



**UNITED STATES
NUCLEAR REGULATORY COMMISSION**
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May 26, 1995

MEMORANDUM TO: Mysore Nataraja, Acting Section Leader
Geosciences/Geotechnical Engineering Section
ENGB/DWM/NMSS

FROM: Stephen McDuffie, Geologist *SM*
Geosciences/Geotechnical Engineering Section
ENGB/DWM/NMSS

SUBJECT: TRIP REPORT FOR APRIL 4-6, 1995, SITE VISITS TO PAIUTE RIDGE
AND YUCCA MOUNTAIN

On April 4-6, 1995, I participated in a variety of activities at the Nevada Test Site (NTS). April 4 featured a visit to the Paiute Ridge area in the northeast section of NTS. This is the location of some analog studies being conducted by scientists at the Los Alamos National Laboratory under study plan 8.3.1.8.1.2, part of the U. S. Department of Energy's (DOE's) volcanism investigations for the Yucca Mountain site. In addition to myself, participants included Linda Kovach of NRC's Office of Nuclear Regulatory Research, Britt Hill and Chuck Connor of the Center for Nuclear Waste Regulatory Analyses (CNWRA), and Stephen Self and Paul Delaney, Volcanology Consultants for the CNWRA.

The group visited some of the same exposures seen last October on a field trip after the CNWRA volcanism peer review (see memorandum from McDuffie to Bell, December 7, 1994), though we observed some features in more detail. We discovered an informative outcrop of an approximately 8 Ma basaltic dike which suggests that the dike was emplaced near the contact of a poorly welded silicic tuff and overlying air fall unit. Delaney, one of the foremost experts on dike emplacement, was enamored with the unusual thickness of the dike (close to 10 meters in places). He believes the thickness results from the exposed level being very close to the paleo-surface, as well as the very low strength of the host tuff units. The group later examined a V-shaped sill associated with the Paiute Ridge intrusive complex. This intrusive body was also examined in October.

Bob Tyrrell, a representative of DOE-Nevada who accompanied us to the Paiute Ridge site, mentioned that he has received a request for access from a contractor to the State of Nevada. Apparently the State is funding some independent volcanology work in the Paiute Ridge area.

On April 5-6, I observed activities at the Yucca Mountain area, including the Exploratory Studies Facility (ESF). In the morning of April 5, I met Mysore Nataraja (NRC), Tom Fortner (DOE), Jim Grubb (State of Nevada), Dana Rogers (Morrison-Knutson), and Nancy Chappel (TRW) at the Field Operations Center (FOC). Nataraja was on site as part of an NRC in-field verification of the

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Management and Operating contractor (M&O), and I spent the day assisting him with his verification duties. After receiving a safety briefing, the group proceeded to the ESF pad for a tour. Tunnel boring machine (TBM) operations had been slowed for nearly a week due to loose rock conditions and the need to place sand backfill behind the TBM grippers. Such sand, which Rogers said compacts quite well, is taken from the borrow pit about a mile from the ESF. Rogers also stated the belief that the TBM will encounter rock of variable quality over the next 200-300 m. I asked about steel set manufacture, and Rogers said the Reynolds Electrical and Engineering Company is now manufacturing the steel sets in Area 6 of the NTS. Eight to nine sets can be manufactured in a day.

After observing a portion of the weekly ESF status meeting, our group was escorted underground. Dick McDonald (M-K), Jim Replogle (DOE), and Carey Johnson (Kiewit) accompanied the group. I had hoped to observe mapping of the tunnel walls, but no mapping was underway at the time. Fortner described alcove number 2, on which construction will begin in about a month. It will be a 12 foot by 12 foot opening 42-43 meters deep. Portions of steel sets 92-96 will be removed before constructing the alcove, which will investigate the properties of the Bow Ridge fault, among other things. The alcove will project from the existing tunnel at an angle of 57 degrees, which will intercept a shear zone which is oriented about 60 degrees from the tunnel trend. The alcove location was chosen in part because the rock quality values at that location are quite high. We proceeded to the forward area of the TBM, but there was little activity at the time. As for the conveyor system, Fortner said the full conveyor system should be in place in June.

Before leaving the ESF pad, Nataraja and I met with a number of representatives from DOE and the M&O to discuss findings from the in-field verification. We discussed how ground support decisions are made, then addressed the topic of reportable geologic conditions. There was a difference of opinion between NRC and DOE staff over whether loose rock conditions encountered by the TBM are reportable conditions as defined by DOE Administrative Procedure 6.14. Apparently DOE plans to revise this procedure in the near future. We briefly discussed DOE's lifting of the hold point for pneumatic pathways studies. DOE recently decided to lift this potential hold point for TBM progress (at station 8+00) because they have the proper instrumentation in place, and the region has experienced enough frontal systems this winter to gather the requisite pneumatic data.

On April 6, I met Chad Glenn of the NRC On-site Representative (OR) office at the FOC. Glenn and I visited the ESF with the chief purpose of observing tunnel mapping activities. We wanted to see how data is collected and recorded on maps in the field. Tom Fortner expressed reluctance to have us visit the forward area of the TBM. The loose rock conditions are somewhat hazardous, and DOE is trying to limit traffic within the tunnel. As Nataraja and I had been to the forward area the day before and there was little new to see, we felt DOE's request was reasonable. Doc McNeely (M-K) escorted us into the tunnel as far as the mapping gantry, where we spoke briefly with Steve Beason of the U. S. Bureau of Reclamation (USBR). Beason is the principal investigator in charge of tunnel mapping. We witnessed the process of

creating a full periphery map of the tunnel. Glenn and I had no concerns with the work we observed. However, it is worth noting that some discussion remains among the mappers and constructors about the amount of lagging used in tunnel support. Lagging makes the mapping difficult, but constructors feel it is necessary for worker safety.

After departing the ESF, Glenn and I visited the drilling operation at UZ-7a. We spoke with Arthur Mendenhall of SAIC about the drilling, which had reached a depth of 261 feet at that time. He said that core recovery has ranged from 40-100 percent, which is much better than expected based on the quality of rock observed in the cut exposed when the drill pad was constructed. Glenn and I looked at the cut, which exposes a portion of the Ghost Dance fault. The exposed area has been expanded somewhat over the last 2 months. We noticed two distinct offset planes; the major offset at the east side of the exposure and a less obvious offset several tens of meters to the east. We also noticed that fractures close to the original ground surface appear to have much greater cementation by calcite-silica material than those several feet down.

Back at the FOC, Glenn and I spoke with Ken Skipper (DOE) about what sort of maps are available for NRC perusal at the FOC. He later took us to see Mike Fahy of USBR, who showed us some completed full-periphery maps of the ESF. Glenn and I also accompanied Skipper to the weekly meeting on the status of surface-based activities. In this meeting we learned that construction of the pad for borehole UZ-4 will begin shortly. In hole SD-7, which has encountered a perched water zone, the hole will likely be reamed to prevent water transport until the underlying aquiclude is discovered.

After the meeting, Glenn and I met with Dan Soeder (USGS) to discuss SD-7 in more detail. Soeder says the investigators were somewhat surprised to find a perched water horizon at this location. The perched zone was encountered within the Calico Hills unit, at a down-hole depth of 1602 feet. The water is at a similar stratigraphic horizon to the perched water found in holes UZ-14, NRG-7/7a, and SD-9, farther north, but Soeder doubts the water bodies are connected. The water in SD-7 appears to be cleaner, and it has a lower pH. Analyses should give a fairly accurate age for this water; these results should be available in June or July. The aquifer may have been confined, as the level in the hole rose from 1602 to 1574 feet after water was encountered. Several thousand gallons have since been removed during pumping tests, and the level now stands near 1585 feet. They suspect the pumping tests have drawn the level down about 10 feet. Pumping tests reveal high transmissivity around this hole, as water levels recovered rapidly after drawdown.

Near the end of the day, Glenn and I visited the Large Block Test at Fran Ridge. Workers were in the process of drilling several test holes into the wall rock surrounding the large block. A number of instrument holes are already drilled into the large block itself. Within the walls surrounding the block cut, we noticed quite a variation in fracture density and calcite-silica cementation.

Associated with this trip, I attended a DOE-NRC site visit devoted to the

M. Nataraja

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Associated with this trip, I attended a DOE-NRC site visit devoted to the Lathrop Wells volcano. This was held Sunday, April 2, and Monday, April 3. A separate report documenting the observations from this visit will be co-authored by John Trapp (NRC). If there are any questions regarding this report, I can be reached at 415-6684.

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