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CLOSURE OF OPEN ITEM 16 FROM THE NEVADA NUCLEAR WASTE STORAGE INVESTIGATIONS (NNWSI) PROJECT/NUCLEAR REGULATORY COMMISSION (NRC) MEETING OF AUGUST 27-28, 1985

References: (1) Letter, Vieth to Linehan, dtd 3/4/86
(2) Letter, Vieth to Linehan, dtd 6/2/86
(3) Letter, Linehan to Vieth, dtd 10/31/86
(4) Letter, Vieth to Linehan, dtd 7/15/85

During the NNWSI Project/NRC meeting on the Exploratory Shaft Facility (ESF) in August 1985, and subsequent correspondence, it was noted by the NRC that the NNWSI Project used the term "Calico Hills" to designate at least three different entities: a geological unit; a geohydrological unit, and a thermomechanical unit. NRC commented that the NNWSI Project should establish consistency in the use of the term "Calico Hills.". In addition, the NRC pointed out that there appeared to be a discrepancy between the thickness of the Calico Hills presented in the Project's original performance analysis report (reference 4) and that determined by the NRC from the Department of Energy (DOE) literature. Finally, the NRC staff expressed concern about the penetration of the Exploratory Shaft into the Calico Hills. The previous transmittal to the NRC by the NNWSI Project did not fully respond to the NRC's concerns (reference 3).

The following discussion should clarify the NNWSI Project's use of the term "Calico Hills" and serve to close Open Item 16 from the August 1985 meeting, which reads:

> "The DOE will furnish the NRC with the document which contains recent information on thickness of the Calico Hills."

The NRC concerns are related to 1) the thickness of the Calico Hills stratigraphic unit, and 2) the inappropriate use of the term "Calico Hills." The term "Calico Hills" has been used by the NNWSI Project to designate four different entities: a stratigraphic unit, a geohydrological unit, a petrological (zeolitized) unit, and a thermomechanical unit. In the future, the stratigraphic unit will be designated the "Calico Hills." Petrologic units, geohydrologic units, and thermomechanical units may be discontinuous within a formation or extend across formation boundaries and the term "Calico Hills" will no longer be used to refer to these units.

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In a previous attempt to close Open Item No. 16, the NNWSI Project stated (reference 2) that the report entitled "A Three-Dimensional Model of Reference Thermal/Mechanical and Hydrological Stratigraphy of Yucca Mountain, Southern Nevada" (SAND84-1076) contained the information requested by the NRC. The NRC staff review of the report indicated that the requested information was not contained therein (reference 3).

Both the NRC and the NNWSI Project are partially correct in their assertions about this report. Information on the thickness of the Calico Hills as a stratigraphic unit is not contained in the report, although information on the zeolitized portion of the stratigraphy is given. On a regional basis, the relationship of the Calico Hills and the zeolitized rock zone is not uniform, and the zeolitized zone pinches out to the west and extends, in places, above and below the Calico Hills.

Misunderstanding which resulted in this Open Item No. 16 involves the use of the stratigraphic name, Calico Hills, to refer to thermomechanical, zeolitic and hydrological units. Enclosure 1 shows the variation in thickness of the Calico Hills and the zeolitic unit below the repository. The Calico Hills thickness at USW G-4, the nearest core hole to the exploratory shaft, is 296 ft (90.2m) (USGS-OFR-84-789), while the zeolitized interval is 429 ft.(131m) thick (SAND84-1076). Although the zeolitized unit at USW G-4 is slightly less than the 150m reported by the original performance analysis document, the three-dimensional model (SAND84-1076) indicates a thickening toward the new Exploratory Shaft site (ES-1) (approximately 460 ft or 140m).

An important point regarding the geometric characterization of the zeolitic interval is the elevation of its top. The top of the zeolitized interval II (Los Alamos report LA-9707-MS) at USW G-4 is at an elevation of 2802 feet (SAND84-1076).

In summary, thicknesses and top elevations of the Calico Hills and the zeolitized interval II at the new Exploratory Shaft (ES-1) site were estimated by using a linear interpolation method on published drill hole data for USW G-4, UE 25a-1, and UE 25b-1 (Enclosure 2). The Calico Hills is 326 ft (99m) thick at ES-1, while the zeolitized interval II is 446-449 ft (136-137m) thick at ES-1. The top elevation for the Calico Hills is 2729 ft (832)m) at ES-1, while the top elevation for the zeolitized interval is 2766-2771 ft (843-845m) at ES-1. For performance assessment purposes, the bounding assumption for the ES-1 location discussed in August 1985, was a thickness of 150m of "zeolitized Calico Hills." Misuse of the term "Calico Hills" accounts for most of the confusion on the thickness of these intervals in the vicinity of the Exploratory Shaft.

Please address questions on this topic to Jerry S. Szymanski at FTS 575-1503.

Mitchell P. Kunich, Acting Director
Waste Management Project Office

WMPO:JSS-2306

Enclosures:
As stated

JUL 20 1987

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Enclosure 1

Elevation to the top of and thickness of the Calico Hills, Reference Stratigraphic Units and Zeolitized Interval

	Top Elevation (ft/m)		Thickness (ft/m)	
Hole Designation	Calico Hills	CHn1z	Calico Hills	Zeolitized Interval
USW G-1	2923/891	2956/901	376/115	475/145
USW G-3	3450/1052	not zeolitized	147/45	0/0
USW G-4	2760/841	2802/854	296/90	429/131
UE 25a-1	2572/784	2617/798	476/145	528/161
UE 25b-1	2704/824	2589/789	469/143	546/166

Notes:
1. Calico Hills is a geological unit.
2. Zeolitized interval is equivalent to CHn1z + CHn2z + CHn3z (Sandia Report SAND84-1076) or approximately to Interval II (Los Alamos National Laboratory Report LA-9707-MS).

Enclosure 2

Interpolated Thickness and Top Elevation of the Calico Hills and The Zeolitized Interval (II) between the Repository and the Underlying Water Table

Geometric Parameter	Parameter Location (Hole Name) USW G-4	FS-1 (New)	UE-256-1	UE 25a-1	Source of Data
Top Elevation of zeolitic interval in feet (meters)	2802 (854)	2766-2771 (843-845)	2589 (789)	2617 (798)	Ortiz, et al., (SAND84-1076) 1985 (Tables B-1, B-2 and B-6)
Thickness of zeolitic interval, in feet (meters)	429 (131)	446-449 (136-137)	546 (166)	528 (161)	Ortiz, et al., 1985 (Tables B-1, B-2 and B-6)
Top Elevation of Calico Hills formational unit, in feet (meters)	2760 (841)	2729 (832)	-	2573 (784)	USW G-4: Spengler, et al. (USGS-OFR-84-789), 1984 (Table 2). UE 25a-1: Bish, et al., (LA-9321-MS), 1982 (Table II).
Thickness of Calico Hills formational unit, in feet (meters)	296 (90)	326 (99)	469 (143)	476 (145)	UE 256-1: Scott, et al., (USGS-OFR-84-491), 1984 (Table 3).

Notes:
1. ES-1 and UE 25a-1 were projected onto a line connecting USW G-4 and UE 25b-1.
2. The top elevations and thicknesses for the zeolitic interval (II) and the Calico Hills below the repository and above the underlying water table were determined by linear interpolation of data for USW G-4, UE 25a-2 and UE 25b-1.