIRS. All deficiencies will be classified relative to their significance and impact. A decision will then be made with regard to the need to initiate a DR or CAR and what course of corrective action is needed, to prevent any repetitive occurrences of S/N deficiencies in the future. The OR will track, monitor, and report on the progress of this activity.

### **TRENDING**

#### ***Current Status***

The OR reviewed the information from the OQA Trend Program input as documented in the semi-annual QA Trend Report. The current practice in effect for each DR/CAR is to capture all applicable program elements and then enter the applicable deficiency cause codes. There may be several causes designated for a particular program element. Once the deficiency is evaluated for the actual extent of condition, this evaluation gets documented in the deficiency document. These factors do not get entered into the trending program. Consequently, current practice does not reflect the extent of the condition or additional program elements. The deficiency document, which normally represents a relatively fewer number of individual products affected by the deficiency, is treated the same way as one which is widespread throughout the project. In the OR's opinion, this type of trending does not give management a good picture of how long an actual problem has been in existence and how repetitive the problems were within an individual deficiency. It is recommended that DOE OQA revisit the trending practice and reconsider whether the current trending program methodology meets the intended function of accurately identifying specific areas of concern and associated metrics.

## **MODEL VALIDATION**

### ***Current Status***

On May 3, 2001, DOE issued a CAR Number BSC-01-C-001, identifying that Yucca Mountain Project personnel failed to consistently implement applicable procedure requirements for model validation. DOE's investigation of this issue concluded that an adverse trend existed based on the repetitive nature and number of deficiencies identified as well as the extent of the condition. Additionally, DOE concluded that previous corrective actions had not been effective in correcting the identified deficiencies. Accordingly, DOE considers the area of model validation to be a significant condition adverse to quality. As stated in the Conclusion section of the CAR, "The results of this evaluation of the AMR's and calculations that support the TSPA identified systematic examples of inadequate model validation in accordance with AP-3.10Q, DOE's procedure controlling model validation, in 18 of the 24 model validations examined." These 18 models support the TSPA Model for Site Recommendation (TSPA-SR).

## **TECHNICAL ERRORS AND/OR INCONSISTENCIES IN DOE'S TSPA, ANALYSIS, COMPUTER CODES AND CALCULATIONS**

### ***Current Status***

On May 17, 2001, the NRC sent a letter from William Reamer, to Stephen Brocoun (DOE), discussing apparent technical errors and/or inconsistencies between the issued TSPA report and the TSPA-SR model. Specifically, the letter indicated that the staff had identified technical errors and/or inconsistencies between the TSPA-SR report and model, the underlying AMR, the results of the computer code used for TSPA-SR, and associated hand calculations.

This letter requested that DOE identify the scope of the errors in order to evaluate the implications for the quality and adequacy of DOE's performance assessment and the associated TSPA-SR documents. Furthermore, the letter asked that DOE indicate how these errors have been addressed through the project's Quality Assurance Requirements Description document and the implementing procedures.

## **SOFTWARE CONTROLS**

### ***Current Status***

On June 7, 2001, the DOE Bechtel-SAIC Company, LLC (BSC, LLC) directed a limited management stand-down with regard to software development. This directive resulted from the accumulation of issues regarding the indeterminate status of quality-affecting software being used in technical products. On June 12, 2001, DOE issued CAR Number YMSCO-01-C-002, addressing the following software control problems: 1) deficiencies in procedure compliance (lack of effective independent verification and validation); 2) lack of supplemental procedures (software development and life cycles); and 3) lack of effective training and implementation regarding software development. It is noted that within this area previous deficiencies have been identified, (e.g. CAR LVMO-98-C-006 concerning ineffective software controls and CAR LVMO-00-C-001 involving failure to follow procedure and use of unqualified software).

During the June 13, 2001, NRC/DOE Quarterly QA Breakout Session and Management Meeting, DOE outlined their action plan for addressing the TSPA issues identified in the staff's May 17, 2001 letter. As described in these meetings, DOE's action plan includes remedial and investigative actions, root cause analysis, and corrective action to prevent recurrence. DOE also plans to enhance and upgrade several of its procedures to

incorporate corrective action and to provide controls for the transition from site characterization to design and construction phases.

These deficiencies are of concern to the NRC because they appear to be repetitive in nature, and indicate that the QA program was not being effectively implemented in the areas of model validation and software control. The OR's will continue to monitor these activities and document the results in a future report.

## 5.0 OUTREACH ACTIVITIES

### **Division of Waste Management Staff Brief Clark County Yucca Mountain Nuclear Waste Advisory Committee**

On March 21, 2001, Division of Waste Management (DWM) staff, including the OR's, were invited to attend a bi-monthly meeting of the Clark County Yucca Mountain Nuclear Waste Advisory Committee. During this public meeting, the DWM staff presented an overview of the NRC's independent oversight role regarding the potential high-level waste repository at Yucca Mountain, and a discussion of the current status of rulemaking activities. The DWM staff also described the NRC's role regarding the shipment of high-level waste, the respective status of the NRC and the EPA radiation standards and plans for future public interactions. This presentation afforded an opportunity for the constructive exchange of information with the affected units of local government, citizen groups, and members of the public. The meeting was also attended by representatives from U.S. Senator Harry Reid's and U.S. Senator John Ensign's staff as well as the news media. The meeting provided an opportunity for the effective exchange of ideas and the Clark County officials encouraged the continued attendance of the staff at future Committee meetings.

### **Division of Waste Management Staff Participate In On-Site Representatives Open House**

Division of Waste Management staff, including the OR's, OR secretary and two members from the Spent Fuel Projects Office (SFPO) participated in an NRC sponsored open house on March 28, 2001, in Las Vegas Nevada. The purpose of the open house was to allow members of the community to meet the OR's and discuss issues related to pre-licensing activities for the potential high-level waste repository at Yucca Mountain. The open house provided an effective forum for the constructive exchange of information with the more than 50 members of the public, citizen groups and media representatives who attended. The continued involvement of NRC representatives at community activities, such as this, represents an important extension of the agencies' outreach program.

### **Division of Waste Management Staff Attend a Public Meeting in Caliente, Nevada**

On March 29, 2001, members of DWM and two representatives from SFPO attended a public meeting in Caliente, Nevada. Prior to the meeting, the staff met with city and county officials who urged the NRC to consider how transportation emergency response actions might be addressed in any NRC authorization to the DOE. During the meeting the NRC staff described the NRC's role in pre-licensing activities related to the proposed high-level waste repository at Yucca Mountain, provided an update on project issues, and addressed the provisions for public involvement in the licensing process. The staff also discussed spent fuel transportation issues including the functions of the NRC and DOT, routing factors, safety considerations for spent fuel transport and NRC cask

performance standards. This public meeting provided an opportunity for the NRC's staff members to pro-actively interact with members of the community in a manner which enhances public confidence.

#### **Public Meetings on NRC's Formal Hearing Process for a Possible High-Level Waste Repository at Yucca Mountain, Nevada**

In response to public requests, DWM staff including the OR's, continued its series of public meetings on the high-level waste repository licensing process. With support from the Office of General Counsel and the Spent Fuel Project Office, meetings were held in Pahrump, NV, on May 22, 2001, and in Las Vegas, NV, on May 23, 2001. The purpose of these meetings was to explain the formal hearing process the NRC would use to decide whether to issue a construction authorization for a possible repository at Yucca Mountain, Nevada. The meetings began with a review of the events that would have to take place before NRC would begin a formal hearing, a general review of the NRC's licensing role, and a general description of the NRC's formal hearing process. Question and answer periods followed breaks between presentations. In addition, members of the NRC staff were available for informal discussion with members of the public. Both meetings were received well and public reaction was generally favorable. Additionally, the staff received a request to consider holding another, general meeting in northern Nevada to acquaint Nevada citizens there with the role and responsibilities of the NRC.

#### **Division of Waste Management Staff Attend a Public Meeting in Mesquite, Nevada**

On May 28, 2001, members of the Division of Waste Management and a representative from the Spent Fuel Projects Office attended a public meeting in Mesquite, Nevada. During the meeting the staff, with support from the OR's, provided an overview of the NRC's role in pre-licensing activities related to the potential high-level waste repository at Yucca Mountain and a general description of the provisions for public involvement in the licensing and hearing process. The staff also discussed spent fuel transportation issues including the functions of the NRC and the Department of Transportation, routing factors, safety considerations for spent fuel transport and NRC cask performance standards. Relevant handout materials were provided to the approximately 50 residents who attended the meeting and the staff responded to questions from members of the public. The staff's presentations were well received and the meeting provided an opportunity for the NRC's staff members to effectively interact with members of the community.

## **6.0 EXPLORATORY STUDIES FACILITIES (ESF), AND NRC KEY TECHNICAL ISSUES**

### **ENHANCED CHARACTERIZATION of the REPOSITORY BLOCK (ECRB)**

The excavation of the ECRB, completed on October 13, 1998, allows the collection of scientific and engineering data in stratigraphic units that constitute the bulk of the potential repository horizon. DOE continues ECRB construction and testing activities to maximize the amount of data available to support DOE TSPA - Site Recommendation. Enclosure 2 provides ESF and ECRB test locations. ECRB construction and testing activities are summarized below.

#### **Passive Hydrologic Test**

##### ***Background:***

Since June 1999, sections of the ECRB have been isolated from the rest of the underground facility by the construction of sealed bulkheads. These bulkheads are

located at Stations 17+63, 25+03 and 26+00. No forced ventilation occurs beyond the bulkheads, except during brief entries to collect data and perform maintenance. This is a passive test designed to allow the isolated parts of the ECRB to return to ambient (pre-construction) moisture and temperature conditions to determine if dripping from the rock-mass can be observed. Hundreds of moisture monitoring probes are installed in tunnel walls at depths of up to 2 meters. While some test probes show evidence of rewetting, DOE scientists state that moisture conditions in this section of the ECRB have not fully re-equilibrated. DOE plans to continue this test through FY2001.

***Current Status:***

The September/October 2000 OR Report, initially suggested that DOE consider developing a detailed plan describing the test purpose and objective, approach, pre-test predictions, schedule and use of data collected. In the OR view, such a plan would provide greater confidence that test results would address data needs for DOE-NRC issue resolution activities. DOE is presently developing a plan for this test that provides this information, and this plan is expected to be completed by August 2001. DOE is also developing a procedure to enhance the documentation and transparency for future scientific and engineering testing. The procedure will impose additional controls for documenting test requirements, pre-test predictions, and other relevant information in advance of future testing. This procedure is expected to be issued in the August 2001 time frame. The OR's will continue to monitor the development of this information. In April 2001, DOE lost electrical power to the TBM and to data loggers between Stations 25+03 and 26+00. On May 22, DOE reopened the bulkheads (Stations 17+63, 25+03, and 26+00) for one day to restore electrical power. Electrical power was restored to the data loggers, but not to the TBM. This entry was unique from previous entries, because it was conducted without ventilating this section of the ECRB before entry. The OR's requested that DOE scientists record their observations of moisture and other relevant conditions during this entry. DOE plans to report on their observations in July 2001. The next planned opening of these bulkheads is scheduled for October 2001.

**Niche #5**

***Background:***

This niche is constructed at Station 16+20 to conduct seepage testing in the Topopah Spring lower lithophysal zone. Over two-thirds of the potential repository is planned to be located in this rock unit. Niche walls and boreholes have been instrumented with moisture monitoring equipment. Test results will feed the unsaturated zone flow and transport process model report.

***Current Status:***

Over this period, DOE completed the construction of .batwings. on each side of Niche 5. These batwings are designed to enhance DOE's ability to monitor and collect any moisture moving around this niche when seepage testing resumes in July 2001. Seepage testing in Niche 5 is expected to continue through FY2001.

**Systematic Hydrologic Characterization (SHC)**

***Background:***

DOE scientists are conducting SHC testing to investigate the spatial variability of hydrologic properties affecting seepage processes. DOE plans to drill approximately 20 boreholes in the Topopah Spring lower lithophysal zone. These boreholes will be used for air permeability and liquid release/seepage measurements along with gas tracer

measurements. Test results will feed the near-field and unsaturated zone flow and transport process model reports.

***Current Status:***

Over this period, DOE continued to drill and conduct SHC testing in a series of 20 meter deep boreholes in the Topopah Spring lower lithophysal zone. DOE plans to continue this testing through FY2001.

**In-Situ Thermal Conductivity Measurements**

***Background:***

DOE's thermal properties data of the Topopah Spring lower lithophysal tuff unit is limited to a small number of laboratory measurements. Therefore, DOE plans to collect in-situ thermal conductivity measurements by drilling a series of 8.5 meter deep boreholes in this rock unit. Each set of boreholes will contain a heater hole along with one or more observation holes containing temperature sensors. The thermal pulse measured from the heater will allow the in-situ thermal conductivity of the rock to be calculated.

***Status:***

Over this period, DOE completed drilling the third of four sets of thermal conductivity boreholes planned for FY2001. The three completed sets of boreholes are located at Stations 15+43, 15+65 and 17+38. Thermal conductivity boreholes at Station 15+65 are instrumented and collecting data. This testing will continue through FY2001.

***Alcove 8:***

***Background:***

This alcove is constructed at Station 8+00 to conduct seepage testing from the Topopah Spring upper lithophysal zone to the underlying Topopah Spring middle nonlithophysal zone. DOE completed drilling a series of boreholes downward from this alcove for moisture monitoring. Niche #3, previously constructed in the Topopah Spring middle nonlithophysal zone, is situated 20 meters directly below this alcove and will be used in this test. Infiltration systems constructed on the floor of Alcove 8 will apply traced water at a measured rate. Boreholes in Alcove 8 and Niche #3 will be used to monitor changes in moisture content and other properties of the rock-mass. DOE scientists plan on monitoring these boreholes using ground penetrating radar, neutron logging, and acoustic tomography. Test results will feed near field and unsaturated zone flow and transport process model reports.

Two infiltration plots have been constructed on the floor of this alcove. One plot measured approximately 1 X 1 meter, and the second plot approximately 3 X 4 meters. The 1 X 1 meter plot was constructed on a segment of a small fault exposed both on the floor of Alcove 8 and the roof of Niche 3. From August to December 2000, DOE scientist's ponded water on this fault and monitored moisture conditions in Niche 3 to determine the breakthrough time of traced water, but no breakthrough occurred. According to DOE scientists, this fault is filled with gouge (clay like material) which may be inhibiting flow. DOE scientists report that subsequent analyses of this gouge material indicate the presence of smectite (clay that swells with water). To enhance infiltration and seepage processes along this fault, DOE scientists enlarged the infiltration plot. A trench (roughly 15 centimeters deep, 40 centimeters wide, and 4 meters long) was constructed along this fault. This trench allows water to pond over the entire length of the fault exposed in the floor of Alcove 8. On March 6, 2001, DOE started infiltration on

this trench, and on April 6, 2001, DOE scientists detected initial breakthrough of traced water in Niche #3.

***Current Status:***

According to DOE, the current infiltration rate on the trench in Alcove 8 is approximately 9.0 liters per hour, and the seepage rate in Niche #3 is roughly 5 percent of the infiltration rate. DOE has deferred the start of infiltration on the 3 X 4 meter plot until testing on this fault is completed. Seepage testing on this fault is expected to continue through FY2001.

**EXPLORATORY STUDIES FACILITY (ESF) TESTING**

DOE has completed moisture monitoring and testing in Alcoves 1, 2, 6, and Niches 1, 2. Limited moisture monitoring and seepage testing continues at Alcoves 3, 4, 7 and Niches 3 and 4. Ongoing ESF testing activities are summarized below.

**CHLORINE-36 VALIDATION STUDY**

***Background:***

DOE scientists are proceeding with a study to validate the presence of bomb-pulse chlorine-36 at two locations in the ESF. Approximately 60 samples have been collected in the vicinity of the Drill Hole Wash Fault and the Sundance Fault where elevated concentrations of chlorine-36 were detected in a previous study. These samples are being analyzed for chlorine-36, tritium, technetium-99, and supplemented by analyses of uranium, thorium, iodide-129 and radium isotopes. To date, this validation study has detected no elevated chlorine-36 values; however, additional samples await analyses. According to DOE scientists, one possible explanation for the apparent disagreement between results of this study and an earlier study may lie in sample preparation and processing techniques. One of the two laboratories involved is thought to have used a more aggressive crushing technique and longer leach times which may release more rock chloride thus reducing the ratio of chlorine-36 to chlorine. To determine the effect of two different sample preparation and processing techniques, a bulk sample has been collected from the ECRB, crushed to a uniform size, and sample splits shipped to the two laboratories for analyses. According to DOE, the results of these analyses will be compared and the two laboratories will then agree to a standard sample processing method for subsequent Chlorine-36 analyses. The two laboratories will synthesize their results and prepare a report documenting their findings including implications for conceptual models of unsaturated zone flow and transport. An interim report is expected to be completed by the end of CY2001.

***Current Status:***

The two laboratories completed separate leaching experiments of reference sample splits to determine what effect different leaching procedures have on the release of rock chloride and chlorine-36 analyses. According to DOE, preliminary results indicate that chlorine-36 analyses are sensitive to the sample leaching time. These results suggest that minimal sample treatment (e.g., passive leaching and reduced leaching time) yields higher ratios of chlorine-36 to chlorine. Based on these results, the DOE laboratories have tentatively agreed that the protocol for chlorine-36 analyses will use a 24 hour or shorter passive leach technique, and require that the Sample Management Facility crush all samples to a uniform size for leaching. DOE scientists plan to establish a standard protocol which will be used to analyze the remaining Chlorine-36 validation samples. The analyses of the remaining validation study samples, using this protocol, is expected to begin in August 2001.

## **Alcove 5 (Thermal Testing Facility Access/Observation Drift, Connecting Drift, and Heated Drift)**

### ***Background:***

DOE initiated the heating phase of this test on December 3, 1997. The four-year heatup phase will be followed by a four-year cool-down phase. Heat generated by nine electrical floor heaters and 50 electrical wing heaters simulate heat from emplaced 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 four thousand sensors positioned in 147 boreholes around the heated drift. A data collection system records measurements from these sensors.

### ***Current Status:***

DOE continues to maintain drift wall-rock temperatures below 200° Centigrade (392° Fahrenheit). DOE plans to hold these wall-rock temperatures through CY2001 to evaluate the effect of sustained heating on the hydrologic, chemical and mechanical behavior of the rock. On June 21, 2001, sensors in the heated drift recorded the following preliminary temperatures: canister temperature of 196.1° Centigrade (385° Fahrenheit), rock-mass surface temperature of 193.9° Centigrade (381° Fahrenheit), and air temperature of 199.4° Centigrade (391° Fahrenheit).

DOE scientists continue to monitor moisture and rock mass changes around the Heated Drift via geophysical logging of selected boreholes. DOE also monitors rock mass changes inside the Heated Drift by a remote operated camera. Over this period, DOE scientists issued a report<sup>1</sup>, issued May 10, 2001 on observations of scaling in the roof of the Heated Drift. DOE also collected eight side-wall core samples from boreholes adjacent to the Heated Drift and detected evidence of dissolution and precipitation of minerals in fractures.

## **Fluid Inclusion Study**

### ***Background:***

UNLV scientists have completed a study to determine the origin and age of fluid inclusions found in secondary minerals (calcite and silica) at Yucca Mountain. Over 150 samples from the ESF and ECRB have been collected and characterized to better understand the development of secondary minerals and spatial distribution of fluid inclusions.

### ***Current Status:***

UNLV's final report has been delayed several months. This report is presently expected to be submitted to DOE by the end of FY2001.

## **Laser Strainmeter Test**

### ***Background:***

Under a cooperative agreement with the Yucca Mountain Site Characterization Office, the University of California, San Diego will install and monitor a long-baseline strainmeter (LSM) in the ESF. The LSM experiment will supplement Global Positioning

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<sup>1</sup> Reference: Drift Scale Test (DST) White Paper: Scaling Along the Roof of the Heated Drift, May 10, 2001

System surveys conducted at five sites in the Yucca Mountain area from 1991 to 1997, which indicated higher crustal elongation rates (strain rates) than those indicated by the volcanic and tectonic history of the region. The general test description consists of the installation and operation of the LSM along the South Ramp of the ESF. A laser will measure the distance between two end monuments.

***Current Status:***

DOE continues with the construction of strainmeter niche monuments. Construction and installation of the remaining components of this system have been deferred pending the availability of the principal investigator to complete this work. The LSM is presently expected to be operational by the end of CY2001.

**SURFACE-BASED TESTING**

**Alluvial Tracer Complex (ATC)**

***Background:***

The ATC is a joint Nye County and DOE Cooperative Program to investigate flow and transport properties of the saturated alluvium. Single-well ATC testing is being conducted at well NC-EWDP-19D/D1 (Enclosure 3) and includes both hydrologic and tracer testing. Cross-well hydrologic and tracer testing will also be performed at NCEWDP-19D/D1 following the completion of single-well activities. Nye County drilled 19D/D1 to a depth of 1438 feet and encountered water at 366 feet and volcanic rocks at 810 feet. This well was completed to isolate six water bearing zones (4 in alluvium and 2 in volcanic rocks). Nye County instrumented wells NC-EWDP-4PA, 4PB, 19P, 15P and Washburn to determine the affects of ATC hydrologic testing on surrounding wells.

***Current Status:***

Over this period, single-well tracer testing was completed in NC-EWDP-19D/D1. Nye County plans to drill up to 4 additional wells, to a depth of 800-1000 feet, for cross-hole testing at this location. This drilling is expected to start in July 2001. Enclosure 4 provides the well configuration for cross-hole testing.

**Waste Handling Building Geotechnical Investigation**

***Background:***

DOE is conducting a geotechnical investigation at the Yucca Mountain North Portal area to collect data for the design of a waste handling building for a potential repository. This activity involves drilling a series of boreholes and excavating trenches/test pits to characterize this area.

***Current Status:***

Over this period, DOE continued the work of integrating geotechnical information collected from drilling and geophysical logging of 15 shallow boreholes and four test pits. A final report is expected to be submitted to DOE by the end of FY 2001.

**Characterization of Near Surface Velocity Structure**

***Background:***

DOE is collecting near surface velocity data at Yucca Mountain for use in the design of surface and subsurface facilities for a potential repository at Yucca Mountain.

***Current Status:***

Over this period, DOE conducted nine Spectral-Analysis-of Surface Waves (SASW) surveys to assess shear wave profiles of shallow rock units at Yucca Mountain. DOE scientists also collected additional data by running seismic logs in neutron boreholes: N27, N46, N64, N66, N71, N75, and N94. Over the next couple months, additional testing at Yucca Mountain will attempt to extend the near surface velocity structure characterization to the potential repository horizon. DOE expects to complete this testing by the end of FY2001.

**Busted Butte Unsaturated Zone Transport Test**

***Background:***

The planned hydrologic and tracer testing at Busted Butte is designed to provide data to help model flow and transport of radionuclides in the unsaturated zone under the proposed repository. The Busted Butte underground facility includes a 72.5 meter main drift and a 19 meter test alcove. The test is fielded in the base of the Topopah Spring non-to-partly-welded vitric sub-zones and the top of the Calico Hills Formation. Phase I tracer testing was completed in 1998. Phase II tracer testing was conducted in a separate 10 X 10 X 6 meter block of rock and this testing was completed in December 2000.

***Current Status:***

DOE continued post-test characterization of Phase II tracer testing. This work includes: overcoring selected injection boreholes, partial mine-back of the test block, and rock sampling and analyses to better characterize the distribution of reactive and nonreactive tracers. Over this period, DOE continued the partial mine-back and sampling of the Phase II block. To date, 6 of 8 faces of this block have been excavated and sampled. This work is presently expected to be completed by the end of FY2001. Atomic Energy of Canada, LTD., continues radionuclide transport testing on blocks of rock extracted from the Busted Butte Test Facility.

**ENGINEERED BARRIER SYSTEM (EBS) TESTING**

The Engineered Barrier System Operations (EBSO) Office of the Yucca Mountain Project continues to perform EBS testing. The EBS tests are performed in a Pilot Scale Test Facility located in North Las Vegas. Test results feed the EBS degradation and transport process model report.

**PILOT SCALE TESTING**

**Pre-closure Ventilation Test**

***Background:***

DOE's System Design Description for the emplacement drift system states that the subsurface ventilation will remove 70 percent of the heat generated by the waste packages during pre-closure. DOE is conducting a multi-phase pre-closure ventilation test in the EBS test facility. The objectives of this test are to (1) develop data to support the design of the ventilation system for the potential repository to maintain sub-boiling emplacement drift temperatures; and (2) provide data to support computer models used for ventilation calculations. This testing is expected to be completed by the end of FY2001.

***Current Status:***

Phase II EBS ventilation testing, which started in April 2001, continued over this period. To date, 6 of 14 Phase II tests have been completed. Phase II testing is expected to

simulate the ability of the inlet air, at different temperatures, to maintain sub-boiling temperatures at the emplacement drift wall in a potential repository. DOE completed a description of Phase III testing over this period.

## 7.0 GENERAL

### 1.0 Appendix 7 Interactions

None

### 2.0 Other

#### **Public Comments on DOE's Supplemental Draft Environmental Impact Statement**

On May 4, 2001, DOE released their Supplemental Draft Environmental Impact Statement (SDEIS). Following the release of the Draft EIS, in July of 1999, DOE continued to evaluate design options and various operating modes that would reduce uncertainties related to the proposed repository performance and potentially improve operational parameters. The SDEIS provides DOE's most recent information on the repository design evolution and the potential environmental impacts associated with the updated design information. As stated in the SDEIS, DOE intends to integrate public comments and the information in the supplement, as well as the Draft EIS and DOE responses to those comments, in the Final EIS.

A significant aspect of DOE's SDEIS comment process, involved the conduct of three public hearings in Nevada during the 45-day comment period provided for in the supplemental document. These public hearings which included a formal (recorded) comment period were held in Amargosa Valley on May 31, 2001, in Las Vegas on June 5, 2001, and in Pahrump on June 7, 2001. The OR's attended these hearings in order to gain a better understanding of the issues that were of public interest. The OR's also provided summary reports of these public hearings to the cognizant staff in the Division of Waste Management.

#### **Conference on High-Level Radioactive Waste Management**

From April 30 through May 2, 2001, NRC staff members, and representatives from the Center for Nuclear Waste Regulatory Analyses (Center) participated in the Ninth International Conference on High-Level Radioactive Waste Management held in Las Vegas, Nevada. In the Opening Plenary, the Deputy Executive Director for Materials, Research and State Programs, presented an NRC perspective on current nuclear issues. During the Conference, NRC staff including the OR's, and representatives from the Center organized and chaired several sessions and gave presentations on the following topics: (1) Yucca Mountain review plan; (2) issue resolution in hydrology and radionuclide transport; (3) conceptual models for radionuclide release and approaches to confirm waste package performance; (4) sensitivity analysis in performance assessments; (5) repository pre-closure safety issues; (6) quality assurance; and (7) bringing a licensing focus to NRC's High-Level Waste Program. These presentations were well received and the exchange of technical information was regarded as beneficial.

### **Meetings Related to the Department of Energy's High Level Waste Program**

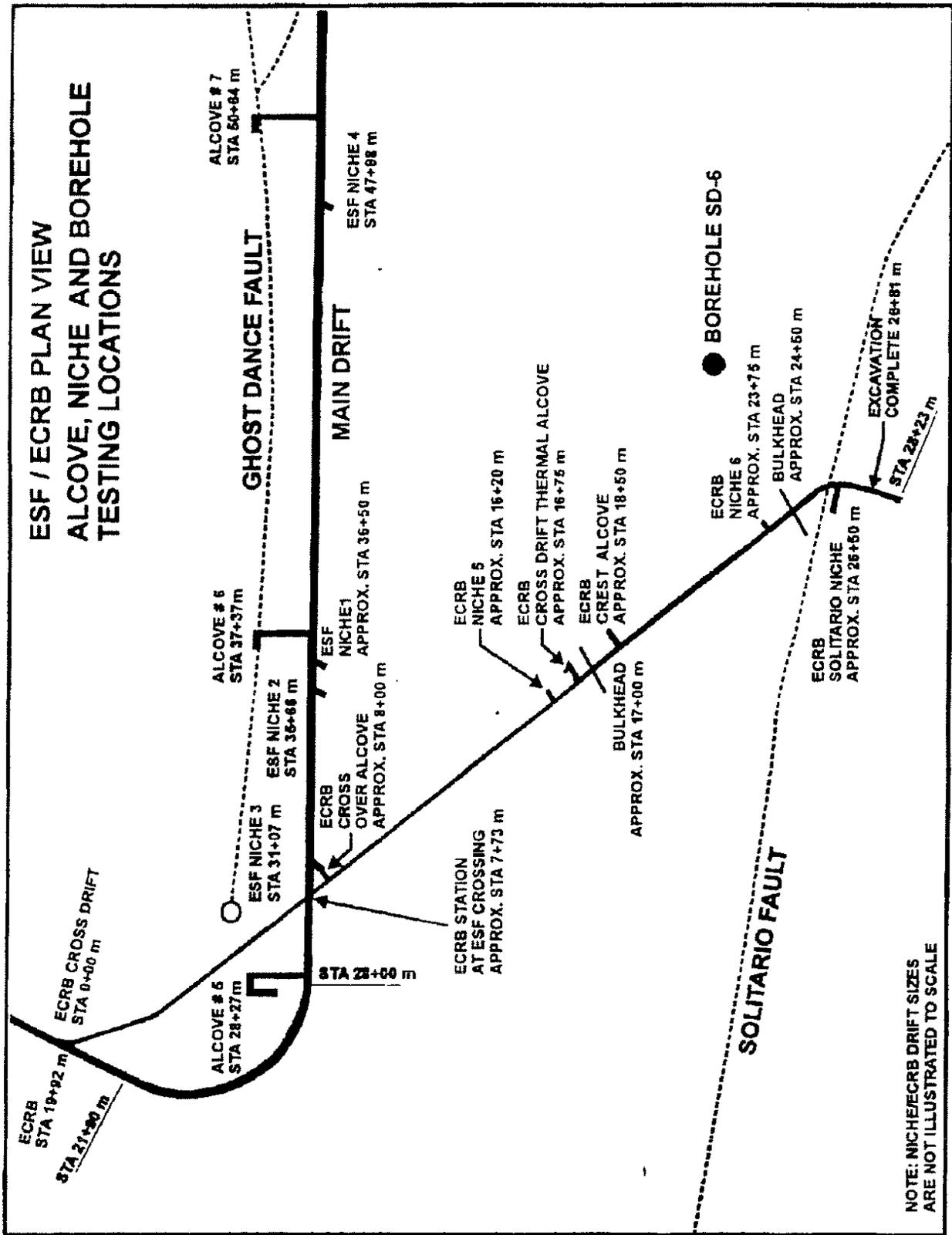
Management and staff from the NRC and the DOE participated in two public meetings conducted in Rockville, Maryland, on June 13, 2001. The purpose of these meetings was to discuss current topics related to DOE's High-Level Waste (HLW) Program, and the proposed Yucca Mountain Geologic Repository. These quarterly meetings, which are conducted in accordance with the guidelines for communications under the Nuclear Waste Policy Act of 1982, as amended, are part of the pre-licensing and consultation process between the NRC and DOE concerning the potential repository. Separate staff level meetings were held on the morning of June 13, 2001, concerning quality assurance issues and the status of the key technical issue resolution process. During the afternoon session, NRC and DOE management met to discuss current and planned activities, quality assurance and performance assessment management plans and issues related to DOE's Employee Concerns Program. These meetings were beneficial in identifying current DOE management initiatives and planned project activities.

### **Site Visits**

May 24, 2001, a member from the NRC Office of General Counsel and the OR's visited the Yucca Mountain Site. The purpose of this visit was to obtain an overview of the Exploratory Studies Facility and Yucca Mountain Crest.

June 21, 2001, a member of the NRC Environmental and Performance Assessment Branch and the OR's visited the Yucca Mountain Site. The purpose of this visit was to obtain an overview of the Exploratory Studies Facility and the Yucca Mountain Crest.

There were no outstanding issues raised as a result of these visits.

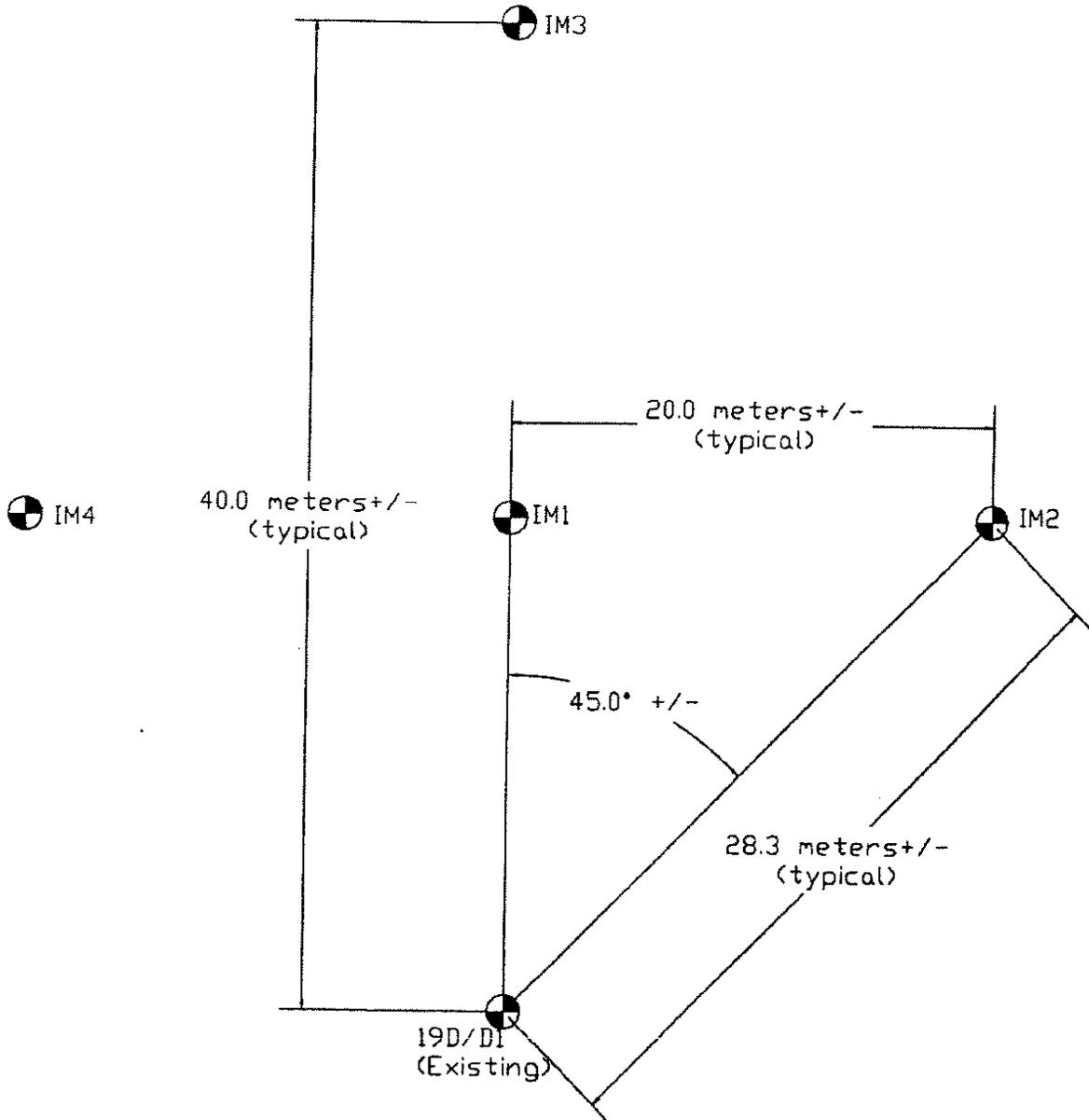


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Enclosure 2



# ATC SITE LAYOUT



ATC Cross-Hole Configuration

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