

APACHE LEAP

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MAY 08 1990

Mr. Ralph Stein, Associate Director  
for Systems Integration and Regulations  
Office of Civilian Radioactive Waste Management  
U.S. Department of Energy, RW-30  
Washington, D.C. 20585

Dear Mr. Stein:

SUBJECT: NRC STAFF OBSERVATIONS OF PROTOTYPE DRILLING AND CORE SAMPLES PROCESS

The purpose of this letter is to provide you with the enclosed summary of the U.S. Nuclear Regulatory Commission (NRC) staff's March 19-22, 1990 observation of the U.S. Department of Energy Prototype Drilling and Core Sample Process Program at the Apache Leap drilling location in Arizona and the Nevada Test Site. As indicated in the summary, the NRC observation of this program should not be construed as an NRC audit. Therefore, no responses to NRC staff comments or recommendations are required.

If you have any questions on the summary or the NRC site visit, please contact the NRC Quality Assurance Project Manager, Mark Delligatti of my staff on (301) 492-0430.

Sincerely,

ORIGINAL SIGNED BY

John J. Linehan, Director  
Repository Licensing and Quality  
Assurance Project Directorate  
Division of High-Level Waste Management  
Office of Nuclear Material Safety  
and Safeguards

Enclosure: As stated

cc: R. Loux, State of Nevada  
C. Gertz, DOE/NV  
S. Bradhurst, Nye County, NV  
M. Baughman, Lincoln County, NV  
D. Bechtel, Clark County, NV  
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Date: 4/12/90 : 4/12/90 : 4/12/90 : 4/17/90 : 4/18/90 : 4/18/90

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Date: 4/18/90 :

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SUMMARY OF NRC STAFF OBSERVATIONS OF THE APACHE LEAP  
PROTOTYPE DRILLING AND CORE SAMPLE PROCESS PROGRAM

On March 19 and 20, 1990, members of the Nuclear Regulatory Commission staff (NRC) observed the Department of Energy (DOE) Prototype Drilling operation conducted at the Apache Leap drilling location approximately seven miles east of Superior, Arizona. On March 22, 1990, the NRC staff observed how the core samples transported from the Apache Leap location were processed at the Sample Management Facility (SMF) located on the Nevada Test Site. A list of participants and observers is provided in Attachment 1.

Assisting the NRC staff was a consultant geologist from the NRC staff contractor for the high-level waste program (Center for Nuclear Waste Regulatory Analyses). The results of this individual's observations are provided in Attachment 2. The NRC staff considers his recommendations to be consistent with the NRC staff recommendations described below.

The overall purpose of the DOE Prototype Drilling program is to gain sufficient experience to determine whether the prototype air drilling and coring equipment, that has been specially designed and built for the Yucca Mountain Project, can satisfactorily retrieve core from the required depths. Satisfactory retrieval will be demonstrated by core samples which can provide the necessary scientific information for site characterization of the high-level radioactive waste geological repository.

To accomplish the Prototype Drilling program, two separate holes are to be drilled, both with core samples taken and processed at ten foot intervals. The first is to be drilled to a planned depth of 1700 feet, and the second, to a planned depth of about 250 feet. The entire Prototype Drilling program is considered a QA Level III activity which is defined as, "an activity having no major function in the characterization of the site and design of the repository, but requires good practices for its intended use." Attachment 3 contains a pictorial illustration of the drilling and coring operations.

The NRC staff observed two days of the drilling and coring operations whereby 3½ inch diameter core samples were obtained from approximately 40 feet of core runs. The coring operation commences with the rig drilling 10 feet and then removing the core samples from the borehole. The inner core barrel (two joined cylindrical halves of metal tubing which capture the core samples) is then removed from the outer core barrel and taken into the core logging trailer for top to bottom identification, core recovery and adjustment for 'representativeness,' video photographing, logging and shipment to the SMF.

Photographing is not done until after the core is broken and samples are removed from the core sample run, and after the core is adjusted for 'representativeness.' The NRC staff suggested that the video photographing of the core be done immediately upon opening the inner core barrel. The suggested modification would provide documentation of the original appearance and

condition of the entire core run, rather than what remains after samples are removed and the core is moved and manipulated.

In order to contain the core moisture properties, the U.S. Geological Survey (USGS) has requested that DOE, when possible, place a lexan liner (a 10 foot clear plastic cylindrical liner) within the inner core barrel before the core sample run begins. The result is that the core is encapsulated within the lexan liner which is immediately sealed upon removal from the inner core barrel. It was apparent that the lexan liner could reduce core recovery because it offered resistance while coring as the core sample entered the inner core barrel. The NRC staff witnessed such a problem when, during one of the core runs, the driller had difficulty recovering the inner core barrel. The inner core barrel had split and expanded and jammed in the outer core barrel. After considerable effort and lost time, the inner core barrel was recovered, and, when opened, revealed that the lexan liner had crumpled, accordion-like, and apparently had prevented the core from entering the inner core barrel. Since the liner prevented the core from moving into and along the inner core barrel, the core sample spread laterally and forced open the barrel causing it to wedge within the outer core barrel.

The NRC staff recommended that the need for the lexan liner should be re-evaluated since it had negative effects on the sampling and sample handling procedures. A USGS representative should be present at the drill site to determine if the results justify the problems created by the lexan liner.

When the SMF receives the core samples, they are inspected for shipping damage and appropriate field documentation. If acceptable, the samples are admitted to the SMF for confirmation of the field logging, further documentation, core slabbing, distribution to the USGS, and archival storage.

The staff learned while observing the SMF procedures, that the logging done at the site and continued at the SMF, does not result in the "official" log of the core. This is to be produced by the USGS staff. USGS will relog the core, without being required by procedure to observe or perform the field logging or the sample handling at the SMF, and produce the "official" log of the core. The NRC staff questioned how this can be done in an optimum fashion without USGS participation in any of the field and SMF operations. It is entirely possible that their perceptions, observations, and interpretations will differ from those of the field operations and SMF geologists. The NRC staff recommended that if the USGS is to produce the "official" core log, they should have personnel in the field to observe and actually do the field logging. Furthermore, the original field logging data will provide more credibility for acceptable evidence at adjudicatory hearings involving the licensing process.

Since the Prototype Drilling operation is a QA level III activity, the NRC staff made it clear at the beginning that the NRC observation of this activity should not be construed as an NRC audit. Any comments or recommendations resulting from NRC observing the Prototype Drilling operation will not require

a response from DOE. On March 20, 1990, and March 22, 1990, the NRC staff briefed appropriate management of the drilling site and SMF, respectively, and the following NRC comments and recommendations were discussed:

1. At the drilling site, there were two instances (one of which is described above) in which DOE had problems encapsulating the core samples into the lexan liners. In these two instances, the core samples acquired during the drilling process were damaged and partially compressed the lexan liner resulting in poor core recovery. This stopped the drilling operation until the necessary adjustments could be made. The NRC staff commented that if the core moisture property analysis was of such importance, it would appear prudent that a USGS representative be present to analyze the core moisture properties at the field location in lieu of the laboratory location. This could eliminate the need for the lexan liner and the difficulties associated with its use.
2. During the processing of the core samples at the SMF, the NRC staff again commented on the absence of the USGS. Considering the past history and problems encountered in the core sample process, and that USGS will be responsible for producing the official documentation for geologic activities associated with site characterization, the NRC strongly suggested that the USGS be represented at all future drilling and core sampling activities. This would enable them to become familiar with the drilling and core sample process, keep informed of the problems that arise, provide expertise on solutions to such problems, and contribute to enhancing the overall core sample process.
3. The NRC staff observed that there did not appear to be any instances where procedures or documentation explicitly required independent verifications or inspections for the more important activities. From a licensing viewpoint, the NRC staff recommended that controls be established for designated independent verification points during successive stages of the core sampling process. This would provide confidence that the process was independently verified in accordance with established guidelines and/or procedures.
4. At times, there appeared to be a lack of communication between the Lead Driller and Lead Geologist. On several occasions, the Lead Driller was the only individual taking the drilling depth measurements. The NRC staff suggested that the field geologist logging the core be allowed to confirm the core sample depth intervals that are measured by the driller. DOE indicated that when the actual drilling and coring commences at the Nevada Test Site for the Yucca Mountain Project, the Lead Geologist and Lead Driller will be required to communicate effectively for all technically-related aspects associated with drilling and core sampling.

5. When the core samples were taken from the drill rig to the SMF trailer for logging, they were identified for top to bottom core location and depth of core sample. As discussed above, the core run was not photographed until the core had been broken, whole samples removed, and adjusted for 'representativeness.' The NRC staff recommended that the video photographing of the core be done immediately after the inner core barrel containing the core is opened. Also, the NRC staff recommended that the entire drilling and core sampling process be videotaped for use as a tutorial in familiarizing and training personnel performing quality-affecting activities.
6. Copies of the procedures were present and used at the drilling and SMF locations. Since this was a prototype exercise, certain of the procedures were unapproved draft procedures. As work progressed and as experience was gained in their use, it necessitated handwritten changes to the procedures by the users. A positive aspect is that the procedure changes in several instances, were made by the same individual that was instrumental in writing the procedure.

The NRC staff expressed to DOE that, overall, they appeared to be developing proper procedures for the drilling and core sampling program. The NRC staff believes the prototype drilling and coring exercise was worthwhile to obtain the necessary expertise in preparation for the site characterization of Yucca Mountain for the geologic nuclear waste repository.

Overall, the NRC staff's observations of the prototype drilling were favorable, however, there appears to be limitations on the drilling rig itself. It appears that the drilling rig is not capable of slant hole coring which the NRC staff believes may be necessary to investigate the near-vertical jointing and fractures expected at Yucca Mountain. Also, it appears that it will not be possible to orient (north-south orientation) the cores obtained with this device.

Attachment 1

Attendees at the Apache Leap

Prototype Drilling and Core Sample Process Program

March 19-22, 1990

NRC

K. Hooks  
P. Prestholt  
T. Cardone  
W. Belke  
R. Galster (Consultant)

DOE

R. Long  
A. Williams

REECo

D. Wonderly  
R. Scott  
R. Sowers  
F. Huntsman

Lang

B. Werner  
(4) Assistants

SAIC

N. Stellavato  
J. Davis

HARZA

A. Paige  
J. Hartley  
C. Lewis

F&S

E. Wright

Westinghouse

J. Moyer