

Figure 1.1-74. Hazard Curves at Reference Rock Outcrop for Peak Horizontal Ground Acceleration and 1 Hz Horizontal Spectral Acceleration



- Figure 1.1-75. Deaggregation of Mean Seismic Hazard for Horizontal Spectral Acceleration at 10<sup>-4</sup> Annual Exceedance Probability for the Reference Rock Outcrop
- NOTE: Graph (a) is for 5 to 10 Hz horizontal spectral acceleration; graph (b) is for 1 to 2 Hz horizontal spectral acceleration.





NOTE: On some plots, the median and 15th percentile curves have an annual probability of exceedance of less than  $10^{-8}$  and are not shown.





NOTE: APEs = annual probabilities of exceedance Source: BSC 2008c, Figure 6.1-1.



Figure 1.1-78. Schematic Representation of the Locations for Which Seismic Input Ground Motions are Developed

- NOTE: Vertically exaggerated.
- Source: BSC 2008c, Figure 1-1



Figure 1.1-79. Conditioned and Unconditioned Reference Rock Outcrop Mean Horizontal Peak Ground Velocity Hazard Curves

NOTE: Point A = reference rock outcrop (see Figure 1.1-78); solid line = unconditioned peak ground velocity hazard curve; dashed line = conditioned peak ground velocity hazard curve. PGV = peak ground velocity.

Source: BSC 2008c, Figure 6.5.1-7.



- Figure 1.1-80. Conditioned and Unconditioned Reference Rock Outcrop Mean Horizontal Peak Ground Acceleration Hazard Curves
- NOTE: Point A = reference rock outcrop (see Figure 1.1-78); solid line = unconditioned peak ground acceleration hazard curve; dashed line = conditioned peak ground acceleration hazard curve. PGA = peak ground acceleration.

Source: BSC 2008c, Figure 6.5.1-8.



Figure 1.1-81. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-3</sup>

Source: BSC 2008c, Figure 6.5.1-10.



Figure 1.1-82. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-4</sup>

Source: BSC 2008c, Figure 6.5.1-11.



Figure 1.1-83. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-5</sup>

Source: BSC 2008c, Figure 6.5.1-12.



Figure 1.1-84. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-6</sup>

Source: BSC 2008c, Figure 6.5.1-13.



Figure 1.1-85. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-7</sup>

Source: BSC 2008c, Figure 6.5.1-14.



Figure 1.1-86. Reference Rock Outcrop Uniform Hazard Spectra Based on the Extreme-Stress-Drop and Shear-Strain-Threshold Conditioned and Unconditioned Hazard for an Annual Probability of Exceedance of 10<sup>-8</sup>

Source: BSC 2008c, Figure 6.5.1-15.



Figure 1.1-87. Representative Control Motion Response Spectra for Site Response Modeling

NOTE: 1. Labels indicate the magnitude and distance of the reference earthquake providing the response spectral shape that is scaled to the peak ground acceleration level of interest. 2. LF = low frequency (1 to 2 Hz) response spectrum; HF = high frequency (5 to 10 Hz) response spectrum.

Source: 2008c, Figure 6.4.1-17.



Figure 1.1-88. Mean Horizontal and Vertical Seismic Hazard Curves for Peak Ground Acceleration at the Surface Geologic Repository Operations Area

Source: BSC 2008c, Figure 6.5.2-34.



Figure 1.1-89. Mean Horizontal Seismic Hazard Curve for Peak Ground Velocity at the Surface Geologic Repository Operations Area

Source: BSC 2008c, Figure 6.5.2-42.



- Figure 1.1-90. Surface Geologic Repository Operations Area 5%-Damped Horizontal Design Spectra for  $10^{-3}$ , 5 ×  $10^{-4}$ , and  $10^{-4}$  Annual Probabilities of Exceedance
- NOTE: APE = annual probability of exceedance.
- Source: BSC 2008c, Figure 6.5.2-56.



- Figure 1.1-91. Surface Geologic Repository Operations Area 5%-Damped Vertical Design Spectra for  $10^{-3}$ , 5 ×  $10^{-4}$ , and  $10^{-4}$  Annual Probabilities of Exceedance
- NOTE: APE = annual probability of exceedance.
- Source: BSC 2008c, Figure 6.5.2-57.



Figure 1.1-92. Horizontal and Vertical 5%-Damped Design Spectra at 10<sup>-3</sup> Annual Probability of Exceedance at the Repository Block

Source: BSC 2008c, Figure 6.5.3-26.



Figure 1.1-93. Horizontal and Vertical 5%-Damped Design Spectra at 5 × 10<sup>-4</sup> Annual Probability of Exceedance at the Repository Block

Source: BSC 2008c, Figure 6.5.3-27.



Figure 1.1-94. Horizontal and Vertical 5%-Damped Design Spectra at 10<sup>-4</sup> Annual Probability of Exceedance at the Repository Block

Source: BSC 2008c, Figure 6.5.3-28.

			GE	OL	OGI	C LOG OF DRIL	L H	OLE	UE-2	25 F	RF#13 SHEET 1 OF 8			
FEATURE: Waste Handling Facili LOCATION: ESF North Portal Pa BEGUN: 10/6/1998 FINISHED: DEPTH TO WATER: Not Encoun	ity d 12/7/1 tered	PROJECT: Yucca Mountain Project STATE: Nevada COORDINATES: N 765,500.04 E 570,720.12 GROUND ELEVATION: 3671.03 7/1998 TOTAL DEPTH: 350.1 ft ANGLE FROM HORIZONTAL: -90° 1 DEPTH TO BEDROCK: 98.0 ft HOLE LOGGED BY: URS/SMF/USBR REVIEWED BY: M. Luebbers/M. McKeown												
NOTES	DEPTH	SPT	FRACTURE DENSITY	ERING RTIES SSENDARH	WEATHERING	SHEAR WAVE VELOCITY	GEOLOGIC UNIT	CLASSIFICATION	% CORE RECOVERY	% RQD	CLASSIFICATION AND PHYSICAL CONDITION			
PURPOSE OF HOLE:	-										0.0 to 12.5 ft PAD FILL (machine place fill material)			
Preliminary, conceptual-level geotechnical foundation investigations for the design of the potential waste handling facility.	-   -   -   5							GP			0.0 to 5.5 ft: GRAVEL WITH SAND (GP); moist 5.5 to 12.5 ft: WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM); Medium dense, moist, brown, red, and white. Laboratory Classification: 11.3 to 12.8 ft WELL-GRADED GRAVEL			
DRILL RIG:	-						Fill				WITH SILT AND SAND (GW-GM)			
CME 850 DRILLER: M. Pancake	10 - 1 - 1	167						SW-SM			12.5 to 98.0 ft QUATERNARY ALLUVIUM (surficial deposits) Qal 12.5 to 16.0 ft: WELL-GRADED SAND WITH SILT AND GRAVEL (SW-SM); Very dense, moist, gray, and white. 16.0 to 20.0 ft: POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM); Very dense, moist, brown			
DRILLING METHOD: ODEX method from ground surface	111							ew em			Laboratory Classification: 16.3 to 17.55 ft POORLY GRADED			
to 98.0 ft; Modified California (MC) and Pitcher tube samples collected at approximately 5 ft intervals from	15							500-500			20.0 to 32.0 ft: POORLY GRADED SAND WITH SILT AND GRAVEL			
7 to 98 ft; continuous HX wireline from 98.0 to 350.1 ft. The MC samplers were driven approximately 18 in. into the bottom of the borehole by repeatedly dropping a	20	178 9"						GP-GM			Laboratory Classification: 21.2 to 22.7 ft POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM) Laboratory Classification: 26.2 to 27.7 ft POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)			
140 lb hammer a distance of 30 in. MC samples were collected in brass tubes and sealed with vinyl caps. All samples and core were transported to the	بليليليليا	103									32.0 to 35.0 ft: SILT WITH LESS THAN 10% GRAVEL (ML); Medium stiff, dry, tan, sandy. 35.0 to 37.0 ft: POORLY GRADED SAND WITH SILT AND GRAVEL			
Sample Management Facility. DRILLING CONDITION &	25							SP-SM			<ol> <li>Stwi, Weulanderse, ury, beige and gray.</li> <li>37.0 to 42.0 ft: POORLY GRADED GRAVEL (GP); Medium dense, moist, drav and ourole.</li> </ol>			
CASING RECORD:	1111	117									42.0 to 52.0 ft: INTERBEDDED SILTY SAND WITH GRAVEL (SM) AND POORLY GRADED GRAVEL (GP); Very dense, moist, light brown.			
DRILLING FLUID:	30 -										Laboratory Classification: 51.8 to 52.3 ft WELL-GRADED GRAVEL WITH SAND (GW)			
DRILL FLUID LOSSES:	111						Qal	ML			52.0 to 56.5 ft: POORLY GRADED SAND (SP); Very dense, dry, pale brown.			
Not Applicable.	35										56.5 to 71.5 ft: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM); Very dense, dry, brown.			
3.5-inch O. D. schedule 80 PVC	1.1.	24						SP-SM			Laboratory Classification: 56.7 to 57.9 ft POORLY GRADED SAND WITH SILT AND GRAVEL(SP-SM)			
with flush threads sealed by O-rings installed from ground surface to 350.1 ft to enable downhole seismic and suspension	40	24						GP			71.5 to 87.0 ft: SILTY SAND WITH GRAVEL (SM); Very dense, dry, purple and brown.			
sevent note sensine and suspension seismic measurements; neat cement grout with 2 to 5% bentonite added to prevent shrinkage used to fill the annulus was pumped through a tremie pipe that was pulled up as the grout was added; the grout was added in 30 to 50 ft lifts and allowed to cure for at least 8 hr between lifts.	45	140 7" <u>38</u> 3"						SM-GP			Laboratory Classification: 71.5 to 72.8 ft SILTY SAND WITH GRAVEL (SM) Laboratory Classification: 76.4 to 76.9 ft SILTY SAND WITH GRAVEL (SM) Laboratory Classification: 81.4 to 82.15 ft SILTY SAND WITH GRAVEL (SM) aboratory Classification: 86.4 to 87.15 ft SILTY SAND WITH GRAVEL (SM) 87.0 to 98.0 ft: SILTY SAND (SM); Very dense, moist, white to beige, fine grained, trace gravel, transition to bedded tuff; contact with underlying unit (Tpk) is unconformable.			
	55 -										Laboratory Classification: 91.4 to 91.8 tt SILTY SAND WITH GRAVEL (SM)			

## Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 1 of 8)

NOTE: Based on measurements by the drilling engineer, 12 in. of slough material was in the bottom of the borehole when Sample MC-1 was driven. A blow count of 7 was recorded for these 12 in. and a blow count of 15 was recorded for the final 4 in. of the drive. ODEX 165 pipe was used as the rod, rather than the AW rod that was used in the remaining drive samples in this boring. The sampler was not driven the full 18 in. The blow count is not to be used. In driving MC-3 from 15 to 18 in., the hammer drop exceeded a 30-in. drop. The recorded blow count of 167 is consequently too low. All of the samples on which a sieve analysis was performed were tested for reaction with dilute hydrochloric acid. A reaction was noted in all of the samples. The reaction was moderate for the two samples from 76.4 to 76.7 ft and 81.5 to 81.8 ft. The reaction was strong for the remaining samples. Two Pitcher tube samples were attempted from 7 to 9 ft and 13 to 14 ft. RQD = rock quality designation; SPT = standard penetration test.

FFATURE     Webs Honding Folding     STATE: Investige     STATE: Investige       DEPTH TO MATTER:     Mellow Honding     STATE: Investige     STATE: Investige       DEPTH TO MATTER:     Mellow Honding     STATE: Investige     STATE: Investige       NOTES     Image: State	Γ				GE	EOL	OG	IC LOG OF DRI	OLE	UE-2	25 F	RF#13 SHEET 2 OF 8	
NOTES         Bit APR WWE VELOCITY BIT BIT ON ONE AND PHYSICAL CONDITION           1000000000000000000000000000000000000	F	EATURE: Waste Handling Fac OCATION: ESF North Portal Po- BEGUN: 10/6/1998 FINISHED DEPTH TO WATER: Not Encour	ility ad : 12/7/ <sup>.</sup> ntered	1998				PROJECT: Yucca COORDINATES: TOTAL DEPTH: 3 DEPTH TO BEDRO	a Mounta N 765,4 350.1 ft OCK:	ain Proje 500.04 98.0 ft	ct E 570,	720.12	STATE: Nevada GROUND ELEVATION: 3671.03 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: URS/SMF/USBR REVIEWED BY: M. Luebbers/M. McKeown
SP     SP       100     55       100     55       100     55       100     55       101     55       102     55       103     55       104     55       105     55       106     55       107     55       108     55       109     55       100     55       101     55       102     55       103     55       104     55       105     55       106     55       107     55       108     56       109     56       100     100       100     100       100     100       101     100       102     56       103     100       104     100       105     100       106     100       107     100       108     100       109     100       100     100       100     100       100     100       100     100       100     100       100     100       <		NOTES	рертн	SPT	FRACTURE DENSITY	ERTIES SSENDARH	WEATHERING	SHEAR WAVE VELOCITY	GEOLOGIC UNIT	CLASSIFICATION	% CORE RECOVERY	% RQD	CLASSIFICATION AND PHYSICAL CONDITION
56         9         90         104         80         104         100         90         104         100         105         106				91 6"									Laboratory Classification: 97.8 to 98.1 ft
BS       BS <td< td=""><td></td><td></td><td></td><td>0</td><td></td><td></td><td></td><td></td><td></td><td>SP</td><td></td><td></td><td>98.0 to 164.4 ft: COMB PEAK IGNIMBRITE - Tuff "X" (Tpki)</td></td<>				0						SP			98.0 to 164.4 ft: COMB PEAK IGNIMBRITE - Tuff "X" (Tpki)
00       00 <td< td=""><td></td><td></td><td>55</td><td>108</td><td></td><td></td><td></td><td></td><td></td><td></td><td>-</td><td></td><td>98.0 to 98.5 ft: Very light gray; well indurated (silicified) matrix showing oriented pumice; approximately 40% pumice; 5 to 7% lithic fragments, subrounded to angular, 1 to 2% phenocrysts of quartz(?), felsics, and mafics (biotite(?)).</td></td<>			55	108							-		98.0 to 98.5 ft: Very light gray; well indurated (silicified) matrix showing oriented pumice; approximately 40% pumice; 5 to 7% lithic fragments, subrounded to angular, 1 to 2% phenocrysts of quartz(?), felsics, and mafics (biotite(?)).
95       95       10       24       10       25 <td< td=""><td></td><td></td><td>60-</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>98.5 to 98.7 ft: Thin bed; white; very fine grained; partly silicified; no distinct pumice.</td></td<>			60-										98.5 to 98.7 ft: Thin bed; white; very fine grained; partly silicified; no distinct pumice.
65       100       160.0 to 162.2 ft: White: nonwelded; devinitied; 20 to 30% pumoe; 2% processes; 1% libit fragments.         70       100       162.4 to 162.8 ft: White: nonwelded; devinitied; 30 to 30% pumoe; 2% processes; 2% phonocysts; 2% libit cragments.         70       167       100       167         70       167       100       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       167       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit processes; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit processes; 2% libit cragments.         70       100.5 ft; alight processes; 2% phonocysts; 2% libit processes; 2% libit proceseses; 2% libit processes; 2% libit; 100.5 ft; alit proce				113 8"	-								98.7 to 160.0 ft: White; nonwelded; devitrified; 25 to 30% pumice; 1 to 2% phenocrysts of feldspar, quartz, rare mafics including biotite(?); approximately 5% lithic fragments.
110       110         110       1			65-							SP-SM			160.0 to 162.2 ft: White; nonwelded; devitrified; 20 to 30% pumice; 2% phenocrysts; 1% lithic fragments.
70       107         107       107         70       107         70       107         107       107         70       107         75       107         76       107         76       107         76       107         76       107         76       108         61       108         76       108         76       108         76       108         76       108         76       108         76       108         76       108         76       108         77       108         76       108         77       108         76       108         77       108         78       108         79       108         70       108         70       108         70       108         70       108         70       108         70       108         70       108         70       108         <				119 5"									162.4 to 162.6 ft. Pinkish gray; very fine grained; 1 to 2% small (<1 mm) phenocrysts and 2% very fine grained lithic fragments.
167       100       1			70-										50% pumice at base; 2% phenocrysts; 2% lithic fragments.
SM Biocontinuity Measurements: Discontinuity Measurements: Discontinuit			75	167 10"					Qal				Intensely fractured from 98.0 to 100.5 ft; unfractured from 100.5 to 102.5 ft; intensely fractured from 102.5 to 105.8 ft; slightly fractured from 105.8 to 108.1 ft; intensely to moderately fractured from 108.1 to 115.8 ft; very intensely to intensely fractured from 115.8 to 121.1 ft; moderately fractured from 121.1 to 122.8 ft; intensely to moderately fractured from 122.8 to 145.3 ft; if 8.8 to moderately fractured from 145.3 to 161.8 ft and intensely to moderately fractured from 161.8 to 164.4 ft.
80     66     102.9     20     R3     trace to paper thin light brown coating       85     66     7     102.9     20     R3     trace to paper thin light brown coating       85     85     102.9     20     R3     trace to paper thin light brown coating       102.9     30     R3     trace to paper thin light brown coating     102.9     20     R3       85     85     100     66     R2     trace to paper thin light brown coating     120.9     30     R3     trace to paper thin light brown coating       120.9     30     R3     trace to paper thin light brown coating     121.7     50     R2     trace to paper thin light brown coating       125.8     40     R2     trace to paper thin light brown coating     126.0     40     R2     trace to paper thin light brown coating       126.0     40     R2     trace to paper thin light brown coating     136.0     45     R3     clean       136.0     45     R3     clean     152.6     40     R2     trace to paper thin light brown coating       164.4     169.3     TVA CANVON ASHFALL TUFF (nonweided) Tpbt5     Falue thin light brown coating     164.4     168.3     file light brown coating       100     47     FD7     H4     W2     100<				100 6"									Discontinuity Measurements: Inclination from Depth (ft.) Core Axis (*) Rough Infilling 99.5 40 R2-R3 trace to paper thin light brown
85       Coaling       Coaling         85       3"       104.6       60       R2       trace to paper thin light brown coaling         109.0       35       R2       trace to paper thin light brown coaling       120.9       30       R3       trace to paper thin light brown coaling         90       121.7       50       R2       trace to paper thin light brown coaling       121.7       50       R2       trace to paper thin light brown coaling         120.9       30       R3       trace to paper thin light brown coaling       121.7       50       R2       trace to paper thin light brown coaling         126.0       40       R2       trace to paper thin light brown coaling       126.0       40       R2       trace to paper thin light brown coaling         136.0       45       R3       clean       145.0       30       R2-R2       log       100       152.8       40       R1       paper thin light brown coaling         152.4       40       R1       paper thin light brown coaling       154.4       100       154.4       100       154.4       100       155       100       154.4       100       154.4       106.8       100       155       100       164.4       166.8.1       100       166.8.1			80-							SM			102.9 20 R3 trace to paper thin light brown
3*       3*       109.0       35       R2       trace to paper thin light brown coating         120.9       30       R3       trace to paper thin light brown coating       121.7       50       R2       trace to paper thin light brown coating         90       125.8       40       R2       trace to paper thin light brown coating       126.0       40       R2       trace to paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating       126.0       40       R2       trace to paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating       126.0       40       R1       paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating       126.0       40       R1       paper thin light brown coating         126.0       40       R1       paper thin light brown coating       126.0       40       R1       paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating       126.0       126.0       R1       paper thin light brown coating         126.0       40       R1       paper thin light brown coating       126.0       R2       trace to paper thin light bro				66									coating 104.6 60 R2 trace to paper thin light brown
85       100       4"       FD7       100       43         100       44       V1       V1       V1       V1       V1         100       43       100       68       100       65       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100       168.15       100.15       100       168.45       106.05       100       168.45       106.05       100       168.15       100.05       100       168.45       100.05       100       100       168.15       100.05       100       100       168.15       100.05       100       100       168.15       100.05       100       100       168.15       100.05       100       100       168.15       100.05       100       100       100       168.15       100.05       100       100       168.15       100.05       100       168.			-	3"	1								109.0 35 R2 trace to paper thin light brown coating
90       125       121.7       50       R2       trace to paper thin light brown coating         90       125.8       40       R2       trace to paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating         125.7       5"       136.0       45       R3         90       125.8       40       R2       trace to paper thin light brown coating         126.0       40       R2       trace to paper thin light brown coating         126.0       41       R3       clean         145.0       30       R2-R3       clean         145.0       30       R2-R3       clean         152.6       40       R1       paper thin light brown coating         154.9       55       R2       trace to paper thin light brown coating         164.4       169.3       TIVA CANYON ASHFALL TUFF (nonweided) Tpbt5         Fallou tephra (7): grayish-orange pink to pale brow; arglic alteration       coating         100       43       100       43         44"       FD7       100       43         100       43       100       68         100       68       100       68         10			85-					III					120.9 30 R3 trace to paper thin light brown coating
3"       3"       100       125.5       40       122.5       125.5       40       122.5       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.6       125.7				88									121.7 50 R2 trace to paper thin light brown coating
90 90 95 5 <sup>°</sup> 95 4 <sup>°</sup> FD7 H4 Wz FD7 H4 Wz FD7 H4 Wz FD7 H4 Wz H4 H4 H			-	3"	]								125.5 40 R2 trace to paper thin light brown coating 126.0 40 R2 trace to paper thin light brown
SM 145.0 30 R2-R3 clean 152.6 40 R1 paper thin light brown coating 152.6 40 R1 paper thin light brown coating 164.4 to 169.3 TIVA CANYON ASHFALL TUFF (nonwelded) Tpbt5 Fallout tephra cocurs at 166 8t; moderate red, wery well sorted fallout tephra orange pink, heavily altered from 164.4 to 166.8 t; contact with underlying unit (Tprxt4) dips 30° blow horizontal and is distinct and separated. Discontinuities No discontinuities			90-										coating 136.0 45 R3 clean
95 4" FD7 4" FD7 FD0 H4 W2 FD7 H4 W2 H4 H4 H				125 5"						SM			145.0     30     R2-R3     clean       152.6     40     R1     paper thin light brown coating       154.9     55     R2     trace to paper thin light brown coating
4"       FD7         100       4"         FD0       H4         W2       H4         FD0       H4         W2       H4         FD7       H4         F			95	-73									164.4 to 169.3 TIVA CANYON ASHFALL TUFF (nonwelded) Tpbt5 Fallout tephra (?); grayish-orange pink to pale brown; argilic alteration (core damp, sticky, surface smeared by core catcher); approximately 10% white pumice; 10% variably colored, altered ittic fragments; a thin (16 mm) layer of pale to moderate red, very well sorted fallout tephra occurs at 166.8 ft; moderate red to moderate reddish orange and qrayish
FD0 H4 W2 I I I I I I I I I I I I I I I I I I			100	4"	FD7				Tuff "v		100	43	orange pink, heavily altered from 166.8 to 169.3 ft; moderately soft from 164.4 to 166.8 ft; moderately weathered from 164.4 to 166.8 ft; intensely to moderately fractured from 164.4 to 166.8 ft; contact with underlying unit (Constant) dia 20.0 kplaw between the soft soft for the soft soft soft soft soft soft soft soft
					FD0 FD7	H4	W2		(Tpki)		100	68 65	unit (1pcm4a) dips 30° below norizontal and is distinct and separated. Discontinuity Measurements: No discontinuities

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 2 of 8)

			GE	EOL	OGI	C LOG OF D	RF#13 SHEET 3 OF 8					
FEATURE: Waste Handling Fac	ility					PROJECT:	Yucca	Mounta	in Projec	ct	720 12	STATE: Nevada
BEGUN: 10/6/1998 FINISHED	au ): 12/7/1	1998				TOTAL DEPT	TH: 3	50.1 ft	00.04	L 370,	120.12	ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	ntered					DEPTH TO B	BEDRO	DCK:	98.0 ft			HOLE LOGGED BY: URS/SMF/USBR
												REVIEWED BY: M. Luebbers/M. McKeown
			ENGIN PROP	EERING ERTIES								
			VSIT)					⊢⊢		VERY		
NOTES			E DEI	s	ß	SHEAR WAVE VELO	CITY	, IN ,	J SK / SS	ECO.		CLASSIFICATION AND PHYSICAL CONDITION
	E		CTUR	DNES	Ë			LOGIC	Γ Γ	DRE F	R	
	DEP	SPT	FRA	HAR	VEA	1000 2000 5000 6000 7000	0006	GEO	/ 5	% C(	% R	
	105		FD7									169.3 to 175.9 TIVA CANYON CRYSTAL RICH NONLITHOPHYSAL TUFF (moderately to strongly welded tuff) Tpcrn4d
	1 3		FD3	1						100	65	Pale red; moderately welded, devitrified; 7 to 10% vesicular pumice; 7% phenocrysts of feldspar, rare quartz, altered biotite and other mafics;
						: :   : : : : :						In thic fragments rare to absent; moderately hard; moderately to slightly weathered; very intensely fractured; contact with underlying unit (Tpcrn3) is underlying to be low with a prior the start of the start in the start is a start in the start in the start is a start in the start in the start is a start in the start in the start is a start in the start in the start is a start in the start in the start in the start is a start in the start i
	110											his gradauonal and broken, with significant change in alteration.
	-		EDG							100	42	
							i i					Depth (ft) Core Axis (°) Rough Infilling 169.3 to 170.2 85 R2 trace to paper thin light tan
	115											coating 175.0 to 176.0 intersecting R3 trace to paper thin white
	-						i i			98	52	
	3											TUFF (moderately to strongly welded tuff) Tpcrn3
			FD8		W2		ii.					fragments absent; clay-altered, soft, greenish fragments, not aligned, waxy textured, approximately 1 cm: large (2 cm) yesiculated numice
	120-					[]				72	32	mixed with small flattened cavities (eroded out pumice?); moderately hard; slightly weathered to fresh; very intensely fractured; contact with
			FD5			<i>f</i>						underlying unit (Tpcrn2) is gradational and broken.
						1						Discontinuity Measurements: Inclination from
	125					/				94	30	Depth (ft) Core Axis (°) Rough Infilling 179.1 70 R4 trace light brown 191.2 70 R4 trace light brown
							i i i i					fragments; 0-1 mm white
	3											182.0 intersecting R4 clean 70 and 85
	130			H4		; ; <del>}</del> ; ; ; ; ; ;	i i	Tuff "x	-	16	0	186.5 70 R2-R3 trace white mineral
	3					<del> </del>		(Тркі)				186.6 to 202.0 TIVA CANYON CRYSTAL RICH NONLITHOPHYSAL
						: : <del>)</del> : : : :	ii.					TUFF (moderately to strongly welded tuff) Tpcrn2 Pale red; same as overlying unit except at 191.5 ft alteration becomes
	135		FD6			{ ; ; <b>{</b> ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;				<u> </u>	40	Intense, pumice very sort, matrix rough, matrix waxy, rriable, plastic, and sticky from 195.5 to 196.5 ft with splotches of blue/white mineral (opal?);
						<del> </del>				00	42	fresh 186.6 to 191.4 ft, slightly weathered 191.4 to 202.0 ft; very intensely fractured: contact with underlying unit (Torrn1) is gradational
						<del>)</del>						and broken.
	140				W3	: : : <b>:</b>						Discontinuity Measurements: Inclination from
										100	43	Depth (ft) Core Axis (°) Rough Infilling 187.4 30 R3 clean
	3					4						188.0 50 R3 bluish drusy quartz and white noncrystalline coating
	145											192.4 40 R2 trace white noncrystalline
				1						96	38	material 194.2 30 R3 local brown stain
	=											195.2     35     R4     caliche cemented breccia       196.9     25     R3     patches of white mineral       100.0     25     R3     patches of white mineral
												198.3     30     R2 - K3 patches of white mineral       198.8     40     R2 - R3 patches of white mineral       200.6     45     R2
	150		FD3	03 W1 4						100	24	200.0 40 Tr2 patches of while mineral
						│ ┆ ┆ <b>∦</b> ┆ ┆ ┆ ┆ ┆						202.0 to 219.1 TIVA CANYON CRYSTAL RICH NONLITHOPHYSAL TUFF (strongly welded tuff) Tpcrn1
	=					↓ ↓				100	34	Light brownish gray, moderately welded, devitrified; 10 to 15% pumice, up to 25 to 35% locally, moderately to highly flattened, up to core diameter;
	155					<u> </u>				100	34	10% phenocrysts of feldspar and rare quartz(?); some vapor phase

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 3 of 8)

	GEOLOGIC LOG OF DRILL HOLE UE-25 RF#13       SHEET 4 OF 8         EATURE: Waste Handling Facility       PROJECT: Yucca Mountain Project       STATE: Nevada       STATE: Nevada													
FEATURE: Waste Handling Faci LOCATION: ESF North Portal Pa BEGUN: 10/6/1998 FINISHED DEPTH TO WATER: Not Encour	ility ad : 12/7/1 ntered	1998				PROJECT: Yucca COORDINATES: TOTAL DEPTH: 3 DEPTH TO BEDRO	Mounta N 765,5 50.1 ft DCK:	iin Projec 500.04 98.0 ft	ct E 570,	720.12	STATE: Nevada GROUND ELEVATION: 3671.03 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: URS/SMF/USBR REVIEWED BY: M. Luebbers/M. McKeown			
NOTES	рертн	SPT	FRACTURE DENSITY	ERTIES SSENDARD	WEATHERING	SHEAR WAVE VELOCITY	GEOLOGIC UNIT	CLASSIFICATION	% CORE RECOVERY	% RQD	CLASSIFICATION AND PHYSICAL CONDITION			
	1111		FD3	на					100	34	Alteration of matrix; moderately hard; slightly weathered from 202.0 to 204.7 ft, slightly weathered to fresh from 204.7 to 219.1 ft; contact with underlying unit (Tpcpul) is a possible fault(?) contact, broken; material from 215.4 to 219.1 ft not recovered.			
	160				W1		Tuff "x (Tpki)		100	82	Discontinuity Measurements: Inclination from Depth (ft) Core Axis (*) Rough Infiling 207.1 40 R3 trace light brown stain 212.8 80 R3 trace white mineral			
	165		FD6	H5	W5			-	100	73	219.1 to 231.5 TIVA CANYON CRYSTAL POOR UPPER			
			NR	NR	NR		Tpbt5		NR	NR	Densely welded; pale reddish-brown to grayish-orange pink; 2% pumice; 2 to 3% phenocrysts of feldspar, rare mafics; lifting fragments absent; 1% or less oblate lithophysal cavities with vapor phase minerals and			
	170						Tpcrn4	đ	23	0	light gray alteration nms, flattened and approximately 20 degrees to near-perpendicular to core axis; at 231.0 ft first concentration of well-developed spherulites; moderately hard from 219.1 to 225.6 ft, hard from 225.6 to 231.5 ft; slightly weathered to fresh; very intensely fractured; contact with underlying unit (Tpcpmn) is distinct; broken.			
	175				W4			-	62	0	Discontinuity Measurements: Inclination from       Depth (ft)     Core Axis (*)       Rough     Infilling       220-223     multiple       R3     trace to paper thin white and light brown coating       224.8     15       R5     clean       229.0     30       R3     trace tan and light brown stain			
	180						Tpcrn3	3	70	0	231.5 - 286.7 TIVA CANYON MIDDLE NONLITHOPHYSAL TUFF (densely welded) Tpcpmn Pale reddish-brown; densely welded; devitrified; less than 1% pumice, vapor phase altered and eroded out, up to greater than core diameter, locally occur in swarms up to 50%, approximately 5% pumice below 260 ft 2: 03% phenocrysts of fieldspar, hornblende (?); hard from			
	185		FD9	H4	W2			-	82	0	231.5 to 271.0 ft, moderately hard from 271.0 to 271.5 ft, very hard from 271.5 to 286.7 ft, resh from 231.5 to 271.0 ft, sliphty weathered from 271.5 to 286.7 ft, resh from 231.5 to 271.0 ft, sliphtly activate intensely fractured from 231.5 to 231.7 ft, slightly to very slightly fractured from 231.7 to 270.5 ft, intensely to moderately fractured from 270.5 to 286.7 ft; contact with underlying unit (Tpcpmn2) is gradational.			
	190								72	0	Discontinuity Measurements: Inclination from Depth (ft) Core Axis (°) Rough Infilling 233.8 70 R2 trace tan and light brown stain 236.0 80 R4 clean 237.0 35 R4 trace tan, light brown, and			
	195						Tpcrn2	2	91	0	237.5 40 R3 paper thin tan, light brown, and white coating 237.7 45 R3 paper thin tan, light brown,			
			v	W3				66	0	and white coating 239.0 45 R2 paper thin tan coating 241.9 20 R2 paper thin tan and white coating 242.1 40 R3 trace white minanel				
	200					-	77	0	242.4         40         R3         trace tan and white mineral           249.6         50         R3         trace tan and white mineral           250.5-250.7         20         R4         4 to 6 cm yellowish-orange crystalline infilling           251.6         30         R5         white rinter infilling					
	205				W2		Tpcrn1		82	0	256.415R3paper thin tan and white coating257.270R3paper thin tan and white coating261.730R4clean			

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 4 of 8)

			GE	EOL	OG	C LOG C	of Dri	LL H	RF#13			SHEET 5 OF 8			
FEATURE: Waste Handling Fac LOCATION: ESF North Portal P BEGUN: 10/6/1998 FINISHED DEPTH TO WATER: Not Encou	ility ad b: 12/7/ <sup>,</sup> ntered	1998				PROJE COOR TOTAL DEPTH	ECT: Yucca DINATES: DEPTH: 3 TO BEDR	a Mounta N 765,5 350.1 ft OCK:	2	STATE: Neva GROUND ELE ANGLE FROM HOLE LOGGE REVIEWED B	ada EVATION I HORIZO ED BY: L Y: M. Lu	: 3671.03 DNTAL: -90° JRS/SMF/USBR lebbers/M. McKeown			
			ENGIN	EERING	6	1			z /			1			
NOTES	ОЕРТН	SPT	FRACTURE DENSITY	HARDNESS	WEATHERING			GEOLOGIC UNIT	CLASSIFICATIO	% CORE RECOVERY	% RQD		C AND PI	LASSIF HYSIC/	FICATION AL CONDITION
	-									82	0	263.0 263.2	20 20	R4 R4	clean 1 mm tan and white infilling
	210							Tpcrn1		92	6	267.2 269.1 270.6 271.7	70 60 30 20	R2 R2 R5 R5	trace tan and white mineral trace to 1 mm light brown mineral paper thin white and light brown coating 4 to 6 cm very pale orange,
	215														very fine grained well sorted fallout tephra
				H4					-	96	0	272.0 273.0 274.2 275.0 275.4 276.7	20 10 40 30 45 40	R5 R3 R5 R5 R2 R4	patches of white mineral 1 mm white mineral paper thin white mineral paper thin white mineral paper thin white mineral trace white mineral
	220		FD9	) W2						82	0	277.2 278.5 278.7	20 55 25	R4 R2 R5	paper thin white mineral paper thin white mineral paper thin white and tan mineral paper thin white mineral
						:: <b>\</b> ::						280.5 281.0	25 25	R5 R5	paper thin white mineral paper thin white and tan
	225				-		Трсри		34	0	282.5 283.5 281.4-285.7	15 10	R5 R5	mineral trace of white mineral trace to paper thin white mineral trace to paper thin white	
	-					i i <u>/</u> i i						201.4 200.7	20	144	mineral
	230			-					-	72	50	286.7 to 300 (densely we Ignimbrite; p less than 5%	9 TIVA CAN elded) Tpcpll bale red to mod % pumice; 2 to 3	YON LOV erate ora 3% feldsp	VER LITHOPHYSAL TUFF densely nge-pink; densely welded, devitrified; var phenocrysts, rare mafics; rare
	235									100	63	phase mine hard; slight 286.7 to 293 contact with	ral coating and y weathered to 3.0 ft, very inter underlying unit	alteration fresh; inte sely fract t (Tpcpmr	, moderately liateried with vapor rims, up to core diameter; very ensely to moderately fractured from tured from 293.0 to 300.9 ft; 1) is broken.
	240			НЗ			×			100	81	Discontinuit Depth (ft) 287.7 289.3	y Measurement Inclination fron Core Axis (°) 20 30	ts: n Rough R3 R2	Infilling trace to paper thin white mineral paper thin white and yellowish brown mineral
	245						¥					290.3 291.7	30 25	R4 R2	paper thin white mineral trace tan mineral
			FD2		W1			Tpcpm	n	100	100	294.6-301.0 300.9 to 350. (densely we	1 TIVA CANY 1 TIVA CANY Ided) TpcpIn	K3	VER NONLITHOPHYSAL TUFF
	250									100	76	2 mm altera devitrified; 2 primarily fel- fresh from 3 fresh from 3	tion spots usua 2 to 3% pumice, dspar, rare maf 600.9 to 316.2 ft 17.0 to 350.1 ft	illy around slightly around slightly a ics; rare l t, slightly t; modera	J openorysty, i densely welded, j openorysty, i densely welded, iltered/eroded; 2% phenocrysts, ithic fragments; very hard; weathered from 316.2 to 317.0 ft, tely fractured.
	255									100	83	Discontinuit Depth (ft) 294.6-301.0 302.2	y Measurement Inclination fro Core Axis (°) 20 50	ts: om Rough R3 R3	Infilling paper thin white mineral trace white mineral
	-									100	82	302.6	60	R2	paper thin white mineral

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 5 of 8)

			GE	EOL	OGI	C LOG OF DRI			SHEET 6 OF 8					
FEATURE: Waste Handling Faci LOCATION: ESF North Portal Pa BEGUN: 10/6/1998 FINISHED DEPTH TO WATER: Not Encour	lity ad : 12/7/1 ntered	998				PROJECT: Yucca COORDINATES: TOTAL DEPTH: 3 DEPTH TO BEDRO	Mounta N 765,5 50.1 ft DCK: 9		STATE: N GROUND E ANGLE FR HOLE LOG REVIEWED	evada ELEVATIO OM HORI GED BY: DBY: M.	N: 3671.03 ZONTAL: -90° URS/SMF/USBR Luebbers/M. McKeown			
			ENGIN	EERING	3	1		z /						
NOTES	DЕРТН	SPT		RTIES	WEATHERING	SHEAR WAVE VELOCITY	GEOLOGIC UNIT	CLASSIFICATIO LITHOLOGY	% CORE RECOVERY	% RQD		AND	CLASS PHYSI	IFICATION CAL CONDITION
									100	82	302.6 303.1 303.4 303.7	10 45 70 20	R5 R5 R3 R4	healed with paper thin white mineral paper thin white mineral paper thin white mineral clean
	265		FD2	НЗ	W1				100	100	305.3 306.5 307.2 307.7 308.7	25 15 40 05 30	R2 R3 R2 R4 R5	1 mm white mineral 1 mm white mineral 1 mm white mineral 1 mm white mineral partially healed with trace white mineral
	270				W3		Tocom		94	34	309.5 309.5 310.1 311.2 311.3 311.5 312.1	30 25 35 50 50 40 35 70	R4 R5 R3 R4 R3 R4 R3	trace tan mineral clean paper thin white mineral patches of white mineral trace of white mineral paper thin white mineral
	275						, bobu		94	45	314.9 315.3 315.7 316-319 319.3 320.0	35 25 45 20 25 30	R4 R3 R3 R2 R2 R2 R3	neared with 3 min white to gray mineral (yapor phase mineral?) paper thin white mineral paper thin white mineral paper thin white mineral paper thin white mineral
	280		FD6						100	62	320.9 325.8 326.5 327.6 328.3	65 60 40 60 30	R2 R3 R4 R3 R3	1 mm white mineral clean 1 to 2 mm white mineral healed with a trace of white mineral
	285								100	48	329.6 330.2 330.9 330.95 331.9 332.2	30 35 20 65 70 35	R2 R3 R4 R4 R4 R4 R4	3 mm cemented sand and tan and white mineral paper thin white mineral paper thin white mineral paper thin white mineral clean
	290			H2	W2				96	61	332.5 332.9 334.6 335.3 335.6 336.2 337.0	25 45 40 60 60 25 70	R4 R4 R4 R2 R4 R4 R4	paper thin white mineral 4 mm white mineral paper thin white mineral paper thin white mineral paper thin white mineral tight; clean paper thin white mineral
	295	H2 FD9					Tpcpll		96	32	337.1 337.7 337.8 338.0 338.4 339.8 340.3 240.8	40 45 50 40 60 40 45 25	R4 R4 R4 R3 R2 R3 R3	clean trace white mineral patches of white mineral patches of white mineral patches of white mineral trace white mineral patches of white mineral
	300-					N			33	0	340.8 340.9 341.5	30 50	R4 R4 R4	patches of white mineral patches of white mineral paper thin white mineral
									94	71	342.3 343.5 343.6 343.8 344.1	20 30 25 60 30	R4 R4 R2 R3	neared; 2 mm gray mineral patches of white mineral patches of white mineral patches of white mineral patches of white mineral
	305		FD5		W3		TpcpIn		100	46	345.3 345.5 349.3	30 25 65	к4 R4 R3	1 mm white mineral 1 mm white mineral 1 mm white mineral
	310				W1				100	34				

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 6 of 8)

			G	EOL	OG	IC LOG OF DRIL	L H	OLE	UE-	25 R	F#13 SHEET 7 OF 8
FEATURE: Waste Handling Faci LOCATION: ESF North Portal Pa BEGUN: 10/6/1998 FINISHED DEPTH TO WATER: Not Encour	lity ad : 12/7/1 ntered	998				PROJECT: Yucca COORDINATES: TOTAL DEPTH: 3 DEPTH TO BEDRO	720.12	STATE: Nevada GROUND ELEVATION: 3671.03 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: URS/SMF/USBR REVIEWED BY: M. Luebbers/M. McKeown			
NOTES	рертн	SPT	ERACTURE DENSITY	ERTIES HARDNESS	WEATHERING	SHEAR WAVE VELOCITY	GEOLOGIC UNIT	CLASSIFICATION	% CORE RECOVERY	% RQD	CLASSIFICATION AND PHYSICAL CONDITION
	1111				W1				100	34	
	315				W3				88	26	
	320								100	60	
	325								92	63	
	330		FD5	H2	W1		Tpcpln		88	30	
	335										
	340								68 96 100	27 63 72	
	343								100	70	
						BOTTOM OF HOLE					

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 7 of 8)

			GEOLOGIC LOG C	F DRIL	L HOLE U	E-25 RF#13	SHEET 8 OF 8
FEATURE: Wa LOCATION: ES BEGUN: 10/6/1 DEPTH TO WAT	ste Handling Facility SF North Portal Pad 1998 FINISHED: 12/ TER: Not Encountere	7/1998 d	PROJE COORE TOTAL DEPTH	CT: Yucca DINATES: I DEPTH: 35 TO BEDRO	Mountain Project N 765,500.04 E 5 50.1 ft CK: 98.0 ft	70,720.12 G	STATE: Nevada GROUND ELEVATION: 3671.03 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: URS/SMF/USBR REVIEWED BY: M. Luebbers/M. McKeown
	HARDNI	ISS				WEATHERIN	NG
Alphanumeric	Descriptor	Criteri	a		Alphanumeric	Descriptor	General characteristics
H1	Extremely	Core, f be scra can onl hammer	ragment, or exposure cannot tched with knife or sharp p y be chipped with repeated blows.	ick; heavy	W1	Fresh	Hammer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or
Н2	Very Hard	Cannot pick. C	be scratched with knife or ore or fragment breaks with	sharp	W2	Slightly weathered	snales.
НЗ	Hard	Can be pick wi Heavy h specime	scratched with knife or sha th difficulty (heavy pressu ammer blow required to brea n.	irp ire).	W3	Slightly weathered	Hammer rings when crystalline rocks are struck. Body of rock not weakened. With few exceptions, such as siltstones or shales, classified as rock excavation.
H4	Moderately Hard	Can be pick wi	scratched with knife or sha th light pressure. Core or	rp	W4	Moderately to slightly weathered	
		fragmen blow.	t breaks with moderate hamm	ler	W5	Moderately weather	ed Hammer does not ring when rock is struck. Body of rock is slightly weakened.
Н5	Moderately Soft	Can be sharp p Core or blow or	grooved 1/16 in. (2 mm) dee ick with moderate or heavy fragment breaks with light heavy manual pressure.	pressure. hammer	W6	Intensely to	Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.
H6	Soft	Can be or shar scratch	grooved or gouged easily by p pick with light pressure, ed with fingernail. Breaks	v knife can be with	W7	moderately weather Intensely weathere	ed d Dull sound when struck with hammer,
Н7	Very Soft	light t Can be with fi Breaks	<ul> <li>moderate manual pressure.</li> <li>readily indented, grooved c ngernail, or carved with a with light manual pressure.</li> </ul>	er gouged knife.			usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is significantly weakened. Usually common
					W8	Very intensely	excavation.
					W9	Decomposed	Can be granulated by hand. Always common excavation. Resistant minerals such as guartz may be present as "stringers" or "dikes "
			Description	FRACTUR	E DENSITY		
	descript	or	Descriptor	(Exclude	a es mechanical b	reaks)	
	FD0 FD1		Unfractured Very slightly fractured	No obse: Core re	rved fractures. covered mostly	in lengths greater t	than 3 ft (1 m).
	FD2		Slightly to very slightly fractured				
	FD3		Slightly fractured	Core re	covered mostly ed lengths less	in lengths from 1 to than 1 ft (300 mm)	o 3 ft (300 to 1,000 mm) with few or greater than 3 ft (1,000 mm).
	FD4		Moderately to slightly fractured				
	FD5		Moderately fractured	Core re lengths	covered mostly about 0.67 ft	in lengths from 0.33 (200 mm).	3 to 1.0 ft (100 to 300 mm) with most
	FD6		Moderately to intensely fractured	2			
	FD7		Intensely fractured	Lengths Core re	average from 0 covered mostlv	.1 to 0.33 ft (30 to in lengths less than	o 100 mm) with fragmented intervals. n 0.33 ft (100 mm).
	FD8		Very intensely to intensely fractured		*	-	
	FD9		Very intensely fractured	Core re	covered mostly	as chips and fragmen	nts with a few scattered short core lengths.

Figure 1.1-95. Geologic Log of Drill Hole UE-25 RF#13 (Sheet 8 of 8)

		GEOLOGIC L	.OG	OF	DRII	LL F	IOLE	JE-25 RF#14	SHEET 1 OF 11
FEATURE: Waste Handling Fa LOCATION: ESF North Portal I BEGUN: 9/13/2000 FINISHEI DEPTH TO WATER: Not Encor	cility Pad D: 9/2 unteree	7/2000 d	PRO COO TOT DEF	DJECT: DRDIN FAL DE PTH TC	Yucc ATES: PTH: BEDR	a Mou N 76 550.0 OCK:	ntain Proje 5,308.73 ft 101.8 ft	ct E 571,065.44	STATE: Nevada GROUND ELEVATION: 3651.52 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
		E							
NOTES	DEPTH	SHEAR WAVE VELOCITY	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	IA скарнс	CLASSIFICATION ND PHYSICAL CONDITION
Purpose of Hole:								0.0 to 10	1.8 ft QUATERNARY ALLUVIUM (Qal)
required for waste handling facility foundation parameters and seismic hazard analysis.					0		Qal	0.0 to 5.0 5.0 to 9.0	): No Recovery 1: POORLY GRADED GRAVEL WITH SAND AND SILT
Drill Equipment: Schramm T685 Drill Rig, UDR 1000 Drill Rig	5 -				100	-	0-1	GP-GM     Subangu     Subround     dry strem	Is, About 50% inter to coarse, nand, subrounded to lar gravel; about 40% predominately fine, hard, ded to subangular sand; about 10% nonplastic fines, no gth, rapid dilatancy, low toughness; maximum size
Drillers: D. Harrison, R. Mckay; Dynatec Drilling Inc.; Salt Lake City, Utab.					50		(GP-GM)	9.1 to 11	d. .5: POORLY GRADED GRAVEL WITH SAND (GP)s;
Drilling Method: Used 12 in. hammer to 5.02.	10-				100	-	Qal (GP)s	About 60 about 35 5% nonp toughnee	<sup>1%</sup> fine to coarse, hard subrounded to subangular gravel; % fine to coarse, subrounded to subangular sand; about lastic fines, no dry strength, rapid dilatancy, low ss; maximum size 75 mm, dry, light brown; strong
1.29 stickup. Re-enter hole on 9/13/2000 with PQ coring system. Cored with PQ to 116.06. Used	-				59		Qal GW	11.5 to 1 coarse, t	<ul> <li>4.9: WELL GRADED GRAVEL (GW); About 100% fine to ard, subrounded to angular gravel; maximum size</li> </ul>
HQ coring system. Cored with HQ to the total depth of 549.99.					63		Qal (GP)s	o E 75 mm, 1 1 mm wt 14.9 to 1	ight brown; 10% of graver is partially coated with up to hite caliche.
Drilling Conditions: 0.00 to 443.06: Replaced 2 bits. Drilling Fluid: 0.00 to 5.02: Nonpotable water.	20-				73		Qal (GP)sc	o About /C subangu o nonplast trace of c reaction	1% tine to predominately coarse, hard, subrounded to lar gravel; about 25% predominately fine sand; about 5% ic fines, no dry strength, rapid dilatancy, low toughness; oobbles; maximum size 95 mm, dry, light brown; weak with HCI; firm, weakly cemented.
5.02 to 290.09: Nonpotable water, Quick Gel mud with EZ-Mud. 290.09 to 294.15: nonpotable water, Quik Gel mud with EZ-Mud and LCM to						-		0 0 18.1 to 2 COBBLE ■ angular nonplast	3.2: POORLY GRADED GRAVEL WITH SAND AND ES (GP)sc; About 65% fine to coarse, hard, subangular to gravel; about 30% predominately fine sand; about 5% ic fines, no dry strength, rapid dilatancy, low toughness;
re-establish circulation. 294.15 to 549.99: Nonpotable water, Quick Gel mud with EZ-Mud.	25-				39		GW	trace of to strong	cobbles; maximum size 215 mm, dry, light brown; weak reaction with HCl; firm, weak to moderately cemented. (6.8: WELL GRADED GRAVEL (GW); About 100% fine to
Loss Intervals: 290.09 to 294.15					77		Qal (SM)g	0 - coarse, f 75 mm, l • - 1 mm wf	ard, subrounded to angular gravel; maximum size ight brown; 10% of gravel is partially coated with up to ite caliche.
Casing Record: 0.00 to 4.72: 10.75 O.D. casing. 0.00 to 116.06: PQ casing 116.06 to 549.99: No casing	30-				100	_		26.8 to 3     0	0.6: SILTY SAND WITH GRAVEL (SM)g; About 55% nately fine sand; about 30% predominately fine to coarse, orounded to subangular gravel; about 15% nonplastic dry strength, rapid dilatancy, low toughness; maximum nm, dry: weak reaction with HCI: firm, weakly cemented.
Hole Completion: Ream hole from 5.00 to 550.15 with 8.5 Tricone Bit. Set and cement 512.22 of 4.5" PVC casing.	35 -				23		Qal	0 30.6 to 4 0 About 60 0 about 35 0 nonplast maximur	4.6: POORLY GRADED GRAVEL WITH SAND (GP)s; % predominately fine to coarse, hard, subangular gravel; % predominately fine to medium sand; about 5% ic fines, no dry strength, rapid dilatancy, low loughness; n size 170 mm, dry, light brown; weak reaction with HCl;
	40				100		(GP)s	firm, wea	akly cemented. 7.8: POORLY GRADED SAND WITH GRAVEL (SP)g; 1% predominately fine to medium sand: about 35% fine
					70			o consecutive nonplast maximur firm, wea	c, hard, subrounded to subangular gravel; about 5% ic fines, no dry strength, rapid dilatancy, low toughness; m size 160 mm, dry, light brown; weak reaction with HCl; akly cemented.
	45-				$\vdash$	1		47.8 to 5	2.0. NO RECOVERT
3					91		Qal (SP)g	coarse, t coarse, s moist; no caliche c	and, subrounded to subangular gravel; about 5% fine to subrounded to subangular sand; maximum size 190 mm, or reaction with HCI; approximately 30% of gravel is coated.
	-				0		NR	-	

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 1 of 11)

NOTE: All measurements are in feet unless noted otherwise. LCM (Lost Circulation Material) consists of cellophane cuttings. USCS classifications were determined in the field, with limited access to samples to keep samples intact for future tests. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. USCS soil classifications are based on USBR 5005-86, *Procedure for Determining Unified Soil Classification (Visual Method)*. RQD = rock quality designation; USCS = Unified Soil Classification System.

		GEOLOG	IC L	UE-2	25 RF#14 SHEET 2 OF 11					
FEATURE: Waste Handling Fac	cility			PROJ	JECT:	Yucca	a Mour	tain Proje	ect	STATE: Nevada
LOCATION: ESF North Portal F BEGUN: 9/13/2000 FINISHEI	Pad D: 9/2	7/2000		TOTA	RDINA	.TES: PTH: {	N 765 550.0 fl	5,308.73 t	E 571	1,065.44 GROUND ELEVATION: 3651.52 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	untere	d		DEPT	ТН ТО	BEDR	OCK:	101.8 ft		HOLE LOGGED BY: USBR/SMF
										REVIEWED BY: Mark McKeown
			EN	INDICES	ing i					
					INSIT	VERY		E		
NOTES		SHEAR WAVE VELOCITY	Y SS	(1)	RE DE	RECO			0	AND PHYSICAL CONDITION
	PTH		RDNE	IDING	ACTU	CORE	В	50NO	APHIC	
	B	+ 1000 + 2000 +	H	Š	Ë	%	%	B	В	
		∃ : : <b>;</b> : : : : : : : :				0		NR		About 85% fine to coarse, hard, subrounded to subangular gravel; about 15% predominately fine sand: trace of fines; maximum size
		∃:: <b>{</b> ::::::							•	120 mm, dry, light brown; weak reaction with HCl; soft weakly cemented.
	55 -					71		Qal GW	57	60.5 to 69.3: POORLY GRADED GRAVEL WITH SAND (GP)s;
		<u> </u>							•	<ul> <li>About 80% fine to coarse, hard, subrounded to subangluar gravel;</li> <li>about 15% fine to coarse, subrounded to subangluar sand; about</li> <li>5% populastic fines, po dry strength, rapid dilatancy, low</li> </ul>
		∃ : : <b>.</b> : : : : : E				43		Qal		<ul> <li>toughness; maximum size 170 mm, dry; weak reaction with HCl; soft. weakly cemented.</li> </ul>
		∃::,,::::::						(Gvv)s	•	69.3 to 78.1: POORLY GRADED GRAVEL (GP); About 100% fine
	00-	∃:: <b>,</b> ;;;;;					1		0.0	to coarse, hard, subrounded to subangular gravel; maximum size 120 mm, moist; no to strong reaction with HCl.
		∃ : : <b>↓</b> : : : : : : E				64			00	78.1 to 80.3: POORLY GRADED GRAVEL WITH COBBLES
		∃ : : <b>,</b> : : : : : : E						0.1	0.0	cobbles; moist; cobbles have caliche coating.
	65-	╡┊┊╻╻┊						(GP)s		80.3 to 84.8: POORLY GRADED GRAVEL WITH COBBLES (GP)c; About 80% coarse, subrounded to subangular gravel;
		╡┆┆╎╢┊┆┆┆┆				58			0.0	
		1     <i>[</i>								Pyroclastic flow, nonwelded, moderately indurated light to     medium grav tuff with 10 to 15% light grapping grav.
	70-	<u> </u>							50	pumice clasts, up to 20% grayish-red volcanic lithic clasts and 2 to 3% phenocrysts of sanidine and plagioclase.
		∃:: <b>1</b> ::::				35			201	Generally the tuff is slightly weathered (W4), moderately soft (H5) to soft (H6), and very slightly fractured (FD1). Both upper and
		]     <b> </b>						Qal	20	lower contacts are unconformable.
	75-	∃ : : <b>1</b> : : : : : E					1	GP	20	Depth Angle* Roughness Infilling
		<u>_</u> <b>_</b>				47			200	102.3 75 R2 5 mm clay 115.8 05 R2 < 1 mm light brown stain
		╡┆┆╉┊┆┇┊┊┊				0	1		R	140.4 15 R2 clean 172.5 25 R2 trace clay
	80-	<u>_</u>				82		Qal (GP)c	60	- 172.2 25 R2 trace clay - 188.0 20 R3 to 1 sand - 189.0 20 R3 to 1 sand
		<b>∃</b> : : <b>†</b> : : : : : : : :					]		20	- 190.2 35 R3 3 mm altered tuff
		∃:: <b>∱</b> ::::				49		Qal (GP)c	201	192.5 to 203.4 ft POST TIVA CANYON BEDDED TUFFS
	95	∃:: <b>;</b> ;::::							20	(Tpbt5):     Nonwelded, devitrified, reworked (?) fallout tephra and pyroclastic
		∃ : : <del>{</del> : : : : : : : :			FD5	100	73			tiows separated by distinct paleosols. Bedded tufts are very pale orange with 20 to 30% pumice clasts and less than 1%, pale red volcanic lithic clasts. The tuff has up to 1% quartz
		<u> </u>     <b> </b>	H6		FD6	80	80			sanidine and lesser plagioclase, with less than 1% biotite biotite and manganese oxides. Generally the bedded
		∃ : : <del>}</del> : : : : : : :				88	88			tuffs are very soft (H7), moderately weathered (W6), and slightly to very slightly fractured (FD2). The lower contact is
	90-	<u>∃ : : <del> </del> : : : : : : : :</u>	117	_			00			unconformable.
		╡╎╎╅╎╎╎╎	H/	-	FD4					Discontinuity measurements:     Denth Angle* Roughness Infilling
		∃::↓:::::	Нб	_		88	63	Qal		197.3 20 R3 clean 201.8 45 R3 clean
	95-	╡┆┆╅┆╏┆┆┊┆								
		∃::↓::::	H7		NP	03	03			203.4 to 275.0 ft TIVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tpcrn)
		∃:: <b>↓</b> :::::				33	33			pale red to gravish red, with up to 15% phenocryts.
	100-	╡┆╎ <mark>╷</mark> ┊┊┊┊┊┊	H6		FD2	93	83			and rare biotite. Rare pumice from 212.5 to 222.8 ft and up to 15% pumice clasts from 222.8 to 269.0 ft. From 276.7 to
		∃:: <b>\</b> ::::		_						288.0 ft the tuff has up to 2% pumice clasts and 5 to 8% phenocryts of sanidine and plagioclase with rare biotite.
		╡╎╎╽╎╎	H5			100	65			<ul> <li>Generally the tuff is moderately soft (H5) to mostly moderately hard (H4), moderately to slightly weathered (W4), and intensely</li> </ul>
	105-	<u> </u>								to moderately tracture (FD6). The lower contact is conformable.
		∃ : : : <b>⊺</b> : : : : : :	не		ED1	100	94	Tpki		Depth Angle* Roughness Infilling
1		∃::: <b>!</b> ::::	110							203.6 40 R3 clean - 205.0 0 R3 8 mm silica
		╡╎╎╎╋╎╎╎╎╎						-	1	205.4 30 R3 trace white mineral

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 2 of 11)

			Ģ	<b>SE</b>	OLO	GI	C L	OG	OF I	IOLE I	JE-2	-25 RF#14 SHEET 3 OF 11		
FEATURE: Waste Handling Fac	cility							PRO	JECT:	Yucca	a Mour	ntain Proje	ct	STATE: Nevada
LOCATION: ESF North Portal F	Pad ⊡∙ ∩/2	7/2000						COO		TES:	N 765	5,308.73 +	E 571	71,065.44 GROUND ELEVATION: 3651.52
DEPTH TO WATER: Not Encou	untere	d	,					DEPT	TH TO	BEDR	OCK:	101.8 ft		HOLE LOGGED BY: USBR/SMF
														REVIEWED BY: Mark McKeown
							EN		RING					
									Σ	Ϋ́				
NOTES		SHEA				ITV			DENS	DVE		1		CLASSIFICATION
NOTES				ft/s	VLLOC		ESS	ģ	UREI	E RE		SSI C	⊇	AND PHYSICAL CONDITION
	EPTH						ARDN	ELDI	RACT	COR	RaD	LUSC	RAPH	
	110-	2 10		1 0 <u>2</u>	- 1 600	- 906	Î	3	Ē	%	%	U	U	206.5 40 B3 trace white mineral
			Ĩ			-								L 206.9 20 R3 trace white mineral
		<u> </u>	. Ì₿		i i i	i I				98	96			208.6 30 R2 0 to 5 mm white mineral 213.6 35 R2 clean
	.					1								- 214.7 10 R2 clean - 215.8 10 R3 clean
	115-	1 i i	i ti		:::	i				100	100			L 218.1 30 R3 clean L 223.5 25 R3 clean
	.		¦ †			i I								9– 223.7 50 R3 clean 1 224.7 40 R2 clean
	.		ł			1								1 225.3 20 R2 clean 2 227.8 15 R3 clean
	120-	1 i i				i								.E 228.4 25 R2 sand 230.0 05 R3 clean
	·	11		i i L i	i i i	i				96	88			238.4 30 R2 trace white mineral
			I I			ł								240.1 55 R2 clean 243.3 65 R2 clean 50.1 05 R2 clean
	.		1			i								Slicken-sided
	125-	11		F i		i I								253.2 40 R2 Salid, graver
	.					1								256.7 15 to 40 R2 sand 257.3 60 1 mm white mineral
										97	97		1 197	L 267.4 10 R3 clean 2 267.7 60 R2 2 mm silica
	130-		ļ.		i I								268.0 0 R3 clean 268.4 0 R3 sand	
	·	]			111	-								
		1 i i			111	i								. ☐ 269.3 30 R3 clean . ← 270.5 10 R2 trace white mineral
						1								270.7 20 R2 trace white mineral
	135	1 : :	1			1				96	96			. 274.3 15 R3 clean
	.		1			i I								275.0 to 395.0 ft TIVA CANYON TUFF CRYSTAL POOR
		1				1			504					Pyroclastic flow, densely welded, gravish orange to pale red, with     2 to 5% lithophysal cavities     un to 20 by 40 mm in size
	140-	1 i i	1	Fi.			H6		FD1			Тркі		Lithophysae increase to 15% at 310.0 ft and up to 25%
		11		H.		i I								Phenocryts compose less than 1% of the tuff mostly sanidine and placioclase with minor biotite. Also up to
	.			Ļ!	111	1								3% pumice clasts as large as 40 by 10 mm. Zones of nonwelded, fracture fill(?) from 334 to 359 ft, and 369 to 395 ft
	1/15-	1 i i				i				100	93			composed of reworked and variously bedded clay/silt-sized, tuffaceous material. Generally the tuff is moderately soft (H5) to
	<b>145</b>	4				ŀ				100	00			mostly moderately hard (H4), slightly (W3) to moderately weathered (W5), and intensely to moderately fractured (FD6).
	:													Lower contact is conformable.
		11		T		i I								L Discontinuity Measurements:
	150-			Ī !						-				275.9 20 R2 clean
														278.7-279.4 30 R2 0.6 ft breccia; sand and gravel;
	·					1								279.6-280.0 60 R3 0.4 ft breccia; sand and gravel;
	155-	1 : :				-				99	99			280.1 35 R3 10 mm breccia 282.0 30 R3 trace white mineral
	.	1 : :	ł	l i	111	i								L 280.9-281.2 50-80 rotated; breccia 281.4 55 R3 breccia
		1   i	ļ			1								
		1:												285.0 10 R3 1 mm silica 285.3 25 R2 clean
	160-	11	ļ			i I								286.0         35         R3         trace silica           287.0         25         R2         3 mm silica
	.		Į											207.0 20 K3 1 mm silica 288.4 60 R3 clean
		11	Î											20039 30 R3 Clean 289.0 70 R3 clean P 280.3 15 P2 clean
	165-	11	l †	t i	Ηİ					100	100			L 289.4 65 R3 clean
			ł											290.7 25 R2 trace white mineral 291.4-291.6 35 R3 40 mm clav. sand. gravel
	.	11		L.		i I								292.2 35 R3 gravel 291.9 75 R3 2 mm silica
1	1 .	4			1 I I	1		1	1	1	1	1	1923	L

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 3 of 11)

		GEO	LOGI	C L	OG (	OF C	OLE (	JE-2	25 RF#14 SHEET 4 OF 11		
FEATURE: Waste Handling Fac	cility				PROJ	ECT:	Yucca	Moun	tain Proje	ct	STATE: Nevada
BEGUN: 9/13/2000 FINISHEE	2ad D: 9/27/20	000			TOTA	L DEP	TES: TH: 5	N 765 550.0 ft	,308.73	E 571	1,065.44 GROUND ELEVATION: 3651.52 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	untered				DEPT	Н ТО Е	BEDRO	OCK:	101.8 ft		HOLE LOGGED BY: USBR/SMF
											REVIEWED BY: Mark McKeown
				EN	GINEERI NDICES	NG					
						√SITY	/ERY		⊢		
NOTES	s⊦	HEAR WAVE V	ELOCITY	v,		E DE	RECOV		NN N		CLASSIFICATION AND PHYSICAL CONDITION
	E			DNES	DING	CTUR	OREF	B	ISCS]	PHIC	
	DEP	1000 2000 3000 5000 6000	7000 8000 9000	HAR	WEL	FRA	Ö%	% Ki	lr GEO	GRA	
	170					FD1	100	90			292.3         80         R3         clean           294.9         45         R3         clay, sand           295.1-295.5         30         R3         breccia, sand, gravel, trace clay           295.8-296.0         50         R3         breccia, sand, gravel, trace clay           298.6         30         R3         <1 mm silica
	180	Ţ.		H6	-				Tpki		306.4         25         R3         2 mm silica           310.4         35         R2         1 mm quartz           310.6         30         R3         none           311.3         55         R3         none           311.8         55         R3         none           312.0         45         R3         sand, trace quartz           312.2-313.3         45         R2         breccia; sand and gravel           313.8         05         R3         1 mm vapor phase minerals
							100	80			314.5         35         R3         sand           315.2-316.1         45         R2         breccia; sand, gravel, clay           317.0-320.3         20         R2         sand, gravel, clay           322.5         65         R2         none           322.8         05         R2         trace white mineral           322.9         70         R2         none           323.4         50         R3         none           321.0         60         R3         8 mm vapor phase alteration
	190					FD2	81	74			320.3         10         R3         1.2 If Clay, Sailo, graver           327.3         50         R3         clean           329.2         05 to 35         R2         15 mm clay           344.8         5 to 15         R4         1 mm clay           349.0         05         R3         <1 mm white mineral and clay
	195	Ì		Ц7			78	59	Tpbt5		359.2         40         R3         1 mm clay         1 mm clay           359.9         25         R2         3 mm sand, gravel, clay           360.4         30         R2         clean           361.6         25         R3         clean           362.2-362.4         65         R2         sand, gravel, clay, MnO           363.4         70         R3         trace white mineral           364.6         55         R3         clean
	200	1111				-				ŵ99	- 364.8 20 R2 MnO coating 366.8-367.5 40 R3 clay, sand, gravel
		I									395.0 to 443.7 ft TIVA CANYON TUFF CRYSTAL POOR
	205					FD6	94	46		00.00	<ul> <li>MIJULE NONLITHOPHTSAL ZONE (Ipcpmn)</li> <li>Pyroclastic flow, densely welded, devitified, pale red, tuff with less than 1% lithophysae up to 50 by 10 mm. Less than 1% phenocryts of sandine, plagioclase, and biotite. The tuff has 1 to 2% very light gray pumice clasts and pink spherulites, and up to 10% volcanic lithic fragments. Zones of nonwelded, fracture fill(?) from 402.7 to 431.7 ft, 434.0 to 435.8 ft, and 442.4 to 443.7 ft composed of reworked and variously bedded claysilit-sized, tuffaceous material. Generally the tuff is moderately soft (H5), moderately to slightly meathered (W4), with fracture densities ranging from slightly fractured (FD3) to very intensely fractured (FD8). Lower contact is conformable.</li> </ul>
		iiiµi								р. <u>О</u>	Discontinuity Measurements:
	215			H4			100	60	Tpcrn		Depth         Angle*         Roughness         Infilling           367.9         60         R3         2 mm clay           368.9         05         R2         clay, sand, gravel           370.0         30         R3         MnO stain and 5 mm clay           373.7         15         R4         contact between clayey           373.9         60         R2         2 mm silica           374.3         35         R2         374.3
	220-	1				FD5					- 374.8 60 R2 trace of clay - 375.1 quartz-filled lithophysal cavity
	220						92	25		0 0 0	25 mm thick 375.4 50 R3 trace of clay 375.6 60 R4 378.6 45 R3 trace of clay 378.8 35 R3 378.8 35 R3 379.0 0 R4 1 mm silica 379.6 15 R4 trace silica 379.8 20 R3
		:: <b>{</b> :::				ļ				0.	- 380.0 75 R3 1 mm silica 380.2 65 R3 trace silica
	=						91	56		P	– 380.7 05 R3

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 4 of 11)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#14											SHEET 5 OF 11	
FEATURE: Waste Handling Fac	PRO	PROJECT: Yucca Mountain Project						STATE: Nevada				
LOCATION: ESF North Portal Pad				COORDINATES: N 765,308.73 E 571,065.44						GROUND ELEVATION: 3651.52		
BEGUN: 9/13/2000 FINISHED: 9/27/2000				TOTAL DEPTH: 550.0 ft						ANGLE FRO		NTAL: -90°
DEPTH TO WATER. NOLENCOL	DEP	DEPTH TO BEDROCK: 101.8 ft						REVIEWED	вү: Mark I	McKeown		
		RING			1	<u> </u>						
			INDICE	s								
				L IS	/ERY							
NOTES	TES SHEAR WAVE VELOCITY			E E	ECO		N.					
	Τ		l S Z	LURE	R			일	An			
	EPTI	ARD 888888888888888888888888888888888888	MELD	RAC	, col	° ROI	LUS LUS	RAP				
			>	ED5	01	0			381.0	28	R3	
	230-	<del>)</del>			1			Þ	- 380.8 381.4	55 20	R3 R4	
	3							8 E	381.5 381.7	10	R4 R4	
	-				91	56			- 382.0 382.2	15	R3 R3	trace of clay
									382.1	45	R3	adde Mino, adde oldy
	235							ΙE	382.8	70	R3	trans MrO
	-							þ	- 383.3	30	R4 R4	
		<del>)</del>		ED3			1	- 4-	383.7 384.5	05 10	R4 R2	trace silica, trace clay
	240	H4						P E	- 384.7 _ 384.7	60 35	R3 R3	
	-							o -	- 384.9 - 384.9	20 25	R3 R3	
					90	69		°	. 385.0 386.1	35 10	R3 R4	
	=								386.4 386.7	40 80	R4 R3	
	245-							ĿĒ	387.8/387	.9 75	R2	3 anastamosing vpps, vp coated
	=							þ° F	- 388.7 389.3	20 75	R4 R5	
	1 3						-	-	- 389.5 - 389.8	75 80	R3 R4	trace MnO
	-		-	FD7	86	18		PE	390.4	80 45	R3 R4	vapor phase (Vpp)
	250-			ED0	46	0	1	0 F	- 390.8	75	R3 R4	vapor phase (Vpp)
	=			FD9	40	U	Tpcrn	Ē	392.1	75	R3	trace vapor phase
	-								- 392.6	75	R2	vapor phase to 2 mm (Vpp)
									392.9	80	R2	vapor phase to 1 mm (Vpp)
	255			FD6				ΡĒ	- 395.2 	45 75	R3 R2	vapor phase (Vpp)
	-				11	38			- 398.8	5	R2 R3	
								e of	400.3	80	R3 R2	trace MnO vapor phase (Vpp)
	260							0 F	401.7 401.4	0 80	R3 R4	
								Ē	403.8 408.6	20 45	R2 R4	clay 0.5 2 cm contact (?) between cobble
	=				34	0		Þ.F	-			and pumiceous, lithic-rich infilling
	3							E	408.9/409	.9 40	R4	well-cemented pumiceous lithic-rich infilling w/Tpc frags
	265	<b>†</b>				_	1	PF	409.9/413	.4 40	R3	tuffaceous infilling with <15% white/grav altered pumice
				FD9	81	0		- de	- 417.8 422.9	10 10	R5 R5	clay 20 mm clay 30 mm+ extends into
	3					~		i,oE	429.9	10	R4	next run bedding; fine grained
		н4			97	23		0.	428.0	20 10	R4 R3	bedding; fine grained 2 mm clay
	270-							l o E	432.2	20 15	R3 R3	trace white mineral
	3							Þ.E	432.6	25	R3 R3	trace white mineral
	-							l of	- 434.0	15	R4	tuff
	275			ED4	99	32		P	437.3	80	R2 R2	vpp alteration
	215-							0.0	- 438.7	10	R3	clay
	-			FDC					- 440.3	75	R3 R3	trace white mineral
	=			FD9	<u> </u>		1	0.0	441.4 441.8	65 85	R3 R3	trace white mineral trace white mineral
	280-				1				442.0 - 442.1	85 15	R3 R4	trace white mineral clay; tuff
	=				100	54	<b>T</b>		443.7 to 4	55.6 ft TIVA 0	CANYON TU	JFF CRYSTAL POOR
		<b>   </b>		FU4			I pcpul	0.0	<ul> <li>LOWER L</li> <li>Pyroclasti</li> </ul>	thophysal c flow, densel	Velded, de	c <b>pil)</b> evitrified, moderate orange
	=			<u> </u>					pink tuff w sanidine a	vith 1% very lig and rare biotite	ht gray pun compose le	nice. Phenocryts of ess than 1% of the rock
	285-				<u> </u>		-	0.0	by volume rock by vo	e. Lithophysal olume and are	cavities cor generally 2	mpose up to 15% of the 0 by 30 mm in size.
	=			FD8	98	0		0	Lithophys	ae are filled ar	nd coated w	ith vapor phase minerals to is moderately hard (H4)
	3					-		0.0	slightly we	eathered (W3)	, and intens	ely fractured (FD6).

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 5 of 11)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#14 SHEET 6													
FEATURE: Waste Handling Fac		PROJE	ECT: \	Yucca	STATE: Nevada								
LOCATION: ESF North Portal F		COOR		ES: - ш. Б	N 765	,308.73	E 571	71,065.44 GROUND ELEVATION: 3651.52					
DEPTH TO WATER: Not Encou	DEPTH		EDRC	00.0 I	101.8 ft		HOLE LOGGED BY: USBR/SMF						
REVIEWED BY: Mark McKeown													
			È	Ϋ́									
					DENS	OVE		₽		CLASSIFICATION			
NOTES		f/s	ESS	g	URE	EREC		GIC L	Q	AND PHYSICAL CONDITION			
	EPTH		ARDN		ACT	COR	RQD	[US(	APH				
	ä		Ì	>	Ë	%	%	ö	Ö.	Lower contact is conformable			
	290					98	0		0.0	Discontinuity Measurements:			
	1 1					66	0		.0. 0.	L Depth Angle* Roughness Infilling			
		<b>/</b>				00	U		.00 00	PL 443.7 60 R3 1 mm clay L 444.2 75 R2 clean			
	205	· · · <del>(</del> · · · · · · · ·			-			-	0,0	L 444.9 60 R2 clean L 445.1 35 R2 clean			
	295	-       <del> </del>	H4			100	0		°°°	446.3 15 R2 trace white mineral; sand			
	=	, <b>,</b> , , , , , , , , , , , , , , , , ,							0.0	57 447.2 30 R2 sand ∳ 453.7 60 R2 1 mm silica			
	1 3	4			EDO				.0.0	455.6.0 to 550.0 ft TIVA CANYON TUFF CRYSTAL POOR			
	300-				FDO	91	0		0.0	Pyroclastic flow, densely welded, devitrified, moderate orange pink tuff with less than 1% light gray numice clasts			
	1 3				F				0 .0	Phenocrysts of sanidine and plagioclase compose 1 to 2%     of the rock by volume. Reddish-brown lithic clasts compose less			
		111111				89	12			than 1% of the rock by volume. Generally the tuff is moderately than 1% of the rock by volume. Generally the tuff is moderately			
	305						15			ranging from slightly fractured (FD3) to intensely fractured (FD6). Lower contact undetermined, bottom of borehole at 550.0 ft.			
		t t			-			-		Discontinuity Measurements:			
						70				Depth Angle* Roughness Infilling			
	1 3					10	0		••0	455.7 40 R3 clean 456.4 20 R3 0 to 1 mm silica			
	310-			-				Thopul	0.0	≨ 458.0 45 R3 clean 458.1 35 R3 3 mm silica			
	1 3	<b>.</b>	H5 H4					rpopul	460.2 60 H	↓ 460.2 60 R2 trace white mineral ↓ 460.0 30 R3 trace white mineral			
	-				FD6	99	32		0° 0°	+ 460.4 70 R2 clean 460.9 65 R3 trace white mineral			
	315	I I I I I I I I I I I I I I I I I I I							°0°	461.1 85 R3 trace white mineral 461.3 35 R4 MnO and trace white mineral			
									.0°.	461.0 60 R3 clean 462.1 60 R4 clean			
	Ē								°0.0	463.1 25 R4 trace white mineral			
		· · · · /			FD8	74	0		••••• ••••	L 464.1 55 R3 trace white mineral			
	320	<b>/</b>							0.0	465.0 55 R4 clean			
	EI					83	3 38		.0.	466.3 65 R4 trace white mineral			
	325	A A							0.0	467.0 20 R3 trace white mineral 467.1 75 R2 trace white mineral			
		THE XEEP F			FD6				0,0	→ 467.3 50 R2 4 mm sand and silica → 467.7 50 R3 trace white mineral			
									0,0	468.0 80 R4 trace white mineral 468.2 55 R4 clean			
	1 3					91	41		, ° 0 , 0	→ 468.4 80 R4 clean ↓ 468.5 35 R4 trace white mineral			
									0.0	° 468.7 60 R4 clean ∋ 469.0 70 R4 clean			
	330-			-					, ° 0	469.4         45         R4         trace white mineral           470.0         60         R2         trace white mineral			
	E	4			FD8	6	0		0,0				
	-	$\lambda$							000	-     472.8     80     R2     trace white mineral       -     473.1     75     R3     trace white mineral			
	335								IJŀ	476.8 80 R2 trace white mineral			
	-					100	84		KIG	- 476.2 80 R1 trace white mineral; trace silica			
	1 3	1 1 1 1 1 1 1 1				74 4			$\mathbb{N}/\mathbb{I}$	478.4 85 R1 vapor phase alteration-2 mm			
	-		H7				47		$\mathbb{N}/$	479.0 60 R1 trace white mineral 480.3 70 R1 2 mm vapor phase minerals			
	340-						100	(Fracture		L 480.9 75 R1 2 mm vanor phase minerals			
	]					100	100	Fill)	$\mathbb{W}$	(healed) L 482.4 55 R1 2 mm vapor phase minerals			
	=								M	(healed) 483.1 45 R4 trace white minerals			
	345					81	40			↓ 484.4 65 R4 clean ▲ 484.6 60 R4 clean			
	=								IJA	∏_ 485.4 80 R2 trace white mineral ├- 485.6 75 R4 clean			
									Y F	⊢ 485.9 50 R4 trace white mineral			

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 6 of 11)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#14 SHEET 7 OF 11													
FEATURE: Waste Handling Fac		PROJE	ECT: Yu	icca Mou	intain Proje	ect		STATE: Nevada					
LOCATION: ESF North Portal P		COOR	DINATE	S: N 76	5,308.73	E 571,0	065.44	GROUND ELEVATION: 3651.52					
BEGUN: 9/13/2000 FINISHED: 9/27/2000					. DEPTH	: 550.0	ft 101 0 6			ANGLE FROM HORIZONTAL: -90°			
DEPTH TO WATER: Not Encountered					1 IU BEI	JRUCK.	101.61			HOLE LOGGED BY: USBR/SMF			
											DT. Mark	Moreown	
			EN		NG								
					Σ.	È.							
NOTES					DENS	Š	Ξ			CLASSI	FICATIO	N	
NOTES	5HEAR WAVE VELOCITY		SS	0	RE L			0	AND PHYSICAL CONDITION				
	Ŧ		DNE	Ž		5 8	I SC	Hd					
	H H	1000 2000 5000 6000 8000 8000	HAF	MEI	FRA	8 8		GR/					
							-	UL	486.2	70	R4	clean	
	350-	<u> </u>				0 07		1/E	487.0	80	R2	clean	
	-					9 0/		MAF	488.2 489.1	60	R3 R3	trace white mineral	
	-		H7				-	MI/F	489.7 490.0	30 60	R3 R4	trace white mineral trace white mineral	
						4 20	(Fracture	•111/E	490.0	50	R4 R2	trace white mineral MnO stain	
	355-				FD6	4 32	)	1//F	493.8	30	R3	trace white mineral	
	-				8	6 57	-		493.4	35	кэ	mineral	
	-			1			1		492.8 491.9	20 40	R2 R3	clean clean	
								1/Æ	491.8 491.6	80 30	R3 R3	trace white mineral clean	
	360-	╡╎╋╎╎╏╎╎╎			8	6 17		0.0	491.2	10	R3	clean trace MnO and white minoral	
	-				FD4				495.3	80	R3	clean	
	1 7							0.	495.9 497.4	75 80	R3 R3	clean clean	
		<u> </u>	H4	H				00-E	498.0 498.6	65 80	R3 R3	clean clean	
	365-	╡╎╇╎╎╏╎╎╎			5	7 18	, popul		498.9	60 70	R3 R3	trace white mineral	
	-						4	0.0	499.4	80	R3	clean	
	1 -				FD6			· · ·	499.8	05	R3	clean	
		<u> </u>			8	7 38		0	504.0 503.4	10 85	R3 R3	trace MnO and white mineral trace MnO and white mineral	
	370-						4	WÆ	504.5 506.8	15 80	R3 R3	trace MnO and white mineral trace white mineral	
	-							KIÆ	507.5 508.4	35	R3 R2	clean trace white mineral	
	-		H6	FD3	FD3			MA	500.6	70	R3	trace white mineral	
		<u> </u>			- 7	8 64		ME	501.6	75	R3	clean	
	375-							11/L	501.7	70 75	R3 R3	trace white mineral trace white mineral	
	-				FD7			V//E	502.3 502.6	70 65	R3 R3	trace white mineral trace white mineral	
	-			_				MF	502.7	75 15	R3	trace white mineral	
	-	1   ]		-	FD9			II/F	503.2	85	R3	trace white mineral	
	380	]     <b>       </b>		-	FD8			MÆ	512.1	80	R3	trace white mineral	
	-	╡┆┆┢┆┆┆┆┆┆			9	6 19	( <b>F</b>	N/F	513.0 514.0	70 25	R2 R2	3mm vapor phase mineral trace white mineral	
	-				FD6		Fill)	"Z <i>I</i> F	514.2 514.3	75 10	R2 R2	trace white mineral trace white mineral	
		<b>1</b>     <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>   <b>1</b>						MÆ	515.6 516.4	15	R3	clean trace MpO	
	385	∃ : : <b>↑</b> : : : : : : : : :		ŀ			-	ME	517.8	10	R1	trace clay	
	-	<b>∶∶∶∖</b> , ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;						M	520.4	70	R2 R2	MnO, white mineral stain	
					FD5 10	00 63		1//E	520.6 520.9	75 80	R2 R2	MnO stain clean	
		₹ : : : \\ <u>:</u> : : : : : : :	H3					V/F	520.5 521.2	80 85	R3 R3	clean MnO stain	
	390	∃ : : : <b>^</b> : : : : :						ME	522.0	10	R3	clean	
	-	1 <b>.</b>							523.3	80	R2	15 to 40 mm sand	
		<u> </u>						NÆ.	523.8 524.0	80 25	R2 R3	gravel fragments healed	
	1 7							1PE	526.0	25	R2	0.4 ft sand, gravel, and clay breccia	
	395				1	20 06		NE	528.4 528.9	75 60	R3 R2	trace white mineral clean: slickensides	
	-	<u> </u>				00 00			529.3	65	R2	clean; slickensides	
					FU3			N.F	529.4 530.4	25	R2 R2	3 to 8 mm clay;	
								⊧.∖F				slickensides; polished; hard	
	400	∃ ; ; ; ; <b>†</b> ; ; ; ; ; ]					pcpmn	'N-E	530.8 531.2	55 40	R2 R2	clean clean	
		╡┆┆┆ <b>┽</b> ┆┆┆┆│					1	E:\E	531.7	80 10	R2	trace MnO MnO stain	
	-	∃ ; ; ; ; <b>↓</b> ; ; ; ; ; ;		E					532.0	50	R3	MnO stain	
		∃ : : : : \			FD6			前走	532.1 532.5	55	R3 R2	sand	
	405	<b>∃</b>       <b>1</b>   <b>1</b>	H6		9	5 75	(Fracture	1/F	532.7 532.8	40 50	R2 R3	trace clay; sand sand	
	405				FD3		Fill)	MÆ	533.0 533.1	70 75	R2 R2	sand and gravel	
	-		H4					MILE	533.2	70	R3	clean	

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 7 of 11)
		G	EOL	OGI	C L	OG (	OF C	DRIL	L H	IOLE I	JE-	25 RF#14			SHEET 8 OF 11
FEATURE: Waste Handling Fa	GEULUG EATURE: Waste Handling Facility OCATION: ESF North Portal Pad IEGUN: 9/13/2000 FINISHED: 9/27/2000							Yucca	a Mour	ntain Proje	ct		STATE: N	evada	
LOCATION: ESF North Portal	Portal Pad IISHED: 9/27/2000						RDINA	TES:	N 765	5,308.73	E 571	1,065.44	GROUND E	ELEVATION	I: 3651.52
BEGUN: 9/13/2000 FINISHE	ED: 9/27	/2000						TH: 5	550.0 f	101 0 B					ONTAL: -90°
DEFTH TO WATER. NOT EIK	Juntereu					DEFI	по	BEDRI	OUK.	101.01			REVIEWED	BY: Mark	McKeown
					EN		ING				_	1			
						NDICES									
							LIS1	ÆΥ		_					
NOTES		SHEAR WA	AVE VEL	OCITY			Ē	ECO/		NN N					
	т		ius		NES	₫	TURE	RI RI		Colo	일				
	EPTI	8888	888	88	IARD	U U	RAC	Ö	Rot	Ins	RAP				
		20 20 40	29.09.2	8 8	 H7	>	FD9	0,	o <sup>~</sup>	0	18 H	533.3	65	R3	clean
		t i			H5		FD6				1 Pa	- 533.5 - 536.0	65 70	R3 R3	trace white mineral clean
	410-	<del> </del>		i i				100	92		MA	534.1	45 45	R3 R3	clean
	-	┊┊┊╉┊┊			H6		FD3				MĤ	534.4	50 15	R2 R2	clean
										-		534.6	80	R3 R3	clean
	415	$    \rangle$										534.8	30	R3	trace white mineral
	-	/									V.	535.6	70	R3	sand
		f	111								M	536.3	80	R3	clean
	-	l i <b>k</b> i i	111	ii			FD1	98	98			536.9	80 80	R3 R2	trace white mineral
	420-	$      \lambda $								(Fracture	$\parallel \parallel$	537.5	70	R2 R2	dean
										,	KIG	537.9	75 80	R2 R2	clean clean
		Ī					EDO	60	0		$\mathbb{M}$	538.5	55 85	R2 R2	clean clean
		<b>†</b>	111	i i	H5		FD5	00	0		MF	538.8	85 85	R2 R2	clean
	425-		111	i i							11/	- 539.3 - 539.5	65 70	R3 R3	trace white mineral clean
	1 3						FD3	100	89		M/	539.7 539.8	75 75	R3 R3	clean clean
	-										N?	540.0 540.9	15 20	R3 R3	trace white mineral trace white mineral
	130											- 540.5 540.9	70 60	R2 R2	clean trace white mineral
	430	1	A L L								MIA	540.8 541.2	30 60	R3 R2	clean trace white mineral
	-		<b>N</b>				FD5	96	49	T		541.4 541.6	20 80	R2 R3	trace white mineral trace white mineral
			-   <del> </del>							Ipcpmn	$\sim$	541.8 542.2	85 80	R3 R3	trace white mineral trace white mineral
	435-		141							(Fracture Fill)		- 542.3 542.8	80 85	R3 R3	trace white mineral trace white mineral
			$\sum$							,		543.0 543.5	80 10	R2 R2	trace white mineral clean
			-i H	i i								543.7 543.9	85 80	R3 R2	trace white mineral clean
			- H   <b>1</b>		H4		FD3	100	77	Tpcpmn	· · ·	544.3	85 85	R2 R3	1 to 2 mm clay clean
	440-		╎╎╋									545.0	85 50	R3 R2	trace white mineral
	-		łłł								•••	- 545.7	10 10	R2 R2	clean
			44		H5			67		(Fracture Fill)	IJÌ	546.8	80 50	R2 R2	1 mm clay 1 mm clay
	415										0.0	547.0	75	R2 R3	1 mm clay clean
	++0		- T i	I İ I I			EDe	0-			••• •	-		1.5	
							סטק	95	6		0.0	* Angles	are measured	from core	axis and are plus or minus
			1												
	450		$ \mathbf{X} $							Tpcpll	0.0	÷-			
	-			, i i							°0°				
			/-									+- 			
	-		$\pm N$								0.0	×			
	455			<b>ì</b>	H4			96	48			2 			
											(/ )	E			
			X				EDE				1::/:	È.			
			4				103	400				·E			
	400-		-1					100	67	- ·	1/ 1	F			
			Ī							I pcpln	1.	Ē			
								100	30		/:				
	465		- i i }								1. 1	1_			
1			- 4								1.	F			
				1.1	1					l	1 1/2 1	·-			

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 8 of 11)

		GEOLOG		OG	OF [	DRIL	L H	OLE	JE-25 RF#	#14 SHEET 9 OF 11
FEATURE: Waste Handling Fa LOCATION: ESF North Portal I BEGUN: 9/13/2000 FINISHE DEPTH TO WATER: Not Enco	acility Pad D: 9/27/2 puntered	2000		PROJ COOI TOTA DEPT	iect: Rdina 1L dep 1H to i	Yucca TES: TH: 5 BEDR(	Moun N 765 550.0 ft DCK:	tain Proje 5,308.73 t 101.8 ft	ct E 571,065.44	STATE: Nevada GROUND ELEVATION: 3651.52 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
			EN	GINEER	ING					
NOTES	DEPTH		HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	470				FD5	100	39			
	475				FD4	100	69			
	485	ļ			FD3	98	76			
	495		H4		FD4	100	55	Tpcpln		
	505					100	45			
	515	, i i i i i i i i i i i i i i i i i i i			FD3	100	88			
	525				FD4	99	54			

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 9 of 11)

		GEOLOGI	CLC	OG C	)F C	RIL	L H	OLE U	JE-:	25 RF#14	SHEET 10 OF 11
FEATURE: Waste Handling Fac	cility			PROJE	ECT:	Yucca	Mour	tain Projec	ct	1 005 14	STATE: Nevada
BEGUN: 9/13/2000 FINISHEE	2ad D: 9/27/200	00		TOTAL	DINA I	TH: 5	N 765 50.0 f	5,308.73 t	E 57	1,065.44	ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	untered			DEPTH	I TO E	BEDRO	DCK:	101.8 ft			HOLE LOGGED BY: USBR/SMF
											REVIEWED BY: Mark McKeown
			ENG	GINEERIN	NG						
					VSITY	VERY		⊢			
NOTES	SHE	EAR WAVE VELOCITY	ss		ZE DE	RECO				A	ND PHYSICAL CONDITION
	HTH		RDNE		ACTUI	CORE	gg	OLOG	APHIC		
	1000 DE	2000 2000 2000 2000 2000 2000 2000 200	Η	ME	Ŗ	%	% Е	- B	В	-	
		$\rightarrow$	H4		FD4	99	54		1.7	Ē	
	530			-					ŀ./•.	E	
		4							1.	Ę	
									(; ;/;	E	
	535	· · · · · · · · · · · · · · · · · · ·	H6		FD6	100	18		/	F	
	1 1								ŀ. ŀ	Ē	
								TpcpIn	/ ·	E	
	540			-	_				1. j.	É.	
		ł							(. <sub>(</sub> , ,	E.	
									1	Ē	
	545		H4		FD5	100	36		(; <sub>/</sub> ,	<u>-</u> -	
	]:								//	Ę	
									ŀ. [:	E	
	550	B0		M OF H	OLE				<u> </u> ,	<u>-</u>	

Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 10 of 11)



Figure 1.1-96. Geologic Log of Drill Hole UE-25 RF#14 (Sheet 11 of 11)

		GEOLOGI	C LO	)G	OF [	DRIL	L H	OLE	UE-25 RF#15 SHEET 1 OF 7
FEATURE: Waste Handling Fac	ility			PRO	JECT:	Yucca	a Moun	tain Proje	ect STATE: Nevada
BEGUN: 8/30/2000 EINISHED	'ad )∙ 9/11	1/2000		TOTA		TES: THES: 3	N 765	o,773.64	E 570,224.85 GROUND ELEVATION: 3680.98
DEPTH TO WATER: Not Encou	ntered	1		DEPT	тн то і	BEDR	OCK:	5.0 ft	HOLE LOGGED BY: USBR/SMF
									REVIEWED BY: Mark McKeown
			EN		ING				
					È	ž			
NOTES					DENS	OVE		LN LN	CLASSIFICATION
NOTES		ft/s	ESS	Q	LINE C	RE		S] GIC L	⊇ AND PHYSICAL CONDITION
	PTH		RDN	IDI	RACT!	COR	R dB	OSU	H H H H H H H H H H H H H H H H H H H
Duran (III)	ä	- 100 - 200 - 200 - 200 - 200 - 200 - 200 - 200	ž	3	Ľ.	%	%	ö	
Purpose of Hole: Preliminary, conceptual-level	-								0.0 to 5.0 th PAD FILL (Fill)
investigations for the design of	-					0		Fill	of nonplastic fines on gravel surfaces; derived from moderately to
the waste handling facility.	-								
Drill Equipment:	5 -				FD7	67	0		NONLITHOPHYSAL ZONE (Tpcm)
Schramm T685 Drill Rig, UDR 1000 Drill Rig	-					44			tuff with 15 to 20% phenocrysts of plagioclase, sanidine,
Drillers:	-				FD6	92	30		up to 10% of the tuff, pumice clasts increase to up to 25 to
D. Harrison, R. Mckay, D. Fyffe; Dynatec Drilling Inc.: Salt Lake	10								hard (H4), moderately to slightly weathered (W4), and intensely
City, Utah.	-								erosional), lower contact is conformable.
Drilling Method: Install 12 in, hammer, Hammer to	-				FD4		60		Discontinuity Measurements:
5.03. Cement 10.75 O.D. casing with 1.38 stickup. Re-enter hole									Depth Angle* Roughness Infilling
on 8/30/2000 with PQ coring system. Cored with PQ to 77 16	15-								6.8 65 R2 1.0 in. calcite
Used PQ rods as casing and						0	-		
Cored with HQ to the total depth	-								→ <u>4</u> 9.2 70 R2 0.25 in calcite
Drilling Conditions:	20-						58		0, 13.7 40 0.1 in. clay and sand
77.16 to 289.26 replace bit.	20				FD6				18.0 10 R3 0.3 in. calcite and clay
Drilling Fluid:	-								→ 17.8 70 R2 clean P 18.5 65 R2 clean
5.03 to 330.00: Quick Gel mud	-						36		19.0 35 R2 clean 20.0 05 R2 0.75 in calcite
re-establish circulation.	25-								22.4 55 R3 clean 24.5 30 R2 0.25 in clay
Loss Intervals:	-	1 1 1 1 1 1 1 1 1 1 1 1 <b>4</b> 1 1 1 1 1 1 1				100	0		24.8 50 R3 <0.1 in. gray noncrystalline 25.1 60 R2 <0.1 in. gray noncrystalline
Lost circulation from 51.00 to 330.00.	-		H4				87	Tpcrn	26.6 70 R3 clean 27.1 60 R3 trace iron
Casing Record:	-				EDA				28.4 25 R3 quartz and clay 29.0 40 R3 clay
0.00 to 4.63: 10.75 O.D. casing. 0.00 to 77.16: PQ casing	30-						65		29.3 30-90 R3 calcite? and clay 32.6 - 32.8 15 R3 guartz and clay
77.16 to 330.00: No casing	-								D ↓ 1 34.5 - 35.3 20 R3 clay and pumice 34.4 90 R3 clean
Hole Completion: Ream hole from 5.03 to 330.0.	-								34.9 90 R3 clay and pumice 
Set and cement 4.5" PVC casing.	35-	╡ : : <b>╆</b> : <b>:</b> : : : : :					01		43.4 - 43.8 10 R3 clean 49.3 - 49.5 45 R2 trace clay
	-						04		<ul> <li>✓ 49.6 - 50.3 5-10 R3 trace clay</li> <li>✓ 49.6 - 49.9 10 R3 clean</li> </ul>
	-				FD3				53.1 45 R3 trace clay 55.1 - 57.8 0-5 R4 white mineral, clay
	-								P = 59.6 - 59.7 5 0 R3 clay ■ 61.7 - 62.1 10 R3 trace clay
	40 -						80		65.6 - 66.7 10 R3 breccia zone 65.3 65 R3 sand
	3	<b>       †              </b>							67.7 65 R3 0.1 in. vapor-phase coating 68.8 70 R2 0.1 in. vapor-phase coating
	-				ED7	86	0		Sand 69.8 30 R3 0.1 in. quartz, sand
	45-								O         70.5         30         R2         sand           O         68.4         80         R1         vapor-phase parting
	-	<u> </u>    <b> </b>    <b> </b>				84	47		
					FD3				C 72.8 50 R3 0.1 in. vapor-phase
	-				FD7	100	0		Clean (3.2 55 R3 Clean 74.1 - 74.4 40 R3 0.2 in. breccia-clay, sand, gravel
		<u> </u>			1.01		Ľ		

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 1 of 7)

NOTE: All measurements are in feet unless noted otherwise. No attempts to re-establish circulation were made below 278 ft. LCM (Lost Circulation Material) consists of cellophane cuttings. USCS classifications were determined in the field, with limited access to samples to keep samples intact for future tests. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. USCS soil classifications are based on USBR 5005-86, *Procedure for Determining Unified Soil Classification (Visual Method)*.

RQD = rock quality designation; USCS = Unified Soil Classification System.

1.1-454

	GEOLOGIC LOG OF DRILL H           FEATURE:         Waste Handling Facility         PROJECT:         Yucca Mount           LOCATION:         ESF North Portal Pad         COORDINATES:         N 765										-25 RF#15 SHEET 2 OF 7
	FEATURE: Waste Handling Far LOCATION: ESF North Portal F BEGUN: 8/30/2000 FINISHEI DEPTH TO WATER: Not Encou	cility Pad D: 9/11 untered	/2000		PROJ COOF TOTA DEPT	iect: Rdinat IL Dep' 'H to e	Yucca TES: TH: 3 BEDR(	Moun N 765 30.0 ft DCK:	tain Proje 5,773.64 t 5.0 ft	ct E 570	STATE: Nevada 370,224.85 GROUND ELEVATION: 3680.98 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
				EN		ING					
	NOTES	рертн		HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
						FD7 FD8	100	0			74.6 - 74.7 40 R3 0.1 in. breccia - clay, sand, gravel 75.0 25 R2 clean 76.0 30 R2 fine gravel 77.6 45 R3 trace white mineral 78.3 55 R3 trace white mineral
		33				-	97	11			✓         78.8         70         R3         0.1 in. calcite           ✓         79.5         65         R3         clean           ✓         80.1         25         R2         1.75 in. sand, gravel, calcite           ✓         80.6         35         R2         trace calcite           ✓         80.8         70         R3         trace calcite           ✓         82.3         55         R3         clean
		60				FD7	80 86	0			82.7         85         R3         trace calcite           83.2         60         R3         trace calcite           83.6         60         R4         trace calcite           85.1         55         R3         1 mm crystal calcite, quartz?           85.3         30         R3         1 mm calcite and clay           4         85.7         55         R3         clay and trace calcite
		65	<b> </b>			-	100	40	Tpcrn	0,	78.0 to 196.0 ft TIVA CANYON TUFF UPPER CRYSTAL
		05				FD6	96	0		р. О	Proclastic flow, densely welded, pale reddish-brown tuff with up to 10% lithophysae with light gray crystal coatings. Phenocrysts compose less than 5% of the tuff, consisting 
		70 -				FD4		61			<ul> <li>content decreases to less than 5%, becoming mostly grayish vapor phase mottling. Generally the tuff is moderately hard (H4), moderately to slightly weathered (W4), and intensely to mostly moderately fractured (FD5). Lower contact is conformable.</li> </ul>
								82		.0,	Discontinuity Measurements:
		75				FD6	100	0			93.0 35 R3 2 mm calcite 93.2 80 R3 trace white mineral 93.4 80 R2 trace white mineral 93.4 80 R2 ann
		80		H4		ED5		46		0,0,0,0,0,0	4         95.6         30         R3         trace white mineral           101.0         35         R3         trace white mineral           -         105.6         50         R3         clean           -         108.0         25         R3         clean           -         109.4         45         R3         -           -         109.4         45         R2         -           -         109.4         60         R2         clean
		85				103	94	80			Image: Constraint of the constraint of the
						FD3				0,	122.9 10 R2 clean 123.9 30 R3 1 mm white mineral, sand 129.4 40 R3 4 mm white mineral 130.1 90 R2 1 mm white mineral ↓ 132.4 30 R3 1 mm white mineral
		90 -				FD7	43	0		0,00	3         131.7         75         R3         1 mm white mineral           1         132.9         60         R2         sand, gravel           1         138.4         40         R2         sand, gravel
									Tpcpul		
222		90	<u>f</u>			FD4	85	28			Image: 147.2         70         R2         2 mm white mineral           Image: 147.6         90         R2         clay and sand
11			i i <b>f</b> i i i i i i i				53			0,0	Op         153.0         40         R2         Clay and sand shear zone           2         153.8 - 154.2         25         R3         1 mm white mineral           2         155.3         85         R3         trace clay (grav)
2011/10/0		100				FD7	84	0			1560 - 157.4         0-5         R3         trace while mineral           157.4         70         R2         1 mm white mineral           159.2         35         R3         1 mm white mineral           4         160.5         15         R2         1 mm white mineral           4         160.5         15         R2         1 mm white mineral, sand           4         160.5         15         R2         1 mm white mineral
5		105	1			FD8	100			0.0.0	→ 164.8 30 R3 1 mm white mineral → 165.8 20 R2 sand → 167.6 90 R2 2 mm vapor-phase minerals
*****						FD7	88	10			Image: Weight of the second

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 2 of 7)

	GEOLOGI	C L	OG (	OF D	DRIL	L H	IOLE I	UE-	25 RF#15 SHEET 3 OF 7
FEATURE: Waste Handling Fac		PROJ		Yucca	a Mour	ntain Proje	ect	STATE: Nevada	
BEGUN: 8/30/2000 FINISHEI		TOTA		TH: 3	330.0 f	t	E 570	ANGLE FROM HORIZONTAL: -90°	
DEPTH TO WATER: Not Encou	untered		DEPT	н то е	BEDR	OCK:	5.0 ft		HOLE LOGGED BY: USBR/SMF
		EN	GINEERI	ING			1		
			NDICES	Σ	×				
NOTEO				ENSI-	OVER		Ш		CLASSIFICATION
NOTES	ft/s	ESS	g	URE	EREC		SSICU	2	AND PHYSICAL CONDITION
	DEPTH 000 000 000 000 000 000 000 0	HARDN	VELDII	FRACT	% COR	% RQD	luse	GRAPH	
		-	_	FD7	88	10	0	0,0	- 174.1 40 R3 4 mm white mineral, sand
			-					0.0	→ 175.7 80 R2 1 mm white mineral, sand → 175.7 80 R2 1 mm white mineral, sand → 176.0 20 R3 3 mm guartz
								0.0	179.2         40         R2         trace white mineral           180.6         30         R2         trace white mineral
	115				92	59		0,00	L 181.0 25 R2 trace white mineral, sand 181.8 70 R2 5 mm vapor-phase alteration 183.0 R3 trace white mineral sand
								0.0	183.2 25 R3 trace white mineral, sand 184.1 20 R3 trace white mineral, sand
								0.0	186.0         60         R2         trace white mineral, sand           186.0         30         R3         trace white mineral, sand
	120			FD4			1	0,00	E 186.5 15 KZ 2 mm white mineral 187.3 75 R3 1 mm white mineral E 189.0 30 R3 1 mm white mineral
								0.0	190.6 85 R2 2 mm vapor-phase alteration 190.8 70 R2 clean
	1 <del>1</del> <b>/</b>							.0 0	190.9 70 R2 trace vapor-phase alteration 191.0 30 R3 1 mm white mineral
	125				86	46		0.0	$\sim$ 195.1 70 R2 1 mm vapor-priase alteration $\sim$ 195.1 25 R3 1 mm white mineral, sand $\sim$
								0.0	196.0 to 242.4 ft TIVA CANYON TUFF MIDDLE NONLITHOPHYSAL ZONE (Tpcpmn)
								0	<ul> <li>Pyroclastic flow, densely welded, pale red tuff with less than 5% flattened pumice and less than 1% lithophysae.</li> </ul>
	130							0.0	<ul> <li>Prenotysis content is less than 1% composed of plagioclase, sandine, and biotite. From 242.4 to 256.6 ft, the tuff contains up to 30% lithophysae, some larger than core</li> </ul>
								0,00	diameter. From 256.6 to 330.0 ft, the tuff has less than 1% lithophysae and pumice clasts. There is a clayey breccia
						71		0.00	<ol> <li>zone from 276.2 to 280.3. Generally the tuff is hard (H3), moderately to slightly weathered (W4), and moderately to slightly fractured (ED4)</li> </ol>
	135					/ .		0.0	Discontinuity Measurements:
	<u> </u>							0.0	Depth Angle* Roughness Infilling     106 5 55 P2 3 mm upper phase alteration
					100			0.0	198.1 15 R2 1 mm white mineral 197.3 30 R3 0.5 in white mineral
	140	H4					Tpcpul	0.0	gravel breccia 198.8 30 R3 1 mm white mineral
								0.0	
				FD3		66		0.0.0	202.7 75 R2 2 mm vapor-phase alteration 203.1 75 R2 10 mm vapor-phase
	145					00		0.0	E 203.6 20 R1 trace white mineral 2 204.8 20 R3 trace white mineral sand
								0,0	gravel 205.6 15 R3 1 mm white mineral
								0.00	1         206.0         25         R3         1 mm white mineral           209.1         85         R2         4 mm vapor-phase alteration           208.4         45         R2         4 mm vapor-phase alteration
	150							0.0	$\sim$ 207.7 15 R2 12 mm white mineral, sand $\sim$ 207.0 20 R2 4 mm white mineral, sand
								0.00	216.0 25 R3 1 mm white mineral 212.0 05 R2 1 mm white mineral
					99	86		0.0	212.5 15 K2 1 mm white mineral 213.2 75 R2 3 mm vapor-phase alteration 214.3 15 R2 1 mm white mineral sand
	155							0,0	214.6 80 R2 3 mm vapor-phase alteration 215.5 30 R2 trace white mineral
								0.0	L 216.1 30 R3 1 mm white mineral     216.3 30 R3 1 mm white mineral     16.4 15 R3 1 mm white mineral
	<u>-</u>							°,0°,	217.0 10 R2 1 mm white mineral 217.8 30 R3 1 mm white mineral sand
	160							0.0	218.1 20 R3 1 mm white mineral 218.7 70 R2 6 mm white mineral
								0.0	2 220.1 20 R3 10 mm white mineral 221.8 10 R3 trace white mineral 221.9 45 R3 8 mm white mineral
					95	59		000	224.7 10 R2 trace white mineral 225.9 70 R3 trace white mineral
				FU4				0,0,0	228.3         80         R3         5 mm vapor-phase alteration           231.2         85         R3         3 mm vapor-phase alteration
	∃::: <b>∦</b> ::::							0.0	r 230.5 /0 R3 clean − 231.7 70 R2 1 mm vapor-phase alteration − 233.9 55 R2 clean
							-	0,0	234.3 30 R2 2 mm white mineral, trace MnO(?)

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 3 of 7)

1.1-456

## **GEOLOGIC LOG OF DRILL HOLE UE-25 RF#15**

PROJECT: Yucca Mountain Project COORDINATES: N 765,773.64 E 570,224.85 TOTAL DEPTH: 330.0 ft DEPTH TO BEDROCK: 5.0 ft

SHEET 4 OF 7

STATE: Nevada GROUND ELEVATION: 3680.98 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown

ł				EN	IGINEEF	RING					
	NOTES	DEPTH		HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
		170-					96	55			234.7         10         R3         2 mm white mineral, trace MMO(?)           235.4         25         R3         trace white mineral, trace iron           235.7         20         R3         1 in. white mineral, 1 mm MnO           236.8         40         R2         clean           237.1         20         R3         2 mm white mineral           239.1         30         R2         1 mm white mineral           240.6         40         R3         2 mm white mineral, 1 mm MnO           241.9         85         R2         sand, gravel
		180-				FD4	98	63	Tpcpul		242.4 to 256.6 ft TIVA CANYON TUFF CRYSTAL POOR LOWER LITHOPHYSAL ZONE (Tpcpi) Pyroclastic flow, densely welded, devitrified, moderate orange pink tuff with rare light gray pumice. Phenocryts of sanidine and rare biotile compose less than 1% of the rock by volume. Lithophysal cavities compose 15 to 20% of the rock by volume with some larger than core diameter. Lithophysae are filled and coated with vapor phase minerals to varying degrees. Generally the utif is hard (H3), slightly weathered (W3), and slightly to very slightly fractured (FD2). Lower contact is conformable. Discontinuity Measurements:
						FD7	73	0		0.0.0	– Depth Angle* Roughness Infilling – 243.2 60 R2 2 mm white mineral – 244.9 15 R3 2 mm white mineral
		190-				FD4	96	66			244.3 75 R2 5 mm vapor-phase alteration     249.6 80 R2 1 mm vapor-phase alteration     249.6 80 R2 1 mm gray mineral     250.3 80     250.6 85     256.5 10 R3 trace white mineral     256.6 to 330.0 ft TIVA CANYON TUFF CRYSTAL POOR     LOWER NONLITHOPHYSAL ZONE (TpcpIn)     Pyroclastic flow, densely welded, devirified, pale red tuff with     less than 1% link rary numice clasts. Phenographs of
		200	Ţ.	H4		FD5	95	49			sandine and plagicolase compose less than 1% of the rock by volume. Medium gray lithic clasts compose less 1% of the rock by volume. Clast supported breccia from 276.2 to 280.3 ft. Generally the tuff is moderately hard (H4), slightly weathered (W3), with fracture densities mostly moderately fractured (FD4) to some intensely fractured (FD7) zones. Lower contact undetermined, bottom of borehole at 330.0 ft.
		205									Discontinuity measurements. — Depth Angle* Roughness Infilling 259,7 10 R1 trace white mineral
						FD7	96	28			- 260.7 10 R2 trace white mineral 261.7 70 R3 trace white mineral, MnO 263.1 35 R2 trace white mineral - 264.4 85 R2 trace white mineral
		210-				FD4	98	39	Tpcpmn		264.5         60         R2         trace white mineral           267.2         10         trace white mineral           266.5         40         R3         trace white mineral           267.4         25         R2         trace white mineral           269.5         30         R2         trace white mineral           270.7         65         R3         trace white mineral           271.1         60         R2         trace white mineral           271.3         70         R3         trace white mineral           272.3         85         R2         trace white mineral           272.4         80         R3         trace white mineral           272.3         85         R3         trace white mineral           274.1         85         R3         trace white mineral           274.1         85         R3         trace white mineral           275.3         30         R3         trace white mineral           276.0         40         R2         trace white mineral           276.1         25         R3         trace white mineral           276.3         30         R3         trace white mineral           276.1         <
2			1			FD6		0		•••••	280.6 10 R3 trace MnO and vapor-phase mineral 280.9 80 R3 trace MnO
····		225				FD4	100	69			283.7         65         R3         trace vapor-phase mineral           284.2         25         R3           285.1         55         R3           285.2         75         R3           286.2         60         R3         vapor-phase minerals           286.3         30         R3         trace vapor-phase minerals           286.8         25         R3         trace vapor-phase minerals           287.1         55         R3         trace vapor-phase minerals

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 4 of 7)

FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad

BEGUN: 8/30/2000 FINISHED: 9/11/2000 DEPTH TO WATER: Not Encountered

DOE/RW-0573, Rev. 0

	GEOLOGIC LOG OF DRILL H FEATURE: Waste Handling Facility PROJECT: Yucca Mour COOPENATES: N 28										JE-2	25 RF#15			SHEET 5 OF 7
FEATURE: Waste Handling Fa	PRO.	JECT:	Yucca	a Mour	itain Proje	ct		STATE:	Nevada						
LOCATION: ESF North Portal F	Pad ⊡∙ q/1 <sup>,</sup>	1/2000				COOL	RDINA	TES: TH· '	N 765	5,773.64 H	E 570	),224.85			: 3680.98 
DEPTH TO WATER: Not Encou	untered	1				DEPT	TH TO	BEDR	DCK:	5.0 ft			HOLE LO	GGED BY: 1	JSBR/SMF
													REVIEWE	D BY: Mark	McKeown
					EN		RING								
							È	RY							
NOTES				OCITY			DENS	COVE		± z			CLAS	SIFICATIC	N
NOTES		SHEAR W	ft/s	UCITI	ESS	g	L H	REC		gic n	Q	A	ND PHYS	ICAL CON	DITION
	PTH			~ ~	RDN		ACTI	CORI	RQD	l nsc	RAPH				
	ă -	100 - 1	200	08 00	Ì	3	Ë	%	%	ö	5	- 200.2	60	D2	vanar phana minarala traca
	230								69			- 200.3	95	R3 D2	calcite
	1 3		×								•••	289.3	35 60	R4 R4	1 mm quartz
				i i I I								290.2	30 55	R4 R3	
	225						FD4	100	54		•••	293.0	45 75	R4 R4	trace vapor-phase minerals
	200								54	Tpcpmn	•	294.8			core broken on corroded
			11								•	- 295.7 296.3	25 65	R4 R3	trace vapor-phase minerals
	-										•	297.3 298.9	20 25	R4 R3	trace vapor-phase minerals vapor-phase minerals
	240		i iti				-					299.5	85	R4	trace MnO, vapor-phase minerals
	3		-† I†i									2 300.3 304.3	80	R4	core broken on pumice clast possible mechanical break
											0.0	308.5	60	R3 R4	vapor-phase minerals
	245-		_i ∦i				FD2	99	80		.°°°	- 313.0	15 80	R4 R3	trace vapor-phase minerals
	-										0.0	- 314.5	85 80	R3 R3	trace who, calcite trace vapor-phase minerals trace MnO, vapor-phase
											° ° °	- 314.0	85	R3	minerals
	-		i [ i							Tocoll	0.0		70 20	R3 R4	trace vapor-phase minerals patchy calcite, trace MnO
	250						-			1 popii		317.1	85		core broken on argillically altered pumice
											0.0	- 317.6 318.3	10 80	R3 R3	patchy calcite, trace MnO 3 mm botryoidal silica, 3 mm
			1	i i I I							,°0	319.1	15	R2	clay 3 mm silica, most euhedral,
	255				H4		FD3		79		0.0	-			some botryoidal, some smooth
	-		.¦¦∖								-70	- 319.9 - 320.5	55 45	R2 R4	1 mm silica, 1 mm clay 2 mm silica, trace clay
											1/1	322.5 * Angles	80	K4	patchy silica and clay
			4								(. /.	5 degree	es.		axis and are plus or minus
	260-										/	-			
	-		$\pm 1$								<i> .  </i>	-			
			.¦∦Ī								(· / · .	-			
	265		111				FD2	100	68			-			
	1 3									Tpcpln	/:./:	-			
			- i i i									-			
	270										1.1	-			
	-		1 i i i								/ /	-			
												_			
	-										<i> .  </i>	-			
	275						FD3		80		( /	 			
	3		Į								Ľ4				
	-		1							(clayey breccia)		-			
	280-		11							, 	4	F			
	-		11								$\left  \left( \cdot \right) \right $	-			
	3		i t								<i>!::/:</i>	-			
			- <b>-</b> (		НЗ		FD4	99	84	TpcpIn		-			
	285		ł								1. 1	-			
1	-		_i i↓i								ŀ :/·	-			
:		<u>         </u>	- I - I - İ	1.1							11	-			

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 5 of 7)



Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 6 of 7)

		GEOLOGIC	LOG OF DRI	LL HOLE UI	E-25 RF#15	SHE	ET 7 OF 7			
FEATURE: Was LOCATION: ES BEGUN: 8/30/20 DEPTH TO WAT	ste Handling Facility F North Portal Pad 000 FINISHED: 9/1 ER: Not Encountered	1/2000 d	PROJECT: Yucc COORDINATES: TOTAL DEPTH: DEPTH TO BEDR	a Mountain Project N 765,773.64 E 5 330.0 ft OCK: 5.0 ft	ST/ 70,224.85 GR AN HO RE	ATE: Nevada OUND ELEVATION: 3680.98 GLE FROM HORIZONTAL: -5 LE LOGGED BY: USBR/SMF VIEWED BY: Mark McKeown	8 10° =			
				SOIL						
				(made ground)						
				ROCK						
	Tpcprn	Tpcpul	Tpcpmn	Трср	II Трср	oln Breccia	1			
				0.00						
	00			0 0 0						
			De	VELDING Insely Welded						
Alphanumeric	Descriptor	Criteria		Alphanumeric	WEATHERING Descriptor	General characteristic	s			
H1	Extremely	Core, fragment, or exposed be scratched with knife	sure cannot or sharp pick;	W1	Fresh	Hammer rings when crys struck. Almost always	talline rocks are rock excavation			
112	Voru Hand	can only be chipped with hammer blows.	n repeated heavy			except for naturally w cemented rocks such as shales.	eak or weakly siltstones or			
112	very nard	pick. Core or fragment h repeated heavy hammer b	preaks with lows.	W2	Slightly weathered to fresh					
НЗ	Hard	Can be scratched with kn pick with difficulty (he Heavy hammer blow requi: specimen	nife or sharp eavy pressure). red to break	W3	Slightly weathered	Hammer rings when crys struck. Body of rock n few exceptions, such a shales classified as	talline rocks are ot weakened. With is siltstones or rock excavation			
Н4	Moderately Hard	Can be scratched with kn pick with light pressure	nife or sharp e. Core or	W4	Moderately to slightly weathered	· · · · <b>,</b> · · · · · · · · ·				
Н5	Moderately Soft	Can be grooved 1/16 in.	(2 mm) deep by	W5	Moderately weathered	Hammer does not ring w Body of rock is slight Depending on fracturin	hen rock is struck. ly weakened. g. usually is rock			
		sharp pick with moderate Core or fragment breaks blow or heavy manual pre	e or heavy pressure with light hammer essure.			excavation except in n such as siltstones or	aturally weak rocks shales.			
Нб	Soft	Can be grooved or gouged or sharp pick with light scratched with fingerna	d easily by knife t pressure, can be	W6 W7	Intensely to moderately weathered Intensely weathered	Dull sound when struck	with hammer.			
Н7	Very Soft	light to moderate manual Can be readily indented,	grooved or gouged			usually can be broken heavy manual pressure blow without reference	with moderate to or by light hammer to planes of			
		With fingernail, or car Breaks with light manual	vea with a knife. l pressure.			weakness such as incip fractures, or veinlets significantly weakened excavation.	lent or hairline . Rock is 1. Usually common			
				W8	Very intensely weathered	······				
				W9	Decomposed	Can be granulated by h excavation. Resistant guartz may be present	and. Always common minerals such as as "stringers" or			
			FRACTU	RE DENSITY		"dikes."				
	Alphanum descript	eric Descriptor or	Criter (Exclu	ia des mechanical b	reaks)					
	FDU FD1	UNITACTURED Very slightly f	No obs ractured Core r	erved fractures. ecovered mostly	in lengths greater tha	an 3 ft (1 m).				
	FD2	Slightly to ver slightly fractu	y red							
	FD3	Slightly fractu	red Core r scatte	ecovered mostly ared lengths less	in lengths from 1 to 3 than 1 ft (300 mm) or	3 ft (300 to 1,000 mm) w r greater than 3 ft (1,0	ith few 00 mm).			
	FD4	Moderately to since the fractured	lightly							
	FD5	Moderately frac	tured Core r length	ecovered mostly about 0.67 ft	in lengths from 0.33 t (200 mm).	to 1.0 ft (100 to 300 mm	) with most			
	FD6	Moderately to in fractured	ured I on	e suersee from O	1 to 0 33 ft /20 to 7	100 mm) with from ont	intervals			
	FD8	Verv intenselv	to	ecovered mostly	in lengths less than (	D.33 ft (100 mm).	INCELVELS.			
	FD9	inténsely fract Very intensely	ured fractured Core r	red Core recovered mostly as chips and fragments with a few scattered short core leng						

Figure 1.1-97. Geologic Log of Drill Hole UE-25 RF#15 (Sheet 7 of 7)

		GEOLOGIC L	.0G	OF	DRIL	L H	IOLE I	UE-2	25 RF#16 SHEET 1 OF 9
FEATURE: Waste Handling Fac	cility		PRO		Yucca	a Mour	ntain Proje	ect	STATE: Nevada
BEGUN: 6/26/2000 FINISHEE	au D: 8/7/	/2000	тоти		PTH: 4	452.8 f	t	L 570	ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	Intered	t	DEPT	гн то	BEDR	OCK:	75.7 ft		HOLE LOGGED BY: USBR/SMF
									REVIEWED BY: Mark McKeown
		E		RING					
				LIS	R				
NOTES		SHEAR WAVE VELOCITY		DEN	COV		LINU		CLASSIFICATION
		ft/s S	Ş	R	E RE		SIG	₽	AND PHYSICAL CONDITION
	EPTH	ARDN	ELD	RACT	COR	RQD	LUS(L	RAPH	
PURPOSE OF HOLE:		T 900 C 10 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	5	u.	%	%	Ű	0	- 0.0 to 22.4 ft PAD FILL (Fill)
Develop geologic design data	3							60	L 0.0 - 22.4: POORLY GRADED GRAVEL (GP)
facility foundation parameters	-				0			6	<ul> <li>Predominately fine to coarse, hard, subangular gravel with a trace of nonplastic fines on gravel surfaces: derived from moderately to</li> </ul>
	-							ιŇ	<ul> <li>densely welded Tuff; approximately 50% have a spotty very light gray vapor phase coating: noncrystalline less than 2 mm in</li> </ul>
Schramm T685 Drill Rig, UDR	5-					1		Po	thickness; maximum size recovered, 75 mm.
	-							0 0 0	22.4 to 75.7 ft QUATERNARY ALLUVIUM (Qal)
G. Fox, M. Fyffe, D. Harrison;	3				10			Po	22.4 - 25.9: POORLY GRADED SAND WITH SILT AND GRAVEL (SP-SM)g
City, Utah	10-							00	<ul> <li>About 60% coarse to fine sand; about 30% coarse to fine, angular to subangular gravel of welded tuff and felsic phenocrysts, up to</li> </ul>
DRILLING METHOD:	-						Fill GP	50	30 x 30 mm; about 10% silty fines; maximum size recovered, 50mm: brown with white caliche stringers; hard consistency;
Augered to approximately 3.5 ft where boulder was encountered.	3					1		00	weakly cemented with caliche; weak reaction with HCI.
Pulled auger bit and installed 13.75 in. hammer bit. Continued	-				10			60	25.9 - 33.8: POORLY GRADED GRAVEL WITH COBBLES
with hammer to 4.9 ft. Cemented casing with 1.11 ft stickup.	15-				10			0	<ul> <li>About 90% coarse to fine, hard, angular to subangular gravel of welded tuff, approximately 70% with spotty caliche coatings;</li> </ul>
Re-entered hole with PQ coring system. Cored with PQ to 97.6 ft.	3							$\circ$	about 10% fine to medium sand; several fine-grained caliche fragments; loosely cemented. Total interval (by volume)
Used PQ rods as casing and installed HQ coring system.	-				0			6	approximately 30% cobbles; maximum size recovered, 120 mm.
Cored with HQ to the total depth of 452.8 ft.	20-					1		ιõ	33.8 - 35.2: No Recovery
DRILLING CONDITIONS:	-				0			Po	- 35.2 - 38.1: SILTY SAND WITH GRAVEL AND COBBLES (SM)gc
0.0 to 3.5: Hard, difficult drilling with augers in coarse material	3					1		р ПП	<ul> <li>About 45% predominately fine to coarse, angular to subangular sand; about 35% fine to coarse, angular to subangular gravel of</li> </ul>
3.5 to 4.9: No problems reported.	-				100		Qal		<ul> <li>welded tuff; about 20% silty fines with no dry strength and low plasticity; brown; moist; strong reaction with HCI. Total interval</li> </ul>
characterized by short runs,	25-						(5P-5101)g		<ul> <li>(by volume) approximately 35% cobbles; maximum size recovered, 230 mm.</li> </ul>
out. 66 0 to 223 6: Easier drilling Jess	3				31	1		2	38.1 - 49.8: POORLY GRADED GRAVEL WITH SILT, SAND
blocking off, longer runs.	-				0			Po 1	AND COBBLES (GP-GM)sc About 60% fine to coarse, angular to subangular gravel of welded
characterized by loss of	20-				0		Qal	00	<ul> <li>tuff; about 30% fine to coarse, angular sand; about 10% silty fines</li> <li>with no to low dry strength; light brown; moist; no to strong</li> </ul>
runs.	-	╡╎╢╎╎╎╎╎╎					(GP)c	50	<ul> <li>reaction with HCI. Total interval (by volume) approximately 5%</li> <li>cobbles; maximum size recovered, 90 mm.</li> </ul>
DRILLING FLUID:	=	]   ]			26			60	49.8 - 53.3: SILTY SAND WITH GRAVEL (SM)g
3.5 to 4.9: nonpotable water	3	∃ : <b>↑</b> : : : : : : : ! .						60	About 45% fine to medium sand; about 40% fine to coarse, angular to subangular gravel of welded tuff; about 15% silty fines
4.9 to 452.8: nonpotable water, Hydrogel mud with EZ-Mud and	35-				0			-	<ul> <li>with low plasticity and low dry strength; maximum size recovered,</li> <li>60 mm; light brown; moist; weak to strong reaction with HCl.</li> </ul>
LCM to re-establish circulation.	3				100	1	Qal (SM)gc		53.3 - 56.0: SILTY GRAVEL WITH SAND (GM)s
DRILL FLUID LOSS INTERVALS:	3	∃ ; ; <b>,</b> ; ; ; ; ; ; ; ; ] .					(Givi)ge		About 55% fine to coarse, angular to subangular gravel of welded tuff; about 30% fine to coarse, angular sand; about 15% silty,
11 ft 51 ft	-	]						[•A	<ul> <li>nonplastic fines with low dry strength; maximum size recovered,</li> <li>50mm; light brown; moist; strong reaction with HCl.</li> </ul>
164.6 ft 166 ft	40-				58			Pall	56.0 - 60.4: SILTY SAND WITH GRAVEL (SM)g
227.5 ft 233 ft	-							°.H	<ul> <li>About 50% predominately tine to coarse, angular to subangular sand; about 35% fine to coarse, subangular gravel of Tiva Canyon</li> <li>The following the short of EV with the provided statement of the same statement of the sa</li></ul>
237 ft 245 ft	3				35		Qal	Pall	dry strength; maximum size recovered, 70 mm; light brown, white
250.4 ft 252.5 ft	45-	<b>                         </b>			0	1	(GP-GM)s	۴. A	HCI.
277 ft 278 ft*	=	▋┆╋┆┆┇┆┆┆┆			91	1		5 H	60.4 - 66.0: SILTY GRAVEL WITH SAND (GM)s
* Remaining hole drilled without	3	▋┆▟┆┆┆┆┆┆┆┆			100			6 Ø	Canyon Tuff clasts; about 35% predominately fine sand; about 15% sitty fines with low plasticity and low dry strength; maximum
circulation	-							₿¶	size recovered, 75 mm; strongly cemented with caliche, breaks
		<u> </u>	1			1		1-1711	

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 1 of 9)

NOTE: All measurements are in feet unless noted otherwise. No attempts to re-establish circulation were made below 278 ft. LCM (Lost Circulation Material) consists of cellophane cuttings. USCS classifications were determined in the field, with limited access to samples to keep samples intact for future tests. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. USCS soil classifications are based on USBR 5005-86, *Procedure for Determining Unified Soil Classification (Visual Method)*.

RQD = rock quality designation; USCS = Unified Soil Classification System.

		GEOLOGIC	LC	)G (	OF [	DRIL	L H	OLE	UE-2	25 RF#16 SHEET 2 OF 9	
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 6/26/2000 FINISHED DEPTH TO WATER: Not Encou	cility Pad D: 8/7/ untered	/2000 1	ן ( -	PROJE COOR TOTAL DEPTE	ECT: DINA DEP H TO I	Yucca TES: TH: 4 BEDR(	Moun N 765 52.8 ft DCK:	tain Proje ,055.54 75.7 ft	ect E 570	STATE: Nevada 9,472.65 GROUND ELEVATION: 3672.03 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown	
			ENG IN	INEERI DICES	NG						
NOTES	DEPTH	SHEAR WAVE VELOCITY	HAKDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
CASING RECORD: 0 to 4.9: 10.75 in. O.D. casing 0 to 97.6: PQ casing	. 1 . 1 .					70 87		Qal (SM)g		only with hammer blow; light brown to pale orange; moist; strong reaction with HCI.	
HOLE COMPLETION: Pulled all casing and left open for future geophysical studies.	55					100 83 100		Qal (GM)s		About 45% predominately fine sand, about 35% coarse to fine, angular to subangular gravel of welded Tiva Canyon Tuff and Tuff X, about 20% silty fines; maximum size recovered, 60 mm; strongly cemented with caliche, breaks only with hammer blow; light brown to pale orange: mosit: strong reaction with HCI.	
						100 94 62		Qal (SM)g		75.7 to 133.2 ft COMBS PEAK [GNIMBRITE - TUFF X [Tpki]: Nonwelded flow, moderately indurated, argillized and partially zeolitized, very pale orange with grayish-orange mottling. The tuff has approximately 20 to 25% pumice, up to 35 x 30 mm in size,	
	- 00					100		Qal (GM)c		with about 10 to 15% volcanic lithic clasts. up to 25 x 25 mm. Rare phenocrysts of sanidine, biotite (bronze), magnetite (7), and manganese oxides. Generally the tuff is moderately MB4 wathered, and soft (H6), slightly (W3) to moderately (WB5) weathered, and unfractured (FD0) to slightly fractured (FD2). Lower contact is unfractured (FD0) to slightly fractured (FD2). Lower contact is	
	65					<del>73</del> 100 100		(UW)S		Discontinuity Measurements:	
						97				75.9 70 R2 calicite 130.1 70 R3 trace iron	
	70-					96		Qal (SM)g		133.2 to 137.8 ft POST-TIVA CANYON BEDDED TUFFS (Tpbt5): Nonwelded, possibly reworked fallout tephra and pyroclastic flows separated by distinct paleosols. The tuff is moderately indurated, devittified, pale yellowish-brown with 10 to 15% pumice clasts (up to 10 x 7 mm), and less than 10% volcanic	
	75-				FD2	100	89			<ul> <li>lithic clasts (up to 4 x 5 mm). The bedded tuffs have about 2% phenocrysts of feldspar, quartz, and biotite. Generally the tuff is moderately hard (H4) to soft (H6), slightly (W3) to moderately (W6) weathered, and unfractured (FD0) to slightly fractured (FD3). Lower contact is unconformable.</li> </ul>	
	80-					98	98			Discontinuity Measurements: <u>Depth Angle* Roughness Infilling</u> 137.0 70 R3 light ash 137.3 60 R3 light ash	
	85					100	100			137.8 to 222.0 ft TIVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tpcrn) Pyroclastic flow, densely welded, devitrified, pale red to grayish-red, with 10 to 15% phenocrysts. Phenocrysts are mostly feldspar and biotite with lesser quartz and pyroxene. Rare purnice clasts from 145.9 to 157.1 ft. and up to 20% purnice clasts from 157.1 to 192.0 ft. The tuff has up to 15% lithophysal cavities from 192.0 to 208.0 ft. Generally	
	90-					97	97			the tuff is moderately hard (H4), slightly (W3) weathered, and slightly fractured (FD3) to moderately fractured (FD5). The lower contact is conformable. Discontinuity Measurements:	
	95		14		FD0	100	100	Tpki		138.3         55         R3         calcite           138.6         80         R3         calcite           140.7-141.1         25         R4         trace calcite           141.6         70         R3         trace calcite           141.6.142.1         25         R3         calcite           141.6.5         80         R2         calcite	
	100					100	100			141.85         80         R2         trace calcite           142.5-         70         R3         trace calcite           142.5-142.8         25         R3         brown mineral           143.7         60         R3         trace calcite           143.6-144.6         20         R4         calcite           144.4         80         R2         none           147.2         85         R2         none           147.8-148         30         P3         none	
	105					99	99			147.0-190.1         50         N3         IU0Re           148.9-149.5         25         R3         none           150.3-151.6         FRACTURE ZONE           153.1-157.1         FRACTURE ZONE           160.3-164.4         FRACTURE ZONE           160.3-164.4         FRACTURE ZONE           162.8 (fault?)         30         R3           165.3         50         R3         clay, sand           165.3         40         R3         trace sand           168.1         50         R3         healed           168.7         90         R3         sand	

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 2 of 9)

		GEOLOGI	C LO	OG (	DF D	RIL	LH	OLE I	UE-2	5 RF#16 SHEET 3 OF 9					
FEATURE: Waste Handling Fac	cility			PROJ	ECT: Y	Yucca	Mour	itain Proje	ct	STATE: Nevada					
LOCATION: ESF North Portal P		COOR		ES:	N 765	5,055.54	E 570,4	172.65 GROUND ELEVATION: 3672.03							
DEPTH TO WATER: Not Encou	J: 8/7/	12000		DEPTH	H TO BI	H: 4: EDRC	52.8 п )CK:	75.7 ft		HOLE LOGGED BY: USBR/SMF					
		-								REVIEWED BY: Mark McKeown					
			EN	GINEERI	NG										
			I	NDICES	≻	≻									
					ISNE	OVER		E							
NOTES		SHEAR WAVE VELOCITY	ŝ		E DE	REC		<u>ک</u>		AND PHYSICAL CONDITION					
	E		DNE	DING	CTUF	ORE	R	[SCS]	DHIC						
	DEP	2000 5500 8000 9000 9000	HAR	MEL	FRA	% C(	% R(	GEO	GRA						
	110-	· · · · · · · · · · · · · · · · · · ·							F	169.7 80 R3 clay 169.8 60 R3 clay					
		<b>.</b>							E	170.1 60 R3 clay, sand 170.6 90 R3 clay, sand					
	-	1     <b>)</b>							E.	171.2 15 R3 sand 171.0-174.6 ERACTURE ZONE					
	115								E	174.6 55 R4 trace clay 175.1 60 R4 none					
	-	<b>1</b>				98	98		ΞĒ	176.0 15 R4 sand 176.8 50 R3 bealed					
	-	]       <b> </b>							談 手	177.8 20 R3 clay, sand 179.3 30 R4 clay, sand					
									BE	179.4 80 R4 sand					
	120-		на		FD0				ĿĿ	180.9 20 R2 clay, sand					
								Tpki	F	185.6 40 R3 sand, trace clay					
									ĿΈ	187.9 60 R3 trace sand					
	-	∃ : : : <b>1</b> : : : : : : : :							E	188.5 20 R3 sand, trace clay					
	125-	∃ ; ; ; <b>†</b> ; ; ; ; ; ; ; ]				100	98		ΕĒ	190.6 65 R3 vapor phase alteration					
									E	191.2 05 R3 none 191.8 40 R3 none					
	-								<u>_</u>	192.0 55 R3 hone 193.3 45 R4 none					
	130-	1 4							躑	193.9 45 R4 trace sand 197.3 30 R4 none					
	-				FD1	82	82		24	197.4 30 R3 Idle 197.6 25 R3 clay					
			H6						E	198.9 25 R4 clay 199.4 55 R4 none					
	-		H4		FD0				E	203.4 50 R3 sand 203.8 50 R3 none					
	135	╡╎ <b>┦</b> ╎╎╎╎╎	Н6			98	98	Tpbt5	l F	204.0 40 R3 none 204.7 35 R3 trace sand					
		]   🕂	H5						ISE.	204.9 30 R3 trace sand 203.4-203.6 25 R3 none					
	-	<b>∃   }            </b>			FD3					203.6 90 R2 none 204.1 90 R3 none					
	140								P E	204.2 90 R3 none 204.6 50 R2 none					
	-								ð,	204.7-204.9 30 R2 none 205.7 45 R3 none					
	-		H4		FD5	100	59		Ē	206.8 45 R3 none 206.8-207.3 FRACTURE ZONE					
	2								PE	208.2-208.9 FRACTURE ZONE 209.3 irreg R2 none					
	145	• • • • • • • • • • • • • • • • • • •		-					E	210.3 70 R2 none 210.5-210.7 10 R3 none					
	-	╡┊┊┊╉┊┊┊┊┊┊							PF	212.1-212.2 30 R2 none 213.7 45 R3 quartz crystals					
		∃ : : : <b>↓</b> : : : : : :			FD3	97	78		L E	216.1 75 R3 quartz crystals 221.0-221.3 25 R4 trace calcite					
	<del>:</del>	∃ : : : <b>X</b> : : : : :	H5						[ef	221.1-221.3 35 R2 none					
	150-				FD8					222.0 to 360.0 ft TIVA CANYON TUFF CRYSTAL POOR UPPER LITHOPHYSAL ZONE (Tpcpul)					
	-		H4		FD2				οĒ	Pyroclastic flow, densely welded, moderate orange-pink with light gray mottling, and about 3 to 5% lithophysae (up to 50 x 50 mm)					
		<b>     </b>				91	24	Tpcrn	P F	with light gray crystal coating. Tuff has approximately 5% pumice clasts (up to 10 x 4 mm). There are less than 5%					
	155-	<b>      }        </b>	H5						pumice clasts (up to 10 x 4 mm). There are uses than 3 /o phenocrysts of plagioclase and sanadine, with less than 1						
									Ē	content decreases to less than 1%. Lithophysae, both filled and unfilled, content increases to 20% at 301.0 ft.					
		<u> </u>       <b> </b>						1	þ E	Generally the tuff is moderately hard (H4), slightly (W4) to moderately weathered (W6), and slightly fractured (FD3) to very					
									0-	intensely fractured (FD9). The lower contact is conformable.					
	160-	1	H4		FD5	97	13			Discontinuity Measurements:					
							.0		io:E	Depth Angle* Roughness Infilling 221.8-224.9 FRACTURE ZONE					
	165- 165- 165-									225.4 55 R4 trace calcite 225.4-225.8 FRACTURE ZONE					
									225.8-226.0 10 R4 trace calcite 225.8-226.1 70 R3 none	225.8-226.0 10 R4 trace calcite 226.1 70 R3 none					
									L \$	226.1-226.7 FRACTURE ZONE 226.7-226.8 40 R3 none					
1	-	<u> </u>       <b> </b>			FD4	97	44		· of	226.9-227.0 FRACTURE ZONE 227.0-227.2 40 R3 none					
									I° E	227.3 80 R2 none					

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 3 of 9)

		GEOLOGI	C L	OG	OF C	DRIL	L H	OLE I	UE-25 RF#16	SHEET 4 OF 9	
FEATURE: Waste Handling Fa	cility			PRO.	JECT:	Yucca	Mour	itain Proje	ect	STATE: Nevada	
LOCATION: ESF North Portal F	Pad			COO	RDINA	TES:	N 765	5,055.54	E 570,472.65	GROUND ELEVATION: 3672.03	
DEPTH TO WATER: Not Encor	D: 8/7/	2000			AL DEP	TH: 4	152.8 t	757#		ANGLE FROM HORIZONTAL: -90°	
DEI III TO WATER. NOT ERCO	untered									REVIEWED BY: Mark McKeown	
			EN	GINEER							
			I	NDICES							
					VSIT)	VER		⊢			
NOTES		SHEAR WAVE VELOCITY	s			ECO		INN		CLASSIFICATION	
	т	103	NES	5NG	I III	RER	۵	ogic si colic	¥		
	DEPT		4ARD	VELD	RAC	% CO	% RQ	LOE GEOL	BRAF		
	170-		-	_	ED4	0.	0.	-	227.7-22	7.8 90 R3 white mineral	
									228.0-22	8.6 15 R3 none 60 R3 none	
	-				-D0	97	44		229.2-22 230.7-23	9.6 20 R3 none 0.9 55 R2 none	
	-				FDo					90 R2 none 1.5 FRACTURE ZONE	
	175-								231.8	45 R2 trace quartz crystals	
	-								232.3	60 R3 trace quartz crystals	
	-			FI	FD5	100	58		235.0-235 235.0-235 235.8 235.8 235.7-236	5.1 45 R3 trace calcite	
	-									6.3 15 R3 none	
	180-				$\vdash$				236.1-23	6.3 25 R3 trace cardie	
									237.9 238.7-23	45 R2 none 8.9 15-20 R2 quartz crystals	
	-								239.2	60 R2 quartz crystals	
	-								240.0	60 R3 none 50 R2 trace iron oxide	
	185-					100	74		240.4	70 R3 none 1.1 10-15 R3 none	
	-		H5						241.2-24 241.8-24	1.7 15 R3 none 3.8 FRACTURE ZONE	
	-								244.5-24	4.7 20 R2 trace calcite 15 R2 none	
	100								248.6	20 R3 trace white mineral 25 R3 trace white mineral	
	190-				FD4				C _ 249.7 251.8	30 R3 none 5 R3 none	
	-								- 252.5	10 R3 none	
	-								255.8	15 R2 none	
	195					100	74		257.5	40 R3 trace sand	
	-					100	74	Tpcrn	259.5	50 R3 none	
	-								263.5 264.5	20 R3 none	
	-								265.9	15 R3 sand, trace clay 60 R3 none	
	200-								<u> </u>	30 R3 clay 20 R3 sandy breccia	
	-					76	0		272.9-27	7.3 FRACTURE ZONE 0 R4 none	
	-					10	0		278.6 279.1	10 R3 none 50 R4 none	
	_				FD6			1	279.2	40 R4 none 25 R3 none	
	205					82	45		280.6-28	4.4 FRACTURE ZONE 4.6 20 R3 none	
	-					02	-10			4.8 45 R2 none 6.6 35 R3 quartz crystals	
	-								287.7	55 R4 clay, quartz crystals	
						76	0		209.3-29	35 R3 clayey breccia	
	210-					62	0		292.8	30 R3 clay	
		<b>   </b>			FD5				294.7	60 R2 clayey breccia	
	1 -	<b> </b>							297.3-29	7.8 15 R3 trace calcite 70 R3 none	
	215					79	52		298.0 298.2	60R2clayey breccia80R3none	
			H4		FD4				298.9-30 301.5	2.5 FRACTURE ZONE 45 R3 quartz crystals	
									303.1 0 - 305.0-31	35 R3 trace clay 3.7 FRACTURE ZONE	
	=	<b>}</b>							308.6-30 310.4-31	9.1 15 R3 none 0.7 20 R2 clayey breccia	
	220-	<b>.</b>							310.2-31 312.4-31	0.5 30 R2 clayey breccia 2.6 30 R4 trace clay	
					FD5	97	44		314.4-31	4.8 20 R3 none 45 R4 none	
	-								315.6-31	6.0 25 R3 none 50 R2 quartz crystals	
					FD8	58	0		322.0-32	2.2 20 R2 none 4.0 30 R2 clavev breccia	
	225-	<del> </del>			FD6	100	36	Tpcpul	324.3-32	5.1 10 R3 clayey breccia	
	1 3				FD8				324.9-32	5.6 0 R3 clayey breccia	
	-	<b>   </b>			FD6	84	26		325.2-32	7.3 FRACTURE ZONE	

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 4 of 9)

	25 RF#16 SHEET 5 OF 9							
FEATURE: Waste Handling Fa	acility		PROJEC	T: Yucc	a Mour	ntain Proje	ect	STATE: Nevada
LOCATION: ESF North Portal	Pad		COORD	INATES:	N 76	5,055.54	E 570	,472.65 GROUND ELEVATION: 3672.03
BEGUN: 6/26/2000 FINISHE	D: 8/7/2000		TOTAL [	DEPTH:	452.8 f	t		ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Enco	untered		DEPTH	IO BEDR	OCK:	/5./ π		HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
		EN	GINEEDING	2				
			INDICES					
				VER		<sub>+</sub>		
NOTES	SHEAR WAVE VELOCITY	۲ <sub>o</sub>				N		CLASSIFICATION AND PHYSICAL CONDITION
	E	ONES	DING	RE R	R	scsl	HIC	
		HARI	MELL	% CO	% RG	EO GEO	GRAF	
			-	De 84	26		0.0	327.3 35 R2 none
								333.6 50 R3 none 332.7-333.3 20 R3 nuartz calcite
			F	86	32		0.0	- 332.9 50 R3 none 334 7-335 9 0 R2 quartz crystals
	<i>↑</i> , <i>†</i>					-	• • •	- 335.1 50 R3 trace clay - 335.5 75 R3 none
	235			100	48		0.0	335.6 55 R3 none - 336.1-337.3 FRACTURE ZONE
	1 3 1 <del>1</del> 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1		F	D5			0,-0	337.9 40 R2 clayey breccia     338.0-338.4 CLAYEY BRECCIA ZONE
				64	43		0.	338.4 40 R3 none 338.5-338.7 30 R3 none
	240		_	400			0.0	- 338.6 45 R3 none - 339.5-340.8 FRACTURE ZONE
			F	D6	32		0.	- 341.7-345.3 FRACTURE ZONE - 346.0 60 R2 trace quartz
			F	B8 D8 92	0		0.0	- 346.2-347.0 10 R3 none - 346.4-346.8 0 R4 none - 246.5-246.0 10 R4 none
				D5 89	61		0.	_ 346.8 80 R3 none - 346.8 80 R3 none
			Ľ –				0.0	348.3-348.7 20 R3 clayey breccia - 348.7 40 R3 none
	<b></b> ; ; ; <b>↑</b> ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;			93	0		0.0	- 349.2-349.7 15 R3 none 349.0-349.4 20 R3 none
	<u></u>		FD8	D8		-	0.0	- 350.9 30 R3 none - 351.0 60 R3 trace calcite
	250			80	0		0.	- 351.1-351.2 U R3 Clay - 351.6-352.8 FRACTURE ZONE - 354.3-356.1 EPACTURE ZONE
	I ∃ ; ; ; <b>f</b> ; ; ; ; ; ;		F	D6 95	0		000	- 356.4 50 R3 trace calcite - 356.5 85 R3 none
			F	D8 76	16		0,	
	255		_	-		-	°0°	- 358.4 60 R2 clay, calcite - 358.5 60 R2 calcite
	i : i i i i i i i i i i i i i i i i						0	358.7-359.0 20 R4 clay, quartz, calcite 358.9 80 R3 quartz, calcite 559.6 70 R2 irrn ovide, calcite
	<b>i</b> ; ; <b>i</b> i i i i i i i i i i i i i i i i i i		F	D5 94	63	Trand	0.0	
	260	H4				i pcpui	0.	NONLITHOPHYSAL ZONE (Tpcpmn)     Pyroclastic flow, densely welded, predominately pale red tuff with
							.°.°	<ul> <li>less than 5% flattened pumice, and less than 1% lithophysae.</li> <li>The tuff has less than 1% phenocrysts of plagioclase,</li> </ul>
			F		61		0	<ul> <li>sanidine, and rare manganese oxide. Volcanic lithic content increases with depth with poorly developed anastomosing vapor-</li> </ul>
			L C	D4 90	01		0,0	<ul> <li>phase partings. Generally the tuff is moderately hard (H4) to</li> <li>moderately soft (H5) in isolated zones, slightly (W3) to</li> </ul>
	265						0	<ul> <li>moderately weathered (W5), and slightly fractured (FD3) to intensely fractured (FD8).</li> </ul>
	<b>1</b>			90	0		0,0	Discontinuity Measurements:
				98	0	1	0,0	
	270		F	D6		-	0.0	- 360.5 85 R2 breccia, calcite
				73	30		0,0	– 360.7 65 R3 clay, calcite 361.2 85 R2 quartz, calcite
	I ∃					-	0.0	- 362.0 30 R4 calcite - 362.2-362.5 25 R4 none
				19	0		0.0	- 363.1 90 R3 none - 364.0 70 R2 none
			F	78	0	1	0.0	- 304.9-305.2 30 R4 trace calcite - 365.5 80 R4 none - 267.2 85 P2
					Ļ	-	0°0 0	- 372.9 70 R3 clay, quartz - 372.9 70 R3 clay, quartz - 373.1 90 R2 clay, guartz
	T I I I I I I I I I I I I I I I I I I I		F	D6 82	39		0.0	- 373.2-373.7 25 R3 quartz, calcite
	280-						0,00	- 375.8 60 R3 clay - 376.5-376.9 20 R4 none
	<u>∃</u> ;;; <b>⊺</b> ;;; <b>⊺</b> ;;;			40	0		0.0	- 377.0-377.3 25 R3 none - 377.4-377.7 30 R3 none
		F	09	-	-		- 379.7-381.2 0 R4 none 380.8 20 R3 quartz, calcite	
		F	B8 85	0		0.0	- 381.2 90 R3 trace quartz - 381.4-381.6 30 R3 trace quartz, calcite	
	285					1	0	- 382.8-383.2 20 K4 none - 383.3-383.7 CLAYEY BRECCIA ZONE - 283.9.284.2 20 P4
			F	D3 100	52	1	0.0	- 384.3 50 R3 trace quartz

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 5 of 9)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#16 SHEET 6 OF 9												
FEATURE: Waste Handling Fac	cility				PROJECT: Yucca Mountain Projec						STATE: Nevada	
BEGUN: 6/26/2000 FINISHEE	D: 8/7	/2000			TOTA		TH: 4	52.8 ft	,055.54	EDA	ANGLE FROM HORIZONTAL: -90°	
DEPTH TO WATER: Not Encou	untered	t			DEPT	Н ТО В	BEDRO	DCK:	75.7 ft		HOLE LOGGED BY: USBR/SMF	
		1		EN		ING					REVIEWED BY: Mark McKeown	
					INDICES	×						
						ENSIT	OVER		⊨		CLASSIFICATION	
NOTES		SHEAR WA	AVE VELOCITY	ESS	U	JRE DI	REC		aic ur	U	AND PHYSICAL CONDITION	
	EPTH	0000		ARDN	ELDIN	ACTI	CORE	Rab	[USC	RAPH		
		200 - 1	500 500 500 500 500 500 500 500 500	Î	3	Ē	%	%	Ū	0		
	290-					FD3	100	52		0.0	385.5-386.5 FRACTURE ZONE 386.5-386.9 10 R3 trace quartz, trace calcite	
						FD4	97	59		0,0,0	- 388.4-389.5 CLAYEY BRECUAZONE - 393.1 55 R3 quartz, calcite P- 393.8 45 R4 quartz, calcite	
										0.0	394.3 30 R3 clay, quartz, calcite	
	295-	<b>∃</b>       <b> </b>				FD9	87	0		0.0		
								_		0.0	-⊢ 397.7-398.1 25 R2 none ↓ 397.7-398.6 40 R3 none	
						FD7	92	0		0.0	398.6 40 R3 clayey breccia 398.7 60 R2 trace calcite	
	300-					FD8	33	0		0.0	⇒ 399.3 60 R3 trace calcite	
						100	50	0		0,00	→ 401.0 40 R3 breccia, quartz, calcite	
	-					FD3	100	48		0.0	402.7 90 R2 none	
	305-		/			-				0,00	403.0 to 422.5 ft TIVA CANYON TUFF CRYSTAL POOR	
						507	31 100	0		0,0,0	pink tuff with rare light gray pumice. Phenocrysts of sanidine and rare biotite compose less than 1% of the rock by volume.	
	-					FUT	95	0		0.0	Lithophysal cavities compose up to 10% of the rock by volume with vapor-phase mineral coatings, additionally 10%	
	310				-	FD8				0,0,0	<ul> <li>of the rock contains light gray vapor-phase mineral spots</li> <li>up to 30 by 48 mm in size. Generally the tuff is hard (H3), slightly</li> <li>weathered (W3) and slightly to year slightly fractured (ED2)</li> </ul>	
						FD9	91	0		0°00	Lower contact is conformable.	
	-					FD8	81	0		0,00	Discontinuity Measurements:	
	315-	1				FD6				0.0	403.0-403.4 30 R2 quartz, calcite	
							100	81		0.0	404.3-406.0 5 R2 quartz, calcite 404.6 80 R2 none	
	-		$\boldsymbol{\lambda}$	H4		ED 2			Tpcpul	5.00	405.9-406.2 35 R3 quartz, calcite	
	320-					105				0.0	- 408.3 60 R3 trace quartz - 409.2 60 R3 none	
			I							0.0	409.5-409.8 25 R3 trace quartz, calcite	
						FD6	98	53		0.0	T         410.6-411.7         FRACTURE ZONE           415.7         55         R2         clay, quartz, calcite           416.0         416.5         P2         clayway brossing guartz	
	325-					FD8				0,0		
						FD7		_		0.0	422.5 to 452.8 ft TIVA CANYON TUFF CRYSTAL POOR LOWER NONLITHOPHYSAL ZONE (Tpcpin)	
						FD3	96	34		0.0	Pyroclastic flow, densely welded, devirtriled, pale red tuff with less than 1% light gray pumice clasts. Phenocrysts of saidine and planicase compose less than 1% of the	
	330-					FD6	30	34		0.0	rock by volume. Medium gray lithic class compose less 1% of the rock by volume. Generally the tuff is moderately	
	-	$I \cup I \cup$				FD9	67	0		0.0	hard (H4), slightly weathered (W3), with fracture densities mostly moderately fractured (FD5) to intensely fractured (FD7) zones.	
						FD6	92	0		0.0	Lower contact undetermined, bottom of borenoie at 452.8 ft.	
	225	]     <b> </b>				100	52	-		0,0,0	Depth Angle* Roughness Infilling	
	335-	I				FD7	100	0		.0°0	422.9-423.6 5 R3 clayey breccia, quartz, iron	
						FD8 FD5	83	0		0,0	• + +2+3+2+3.0 2∪ rt4 quartz, calcite ↓ 424.6-424.9 10 R3 quartz, calcite ↓ 424.7-425.1 40 R3 quartz calcite	
		<b>1</b>       <b>1</b>				FD9 FD8	100	18		0.0	425.5-425.8 30 R4 calcite, trace iron oxide 426.2-429.2 FRACTURE ZONE	
	340-	1     [				FD5	50	Ŏ		0,0	429.8 30 R4 trace calcite, trace iron	
						FD8	78	35		0.0	← 430.1-430.8 10 K3 trace calcite 430.6-431.3 20 R3 quartz, calcite ← 430.8 45 R4 calcite. trace iron oxide	
		<b>[</b>				FD7	75	0		0.0.	# 431.0-431.6 0-25 R2 quartz, calcite ↓ 431.5-441.7 FRACTURE ZONE	
	345-	1				EDe	93	0		0.0	A35.5-435.8 20 R4 trace calcite, trace iron	
	1 -	1     <b>†</b>				סעי	100	0		0,0,0		

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 6 of 9)

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GEOLOGIC LOG OF DRILL HOLE UE-25 RF#16       SHEET 7 OF 9         FEATURE: Waste Handling Facility       PROJECT: Yucca Mountain Project       STATE: Nevada												
FEATURE: Waste Handling Fac	cility			PROJE	CT: Y	Yucca	Mour	itain Proje	ct	STATE: Nevada		
BEGUN: 6/26/2000 FINISHE	Pad D: 8/	/2000		TOTAL	DEPT	ES: "H: 4	N 765 52.8 f	,055.54 t	E 570	ANGLE FROM HORIZONTAL: -90°		
DEPTH TO WATER: Not Encou	untere	d		DEPTH	I TO BI	EDRO	DCK:	75.7 ft		HOLE LOGGED BY: USBR/SMF		
										REVIEWED BY: Mark McKeown		
			EN		iG							
					USIT	VERY		F				
NOTES		SHEAR WAVE VELOCITY	SS		ZE DE	RECO				AND PHYSICAL CONDITION		
	HL		SDNE		ACTUR	ORE	gg	DLOG	APHIC			
	DE	1000 2000 5000 6000 8000 8000 9000	HAE	Å	FR	%	%	Ū 9	8			
	0.50	╡┆╎╽╷┊┊┊┊┊			FD7 FD6	85	0		000	437.8-438.1 25 R4 trace calcite, trace iron oxide		
	350	∃¦¦ <b>¦</b> ¦¦¦¦¦¦			FD7	80	0		0	438.1 43 K3 trace iron oxide		
		▋▐▐▋▌▌▋			FD8	83	0		°0°.	438.9 90 R3 calcite 441.3-441.5 25 R3 clayey breccia		
		∃ : <i>I</i> : : : : : : : : :		-	FD5	73	47	Tpcpul	.0.	- 441.8 60 R3 calcite - 442.0-442.3 40 R3 none		
	355			-	FD9	56	0		00.00 00.00	443.1 35 R2 none 443.3-443.7 20 R3 quartz, calcite, trace iron oxide		
					FD7	95	0		0.0	443.7-443.9 FRACTURE ZONE 446.4 45 R3 none 449.4-450.0 5-30 R3 trace quartz, calcite, trace		
	360			_		90	0			iron oxide 449.9 80 R3 clayey breccia 449.9-452.8 CLAYEY BRECCIA ZONE		
				-	FD6	100	25					
					FD5	100	67		••••	5 degrees.		
	365	<b>∃ \</b>										
		Į	H4		FD4	100	89			-		
	370			-						-		
		∃ : : : : <b>: </b>   : : : E			FD3				•			
		╡╘╘╘┇┟				100	55			-		
	375			-						-		
		]			FD5							
				-						-		
	380							-		-		
		╡┆┆、、┊┊┊┊┊		1	FD4	94	56	Ipcpmn		-		
		∃							••• •			
	385			-						-		
		╡┊┊┊Ҳ┊┊┊┊			FD6	89	0			-		
		∃::: <b>\</b> :::E	H5		FD7	100	0					
	390	∃ : : : <b>\</b> : : : E								-		
		∃ : : : : <b>\</b> : : : E								-		
					FD3	100	78		••• •• ••	-		
	395	╡╎╎╎╎╽								-		
					$\neg$				. \			
		<u> </u>	H4		ED5	100	63			-		
				100	00			-				
						90	0		0.0	-		
								Tpcpll	). 0			
1						100	0		0.0			

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 7 of 9)

	GEOLOGIC	LOG	OF DR	LL H	IOLE I	UE-2	25 RF#16 SHEET 8 OF 9
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F	acility Pad	PRO. COO	JECT: Yuc RDINATES:	ca Mour N 76	ntain Proje 5,055.54	ct E 570	0,472.65 GROUND ELEVATION: 3672.03
BEGUN: 6/26/2000 FINISHED DEPTH TO WATER: Not Encou	D: 8/7/2000 untered	TOTA DEP	AL DEPTH: TH TO BEDI	452.8 f ROCK:	t 75.7 ft		ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark Mark anum
			RING S				
NOTES		WELDING	FRACTURE D % CORE REC	% RQD	[nscs] Georogic nr	GRAPHIC	AND PHYSICAL CONDITION
			FD6	24		0,0,0	
			FD7	/	-	0,0,0	
	415		FD3 95	81	Tpcpll		
			100	) 56	-	0,0,0	
			FD9 100 FD3 90	0 0 43		0.0	7- 
					-		
			FD5 98	41			
			FD8 100 70	0 0		1.	
	430	44	FD7 100	0 50			
			FD7 89			<i>[/.</i>	·E 
	435		100			1.1	
			FD8 92	0	Tpcpln	//	
	440		FD9 100	0 0		(	
			FD6 100	31			
	++		FD3 or	50		///	
	450		FD7	59			
	BOT	TOM OF	HOLE 90	0		<u> .                                    </u>	-
3							
2							
2							
8							

Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 8 of 9)



Figure 1.1-98. Geologic Log of Drill Hole UE-25 RF#16 (Sheet 9 of 9)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17 SHEET 1 OF 13											
FEATURE: Waste Handling Fac LOCATION: ESF North Portal P BEGUN: 6/27/2000 FINISHED DEPTH TO WATER: Not Encou		PROJ COOF TOTA DEPT	ECT: RDINAT L DEP H TO E	Yucca TES: TH: 6 BEDR(	Moun N 766 67.8 ft DCK:	ntain Proje 5,075.86 t 92.4 ft	ect E 57 <sup>-</sup>	STATE: Nevada I,041.88 GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown			
NOTES	рертн	SHEAR WAVE VELOCITY	SINEER NDICES SNIC	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION		
PURPOSE OF HOLE: Acquire geologic design data required to develop waste handling facility foundation parameters and seismic hazard analysis. DRILL EQUIPMENT: Schram T685 Drill Rig, UDR 1000 Drill Rig DRILLER: G. Fox, D. Harrison: Dynatec Drilling, Inc.; Salt Lake City, Utah. DRILLING METHOD: Installed 12 in. hammer. Hammered hole on 8/7/2000 with PQ to 1953. ft. Used PQ rods as casing and installed HQ coring system. Cored with HQ to 1953. ft. Used PQ rods as casing and installed HQ coring system. Cored with HQ to the total depth of 667.8 ft. DRILLING CONDITIONS: 0.0 to 187.8: Replaced 3 bits, lost circulation at 47.8 ft and 175.3 ft. 187.8 to 667.8: No circulation, hard, smooth drilling. DRILLING FLUID: 0.0 to 4.9: nonpotable water 4.9 to 667.8: non circulation. LOSS INTERVALS: 47.8 ft 175.3 ft 187.5 ft * Remaining hole drilled without circulation CASING RECORD: 0.0 to 195.3: PQ casing 195.3 to 667.8: No casing 195	10 5 10 20 25 30 30 40 40		НА	WE		\$\vec{s}\$         0         100         59         69         49         84         67         48         100         66         100         76         100         93         69         61		Qal (GP)s Qal (GP-GM)s Qal (GP-GM)s Qal (GP-GM)s Qal (GP-GM)s Qal (GP-GM)s Qal (GP)c		<ul> <li>0.0 to 92.4 ft QUATERNARY ALLUVIUM (Qai)</li> <li>0.0 to 5.0: No Recovery</li> <li>5.0 to 7.1: POORLY GRADED GRAVEL WITH SAND (GP)s About 75% coarse to fine, angular gravel; about 20% predominately fine to medium sand; about 5% silly fines; maximum size recovered, 65 mm; slightly to moderately comented with caliche; light brown, moist; strong reaction with HCI.</li> <li>7.1 to 14.2: POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s About 60% gap graded fine and coarse, angular to subangular gravel; about 30% coarse to fine sand; 10% fines with low plasticity; maximum size recovered, 70 mm; noncemented to moderately cemented with caliche; light brown; moist; weak to strong reaction with HCI.</li> <li>14.2 to 22.2: POORLY GRADED GRAVEL WITH COBBLES (GP)c</li> <li>About 85% predominately coarse and fine, angular to subangular gravel of densely welded tiff with some caliche coating; about 10% predominately fine sand; about 5% fines with low plasticity; noncemeted to slightly cemented with caliche; light brown, maroon and gray; moist; strong reaction with HCI. Total interval (by volume) approximately 10% cobbles; maximum size recovered, 120 mm.</li> <li>22.2 to 25.5: POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s</li> <li>About 60% coarse to fine, angular to subangular, well-graded gravet; trace of sand and fines that appeer to be washed out; maximum size recovered, 65 mm; noncementel to slightly cemented with caliche, light brown to gray; moist; strong reaction with HCI.</li> <li>25.5 to 28.4: WELL GRADED GRAVEL (GW) Almost entirely coarse to fine, angular to subangular, well-graded gravet; trace of sand and fines that appeer to be washed out; maximum size recovered, 65 mm; noncemented to slightly cemented with caliche, light brown, gray, white and maroon; moist.</li> <li>28.4 to 32.9: POORLY GRADED GRAVEL WITH COBBLES (GP)c</li> <li>About 45% coarse to fine, angular to subangular, well-graded gravet; trace of sand and fines that appeer to be washed out; maximum</li></ul>	
	-					67		(GW-GM)		About 85% coarse to fine, angular to subangular gravel; about 10% predominately fine sand; about 5% fines with low plasticity; slightly to moderately cemented with caliche; light brown; moist;	

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 1 of 13)

NOTE: All measurements are in feet unless noted otherwise. No attempts to re-establish circulation were made below 187.5 ft. LCM (Lost Circulation Material) consists of cellophane cuttings. USCS classifications were determined in the field, with limited access to samples to keep samples intact for future tests. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. USCS soil classifications are based on USBR 5005-86, *Procedure for Determining Unified Soil Classification (Visual Method)*.

RQD = rock quality designation; USCS = Unified Soil Classification System.

	GEOLOG		OG (	OF D	RILL	Н	OLE I	JE-2	25 RF#17 SHEET 2 OF 13
FEATURE: Waste Handling F LOCATION: ESF North Porta BEGUN: 6/27/2000 FINISH DEPTH TO WATER: Not End		PROJ COOF TOTA DEPT	ROJECT: Yucca Mounta OORDINATES: N 766,0 OTAL DEPTH: 667.8 ft EPTH TO BEDROCK: 9			tain Proje ,075.86 92.4 ft	ct E 571	STATE: Nevada I,041.88 GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown	
		EN	IGINEER	ING					
NOTES				FRACTURE DENSITY	% CORE RECOVERY	% KUD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
				-	67	-		Ð	strong reaction with HCI. Total interval (by volume) approximately 15% cobbles of welded tuff; maximum size recovered, 190 mm.
	55-			=	56 <del>100</del> 57		Oal		44.0 to 50.8: WELL GRADED GRAVEL WITH SILT AND COBBLES (GW-GM)C About 80% fine to coarse, angular to subangular, well graded gravel; about 10% fine to coarse, angular sand; about 10% silty fines; noncemented; light brown to gray, moist; weak to strong reaction with HCI. Total interval (by volume) approximately 5% cobbles; maximum size recovered, 110 mm.
	60				83		(GP)c		50.8 to 65.4: POORLY GRADED GRAVEL WITH COBBLES (GP)c About 90% coarse to fine, angular to subangular, poorly graded gravel; about 5% fine to coarse, angular sand; about 5% silty
					71			000	<ul> <li>fines; noncemented to moderately cemented with caliche; light brown to gray; moist; strong reaction with HCI. Total interval (by volume) approximately 15% cobbles (greater near bottom of interval); maximum size recovered, 135 mm.</li> </ul>
				100			00	<ul> <li>65.4 to 66.3: SILTY SAND (SM)</li> <li>About 80% predominately fine cand: about 20% eithy fines: trace</li> </ul>	
					100	ļ	Qal SM	<u>ل</u>	of fine gravel; maximum size recovered, 5 mm; noncemented; light brown; moist; strong reaction with HCl.
					93	-	Qal (GM)s		66.3 to 69.3: SILTY GRAVEL WITH SAND (GM)s About 55% coarse to fine, angular to subangular, poorly graded gravel; about 30% predominately fine to coarse, angular sand;
					65	(	Qal (GP-GM)s	6	<ul> <li>about 15% sitly tines; maximum size recovered, 75 mm; noncemented; light brown to gray; moist; weak reaction with HCI.</li> </ul>
	75			-	6				69.3 to 71.9: POORLY GRADED GRAVEL WITH SILT, SAND AND COBBLES (GP-GM)sc About 70% predominately coarse to fine, angular to subangular, poorly graded gravel; about 20% coarse to fine, angular to subangular sand; about 10% silty fines; noncemented to
				-	65		Qal		moderately cemented with caliche; light brown to gray; moist; no to weak reaction with HCI. Total interval (by volume) approximately 30% cobbles; maximum size recovered, 100 mm.
	80				53		(GP)c	00	<ul> <li>71.9 to 85.3: POORLY GRADED GRAVEL WITH COBBLES (GP)c</li> <li>About 85% predominately coarse to fine, angular to subangular, poorly graded rayed: about 10% coarse to fine, angular sand:</li> </ul>
				-	81				about 5% fines with no to low plasticity; noncemented; some caliche coating on gravel and cobbles; brown to gray; moist; no to strong reaction with HCI. Total interval (by volume) approximately 30% cobbles of welded tuff; maximum size. 150 mm.
	85-				100			<u>0</u> 0	85.3 to 92.4: SILTY SAND WITH GRAVEL AND COBBLES
				-	97		Qal		(SM)gc About 45% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular gravel; about 15% fines with no to low plasticity; noncemented to strongly cemented with caliche at 87.7; jight brown, gray, beige; moist;
	90 -				100		(SIVI)gc		<ul> <li>weak to strong reaction with HCL. Total interval (by volume) approximately 5% cobbles; maximum size recovered, 100 mm.</li> <li>92 4 to 287 2 ft BEDDED TUEF (Tmpt1)</li> </ul>
					98 9	98			Nonwelded pyroclastic flows with paleosols and reworked tuffaceous sediments. Medium grained (1 to 5 mm), very pale gray and generally massively bedded. Strongly caliche cemented from 92 4 to 96.1 ft. Tuff is moderately to slightly weathered
	95								(W4-5), some isolated intensely weathered (W7) zones; ranges from moderately hard (H4) to soft (H6), most moderately soft
	Ē			FD0	100 1	00			(H4); mostly untractured (FD0) to slightly fractured (FD3) with some small zones of up to intensely fractured (FD7). Lower contact is unconformable
					100 1	00		, coc	Discontinuity Measurements:
		H5		FD1	100 1	00	Tmbt1		<u>— Берип Angle Kougnness Infiling</u> 102.0 70 R3 clay — 104.4 65 R3 clay, calcite — 115.3 35 R4 none — 120.0 30 R4 none
					63 6	53			L 138.8 90 R2 none - 141.4 45 R3 none - 141.8 45 R3 none
				FD0	100 1	00			156.7 30 R3 none 171.0-172.3 0-5 R2 none 176.8 65 R3 trace clay 175.8 60 R3 none
									183.8 60 R3 none

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 2 of 13)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17 SHEET 3 OF 13											
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 6/27/2000 FINISHED DEPTH TO WATER: Not Encod	cility Pad D: 8/29 untered	/2000		PROJE COOR TOTAL DEPTH	ECT: RDINAT L DEP1 H TO B	Yucca TES: TH: 6 BEDRO	STATE: Nevada 1,041.88 GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown				
			EN	GINEERI	NG						
NOTES	DEPTH		HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
	110-				FD0	100	100			- 186.0 40 R3 trace clay - 188.0 40 R3 clay - 188.6 80 R4 none	
						100 100	100 100			- 188.8 85 R3 none - 189.1 90 R3 trace black mineral	
	115				FD1	72	72		\$ O	192.5         30         R2         clayey breccia           199.3         35         R3         none           199.8         90         R2         none           201.0         80         R4         trace clay           214.3         90         R3         none           231.4-243.9         CLAYEY BRECCIA ZONE         244.6           244.6         25         ray clay, fron oxide	
	120		H5		FD2	94	76			- 24/.5-247.8 FRACTURE ZONE 248.0 90 R3 clay 249.1-249.4 15 R3 clay	
						10	10			- 250.2 60 R3 none 251.3-251.9 R2 none - 253.8 85 R3 trace clay - 254.9 85 R4 none - 270.7 80 R3 none - 270.7 80 R3 none	
										⊢ 203.2 90 R2 trade clay ⊢ 291.6 80 R3 clay └ 300.3-300.7 30 R3 none	
											- 300.8 90 R3 none 301.6 80 R2 trace clay
							100		2 287.2 to 348.4 ft COMB PEAK IGNIMBRITE - TUFF X (Tpki):		
	130					100	100			<ul> <li>Nonwelded pyroclastic flow, moderately indurated, approximately 20 to 25% pumice (up to 35 x 30 mm), about 10 to 15% volcanic</li> </ul>	
			H6		FD0	96	96			<ul> <li>Intric tragments (up to 25 x 25 mm). Turt is medium gray with rare phenocrysts of sanidine, biotite, magnetite, and manganese oxides. Generally the tuff is moderately soft (H5), moderately to slightly wathered (W4), and unfractured (FD0) to very slightly fractured (FD1).</li> </ul>	
	135					69	69		. *	Discontinuity Measurements:	
		• • • • • • • • • • • • • • • • • • •			F	100	100			Depth Angle* Roughness Infilling     347.5-348.0 15 R2 trace clay	
	140			-	FD3	100	78	Tmbt1	00	348.4 to 368.9 ft POST-TIVA CANYON BEDDED TUFFS (Tpbt5): Nonwelded, possibly reworked fallout tephra and pyroclastic flows separated by distinct paleosols. The tuff is devitified, pale	
									[ .	<ul> <li>yellowish-brown, moderately indurated, with 10 to 15%</li> <li>pumice, (up to 10 x 7 mm), and less than 10% volcanic lithic fragments cenerally less than 1 mm. The bedded tuffs have</li> </ul>	
	145			-	FD1	100	100			<ul> <li>about 1% feldspar, quartz phenocrysts, and approximately</li> <li>2% biotite. Generally the bedded tuffs are moderately (WG) weathered, mostly unfractured</li> <li>(FD0) to moderately (MG) weathered, mostly unfractured</li> <li>(FD0) to moderately (FD4) with one zone of intensely fractured (FD7) rock.</li> </ul>	
					FD0	100	100			Discontinuity Measurements:     Depth Angle* Roughness Infilling	
	150		H5			100	100		\$ \$	364.2-364.8         20         R3         none           366.6         50         R2         none           376.1         35         R2         trace clay           376.1         35         R2         trace clay           381.2-381.6         25         R2         none	
	155				FD1	100	100			NONLITHOPHYSAL ZONE (Tpern) Pyroclastic flow, moderately to mostly densely welded, devirtified, pale red to grayish red, with 10 to 15% phenocrysts. Phenocryts mostly feldspar and some quartz, with rare biolitie and pyroxene. Rare pumice from 392.0 to 404.6 ft and up to 20% pumice from 404.6 to 457.2 ft. Up to 15% lithopusal cavities from 457.2 to 10.471.4 ft. Generally the rack	
	160					100	100			is soft to mostly moderately hard (H4), moderately to slightly weathered (W4), slightly (FD4) to intensely fractured (FD8). Discontinuity Measurements:	
	165				FD0 -	100	100		ç	Junct         Rouge         Rouge         Rouge         Rouge           381.3382.3         10         R2         none           383.8         75         R3         none           383.8-384.3         10         R3         none           383.8-384.3         10         R3         none           384.3-385.1         0         R3         none           386.8-386.0         25         R3         calcite           386.4-387.2         10         R2         breccia           387.0-388.5         5         R3         calcite           387.1-387.5         25         R3         none	

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 3 of 13)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17 SHEET 4 OF 13												
FEATURE: Waste Handling Fa	cility			PROJEC	T: Yucc	a Mour	ntain Proje	ect	STATE: Nevada			
LOCATION: ESF North Portal F BEGUN: 6/27/2000 EINISHEI	Pad D: 8/29/2000			COORDI	NATES:	N 766 667 8 f	6,075.86 t	E 57 <sup>-</sup>	1,041.88 GROUND ELEVATION: 3672.38 ANGLE EROM HORIZONTAL: -90°			
DEPTH TO WATER: Not Encou	untered			DEPTH	O BEDR	OCK:	92.4 ft		HOLE LOGGED BY: USBR/SMF			
									REVIEWED BY: Mark McKeown			
			ENG									
				È	E A							
NOTES	SHEAR WA	VE VELOCITY					INU		CLASSIFICATION			
		ft/s	VESS	SN SN	KE RE		CS	읟	AND PHYSICAL CONDITION			
		88888	HARD	VELD	cor	% RQI	Ins	GRAPI				
		88788	-			0.	0					
					100	100			+ 390.7 60 R3 none - 391.0 60 R3 none			
	I ∃iii¥								- 391.1-391.7 20 K2 Hone - 391.1-391.7 FRACTURE ZONE			
	<u> </u> ∃ ¦ ¦ ¦ }				100	100			→ 397.2 40 R3 none → 398.7-399.4 5-10 R2 trace clav			
					<b>1</b>			, ooc	399.8 70 R3 none 401.1 60 R3 none			
	1 - 1 - 1 - 1				100	100			L 401.4-402.0 25 R3 clay 402.0-402.5 25 R2 none			
	E				100	100			- 403.4 50 R4 trace clay - 403.8 30 R3 clay			
	180						-		+ 404.4 60 R3 none - 404.6 20-30 R3 clay			
						87			- 407.0-407.6 5-10 R2 none			
									L 411.9-412.1 35 R3 clay F 412.2-413.8 FRACTURE ZONE			
	185								414.2-414.8 15 R3 clay 415.7 70 R3 quartz, calcite			
	1			FI	02 100	100			L 417.3 35 R3 none 417.8 60 R3 none			
	I ∃   t			-	26 100	0		, coc	- 418.8-419.9 5-15 R3 clay 419.9 45 R3 clay			
				FI	05 100	86	-		- 421.5 55 R3 clay - 422.5 55 R3 clay - 423.5-424.0 10-20 R3 none			
									424.3-425.8 0-35 R2 none 425.9 60 R3 iron oxide			
	I ∃ ∷ i k				97	85			426.0         60-80         R3         trace iron oxide           427.0-427.2         45         R2         breccia			
	I ∃ : : : I				100	100			427.4-428.250R2trace calcite428.855R3trace calcite, trace iron			
	195				80	80			L oxide 431.2 40 R3 clay 431.7 95.00 R3 clay			
	∃:::∤				66	66			434.7-437.3 FRACTURE ZONE			
	L I I I I		ц5				Tmbt1		441.5-442.2 5-30 R2 trace iron oxide			
	200							000	443.4 50 R2 none 444.0-444.2 35 R2 trace iron oxide			
	1 <u>-</u>							00	444.4-444.6 40 R3 none 446.7-447.0 40-50 R3 none			
									447.8-448.0 30 R2 none 447.8-448.0 30 R2 none			
	205				100	40			448.2 40-50 R2 None 448.3-49.5 BRECCIA ZONE 448.3-49.5 0.0-20 R2 pope			
									451.6-452.0 0-45 R2 none			
	│ <u>∃</u> ¦¦ <u>†</u> ¦								452.2-452.4 40 R3 none 455.2-455.7 25 R2 none			
	=			_	100	100			+ 458.0-458.2 40 R3 trace iron oxide 458.3-458.6 30 R3 trace iron oxide			
									- 409.4-462.9 FRACTURE ZONE - 463.5 65 R5 none - 463.9 70 P2 broadin			
	-							000	+ +03.9 /0 R2 Dietotia → 464.2 80 R3 breccia → 464.4 80 R3 breccia			
	<u> </u>							60	466.9 75 R4 none 467.9 55 R4 none			
	215				54	50			+ 470.7 90 R3 none			
	<u> </u>								478.0 to 587.3 ft TIVA CANYON TUFF CRYSTAL POOR UPPER LITHOPHYSAL ZONE (Tpcpul)			
	=								<ul> <li>Pyroclastic flow; densely weided; moderate orange-pink with light gray mottling; about 3 to 5% lithophysal, irregular up to 50 x 50 mm</li> </ul>			
	220								<ul> <li>With right gray or ystar columny, putrice very light gray up to</li> <li>10 x 4 mm; rare felsics of sanadine; rare biotite. Hard (H3) to soft</li> <li>(H6), most moderately hard (H4): slichtly (M4) to intensely (W7)</li> </ul>			
2	1 = 1   1								weathered; slightly fractured (FD2) to very intensely fractured (FD9).			
	1 <u>1</u> <u>1</u>				31	11			Discontinuity Measurements:			
									- Depth Angle* Roughness Infilling			
2								v.c	4/8.3         25         R4         none           478.4         70         R4         clayey breccia           478.5         70         R4         clayey breccia			
2	<u> </u>				44	39			478.3 70 R4 Clayey Dreccia     478.8 60 R4 none     479.3 55 R4 none			
-						1						

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 4 of 13)

	GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17         SHEET 5 OF 13           FEATURE: Waste Handling Facility         PROJECT: Yucca Mountain Project         STATE: Nevada													
FEATURE: Waste Handling Fac	EATURE:         Waste Handling Facility         PROJECT:         Yucca Mountain Project         STATE:         Nevada           OCATION:         ESF North Portal Pad         COORDINATES:         N 766,075.86         E 571,041.88         GROUND ELEVATION:         3672.38													
LOCATION: ESF North Portal F BEGUN: 6/27/2000 FINISHEI	Pad ⊃∙ 8/29	9/2000		COOF	rdina 1 dee	TES: PTH' €	N 766 67 8 f	6,075.86 †	E 57'	1,041.88 GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90°				
DEPTH TO WATER: Not Encou	untered	1		DEPT	Н ТО	BEDR	DCK:	92.4 ft		HOLE LOGGED BY: USBR/SMF				
										REVIEWED BY: Mark McKeown				
			EN	GINEER	ING									
					ШТY	RY								
NOTES		SHEAR WAVE VELOCITY			DENS	COVE		L N		CLASSIFICATION				
	_	ft/s	LESS	g	URE.	KE RE		CS]	₽	AND PHYSICAL CONDITION				
	EPTH	888888888	ARD	VELDI	RACT	6 COF	, ROL	[USi	RAPH					
		8 20 20 40 30 50 40 30 50 40 30 50 40 30 50 40 30 50 40 30 50 40 40 40 40 40 40 40 40 40 40 40 40 40	-	>	FD3	م 44	39	Turbad		479.7 65 R5 trace calcite				
	230-					46	0	Impu		- 479.8 45 R4 none 479.8 15 R3 none				
	-								À	- 480.0 50 R4 none 480.1 45 R4 none 480.1 50 R4 none				
									4	L 480.2 50 R4 none - 480.3 60 R4 none - 480.3 85 P4 pope				
	235	• • • • • • • • • • • • • • •							⊲	480.9 30 R3 breccia				
	1 3	1     <del> </del>			FD7	46	0	(Clause)		481.7 70 R4 none 485.4 40 R3 none				
	-		H5		FDI			Breccia)	4	488.7     50     R3     sandy, pumiceous breccia       489.8     55     R3     trace manganese oxide				
	240									491.1 55 R4 sandy, pumiceous breccia 493.6 60 R4 none				
								-		- 493.6 35 R4 none - 493.8 25 R4 none - 499.8 25 R4 none				
						95	0			L 496.3 40 R6 Clay 496.7 45 R4 none 496.9 35 P4 pope				
	-					100	0		. * .	- 496.9 50 R4 none - 497.1 55 R4 none				
	245				FD3	100	94			497.6-499.2 BRECCIA ZONE trace iron oxide 500.1 40 R2 breccia				
	-			-				-		500.3 20 R3 none 500.5 20 R3 none				
		H4 100 53							- 502.8 80 R5 none - 506.8 45 R3 breccia					
	250			-				-	000	- 509.6 15 R3 none 518.9 45 R2 none				
									[ 0.0	1 522.4 15 K2 trace iron oxide 522.6 65 R3 none 523.2 65 P3 pope				
			FD4							- 545.0 10 R3 none - 551.2 25 R2 none				
	255				104	100	51			551.4 30 R4 clay, gravel				
						100	51			- 554.1 5 R3 none - 555.8 30 R3 none				
		1 : : i <b>)</b> : : : : : :								557.5         5         R3         clay, sand, gravel           559.0         5         R3         clay, sand, gravel				
	-									⊢ 559.2 30 R4 sand, gravel				
	260-									- 565.4 30 R3 quanz - 565.4 30 R4 clay				
	1 -					100	100			← 566.9 20 R3 none ← 567.4 15 R2 none				
									000	568.2 35 R3 none 568.9 20 R3 guartz				
	265	<b>1</b>			FD3			Tmbt1		E 569.7 10 R3 quartz 571.1 60 R3 none				
	3	1				100	100			587.3 to 637.6 ft TIVA CANYON TUFF CRYSTAL POOR				
	-	1     <b>†</b>							· `	WIDDLE NONLI HOPH SAL 20NE (Ipcpmn)     Pyroclastic flow; densely welded; predominately pale red with     motiled dark gravish and and configurately not provide a participation.				
	270-		H5							<ul> <li>becomes fine grained and merges with rock fabric with depth;</li> <li>becomes fine grained and merges with rock fabric with depth;</li> </ul>				
		<del>.</del>								altered pumice; less than 1% lithophysal; lithics increase with depth. Moderately hard (H4); slightly to moderately weathered				
	-									(W4); very slightlý fractured (FD1) to moderately fractured (FD6).				
										Discontinuity Measurements:				
2	275-111111111111111111111111111111111111						100		урс V	Lepth Angle' Roughness Infilling     580.4 35 R3 none     50.9 70 R3				
	-									- 581.2 30 R3 none 582.8 15 R3 trace clay				
	-				FD1					- 583.3 15 R3 trace clay 588.8 10 R3 quartz, sand				
	280							-	· `	E 590.0 15 R3 trace quartz 591.5 65 R3 none				
	3								.* 	E 592.1 40 R3 none 594.4 15 R3 sand				
	-									L 595.3 20 R3 none 596.0 20 R3 quartz 507.5 40 R3 quartz				
	285	▋▍▌╋╏▋┇╏╏╏				100	100			T 599.1 20 R3 trace quartz				
	-									P 010.8 30 K4 trace clay 611.2 55 R3 none 1 611.4 50 R3 pone				
									****	- 612.1 30 R3 clay				

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 5 of 13)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17       SHEET 6 0F 13         FEATURE: Waste Handling Facility       PROJECT: Yucca Mountain Project       STATE: Nevada												
FEATURE: Waste Handling Fa	cility		PROJE	CT: Yuc	STATE: Nevada							
BEGUN: 6/27/2000 FINISHEI	D: 8/29/2000		TOTAL	DEPTH:	667.8 f	t.	E 57 1,0	ANGLE FROM HORIZONTAL: -90°				
DEPTH TO WATER: Not Encou	untered		DEPTH	TO BED	ROCK:	92.4 ft		HOLE LOGGED BY: USBR/SMF				
								REVIEWED BY: Mark McKeown				
		EN	GINEERIN NDICES	G								
				VSITY VERY		_						
NOTES	SHEAR WAVE VELOCIT	Y		E DET				CLASSIFICATION AND PHYSICAL CONDITION				
	E	DNES	DING	CTUR ORE F	R	ISCS]	BHIC					
	DEP. 5000 8000 8000 8000 8000 8000 8000 800	HAR	MEL	FRA % C(	% R(	E E	GRA					
	290-	H5		10	0 100		E	615.4 20 R4 none 619.2 35 R2 none				
						1	E	621.1 15 R3 none 622.4 30 R3 none				
		H4					ΙĘ	624.0 15 R2 calcite 624.6 80 R2 none 625.7 40 R3 none				
							s.E	626.4 85 R2 none 628.1 35 R3 quartz				
	295			10	0 100			628.4 60 R2 none 630.2 15 R3 guartz				
	I ∃!! <b>∦</b> !!!!!						離	631.0 30 R3 sand, gravel 632.3 50 R3 none				
		H5		-D1			E	633.7 40 R2 manganese oxide 634.0 15 R3 clay, sand				
	300				_	-		635.4 30 R3 none 635.9 75 R2 none				
							影泪	636.3 5 R3 none 636.7 25 R3 none				
	1 1 1						F	637.4 15 R2 none				
	305-	H4		88	88		I E	637.6 to 653.2 ft TIVA CANYON TUFF CRYSTAL POOR LOWER LITHOPHYSAL ZONE (TpcpII)				
	<b>∫</b>						s•F	Pyroclastic flow, densely welded, devitrified, moderate orange pink tuff with rare light gray pumice. Phenocrysts of sanidine				
							₿.¥E	Lithophysal cavities compose up to 10% of the rock by volume.				
							鮮	moderately hard (H4), slightly weathered (W3), and moderately to intensely fractured (FD6). Lower contact is conformable.				
						1	E	Discontinuity Measurements:				
							E	Depth Angle* Roughness Infilling				
							l E	637.8 20 R3 clay, sand, gravel 638.7 65 R3 pumice 620.0 75 R4 manageneous evide				
				99	99		E	640.5 35 R3 none				
							L F	641.0 35 R2 none 642.1 85 R2 none				
	<u>∃</u> ::i <b>i</b> ::::					Tpki (Tuff X)	l∙∙E	644.0 65 R3 clay, sand 645.2 75 R2 none				
	320			-	-			646.4 70 R2 none 646.6 30 R2 trace white mineral				
	∃::: <b> </b> :::::						際相	648.0-648.7 20 R2 clay, sand, gravel 650.3 30 R3 sand				
							l F	650.4 30 R3 sand 651.9 25 R3 sand				
	325		F	D0 10	0 100		E	653.2 to 667.8 ft TIVA CANYON TUFF CRYSTAL POOR				
		H5					IN F	LOWER NONLITHOPHYSAL ZONE (TpcpIn) Pyroclastic flow, densely welded, devittified, pale red tuff				
	<u>]</u>   <u> </u>	115					E	with less than 1% light gray pumice clasts. Phenocrysts of sanidine and plagioclase compose less than 1% of the rock by volume. Medium gray lithis clasts compose loss than				
							E	1% of the rock by volume. Generally the tuff is moderately hard (H4), slightly weathered (W3), with fracture densities				
						1	ĿF	mostly moderately to intensely fractured (FD7). Lower contact undetermined, bottom of borehole at 667.8 ft.				
							N.F	Discontinuity Measurements:				
							際相	Depth Angle* Roughness Infilling				
	335			10	0 100		E	657.4				
								661.0-662.0 0-10 R4 none 661.1-661.3 30 R3 none				
							影泪	662.4 60 R4 none 663.0 65 R3 none				
	340		-					663.0-663.3 25 R4 none 663.4 55 R3 none				
							L F	003.9-004.1 30 K4 quartz 664.2 65 R2 trace quartz 665.3 30 R4 pope				
								665.7 35 R4 none 666.3 45 R3 trace calcite				
	345-		F	D1 93	93		N.	666.3-666.6 30 R4 none 666.5-667.1 0-10 R3 guartz, calcite				
							際準	667.2 45 R2 clayey breccia				
							E					

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 6 of 13)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17 SHEET 7 OF 13												
FEATURE: Waste Handling Fa	cility			PROJECT: Yucca Mountain Project							evada	
LOCATION: ESF North Portal F	2ad ⊡ 8/29	0/2000				TES: ∙тн∙ ғ	N 766	6,075.86 •	E 571	041.88 GROUND E ANGLE ER		
DEPTH TO WATER: Not Encor	unterec	1		DEPT		BEDRO	DCK:	92.4 ft		HOLE LOG	GED BY: USBR/SMF	
										REVIEWED	BY: Mark McKeown	
			EN	GINEER	ling							
					SITY	ERY						
NOTES		SHEAR WAVE VELOCITY	- 0		DEN	COV		UNIT				
	Ţ	tt/s	NESS	SNG	TURE	RER	Q	ogic scs]	일		ALCONDITION	
	DEPT		HARD	MELC	FRAC	% CO	% RQ	[Ut GEOL	GRAF			
	-				FD1	93	93			* Angles are measured	from core axis and are plus or minus	
	350-	<u>_</u>			10.					. 0 Uegrees.		
	=	<b>∃</b>       <b> </b>								-		
	-	<u> </u>								- - -		
	355-	<u>4                                      </u>			FD0	77	77		<u>م</u> م	-		
	-	<b>∃</b> : : : <b>↓</b> : : : : : :								-		
	=	<b>∃ : : : ↓ : : : : : : :</b>								-		
	-	∃::: <b>↓</b> :::::						Tpbt5	. · ·	- - -		
	360-									-		
	-									- - -		
	-	1 · · · <i>I</i> · · · · · · · ·	H5			84	47			-		
	365-	<u> </u>      <b> </b>								-		
	13	∃ : : : <b>↑</b> : : : : : : : :			FD2				000	-		
		∃       <b>∱</b>				81	81					
	370-								D	-		
	3	<u>                                      </u>						Tpcrn	8	-		
	-	<u> </u>							0. 0	- -		
	375-	<u>                                      </u>			ED7	100	77	(Clayey	·0. 4	-		
	-	<u> </u>			FUI	100		Breccia)		-		
	3	<u></u>							Þ	-		
	=				FD4				0	-		
	380-	1 i i <b>i</b> i i i i i i i i i i i i i i i i		1	104				00	-		
	-	$1 + \lambda$							, ۲.	- - -		
	3	1 : : : X: : : : : : : : : : : : : : : :				100	50		.0	-		
	385-	$1 \dots I$			ED5	100	55		- 2	-		
	1 3								Þ	-		
		1 <i>1</i>							8	· 		
	390-	<b>/</b>			FD4				0.0	-		
		1 <i>†</i>	H4			79	46	Toorn	Þ.,	_		
	-				FD5			ipom	.0	-		
	395-	<u> </u>								-		
5	-	<u> </u>			FD8				Þ	- 		
	=	<u> </u>				100	10		8	-		
	-	<u> </u>				100	40		00	-		
	400-	1     <b> </b>			FD4				Þ.	-		
	-	<u></u>							.0	<del>.</del>		
	3	1     <b> </b>	H7							-		
	405-		H4 H7		FD5	100	28		þ	• 		
	=	∃ : : : <b>↓</b> : : : : : :	H4		FD3	96	65		8	-		

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 7 of 13)

	GEOLOG	IC L	OG OF	DRII	LL H	IOLE I	JE-25 RF#	17 SHEET 8 OF 13
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F	cility Pad		PROJECT: COORDINA	Yucca TES:	a Mour N 766	ntain Proje 6,075.86	ct E 571,041.88	STATE: Nevada GROUND ELEVATION: 3672.38
BEGUN: 6/27/2000 FINISHED DEPTH TO WATER: Not Encou	D: 8/29/2000 untered		TOTAL DEP DEPTH TO	PTH: ( BEDR	667.8 f OCK:	t 92.4 ft		ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF
		EN	IGINEERING					REVIEWED BY: Mark McKeown
				ERY				
NOTES	SHEAR WAVE VELOCITY	ر پر	E DEN	RECOVE				CLASSIFICATION AND PHYSICAL CONDITION
	DEPTH	HARDNE:	VELDING	% CORE I	% RQD	Inscs	BRAPHIC	
					-			
		H4	FD3	96	65			
			FD7			-		
	415	H6 H4	FD5					
		H6		97	47			
	420	H4	FD4					
		ПО	-			-		
	425		500					
			FD6	99	22	Tpcrn		
	430		-					
			FD4	97	56			
			FD7					
		H4	FD5			_		
	440		FD8	100	0 57		0.0	
			FD4					
						-		
	450-		FD7	100	38	(Breccia)		
			FD5			Tpcrn		
		H6	FD3	75	55	(Fracture Fill)	NE E	
		H4	FD7	100	0			
			FD8	78 69	0	Tpcrn		
		-		79	28	-		
I		H6	FD8	0	NR	-	باهراب م	
		H4 H6	FD3 FD7 FD8 FD7 FD8 FD7 FD8	75 100 78 69 79 0	55 0 0 0 38 NR	Tpcrn		

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 8 of 13)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#17 SHEET 9 OF 13												
FEATURE: Waste Handling Fac	ility			PROJECT	: Yucc	a Mour	ntain Proje	ct	STATE: Nevada			
BEGUN: 6/27/2000 FINISHEE	'ad ): 8/29	/2000		TOTAL DI	ATES: PTH:	N 760 667.8 f	5,075.86 t	E 57	71,041.88 GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90°			
DEPTH TO WATER: Not Encou	intered			DEPTH T	) BEDR	OCK:	92.4 ft		HOLE LOGGED BY: USBR/SMF			
									REVIEWED BY: Mark McKeown			
			EN	GINEERING NDICES								
					/ERY							
NOTES		SHEAR WAVE VELOCITY	ŝ		(ECO)		INN		CLASSIFICATION AND PHYSICAL CONDITION			
	Ŧ		DNES	CTUR	OREF	B	ISCS]	PHIC				
	DEP	1000 2000 3000 5000 6000 8000 9000	HAR	WEL	° °	% R	GEC	GR∧				
	-		H6	FD	8 82	41						
	470-	<del> </del>	H5	FD	7 89	56	Ipcrn	8				
	-	<del>   </del>	H4	FD	6 83	83		in d	E FL			
	-	<del> </del>		FD	5 93	93		7 P.				
	475				_		(Fracture Fill)	MA	Æ.			
			H6	ED	4 87	78	,	M				
	3						Tpcrn	11/				
				-				.00				
	480		H4	FD	6 100	52	Tpcpul	0	↓ #			
	-		Н6	FD	8 100	0		ĥЙ	ĴF.			
	=			FD	7 80	46		1				
	485		H4				(Fracture Fill)	M				
								MI				
	3			FD	4 89	74			<u>/E</u>			
	490-						Tpcpul	.0.0				
	=	<b>1</b>	H6	FD	8 69	21	(Fracture		佐 (1) (1) (1) (1) (1) (1) (1) (1) (1) (1)			
	-						Fill)	46	<u>í</u>			
	495		НЗ	FD	7 54	0	(Fracture	IJħ	ĴĘ.			
	-				89	43	Fill)		F			
					100	0	(Breccia)	Å				
	500			FD	8 77	0	(Diccold)	0.0				
	-				-				%_ 0− -			
	3	λ						0,0				
	-	<b> </b>			89	64		, ° 0				
	505	4		FD	5			0,0				
	-							°°°°				
	3				100	20	]	0.0				
	510-		Н4		100	39		), 0 , 0				
	=			FD	7 64	0		0.0	*			
		111		FD	8 100	0	Tpcpul	, 0 , 0				
	515			FD FD	/ /5 8 91	0	-	0,0				
	=			FD	6 81	0	1	0°C				
	-			FD	8 60	0	1	0.0	∞' → • O			
	520-						1	, 0 ° (				
	-							0.0	ବ – ୦୦୦ ୦୦୦			
	3			FD	3 100	86		0				
								0.0				
	525	1						0.0				

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 9 of 13)

		GEOLOGI	C L	OG	OF E	DRIL	L H	OLE I	JE-2	25 RF#17	SHEET 10 OF 13			
FEATURE: Waste Handling Fa	cility			PROJ	ECT:	Yucca	Moun	itain Proje	ct		STATE: Nevada			
BEGUN: 6/27/2000 FINISHE	Pad D: 8/2	9/2000		TOTA	L DEP	TES: TH: 6	N 700 67.8 ft	i,075.80 t	E 57 I	1,041.88	GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90°			
DEPTH TO WATER: Not Encou	untered	ł		DEPT	Н ТО В	BEDRO	DCK:	92.4 ft			HOLE LOGGED BY: USBR/SMF			
			- EN							REVIEWED BY: Mark McKeown				
				INDICES										
					ENSIT'	VERY		F						
NOTES		SHEAR WAVE VELOCITY	SS	0	REDE	RECC			0	A	ND PHYSICAL CONDITION			
	PTH		RDNE		ACTU	CORE	RQD	[USCS	APHIC					
	<u> </u>	1000 100 1000 1	H	ÿ	Ľ.	%	%	3	۳. ۵.					
					FD3	100	86		0°0°	-				
	530-	╡┊┊┊┊┊┊							0.0	-				
									0.00					
		∃ : : : : <b>: {</b> : : : : :				94	90		0.0	-				
	535-					-			0.0	-				
	-	] <b>.</b>							0.0	-				
	-	]         <b> </b>			FD2				0.0	-				
	540-	╡┊┊┊┊┊┟			102				0°.0	-				
	-	<u>↓</u>							0.0	-				
	-					100	07		0.0	-				
	545-					100	51		0,00	-				
		<b>}</b>							°°°	-				
	-	<b>..</b>							0,0	-				
	550-								°0°0	-				
		4							.0. 0.	-				
	-	<u> </u>			FD5	96	29		.0. 0	-				
	555-								0.0	-				
			H4					Tpcpul	0.00	-				
	-				FD7	100	0		0.0	-				
	560-	1     <b> </b>			FD6	94	0		0,0	-				
									0,0	-				
	-				FD3	91	57		0.0	-				
	565-	]							0.0					
									0.0	-				
		<u></u> : : : <u>+</u> : : : : : :			FD5	97	27		0.0	-				
	570-	╡╎╎╎╎┥┥							0,0,0	Ē				
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		<b>↓ \</b>							0°0	-				
	575								°0° 0°	-				
	-	1       <b> </b>				98	87		0,0,0,	-				
		] ; ; ; ; <b>; ;</b> ; ; ; ; ;							0.000					
	580-	<b>╡</b> ┆┆┆┆ <b>┼</b> ┆┆┆			FD3				0,0,0	-				
		1 <i></i>							0.00	- - -				
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	585					100	63		0.0	-				
		╡┊┊┊┊╢							0.0	_				

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 10 of 13)

		GEO	LOGI	C L	OG (	OF C	DRIL	L H	OLE U	JE-2	25 RF#17	SHEET 11 OF 13
FEATURE: Waste Handling Fa	cility				PROJ	ECT:	Yucca	Mour	itain Proje	ct		STATE: Nevada
BEGUN: 6/27/2000 FINISHE	Pad D: 8/29	9/2000			COOF TOTA	RDINA L DEP	TES: TH: 6	N 766 67.8 f	6,075.86 t	E 571	1,041.88	GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Enco	untered	1			DEPT	н то е	BEDRO	DCK:	92.4 ft			HOLE LOGGED BY: USBR/SMF
												REVIEWED BY: Mark McKeown
				EN	GINEER	ING						
						VSITY	VERY		⊢			
NOTES		SHEAR WAVE V	ELOCITY	s		E DEI	RECO				A	CLASSIFICATION ND PHYSICAL CONDITION
	Ŧ			SDNES	DING.	CTUF	ORE	8	uscs]	APHIC		
	DEP	1000 2000 4000 5000 6000	7000 8000 9000	HAF	WEI	FRA	% C	ж К	B B B B C B C B C	GR/		
							400		Tpcpul		-	
	500					FD3	100	63			-	
	590-											
	1.3	<del> </del>									-	
											-	
	595-					FD4	100	88				
	-									°. •	-	
	600-										-	
										• • •		
											-	
	605-		<b>i</b> i i			FD1	100	97		•		
	-		ł : :								-	
	610		¥ i i								-	
	-								Tpcpmn	• • • •		
	615		¥ E				100	77		• • • •	-	
	1		ł i i	H4							-	
	1											
	620					FD2					-	
	1										-	
	625		<b>,</b> i i i				100	97			-	
										• • •		
											-	
	630-									••• ••	-	
	1 3	1:::: <i>1</i>									-	
	-	l l l				FD3	100	62				
5	635										-	
	1 3	<b> </b>       <b> </b>				FDA	100	0		• • •		
	-					FD6	100	υ	Tpcpli (Fracture	În		
	640-	]							Fill)	0.0	<u>-</u>	
							00	75		0,0,0	-	
	-					F 04	59	75	Tpcpll	0°.	⊢ ⊢ ⊢	
1 1 2	645									0,0,0	-	
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Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 11 of 13)

	GEOLOGIC L	OG O	F DRI	LL H	OLE	UE-25 RF#17	<b>7</b> SHEET 12 OF 13
FEATURE: Waste Handling Far LOCATION: ESF North Portal F BEGUN: 6/27/2000 FINISHED DEPTH TO WATER: Not Encou	cility Pad D: 8/29/2000 untered	PROJEC COORD TOTAL DEPTH	CT: Yucc DINATES: DEPTH: TO BEDR	a Mour N 766 667.8 fl OCK:	tain Proje 6,075.86 92.4 ft	ect E 571,041.88	STATE: Nevada GROUND ELEVATION: 3672.38 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
	EM	GINEERIN	G				
NOTES	SHEAR WAVE VELOCITY	INDICES DNIDINA DNIDINA	RACTURE DENSITY % CORE RECOVERY	% RQD	[USCS] GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
			99	75		0.0	
	650-		100	80	Tpcpll		
	655- 	F	D4				
	660		100	67	Tpcpin		
		-	-D6 02	10		1/ E	
	воттс	M OF HC		15		<u> ::/</u> =	

Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 12 of 13)



Figure 1.1-99. Geologic Log of Drill Hole UE-25 RF#17 (Sheet 13 of 13)

FEATURE: Waste handing Facility       PROLECT: Yucza Mountain Project       STATE: Notada         DECATION: SERVICE Provide Provide Comparison of the Com	GEOLOGIC LOG OF DRILL HOLE UE-25 RF#18 SHEET 1 OF 6											
NOTES         BHEAR WAVE VELOCITY         Stress         Stres         Stress         Stress	FEATURE: Waste Handling Fa LOCATION: ESF North Portal F BEGUN: 9/5/2000 FINISHED DEPTH TO WATER: Not Encou		PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca TES: TH: 4 BEDR0	a Moun N 764 193.6 ft DCK:	STATE: Nevada 0,626.93 GROUND ELEVATION: 3640.34 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown					
geotechnical foundation three statistics for the design of the wasit handling facility. Drill Equipment: Schramm ToBS Drill Rig Grow, Uah. Drill Equipment: Schramm ToBS Drill Rig Critier: Or How Source Drill Right (Source Control	NOTES Purpose of Hole: Preliminary, conceptual-level	DEPTH	SHEAR WAVE VELOCITY	HARDNESS		FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
80     Image: state st	Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility. Drill Equipment: Schramm T685 Drill Rig Drillers: G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah. Drilling Method: Install 12 in. hammer, Hammer to 6.01. Cement 10.75 O.D. casing with 129 stickup, Re-enter hole on 9/15/2000 with 8.50 Tricone bit. Drill from 6.01 to total depth of 493.56. Drilling Conditions: Lost circulation from 240.00 to 250.00. Drilling Fluid: 0.00 to 5.00: Nonpotable water. 5.00 to 493.56: Quick Gel mud with E2-Mud and LCM to re-establish circulation. Loss Intervals: 240.00 to 250.00 Casing Record: 0.00 to 6.01: 10.75 O.D. casing. 6.01 to 493.56: No casing Hole Completion: Set and cement 492.41 of 4.50 schedule 80 PVC casing.	5 10 15 20 25 30 40 40 45 55 60 65 70 75 80 85 85							Qal Tmbt1 Tpki		<ul> <li>Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded ignimbitive with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material has white to light gray caliche coatings.</li> <li>60.0 to 65.0 ft BEDDED TUFF (Tmbt1)</li> <li>Bedded tuff, nonwelded, crystallized, very pale-orange with 10 to 12% pumice clasts. Tuff contains less than 1% pale to moderate red volcanic lithtic clasts. Quartz and feldspar phenocrysts range from 10 to 15% of the tuff by volume, and biotite and marganese less than 1%.</li> <li>65.0 to 204.0 ft COMB PEAK (GNIMBRITE - TUFF X (Tpki): Pyroclastic flow, nonwelded, crystallized, with up to 20% phenocrysts. Up to 20% moderate red to medium dark gray, volcanic lithtic clasts.</li> <li>204.0 to 292.0 ft TIVA CANYON TUFF CRYSTAL RICH MONLTHOPHYSAL 200K (Tpcm)</li> <li>Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagioclase phenocrysts, and less than 1% biotite phenocrysts. From 207.0 to 211.0 ft moderately welded tuff has up to 8%, light gray pumice clasts. Frow 211.0 to 217 ft densely welded tuff has up to 10% dark gray pumice. From 217.0 to 223.0 ft grayish-brown pumice content decreases to 15 of 5%. Tuff is pumice poor (less than 1%) biotite phenocrysts. From 207.0 to 211.0 ft moderately welded cury stallized, vapor phase altered on the sub to 10% dark gray pumice. Jos 5% sanidine and plagioclase, and plagin to b 15% very light gray to medium light gray pumice clasts. Lithophysae are distinguished by vapor phase altered chips, indicating the edges of voids in the tuff.</li> <li>22.0 to 425.0 ft TIVA CANYON TUFF CRYSTAL POOR IUPFE LITHOPHYSAL 200K (Tpcpm)</li> <li>Pyroclastic flow, densely welded, crystallized, vapor phase altered, light gray, with yea to 36%, singlited phenocrysts. Tuff has up to 5%, very light gray, burnice clasts. Lithophysae are distinguished by vapor phase altered chips indicate some lithophysae from 360.0 to 367.0 ft.</li> <li></li></ul>	

Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 1 of 6)

NOTE: Hole logged from cuttings. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. RQD = rock quality designation.

	-25 RF#18 SHEET 2 OF 6									
FEATURE: Waste Handling Fa LOCATION: ESF North Portal F BEGUN: 9/5/2000 FINISHED DEPTH TO WATER: Not Enco		PROJ COOF TOTA DEPT	IECT: RDINA AL DEF FH TO	Yucca .TES: PTH: 4 BEDR	a Mour N 764 493.6 f OCK:	ntain Projec 4,522.34 t 65.0 ft	ct E 570	STATE: Nevada 70,626.93 GROUND ELEVATION: 3640.34 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown		
		Τ	EN		राNG S					1
NOTES	DEPTH		AHARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	105 105 110 110 110 125 125 130 125 130 135 140 145 145 140 145 145 140 145 145 145 145 145 145 145 145							Tpki		

Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 2 of 6)

		GEOLOGIC	JE-2	25 RF#18	18 SHEET 3 OF 6						
FEATURE: Waste Handling Fa			PROJ	ECT:	Yucca	a Mour	itain Proje	ct		STATE: Nevada	
LOCATION: ESF North Portal F	Pad 0. 9/21/	2000		COOF		TES: ∕TH·⊿	N 764	1,522.34	E 570	0,626.93	
DEPTH TO WATER: Not Enco	untered	1		DEPT	н то	BEDR	DCK:	65.0 ft			HOLE LOGGED BY: USBR/SMF
									REVIEWED BY: Mark McKeown		
			EN	GINEER NDICES	ING						
					SIT	ERY					
NOTES		SHEAR WAVE VELOCITY	(0		DEN	ECOV		INU			
	Ŧ	105	ONES	DING	TURE	RERI	Q	ogic si scs]	HIC	A	ND FITISICAL CONDITION
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	335	<i>‡</i>							) 0 0		

Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 3 of 6)
GEOLOGIC LOG OF DRILL HOLE UE-25 RF#18 SHEET 4 OF 6											
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 9/5/2000 FINISHED	ıcility Pad 0: 9/21/2000		PROJ COOF TOTA	ECT: RDINA	Yucca .TES: PTH: /	a Moun N 764 493.6 f	ntain Proje 4,522.34 t	ct E 570,6	STATE: Nevada 26.93 GROUND ELEVATION: 3640.34 ANGLE FROM HORIZONTAL: -90°		
DEPTH TO WATER: Not Encou	untered		DEPT	Н ТО	BEDR	OCK:	65.0 ft	<u>.                                    </u>	HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown		
		ENG	GINEER	ING ≻⊥ISP	/ERY						
NOTES	SHEAR WAVE VELOCITY	HARDNESS	MELDING	FRACTURE DEN	% CORE RECOV	% RQD	[USCS] GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION		
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	440-1-1-1-440-1-1-1-440-1-1-1-440-1-1-1-1						Tpcpmn				

Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 4 of 6)



Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 5 of 6)



Figure 1.1-100. Geologic Log of Drill Hole UE-25 RF#18 (Sheet 6 of 6)

		GEOLOGI	C L	OG (	OF I	DRIL	L H	OLE I	JE-25 RF#19 SHEET 1 OF 7
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 10/12/2000 FINISHE DEPTH TO WATER: Not Encou	cility Pad ED: 10/23 untered	3/2000		PROJ COOF TOTA DEPT	ECT: RDINA L DEF H TO	Yucca TES: PTH: 6 BEDR6	a Moun N 765 645.2 ft OCK:	tain Proje 5,880.41 : 120.0 ft	xt STATE: Nevada E 571,383.73 GROUND ELEVATION: 3661.81 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	DEPTH	HEAR WAVE VELOCITY	HARDNESS	GINEER NDICES DNICTEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole:         Preliminary, conceptual-level         geotechnical foundation         investigations for the design of         the waste handling facility.         Drill Equipment:         Schramm T685 Drill Rig         Drillers:         G. Fox, V. Mora, M. Fyffe;         Dynatec Drilling Inc.; Salt Lake         City, Utan.         Drilling Method:         Install 12 in. hammer. Hammer to         4.87, Cement 10.75 O.D. casing         with 1.25 stickup, Re-enter hole         on 10/13/2000 with 8.50 Tricone         bit. Drilling Conditions:         Lost circulation at 285.00,         300.00, 320.00, 572.73 and         S85.00.         Drilling Fluid:         0.00 to 4.87: Nonpotable water.         4.87 to 645.15: Quick Gel mud         with E2-Mud and LCM to         re-establish circulation.         Loss Intervals:         285.00.         Casing Record:         0.00 to 4.87: 10.75 O.D. casing.         4.87 to 645.15: No casing         Hole Completion:         Set and cement 645.70 of 4.50         schedule 80 PVC casing.         Note: Hole was initially drilled to         645.15. Driller advanced at least <td>داخلی         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰</td> <td></td> <td>HAR</td> <td>MEI</td> <td>FRAC</td> <td>% CC</td> <td>% RG</td> <td>Qal</td> <td><ul> <li><b>0.0 to 120.0 ft QUATERNARY ALLUYUUM (Qai)</b></li> <li>Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded inmibrite with minor fragments of white honwelded tuff. Up to 15% of the densely welded material have white to light gray caliche coatings.</li> <li><b>1.0.0 280.0 ft BEDDED UFF (Tmbt1)</b></li> <li>The Ainiter Messa Bedded Tuff composed of bedded and fraworked tuff. Bedded tuff is nonwelded, argillic, with up to 10% quartz, plagioclase, and sanidine phenocrysts. Bedded tuff contains up to 15% orgillexilly altered pumice clasts. Some beds have up to 4% volcanic lithic clasts. Tuff is predominately grayish-orange pink and drill-cutting returns are and to sill scied.</li> <li><b>0.0 to 410.0 ft COMB PEAK (DNIMBRITE - LUFF X (Tpki)</b>. Wroicastic flow, nonwelded, crystallized, with up to 20% pumice clasts. Tuff contains 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 8% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink and till-cutting returns are and twitis class. Tuff contains 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 8% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink into sillicification.</li> <li><b>0.10 to 40.0 ft TVLA CANYON UFF CRYSLA (DK)</b>. Drugiatic flow, moderately to densely welded, crystallized, with a to 10% dark gray pumice clasts. compose up to 15% pumice clasts and 5% volcanic lithic clasts. Tuff is predominately grayish-orange pink and till the utiff strystal port with tho 2% quartz and sanidine phenocrysts. From 425 to 436 ft the tuff strystal port with only 3% clasts content. From 43 to 10% dark gray pumice clasts. composing up 15% of cost.</li> <li><b>1.0.1.0.1.0.1.0.1.0.1.1.0.1.0.1.0.1.1.0.1.0.1.0.1.0.1.0.1.0.1.0.1.0.1.0.0.1.0.0.1.0</b></li></ul></td>	داخلی         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰         ۲۰۰۰۰		HAR	MEI	FRAC	% CC	% RG	Qal	<ul> <li><b>0.0 to 120.0 ft QUATERNARY ALLUYUUM (Qai)</b></li> <li>Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded inmibrite with minor fragments of white honwelded tuff. Up to 15% of the densely welded material have white to light gray caliche coatings.</li> <li><b>1.0.0 280.0 ft BEDDED UFF (Tmbt1)</b></li> <li>The Ainiter Messa Bedded Tuff composed of bedded and fraworked tuff. Bedded tuff is nonwelded, argillic, with up to 10% quartz, plagioclase, and sanidine phenocrysts. Bedded tuff contains up to 15% orgillexilly altered pumice clasts. Some beds have up to 4% volcanic lithic clasts. Tuff is predominately grayish-orange pink and drill-cutting returns are and to sill scied.</li> <li><b>0.0 to 410.0 ft COMB PEAK (DNIMBRITE - LUFF X (Tpki)</b>. Wroicastic flow, nonwelded, crystallized, with up to 20% pumice clasts. Tuff contains 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 8% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink and till-cutting returns are and twitis class. Tuff contains 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 8% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink into sillicification.</li> <li><b>0.10 to 40.0 ft TVLA CANYON UFF CRYSLA (DK)</b>. Drugiatic flow, moderately to densely welded, crystallized, with a to 10% dark gray pumice clasts. compose up to 15% pumice clasts and 5% volcanic lithic clasts. Tuff is predominately grayish-orange pink and till the utiff strystal port with tho 2% quartz and sanidine phenocrysts. From 425 to 436 ft the tuff strystal port with only 3% clasts content. From 43 to 10% dark gray pumice clasts. composing up 15% of cost.</li> <li><b>1.0.1.0.1.0.1.0.1.0.1.1.0.1.0.1.0.1.1.0.1.0.1.0.1.0.1.0.1.0.1.0.1.0.1.0.0.1.0.0.1.0</b></li></ul>
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Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 1 of 7)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#19 SHEET 2 OF 7										
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F	cility Pad			PROJE COOR!	ECT: DINA	Yucca TES:	a Mour N 765	ntain Proje 5,880.41	ct E 571	STATE: Nevada 11,383.73 GROUND ELEVATION: 3661.81
BEGUN: 10/12/2000 FINISHE	ED: 10/	/23/2000			- DEP	TH: 6	345.2 f ∩СК:	t 120.0.ft		ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SME
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NOTES					ENSITY	OVERY		μ		CLASSIFICATION
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Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 2 of 7)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#19 SHEET 3 OF 7										
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 10/12/2000 FINISHE DEPTH TO WATER: Not Encou	cility Pad ED: 10/23/2000 untered	PR CC TC DE	OJECT: ORDIN/ TAL DE PTH TO	Yucca ATES: PTH: 6 BEDR	a Mour N 765 645.2 fi .OCK:	ntain Proje 5,880.41 t 120.0 ft	ct E 571,383.73	STATE: Nevada GROUND ELEVATION: 3661.81 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown		
			ERING	-						
NOTES	SHEAR WAVE VELOCITY fts HEAR 00 00 00 00 00 00 00 00 00 00 00 00 00	HARDNESS	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS] GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION		
	220         220         220         221         225         235         235         240         240         240         241         245         245         255         245         255         2					Tmbt1				
	325-11 330-11 330-11 335-11									

Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 3 of 7)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#19 SHEET 4 OF 7											
FEATURE: Waste Handling Fa	acility	I	PROJE	CT:	Yucca	Moun	ntain Proje	ct			
BEGUN: 10/12/2000 FINISH	Pad IED: 10/23/2000	-	TOTAL	DEPT	ЕS: ГН: 6	N 763 645.2 ft	5,880.41 t	E 5/1,30	ANGLE FROM HORIZONTAL: -90°		
DEPTH TO WATER: Not Enco	ountered	[	DEPTH	ТОВ	EDRO	CK:	120.0 ft		HOLE LOGGED BY: USBR/SMF		
		- ENG	NEEDIN	2					REVIEWED BY: Mark McKeown		
			IDICES	~	~						
				ENSIT	DVER		⊑				
NOTES	SHEAR WAVE VELOCITY	Ess	ġ	JRE DI	EREC		Sic U	<u>ں</u>	AND PHYSICAL CONDITION		
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Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 4 of 7)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#19 SHEET 5 OF 7											SHEET 5 OF 7
FEATURE: Waste Handling Fac	cility			PROJ	ECT:	Yucca	a Mour	ntain Proje	ct		STATE: Nevada
LOCATION: ESF North Portal F	Pad	23/2000		COOF		TES:	N 765	5,880.41 +	E 571	1,383.73	GROUND ELEVATION: 3661.81
DEPTH TO WATER: Not Encou	untered	5/2000		DEPT	'H TO '	BEDR	OCK:	120.0 ft			HOLE LOGGED BY: USBR/SMF
											REVIEWED BY: Mark McKeown
			EN	GINEER	ING						
					зтY	RY					
NOTES	5	HEAR WAVE VELOCITY			DEN	COVE		LINU			CLASSIFICATION
	-	ft/s	VESS	۵ Z	LURE	ZE RE		CSJ	₽	AN	ID PHYSICAL CONDITION
	DEPTI	1000 22000 5000 6000 8000 8000	HARD	WELD	FRAC.	% COI	% RQI	GEOL	GRAP		
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Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 5 of 7)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#19 SHEET 6 OF 7											
FEATURE: Waste Handling Fac	sility	l			Yucca	Moun	tain Proje	ct E 571 3	STATE: Nevada		
BEGUN: 10/12/2000 FINISHE	ED: 10/23/2000	-	TOTAL	_ DEP	TH: 6	645.2 ft	t	L 07 1,0	ANGLE FROM HORIZONTAL: -90°		
DEPTH TO WATER: Not Encou	intered	I	DEPTH	H TO E	BEDRO	OCK:	120.0 ft		HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown		
		ENGINEERING									
			IDICES	È	RY						
NOTES	SHEAR WAVE VELOCITY			DENS	COVE		LINU				
	ft/s 王	DNESS	DING	CTURE	DRE RE	g	SCS	SHC	AND PHYSICAL CONDITION		
	DE P 1000 2000 3000 5000 6000 7000 8000	HAR	WELI	FRAG	% CC	% RC	GEOI	GRAI			
	580-							0.0			
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	585										
	590							0.0			
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	615							0.0			
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	635										
	640						Tpcpmn				
	B	оттом	1 OF H	OLE							

Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 6 of 7)



Figure 1.1-101. Geologic Log of Drill Hole UE-25 RF#19 (Sheet 7 of 7)

	GEOLOGIC	LOG OF DR	ILL HOLE U	UE-25 RF#20 SHEET 1 OF 3				
FEATURE: Waste Handling Fa LOCATION: ESF North Portal F BEGUN: 9/5/2000 FINISHED DEPTH TO WATER: Not Encor	icility Pad ): 9/8/2000 untered	PROJECT: Yuc COORDINATES: TOTAL DEPTH: DEPTH TO BEDI	JECT: Yucca Mountain Project     STATE: Nevada       JRDINATES: N 765,637.36 E 570,796.82     GROUND ELEVATION: 3671.2       'AL DEPTH: 160.0 ft     ANGLE FROM HORIZONTAL: -       'TH TO BEDROCK: 98.0 ft     HOLE LOGGED BY: USBR/SM       REVIEWED BY: Mark McKeow					
NOTES	SHEAR WAVE VELOCITY ft/s 000000000000000000000000000000000000	MELEDING WELDING WELDING FRACTURE DENSITY & CORE RECOVERY	% RaD GEOLOGIC UNIT [USCS]	CLASSIFICATION AND PHYSICAL CONDITION				
<ul> <li>Purpose of Hole: Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility.</li> <li>Drillequipment: Schramm T685 Drill Rig</li> <li>Drillers: G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.</li> <li>Drilling Method: Install 12 in. hammer. Hammer to 5.00. Cement 10.75 O. D. casing with 1.30 stickup. Re-enter hole on 9/8/2000 with 8.50 Tricone bit. Drilling Conditions: Smooth easy drilling.</li> <li>Drilling Fluid: 0.00 to 5.00: Nonpotable water. 5.00 to 160.00: Quick Gel mud with EZ-Mud.</li> <li>Loss Intervals: NA</li> <li>Casing Record: 0.00 to 5.00: 10.75 O.D. casing. 5.00 to 160.00: No casing</li> <li>Hole Completion: Set and cement 159.70 of 4.50 schedule 80 PVC casing.</li> </ul>	3     10       10     11       11     15       20     11       11     15       21     11       12     11       14     11       15     11       16     11       17     15       18     11       19     11       10     11       11     15       11     14       12     14       14     14       15     14       15     14       16     14       17     14       18     14       19     14       10     14       10     14       15     14       16     14       17     14       18     14       19     14       10     14       10     14       10     14       10     14       10     14       10     14       10     14       11     14       12     14       14     14       15     14       16     14       17		Gal	<ul> <li>0.0 to 28.0 ft PAD FILL (Fill)</li> <li>Predominately fine to coarse, hard, subangular gravel with a trace of nonplastic fines on gravel surfaces; derived from moderately to densely welded tuff.</li> <li>28.0 to 98.0 ft QUATERNARY ALLUVIUM (Qai)</li> <li>Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded igninbrite with minor fragments of white norwelded tuff. Up to 15% of the densely welded material have white to light gray caliche coatings.</li> <li>98.0 to 102.0 ft POST-TIVA CANYON BEDDED TUFFS (Tpbt5):</li> <li>Bedded tuff, nonwelded, argillic with 1 to 2% quartz and sanidine phenocrysts. Pumice clasts compose up to 20% pumice clasts and 5% volcanic lithic clasts. Tuff is predominately very pale orange and white.</li> <li>102.0 to 127.0 ft TVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tpcm)</li> <li>Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagioclase phenocrysts, ard less than 1% biotite phenocrysts. From 102 to 123 to 127 the tuff has up to 7% dark gray pumice clasts. Composing up 10% of rock.</li> <li>127.0 to 160.0 ft TIVA CANYON TUFF CRYSTAL POOR UPPER LITHOPHYSAL ZONE (Tpcpu)</li> <li>Pyroclastic flow, densely welded, crystallized, wery light gray pumice clasts. Composing up 10% of rock.</li> <li>127.0 to 160.0 ft TIVA CANYON TUFF CRYSTAL POOR UPPER LITHOPHYSAL ZONE (Tpcpu)</li> <li>Pyroclastic flow, densely welded, crystallized, uppor-phase altered, light gray, unice clasts. Lift be utiff has up to 15%, wery light gray, whice clasts. Lift by typase are distinguished by vapor-phase altered chips, indicating the edges of voids in the tuff.</li> </ul>				
			Tpbt5					

Figure 1.1-102. Geologic Log of Drill Hole UE-25 RF#20 (Sheet 1 of 3)

		GEOLOGI	CL	OG (	OF [	DRIL	L H	OLE	UE-2	25 RF#20	SHEET 2 OF 3
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 9/5/2000 FINISHED: DEPTH TO WATER: Not Encou	EATURE: Waste Handling Facility OCATION: ESF North Portal Pad EGUN: 9/5/2000 FINISHED: 9/8/2000 DEPTH TO WATER: Not Encountered							tain Proje ,637.36 98.0 ft	ect E 570	0,796.82	STATE: Nevada GROUND ELEVATION: 3671.26 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	рертн	SHEAR WAVE VELOCITY	HARDNESS	SINEER DICES SNICTEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	F	CLASSIFICATION AND PHYSICAL CONDITION
	105-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-		НАК	M OF H	HOLE	% CO	% HO	Tporn Tpcrn			

Figure 1.1-102. Geologic Log of Drill Hole UE-25 RF#20 (Sheet 2 of 3)



Figure 1.1-102. Geologic Log of Drill Hole UE-25 RF#20 (Sheet 3 of 3)

	GEOLOGIC L	G OF DRILL HOLE UE-25 RF#21	SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad BEGUN: 9/6/2000 FINISHED: 9/7/2 DEPTH TO WATER: Not Encountered	2000 1	ROJECT: Yucca Mountain Project     STATE: Net       OORDINATES: N 765,898.81 E 570,739.18     GROUND E       OTAL DEPTH: 192.2 ft     ANGLE FRC       EPTH TO BEDROCK: 115.0 ft     HOLE LOGG       REVIEWED	ivada LEVATION: 3673.02 DM HORIZONTAL: -90° 3ED BY: USBR/SMF BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY t/s SUBURN SHEAR WAVE VELOCITY SSBURN SSSBURN SSBURN SSBURN SSBURN	NICES NICES LIENIG INCES I	FICATION ;AL CONDITION (Fill) oarse, hard, subangular gravel with a trace
geotechnical foundation investigations for the design of the waste handling facility.       5         Drill Equipment: Schramm T685 Drill Rig       10         Drillers: G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.       15         Drilling Method: Install 12 in. hammer. Hammer to 5.01. Cement 10.75 O.D. casing with 1.00 stickup. Re-enter hole on 9/6/2000 with 8.50 Tricone bit. Drilling Conditions: Lost circulation at 125.00 and 190.00       30         Drilling Fluid: 0.00 to 5.01: Nonpotable water. 5.01 to 125.00: Quick Gel mud with EZ-Mud. 125.00 to 192.23; Quick Gel with EZ-Mud and LCM to re-establish circulation.       40         Loss Intervals: 125.00 and 190.00       50         Casing Record: 0.00 to 5.01: 10.75 O.D. casing. 5.01 to 192.23: No casing       50         Not to Sol: 100, 75 O.D. casing. 5.01 to 192.23: No casing.       51         Set and cement 192.04 of 4.50 schedule 80 PVC casing.       60         70       75       80         80       80       80		Cal	ravel surfaces; derived from moderately to RARY ALLUVIUM (Qai) Insisting of a mixture of pale red and light nimbrite with minor fragments of white 15% of the densely welded material ailche coatings. <b>EXAMON TUFF CRYSTAL RICH</b> <b>INE (Torm)</b> ately to densely welded, crystallized, and plagioclase phenocrysis, and less rysts. From 102 to 110 ft the tuff pumice clasts. From 110 to 123 ft rith only 1% clast content. From s a mix of light brownish-gray and very, . composing up 10% of rock. <b>CANYON TUFF CRYSTAL POOR</b> 2 to 3% sanidine and plagioclase, a phenocrysts. Tuff has up to 15%, clasts. Lithophysae are phase altered chips, indicating the edges

Figure 1.1-103. Geologic Log of Drill Hole UE-25 RF#21 (Sheet 1 of 3)

NOTE: Hole logged from cuttings. LCM (Lost Circulation Material) consists of cellophane cuttings or cotton seed hulls. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. RQD = rock quality designation.

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#21 SHEET 2 OF 3									
FEATURE: Waste Handling Fa	cility		PRO	JECT:	Yucca	a Mour	ntain Proje	ct	STATE: Nevada
LOCATION: ESF North Portal F	Pad		C00	RDINA	TES:	N 765	5,898.81	E 570,739.18	GROUND ELEVATION: 3673.02
DEPTH TO WATER: Not Encou	: 9/7/20 Intered	000	DEP	AL DEF TH TO	PTH: T	192.2 f OCK·	t 115.0 ft		ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SME
			52.		DEDIT	0011.	110.0 1		REVIEWED BY: Mark McKeown
			ENGINEER	RING					
		-	INDICE	¦   }	≿				
				ENSI.	OVEF		Ę		CLASSIFICATION
NOTES		SHEAR WAVE VELOCITY	8 0	RE D	REC			A	AND PHYSICAL CONDITION
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Figure 1.1-103. Geologic Log of Drill Hole UE-25 RF#21 (Sheet 2 of 3)



Figure 1.1-103. Geologic Log of Drill Hole UE-25 RF#21 (Sheet 3 of 3)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#22 SHEET 1 OF 6											
FEATURE: Waste Handling Far LOCATION: ESF North Portal F BEGUN: 7/25/2000 FINISHEI DEPTH TO WATER: Not Encou	cility Pad D: 8/19 Intered	5/2000 1		PROJ COOF TOTA DEPT	ECT: RDINA L DEF H TO	Yucca TES: PTH: 5 BEDR(	a Moun N 766 540.6 ft OCK:	tain Proje 5,206.2 E t 80.0 ft	ect E 570,	STATE: Nevada 793.48 GROUND ELEVATION: 3679.17 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown	
NOTES Purpose of Hole: Develop geologic develop waste handling facility foundation parameters and seismic hazard analysis.	DEPTH	SHEAR WAVE VELOCITY ft/s 00 00 00 00 00 00 00 00 00 00 00 00 00	HARDNESS	SINEER NDICES	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION 0.0 to 80.0 ft QUATERNARY ALLUVIUM (Qal) Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded ignimbrithe with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material have white to light gray caliche coatings. 80.0 to 318.0 ft BEDDED TUFF (Tmbt1)	
Drill Equipment: Schramm T685 Drill Rig, UDR 1000 Drill Rig. Drillers: George Fox, D Harrison, R Mckay: Dynatec Drilling Inc.; Salt Lake City, Utah. Drilling Method: Install 12 in. hammer. Hammer to 5.00. Cernen 10.75 O.D. casing with 1.02 stickup. Drill to depth of 511.47 with 8.50 Tricone bit. Install PQ rods to serve as temporary casing. Install HQ core system. Core with HQ to total depth of 540.56: Drilling Conditions: Drilling Fluid: 0.00 to 5.00: Nonpotable water. 5.00 to 540.56: Nonpotable water, Quick Gel Mud with EZ-Mud and LCM to re-establish circulation. Loss Intervals: 443.00 to 490.00: circulation was re-established in some intervals. Casing Record: 0.00 to 5.00: 10.75 O.D. casing 511.47 to 540.56: PQ casing (?) Hole Completion: PVC casing set and cemented to total depth of 511.38.	10 15 15 20 15 15 15 15 15 15 15 15 15 15							Qal Tmbt1		Pre-Rainier Mesa Bedded Tuft composed of bedded and reworked tuff. Bedded tuff is nonwelded, angilic, with up to 10% quartz, plagioclase, and sanidine phenocrysts. Bedded tuff contains up to 4% volcanic lithic clasts. Tuff is predominately grayish-orange pink and drill cuttings returns are sand to sill sized.         318.0 to 415.0 ft COMB PEAK IGNIMBRITE - TUFF X (Tpki): Pyroclastic flow, nonwelded, crystallized, with up to 15% pumice clasts. Tuff contants 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 3% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink with possible minor silicification.         415.0 to 438.0 ft POST-TIVA CANYON BEDDED TUFFS (Tpbt5):         Bedded tuff, nonwelded, argillic with 1 to 2% quartz and sanidine phenocrysts. Pumice clasts compose up to 15% pumice clasts and 5% volcanic lithic clasts. Tuff is predominately very pale orange and white.         438.0 to 530.5 ft TIVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tpcm)         From 438.0 to 511.5 ft borehole was mud-rotary drilled, the following is a description of drill chips. Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagioclase phenocrysts, and less than 1% biotite phenocrysts. From 455 to 485 ft the Uff has a mix of light brownish-gray and very light gray pumice clasts, composing up 10% of rock. No recovery from 485 to 505 4.45. Chi tuff has pumice clasts up to 20 by 5 min size. Up to 10% sanidine and plagioclase phenocrysts with less than 1% biotite phenocrysts. Generally the rock is soft to mostly moderately hard (H4), moderately to slightly weathered (W4), slightly (FD4) to moderately fractured (FD5).         Discontinuity Measurements:         Depth       Angle* </td	

Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 1 of 6)

NOTE: Hole logged from cuttings to 511.47 ft and core from 511.47 to 540.56 ft. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. No usable velocity data acquired above 229 ft. RQD = rock quality designation; SPT = standard penetration test.

	GEOLO	GIC L	OG (	)F [	DRIL	LLH	IOLE I	UE-	25 RF#22 SHEET 2 OF 6
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F	FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad							ect E 570,	,793.48 GROUND ELEVATION: 3679.17
BEGUN: 7/25/2000 FINISHED DEPTH TO WATER: Not Encou	D: 8/15/2000 untered		TOTAL DEPTI	_ DEP	'TH: 5 BEDR	540.6 fl OCK:	t 80.0 ft		ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF
									REVIEWED BY: Mark McKeown
		EN	INDICES	NG ≻	· _				
NOTES				DENSIT	COVERY		LIN		CLASSIFICATION
NOTES	E	DNESS	SNG	CTURE (	RE REG	B	OGIC L	HIC	AND PHYSICAL CONDITION
	DEP1 2000 2000 5000 6000 7000	9000 HARE	MELC	FRAC	% CC	% RC	GEOL	GRAF	
									E 530.0 90 R3 E 530.5 to 540.6 ft TIVA CANYON TUFF CRYSTAL POOR
									UPPER LITHOPHYSAL ZONE (Tpcpul)     Pyroclastic flow, densely welded, crystallized, medium gray     with less than 5% pumice clasts up to 35 by 5 mm. No
	110								<ul> <li>lithophysae are present in this core run, however contact is distinguished by the decrease in phenocrysts to, 2 to 3%</li> <li>sanidine and plagioclase with less than 1% biotite. Tuff</li> </ul>
									<ul> <li>has less than 1% dark-yellowish brown and light gray</li> <li>volcanic lithic fragments. Generally the rock is moderately hard</li> <li>(H4), moderately (W4) weathered, and moderately fractured</li> </ul>
	120-1-1-1-1-1-1-1								E (FD5). E Discontinuity Measurements:
									Depth Angle* Roughness Infilling
									E 530.9 30 R4 E 531.7 55 R4 E 532.6 15 R3
									E 533.1 70 R4 vapor phase 534.4 75 R4 vapor phase 535.0 50 R4
	135								E 535.4 90 R4 vapor phase E 535.6 85 R4 vapor phase and calcite E 536.2 60 R3
	140							000	537.0 60 R2 rubble 537.5 52 R4 537.7 48 R3 vanor phase
	145								E 538.5 60 R3 vapor phase 538.9 - 540.6 breccia zone
									Angles are measured from core axis and are plus or minus     5 degrees.
	155								
	160						Tmbt1	000	
	165							100	
	170								
	185							,000	
	190								
	195								
	210	-						005	
1	215								
	1 3 1 1 1 1 1 1 1 1 1							1.	-

Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 2 of 6)

		GEOLOG	JE-2	25 RF#22 SHEET 3 OF 6						
FEATURE: Waste Handling Fa LOCATION: ESF North Portal BEGUN: 7/25/2000 FINISHE DEPTH TO WATER: Not Enco		PROJ COOF TOTA DEPT	IECT: RDINA \L DEP TH TO	Yucca TES: 'TH: { BEDR:	a Mour N 766 540.6 fi OCK:	ntain Projec 5,206.2 E t 80.0 ft	ct E 570,7	STATE: Nevada 793.48 GROUND ELEVATION: 3679.17 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown		
			EN		ING					
NOTES	рертн		HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	240 1111112 225 1111112 230 1111112 230 1111112 240 1111112 240 1111112 240 1111112 240 1111112 240 1111112 240 1111112 240 1111112 240 11111112 240 111111112 240 111111111111111111111111111111111111							Tmbt1		

Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 3 of 6)

		GEOLOGIO	CL	OG	OF I	DRII	LH	OLE l	JE-2	-25 RF#22 SHEET 4 OF 6
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 7/25/2000 FINISHEI DEPTH TO WATER: Not Encou	FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad BEGUN: 7/25/2000 FINISHED: 8/15/2000 DEPTH TO WATER: Not Encountered						3 Mour N 766 540.6 f OCK:	itain Projec 3,206.2 E t 80.0 ft	ct 3 570,3	STATE: Nevada ),793.48 GROUND ELEVATION: 3679.17 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF
		· · ·	EN		NG.					REVIEWED BY: Mark McKeown
			EN	GINEER INDICES		OVERY		Ę		CLASSIFICATION
NOTES	DEPTH	SHEAR WAVE VELOCITY ft/s & & & & & & & & & & & & & & & & & & &	HARDNESS	WELDING	FRACTURE D	% CORE REC	% RQD	EUSCS]	GRAPHIC	AND PHYSICAL CONDITION
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	445							Tpcrn	.0 .0 .0	
	450 455								A	

Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 4 of 6)



Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 5 of 6)

			GEOLOGIC LOG O	F DRI	LL HOLE U	E-25 RF#22	SHEET 6 OF 6				
FEATURE: Wa LOCATION: E: BEGUN: 7/25/3 DEPTH TO WA	uste Handling Facility SF North Portal Pad 2000 FINISHED: 8/1 TER: Not Encountere	5/2000 d	PROJE COORD TOTAL DEPTH	CT: Yucca NATES: DEPTH: 5 TO BEDRO	a Mountain Project N 766,206.2 E 57 540.6 ft OCK: 80.0 ft	S 70,793.48 G A H R	TATE: Nevada ROUND ELEVATION: 3679.17 NGLE FROM HORIZONTAL: -90° IOLE LOGGED BY: USBR/SMF EVIEWED BY: Mark McKeown				
				C	SOIL Quaternary Alluvium (Qal)						
	Ρ	re-Rainier Mesa Bedded Tuff (Tmbt1)	Tuff "x" (Tpki)		ROCK Post-Tiva Tpo Canyon Bedded Tuff		Трсриі				
					<b>1000000</b>						
				w	ELDING						
			Nonwelded	_		Densely Welded					
	HADDNI	FCC				WEATUEDTN	a.				
Alphanumeric	Descriptor	Criteri	a		Alphanumeric	Descriptor	General characteristics (strength, excavation, etc.)				
Н1	Extremely	Core, f be scra can onl hammer	ragment, or exposure cannot tched with knife or sharp p y be chipped with repeated blows.	ick; heavy	W1	Fresh	Harmer rings when crystalline rocks are struck. Almost always rock excavation except for naturally weak or weakly cemented rocks such as siltstones or shalos				
Н2	Very Hard	Cannot pick. C repeate	be scratched with knife or ore or fragment breaks with d heavy hammer blows.	sharp	W2	Slightly weathered to fresh	SlidleS.				
НЗ	Hard	Can be pick wi Heavy h specime	scratched with knife or sha th difficulty (heavy pressu ammer blow required to brea n.	rp re). k	W3	Slightly weathered	Hammer rings when crystalline rocks are struck. Body of rock not weakened. With few exceptions, such as siltstones or shales, classified as rock excavation.				
H4	Moderately Hard	Can be pick wi fragmen	scratched with knife or sha th light pressure. Core or t breaks with moderate hamm	rp er	W4	Moderately to slightly weathered	d Uneman door not ying then yook in atyuak				
Н5	Moderately Soft	Can be sharp p Core or blow or	grooved 1/16 in. (2mm) deep lick with moderate or heavy fragment breaks with light heavy manual pressure.	by pressure. hammer		Moderatery weathere	Body of rock is slightly weakened. Depending on fracturing, usually is rock excavation except in naturally weak rocks such as siltstones or shales.				
Н6	Soft	Can be or shar	grooved or gouged easily by p pick with light pressure,	knife can be	W6	Intensely to moderately weathere	d				
Н7	Very Soft	Can be with fi Breaks	o moderate manual pressure. readily indented, grooved o ngernail, or carved with a with light manual pressure.	r gouged knife.	W7	intensely weathered	usually can be broken with moderate to heavy manual pressure or by light hammer blow without reference to planes of weakness such as incipient or hairline fractures, or veinlets. Rock is fractures of the second such by common excavation.				
					W8	Very intensely weathered					
					W9	Decomposed	Can be granulated by hand. Always common excavation. Resistant minerals such as quartz may be present as "stringers" or				
				FRACTU	RE DENSITY		"dikes."				
	Alphanum descript	neric for	Descriptor	Criter: (Exclud	ia des mechanical b	oreaks)					
	FD0 FD1		Unfractured Very slightly fractured	No obse Core re	erved fractures. ecovered mostly	in lengths greater +	han 3 ft (1 m).				
	FD2		Slightly to very slightly fractured			gene ground t					
	FD3		Slightly fractured	Core re scatter	ecovered mostly red lengths less	in lengths from 1 to than 1 ft (300 mm)	3 feet (300 to 1,000 mm) with few or greater than 3 ft $(1,000 \text{ mm})$ .				
	FD4		Moderately to slightly fractured			,					
	FD5		Moderately fractured	Core re lengths	to 1.0 ft (100 to 300 mm) with most						
	FD6		Moderately to intensely fractured	<u>,</u>							
	FD7		Intensely fractured	Length: Core re	s average from C ecovered mostly	.1 to 0.33 ft (30 to in lengths less than	100 mm) with fragmented intervals. 0.33 ft (100 mm).				
	FD8		Very intensely to intensely fractured		1						
	FD9		Very intensely fractured	Core recovered mostly as chips and fragments with a few scattered short core length							

Figure 1.1-104. Geologic Log of Drill Hole UE-25 RF#22 (Sheet 6 of 6)

	GEOLOGI	LOG OF	DRILL I	HOLE	UE-25 RF#23 SHEET 1 OF 3
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 9/25/2000 FINISHEL DEPTH TO WATER: Not Encou	cility Pad D: 9/27/2000 untered	PROJECT: COORDINA TOTAL DEI DEPTH TO	Yucca Mou ATES: N 76 PTH: 159.1 BEDROCK:	untain Proje 65,311.43 ft : 76.0 ft	Inct STATE: Nevada E 570,465.03 GROUND ELEVATION: 3673.98 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY	HARDNESS INDICES WICK HARDNESS WICK HARDNESS HAR	% CORE RECOVERY % RQD	GEOLOGIC UNIT	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility.	5			Fill	0.0 to 12.0 ft PAD FILL (Fill)     Predominately fine to coarse, hard, subangular gravel with a trace     of nonplastic fines on gravel surfaces; derived from moderately to     densely welded tuff.     12.0 to 76.0 ft QUATERNARY ALLUVIUM (Qal)     Tuffaceous alluvium consisting of a mixture of pale red and light     grav dnesely welded importe with priors fragments of while
<ul> <li>Drill Equipment: Schramm T685 Drill Rig</li> <li>Drillers: G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.</li> <li>Drilling Method: Install 12 in. hammer. Hammer to 5.00. Cement 10.75 O.D. casing with 1.03 stickup. Re-enter hole on 9/26/2000 with 8.50 Tricone bit. Drill from 5.00 to total depth of 159.10.</li> <li>Drilling Conditions: 1 new bit. Circulation weak from 119.71 to 139.40</li> <li>Drilling Fluid: 0.00 to 5.00: Nonpotable water. 5.00 to 119.71 to 159.10: Quick Gel with EZ-Mud and LCM to improve circulation.</li> <li>Loss Intervals: 119.71 to 139.40: Circulation weak</li> <li>Casing Record: 0.00 to 5.00: 10.75 O.D. casing. 5.00 to 159.10: No casing</li> <li>Hole Completion: Set and cement 158.96 of 4.50 schedule 80 PVC casing.</li> </ul>	10-11 15			Qal Tpki Tpbt5 Tpcrn	The second se

Figure 1.1-105. Geologic Log of Drill Hole UE-25 RF#23 (Sheet 1 of 3)

	GEOLOG	C LOG	OF I	DRIL	LH	OLE	UE-25 RF	#23 SHEET 2 OF 3
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 9/25/2000 FINISHED DEPTH TO WATER: Not Encou	cility <sup>2</sup> ad D: 9/27/2000 untered	PRC COC TOT DEF	DJECT: DRDINA AL DEF PTH TO	Yucca TES: PTH: 7 BEDR	a Mour N 765 159.1 f OCK:	ntain Proje 5,311.43 t 76.0 ft	ct E 570,465.03	STATE: Nevada GROUND ELEVATION: 3673.98 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY	ENGINEE INDICE SSENDING HARDNESS	ERACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	105- 105- 110- 120- 120- 130- 130- 130- 140- 140- 140- 155-	OTTOM OF	HOLE			Tpcm		

Figure 1.1-105. Geologic Log of Drill Hole UE-25 RF#23 (Sheet 2 of 3)



Figure 1.1-105. Geologic Log of Drill Hole UE-25 RF#23 (Sheet 3 of 3)

GEOLOGIC LOG OF DRILL HOLE U												UE-2	-25 RF#24 SHEET 1 OF 4
FEATURE: Waste Handling Fac LOCATION: ESF North Portal P BEGUN: 8/15/2000 FINISHED DEPTH TO WATER: Not Encou			PRO COO TOTA DEPT	JECT: RDINA AL DEF TH TO	Yucca TES: PTH: 2 BEDR(	a Moun N 766 268.0 ft DCK:	tain Proje ,344.31 30.0 ft	ect E 570	STATE: Nevada 70,542.26 GROUND ELEVATION: 3684.48 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown				
NOTES	DEPTH	SHEAF	VAW 3000	E VEI		HARDNESS	GINEEF NDICES DNICTEM		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility.	5										Fill		0.0 to 10.0 ft PAD FILL (Fill)     Predominately fine to coarse, hard, subangular gravel with a trace     of nonplastic fines on gravel surfaces; derived from moderately to     densely welded tuff.     10.0 to 30.0 ft QUATERNARY ALLUVIUM (Qal)     Tuffaceus alluvium consisting of a mixture of pale red and light
Drill Equipment: Schramm T685 Drill Rig Drillers: G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.	10 15 20										Qal		gray densely welded ignimbrite with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material has white to light gray caliche coatings. 30.0 to 110.0 ft TIVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tporn) Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagloclase phenocrysts, and less
Drilling Method: Install 12 in. hammer. Hammer to 5.06. Cernent 10.75 O.D. casing with 1.07 stickup. Re-enter hole on 8/17/2000 with 8.50 Tricone bit. Drill from 5.06 to total depth of 267.96.	25 30							-					than 1% oldute phenocrysts. From 44.0 to 57.0 ft the turn is pumice poor with less than 1% clast content. From 57.0 to 93.0 ft the tuff has a mix of light brownish-gray and very light gray pumice clasts, composing up 15% of rock. Based on the occurrence of vapor phase mineralization fragments in the chips, there is a lithophysal bearing zone from 93.0 to 104.0 ft phenocryst content begins to decrease at 104.0 ft.
Drilling Conditions: Lost circulation to weak circulation from 100.00 to 267.96. 233.00 to 236.00 very soft drilling. Smooth to rough drilling in some intervals.	35   1   1   1   1   1   1   1   1   1												UPPER LITHOPHYSAL ZONE (Tpcpul) Pyroclastic flow, densely welded, crystallized, vapor phase attered, light gray, with less than 1% sanidine, plagioclase, and biotite phenocrysts. Tuff has less than 1%, very light gray, pumice clasts and volcanic lithic fragments. Lithophysae are distinguished by vapor phase altered chips, indicating the edges of voids in the tuff.
0.00 to 5.06: Nonpotable water. 5.06 to 100.00: Quick Gel mud with EZ-Mud. 100.00 to 267.96: Quick Gel with EZ-Mud and LCM to re-establish circulation.	45 50											0 0 0 00 0 0	230.0 to 268.0 ft TIVA CANYON TUFF CRYSTAL POOR     MIDDLE NONLITHOPHYSAL ZONE (Tpepmn)     Pyroclastic flow, densely weided, crystallized, pale red,     with less than 1% sanidime, plagioclase, and biotite     phenocrysts. Tuff has up to 1% pumice clasts and less than     % volcanic lithic clasts.
Casing Record: 0.00 to 5.06: 10.75 O.D. casing.	60												
Hole Completion: Set and cement 266.05 of 4.50 schedule 80 PVC casing.	70										Tpcm		
	80	1	ţ										
	90												
	53											-0 <b>-</b>	) 

Figure 1.1-106. Geologic Log of Drill Hole UE-25 RF#24 (Sheet 1 of 4)

	GEOLOGI	C L	og c	)F [	DRII	LL H	OLE	UE-2	-25 RF#24 SHEET 2 OF 4
FEATURE: Waste Handling Fac	icility		PROJE	ECT:	Yucca	a Moun	tain Proje	ect	STATE: Nevada
LOCATION: ESF North Portal F BEGUN: 8/15/2000 FINISHEI	Pad D: 8/23/2000		TOTAL	DINA DEP	TES: /TH: 2	N 766 268.0 f	3,344.31 t	E 570	20,542.26 GROUND ELEVATION: 3684.48 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	untered		DEPTH	1 TO E	BEDR	OCK:	30.0 ft		HOLE LOGGED BY: USBR/SMF
									REVIEWED BY: Mark McKeown
		EN		ig ≻	Ī _	T I	Γ		
				LISN3	DVERY		_		
NOTES	SHEAR WAVE VELOCITY	ESS	0	JRE DE	E RECC		S] UN	0	AND PHYSICAL CONDITION
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	125							0.00	
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	135							0,0,0	
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	145							0.0	
	150							0.0	
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	175							0.0	
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	190							0,0,0	, 
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	200							0,0	
	205							0.0	
								0,00	
								°0°	
	215							0,0	
	∃:: <b>:</b>							0.0	

Figure 1.1-106. Geologic Log of Drill Hole UE-25 RF#24 (Sheet 2 of 4)



Figure 1.1-106. Geologic Log of Drill Hole UE-25 RF#24 (Sheet 3 of 4)



Figure 1.1-106. Geologic Log of Drill Hole UE-25 RF#24 (Sheet 4 of 4)

	GEOLOGIC	LOG	OF	DRII	LL H	OLE	UE-25 RF#25 SHEET 1 OF 3
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 9/21/2000 FINISHED DEPTH TO WATER: Not Encou	sility ?ad ): 9/22/2000 intered	PRC COC TOT DEP	JECT: RDINA AL DEF TH TO	Yucca TES: PTH: BEDR	a Mour N 765 159.0 f OCK:	ntain Proje 5,968.15 t 70.0 ft	ect STATE: Nevada E 570,626.38 GROUND ELEVATION: 3676.54 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY	HARDNESS WELDING WELDING	ERACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility.	5					Fill	0.0 to 10.0 ft PAD FILL (Fill) Predominately fine to coarse, hard, subangular gravel with a trace of nonplastic fines on gravel surfaces; derived from moderately to densely welded tuff.      10.0 to 70.0 ft QUATERNARY ALLUVIUM (Qal) Tuffaceuse allowium consisting of a mixture of nale red and light
Drill Equipment:         Schramm T685 Drill Rig         Drillers:         G. Fox, V. Mora, M. Fyffe;         Dynatec Drilling Inc.; Salt Lake         City, Utah.         Drilling Method:         Instail 12 in. hammer. Hammer to         5.00. Cement 10.75 O.D. casing         with 1.12 stickup. Re-enter hole         bit. Drill from 5.00 to total depth         of 158.97.         Drilling Conditions:         1 new bit.         Drilling Fluid:         0.00 to 5.00: Nonpotable water.         5.00 to 158.97. Quick Gel mud         with EZ-Mud.         Loss Intervals:         None         Casing Record:         0.00 to 5.00: 10.75 O.D. casing.         5.00 to 158.97. No casing         Hole Completion:         Set and cement 158.50 of 4.50         schedule 80 PVC casing.	10- 15- 15- 15- 15- 15- 15- 15- 15					Qal	<ul> <li>gray densely welded ignimbrite with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material has white to light gray caliche coatings.</li> <li><b>70.0 to 125.0 ft TVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSIAL ZONE (Term)</b></li> <li>Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagioclase phenocrysts, and less than 1% biotite phenocrysts. From 70.0 to 87.0 the tuff is pumice poor with less than 1% clast content. From 87.0 to 115.0 ft the tuff as mix of light brownish-gray and very light gray pumice clasts, composing up 10% of rock. Based on the occurrence of vapor phase mineralization fragments in the chips, there is a lithophysal bearing zone from 115.0 to 125.0 ft.</li> <li><b>125.0 to 153.0 ft TVA CANYON TUFF CRYSTAL POOR UPPER LITHOPHYSAL ZONE (Teppu)</b></li> <li>Pyroclastic flow, densely welded, crystallized, vapor phase altered, light gray, with less than 1%, sendidic vapor phase altered, sendidic phenocrysts, and the stand 1%, very light gray, unmice clasts and volcance lithic fragments. Lithophysae are distinguished by vapor phase altered chips, indicating the edges of voids in the tuff.</li> </ul>
	70					Tpcrn	

Figure 1.1-107. Geologic Log of Drill Hole UE-25 RF#25 (Sheet 1 of 3)

		GEOLOGI	C L	OG (	OF [	DRIL	L H	OLE I	JE-2	25 RF#25	SHEET 2 OF 3
FEATURE: Waste Handling Fac LOCATION: ESF North Portal P BEGUN: 9/21/2000 FINISHED DEPTH TO WATER: Not Encou	LOCATION: ESF North Portal Pad BEGUN: 9/21/2000 FINISHED: 9/22/2000 DEPTH TO WATER: Not Encountered						a Moun N 765 159.0 ff DCK:	tain Proje ,968.15 70.0 ft	ct E 570	0,626.38	STATE: Nevada GROUND ELEVATION: 3676.54 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
			EN	GINEERI	NG ≻						
NOTES	SHEAR		HARDNESS	MELDING	FRACTURE DENSIT	% CORE RECOVERN	א געסט	[USCS]	GRAPHIC	Al	CLASSIFICATION ND PHYSICAL CONDITION
	105 101 101 110 110 115 115 115 115 115							Tpcrn			
	130-11 130-11 135-11 140-11 140-11 140-11 140-11 150-11 155-11 155-11							Tpcpul			
		B	отто	MOFH	IOLE					_	

Figure 1.1-107. Geologic Log of Drill Hole UE-25 RF#25 (Sheet 2 of 3)



Figure 1.1-107. Geologic Log of Drill Hole UE-25 RF#25 (Sheet 3 of 3)

		GEOLOGI	СL	OG	OF	DRIL	LH	OLE	UE-	25 RF#26 SHEET 1 OF 4
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F BEGUN: 6/26/2000 FINISHEL DEPTH TO WATER: Not Encou	EATURE: Waste Handling Facility OCATION: ESF North Portal Pad BEGUN: 6/26/2000 FINISHED: 7/25/2000 DEPTH TO WATER: Not Encountered							ntain Proje 5,247.95 t 85.0 ft	E 570	STATE: Nevada 0,579.71 GROUND ELEVATION: 3670.79 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES	DEPTH	SHEAR WAVE VELOCITY	HARDNESS		FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility. Drill Equipment: Schramm T685 Drill Rig	5 -							Fill		<ul> <li>Predominately tine to coarse, hard, subangular gravel with a trace of nonplastic fines on gravel surfaces; derived from moderately to densely welded tuff.</li> <li>14.0 to 85.0 ft QUATERNARY ALLUVIUM (Qal)</li> <li>Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded gignimbride with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material have white to lindu rargy action content of a subangular gray and the second s</li></ul>
<ul> <li>Drillers:</li> <li>G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.</li> <li>Drilling Method:</li> <li>Install 12 in. hammer. Hammer to 5.00. Cement 10.75 O.D. casing with 1.13 stickup. Re-enter hole on 77/2000 with 9.7/8 Tricone bit. Drill from 5.00 to depth of 39.39. Drill from 39.39 to total depth of 264.90 with 8.50 Tricone bit.</li> <li>Drilling Conditions:</li> <li>1 new bit. Loss circulation at 258.13.</li> <li>Drilling Fluid:</li> <li>0.00 to 5.00: Nonpotable water.</li> <li>5.00 to total depth of 264.90: Hydro Gel mud with EZ-Mud and LCM to re-establish circulation.</li> <li>Loss Intervals:</li> <li>258.13</li> <li>Casing Record:</li> <li>0.00 to 5.00: 10.75 O.D. casing.</li> <li>5.00 to 39.20: 9 casing.</li> <li>39.20 to 264.90: No casing.</li> <li>Hole Completion: Set and cement 259.90 of 4.50 schedule 80 PVC casing.</li> </ul>	15 20 25 30 35 40 45 55 60 65 70							Qal		<ul> <li>have white to light gray caliche coatings.</li> <li><b>85.0 to 204.0 ft COMB PEAK IGNIMBRITE - TUFF X (Tpki)</b>: Pyroclastic flow, nonwelded, crystallized, with up to 20% pumice clasts. Tuff contains 2 to 3% sanidine, plagioclase, quartz, and less than 1% biotite and hornblende phenocrysts. Up to 8% moderate red to medium dark gray, volcanic lithic clasts. Tuff is predominately grayish-orange pink with possible minor silicification.</li> <li><b>204.0 to 211.0 ft POST-TIVA CANYON BEDDED TUFFS (Tpbt5)</b>: Norwelded, devitrified, reworked (?) Fallout tephra and pyroclastic flows separated by distinct paleosols. Bedded tuffs are very pale orange with 20 to 25% pumice clasts and up to 4%, pale red, volcanic lithic clasts. The tuff has up to 6% quartz, sanidine and lesser plagioclase, with less than 1% biotite and manganese oxides.</li> <li><b>211.0 to 264.9 ft TIVA CANYON TUFF CRYSTAL RICH NONLITHOPHYSAL ZONE (Tporn)</b></li> <li>Pyroclastic flow, moderately to densely welded, crystallized, with 8 to 10% sanidine and plagioclase phenocrysts. and less than 1% biotite bencrysts. Possible vitrophyre from vith up to 3% clast content. From 244.0 to 264.9 ft tuff pumice poor with up to 3% offs clast content. From 244.0 to 264.9 st furf prome poor with up to 3% clast content. From 244.0 to 264.9 st cuff</li> </ul>
	75 80 85 90							Tpki		

Figure 1.1-108. Geologic Log of Drill Hole UE-25 RF#26 (Sheet 1 of 4)

		GEOLOGIC	: L(	IOLE (	JE-2	25 RF#26	SHEET 2 OF 4				
FEATURE: Waste Handling Fa	cility			PROJ	ECT:	Yucca	a Mour	ntain Proje	ct		STATE: Nevada
LOCATION: ESF North Portal F BEGUN: 6/26/2000 FINISHE	Pad :D: 7/2	5/2000		COOH	RDINA	.TES: PTH: (	N 765 264.9 f	5,247.95 †	E 570	0,579.71	GROUND ELEVATION: 3670.79 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encou	unterec	d		DEPT	н то	BEDR	OCK:	85.0 ft			HOLE LOGGED BY: USBR/SMF
											REVIEWED BY: Mark McKeown
	Τ		ENC	GINEER NDICES							
					\ LIN	VERY		_			
NOTES		SHEAR WAVE VELOCITY	ŝ			ZECO'		.INN C		A	CLASSIFICATION ND PHYSICAL CONDITION
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	175	<u>]</u>									
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	185	<b>∃ : : :</b> }: : : : : : : : : : : : : : : :									
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•	205							T-145	. * . 		
	210-	<b> </b>     <b> </b>						Tpbt5			
1	215							Tpcrn	8	E.	
	<del>-</del>	∃ ; ; ; <b>,</b> ; ; ; ; ; ; ] .							0.0	F	

Figure 1.1-108. Geologic Log of Drill Hole UE-25 RF#26 (Sheet 2 of 4)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#26 SHEET 3 OF 4									
FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad BEGUN: 6/26/2000 FINISHED: 7/25/2000 DEPTH TO WATER: Not Encountered			oject: Ordin# Tal def Pth to	Yucca ATES: PTH: 2 BEDR	a Mour N 765 264.9 f OCK:	ntain Proje 5,247.95 t 85.0 ft	ect E 570	S 0,579.71 G A F F	TATE: Nevada ROUND ELEVATION: 3670.79 NGLE FROM HORIZONTAL: -90° IOLE LOGGED BY: USBR/SMF EVIEWED BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY	HARDNESS MIDIC	ERING ES	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	AND	CLASSIFICATION PHYSICAL CONDITION
			T HOLE		6 	Tpcrn			

Figure 1.1-108. Geologic Log of Drill Hole UE-25 RF#26 (Sheet 3 of 4)



Figure 1.1-108. Geologic Log of Drill Hole UE-25 RF#26 (Sheet 4 of 4)
		GEOLOGIO	CL	OG (	OF I	DRIL	L H	OLE	UE-2	-25 RF#28 SHEET 1 OF 2
FEATURE: Waste Handling Fa LOCATION: ESF North Portal F BEGUN: 8/24/2000 FINISHEI DEPTH TO WATER: Not Encor	cility Pad D: 8/2 untere	5/2000 d		PROJ COOF TOTA DEPT	ECT: RDINA L DEF H TO	Yucca TES: PTH: 9 BEDR(	a Moun N 765 99.8 ft OCK:	tain Proje 5,510.21 15.0 ft	ect E 570	STATE: Nevada 70,104.87 GROUND ELEVATION: 3680.63 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES Purpose of Hole: Preliminary, conceptual-level	DEPTH	SHEAR WAVE VELOCITY	HARDNESS	GINEER NDICES SNICTEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	E GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION 0.0 to 5.0 ft PAD FILL (Fill) Predominately fine to coarse, hard, subangular gravel with a trace
geotechnical foundation investigations for the design of the waste handling facility. Drill Equipment: Schramm T685 Drill Rig Drillers: G. Fox V. Mora. M. Fyffe:	5 - 10- 15-							Qal		of nonplastic fines on gravel surfaces; derived from moderately to densely welded tuff. 5.0 to 15.0 tf QUATERNARY ALLUVIUM (QaI) Tuffaceous alluvium consisting of a mixture of pale red and light gray densely welded ignimbrite with minor fragments of white nonwelded tuff. Up to 15% of the densely welded material has white to light gray caliche coatings. 1.6.0 to 70.0 th TUA CANYON TUFF CRYSTAL RICH
Dynatec Drilling Inc.; Šalt Lake City, Utah. Drilling Method: Install 12 in. hammer. Hammer to 4.96. Cement 10.75 0.D. casing with 1.16 stickup. Re-enter hole on 8/25/2000 with 8.50 Tricone bit. Drill from 4.96 to total depth of 99.75.	20- 25- 30-									NonCircle Content of the analysis of the analy
Drilling Conditions: Smooth soft drilling to total depth of hole. Drilling Fluid: 0.00 to 4.96: Nonpotable water. 4.96 to total depth of 99.75: Quick Gel mud with EZ-Mud.	35- 40- 45-							Tpcrn		UPPER LITHOPHYSAL ZONE (Toppul)     Pyroclastic flow, densely welded, crystallized, vapor-phase     altered, light gray, with 2 to 3% sanidine and plagioclase,     and less than 1% biotite phenocrysts. Tuff has up to 5%,     very light gray, pumice clasts. Lithophysae are distinguished     by vapor-phase altered chips, indicating the edges of voids     in the tuff.
Loss Intervals: NA Casing Record: 0.00 to 4.96: 10.75 O.D. casing. 4.96 to 99.75: No casing. Hole Completion: Set and cement 97.98 of 4.50	50-									
schedule 80 PVC casing.	65 70 75									
	80 85 90 95							Tpcpul		
	-100	BO	TTO	M OF H	IOLE				0.0 0.0	

Figure 1.1-109. Geologic Log of Drill Hole UE-25 RF#28 (Sheet 1 of 2)

NOTE: Hole logged from cuttings. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. RQD = rock quality designation.



Figure 1.1-109. Geologic Log of Drill Hole UE-25 RF#28 (Sheet 2 of 2)

	GEOLOGIC L	og of dri	LL HOLE	UE-25 RF#29 SHEET 1 OF 5
FEATURE: Waste Handling Facility LOCATION: ESF North Portal Pad BEGUN: 10/26/2000 FINISHED: DEPTH TO WATER: Not Encounte	ty d : 11/1/2000 tered	PROJECT: Yuco COORDINATES: TOTAL DEPTH: DEPTH TO BEDF	ca Mountain Proj N 766,018.46 430.0 ft ROCK: 85.0 ft	oject STATE: Nevada ⇒ E 570,836.04 GROUND ELEVATION: 3672.71 ANGLE FROM HORIZONTAL: -90° t HOLE LOGGED BY: USBR/SMF REVIEWED BY: Mark McKeown
NOTES Purpose of Hole: Preliminary, conceptual-level	EN SHEAR WAVE VELOCITY t/s SHEAR WAVE VELOCITY HL SHEAR WAVE VELOCITY t/s 0000 +	MELEDING INDICES FRACTURE DENSIT & CORE RECOVERY	% RQD GEOLOGIC UNIT [USCS]	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole:         Preliminary, conceptual-level geotechnical foundation investigations for the design of the waste handling facility.       1         Drill Equipment:       1         Schramm T685 Drill Rig       1         Drillers:       1         G. Fox, V. Mora, M. Fyffe; Dynatec Drilling Inc.; Salt Lake City, Utah.       2         Drilling Method:       1         Install 12 in. hammer. Hammer to 4.50. Cement 10.75 O.D. casing with 1.51 stickup, Re-enter hole on 10/27/2000 with 8.50 Tricone bit. Drill from 4.50 to total depth of 429.92.       3         Drilling Conditions:       3         Smooth soft drilling to total depth of hole.       4         Doil to 4.50: Nonpotable water.       4         4.50 to total depth of 429.92:       4         Quick Gel mud with EZ-Mud.       4         Loss Intervals: NA       5         Casing Record: 0.00 to 4.50: No, 75 O.D. casing.       5         Hole Completion: Set and cement 409.67 of 4.50 schedule 80 PVC casing.       6         7       8         8       9         9       9			Qal	<ul> <li>0.0 to 85.0 ft QUATERNARY ALLUVIUM (Qai)</li> <li>Tuffaceous alluvium consisting of a mixture opale red and light pray densely welded uprimbrite with minor fragments of while nonwelded uprim. One service of the ser</li></ul>

Figure 1.1-110. Geologic Log of Drill Hole UE-25 RF#29 (Sheet 1 of 5)

NOTE: Hole logged from cuttings. Shear Wave Velocity data from GeoVision suspension logging. Data acquired from downhole survey conducted after PVC casing installed. RQD = rock quality designation.

	GEOLOG	#29 SHEET 2 OF 5						
FEATURE: Waste Handling Far LOCATION: ESF North Portal F BEGUN: 10/26/2000 FINISHE DEPTH TO WATER: Not Encou	acility Pad ED: 11/1/2000 untered		PROJEC COORD TOTAL DEPTH	CT: Yu DINATES DEPTH: TO BED	cca Mour 3: N 76 430.01 0ROCK:	ntain Proje 6,018.46 ît 85.0 ft	ct E 570,836.04	STATE: Nevada GROUND ELEVATION: 3672.71 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: USBR/SMF
								REVIEWED BY: Mark McKeown
		ENG		G				
NOTES		ARDNESS	VELDING	RACTURE DENSITY	% RaD	SEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	105- 105- 105- 105- 105- 110-					Tmbt1		

Figure 1.1-110. Geologic Log of Drill Hole UE-25 RF#29 (Sheet 2 of 5)

	GEOLOGI	C LOC	) OF	DRII	LL H	IOLE I	JE-25 RF#2	29 SHEET 3 OF 5
FEATURE: Waste Handling Faci LOCATION: ESF North Portal Pa BEGUN: 10/26/2000 FINISHE/ DEPTH TO WATER: Not Facou	cility <sup>2</sup> ad ED: 11/1/2000 unterad	PR CC TO DF	OJECT: ORDINA TAL DE	Yucca ATES: PTH: 4	a Moun N 766 430.0 f	1tain Proje 3,018.46 t 85.0 ft	ct E 570,836.04	STATE: Nevada GROUND ELEVATION: 3672.71 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: LISBR/SME
			1 111 10	DEDIT	oon.	00.0 1		REVIEWED BY: Mark McKeown
NOTES	SHEAR WAVE VELOCITY tts 문 범 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8	HARDNESS	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS] GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	220 225 225 235 240 240 245 240 245 240 245 255 260 265 275 275 275 285 290 275 290 191 295 191 191 295 191 191 295 191 191 295 191 191 295 191 191 295 191 191 295 191 191 191 195 191 195 195 1					Tmbt1	ւն ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու ներ ու Աստակատակատակատակատակատակատակատակատակատակ	

Figure 1.1-110. Geologic Log of Drill Hole UE-25 RF#29 (Sheet 3 of 5)

		GEOLOGI	C L	OG (	OF [	DRIL	L H	OLE	UE-	-25 RF#29 SHEET 4 OF 5
FEATURE: Waste Handling Fac LOCATION: ESF North Portal F	cility Pad			PROJI COOF	ECT: RDINA	Yucca TES:	a Moun N 766	itain Proje 5,018.46	ect E 570	STATE: Nevada 70.836.04 GROUND ELEVATION: 3672.71
BEGUN: 10/26/2000 FINISHE	ED: 11	/1/2000			L DEP		130.0 fl ОСК-	85.0 ft		ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER. NOLENOL	Untered	1		DEFI	HIUI	BEUR	UUN.	60.U IL		REVIEWED BY: Mark McKeown
			EN		ING					
					ENSITY	OVERY		Ę		
NOTES		SHEAR WAVE VELOCITY	IESS	U Z	URE DI	E REC		ogic un	읒	AND PHYSICAL CONDITION
	DEPTH	1000 5000 8000 8000 9000	HARDN	MELDI	FRACT	% COR	% RQD	GEOLO	GRAPH	
	340									
	345									
	350								•••	
								Toki		
	355									
	360									
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	370									
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	400	, , <b>, ,</b> , , , , , , , , , , , , , , ,							Þ • 0	
	405							Tpcrn	0.0	
	410								·0', P',	
	415								0.0	
	100									
	420								0	•
	425								.0,	
	430	B	отто	M OF F	IOLE				2.	. <u>E</u>

Figure 1.1-110. Geologic Log of Drill Hole UE-25 RF#29 (Sheet 4 of 5)



Figure 1.1-110. Geologic Log of Drill Hole UE-25 RF#29 (Sheet 5 of 5)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#42 SHEET 1 OF 3													
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/4/2005 FINISHED: 5/5/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 118.9 BEDROCK	untair 64,63 ) ft : 75	n Project STATE: Nevada I3.04 E 571,142 GROUND ELEVATION: 3634.87 ANGLE FROM HORIZONTAL: -90° 5.4 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung				
NOTES	рертн	HARDNESS	Bineerii Ndices 9 Nigtian	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION				
Purpose of Hole: Renository Eacilities Gentechnical Investigations	-							011	0.0 to 75.4 ft QUATERNARY ALLUVIUM (Qal):				
Repository receives device intera investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller:	5						(SP-SM)gc		0.0 to 7.0 ft POORLY GRADED SAND WITH SILT GRAVEL AND COBBLES (SP-SM)gc: About 55% coarse to fine, subangular sand; about 30% coarse to fine, hard, subangular gravet; about 15% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular cobbles; maximum size 120 mm; dry, brown, no reaction with HCI. Organic material present.				
Travis Ostergerg Boart Longyear Drill Services	Ξ							ē.					
Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 118.90 ft (TD). Drill string inside casing consists of 3% in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit.	10								7.0 to 19.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, hard, subangular gravel; about 45% coarse to fine, subangular sand, coarse sand-size particles fractured with hammer blow, about 5% nonplastic fines; maximum size 75 mm; dry, pink, light brown, strong reaction with HCI.				
Drilling Conditions: Not Reported	-						(GP)s						
Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing.	15							000					
Fluid Loss Interval: NA								0.() 10()					
Casing Record: 8 in. casing from 0.0 to 118.9 ft (TD)								) 0 \\	19.0 to 22.5 ft POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 55%				
Hole Completion: Back fill hole from 118.9 ft (TD) up to 0.0 ft	20						(GP-GM)s		coarse to fine, hard, subangular gravel; about 35% coarse to fine, subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 55 mm; dry, pinkish gray, strong reaction with HCI.				
(ground sunace) with benchnite chips, r un casing.							(SW)g		22.5 to 25.0 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 55% coarse to fine, angular to subangular sand; about 40% predominantly fine, hard, angular to subangular gravej; about 5% nonplastic fines; maximum size 25 mm; dry, gray, moderate reaction with				
	25						SM		C FICI. 25.0 to 25.9 ft SILTY SAND (SM): About 70% coarse to fine, subangular to subrounded sand; about 30%, nonplastic fines with quick dilatancy and low toughness; trace of zenderiestable, fine, here is ubmore due to ubmere device and complex to the approximation of the approximation.				
							(GP)sc	200	proof maintening and the second secon				
	30							e.)	angular to subangular safic, race on nonprastic mes, trace of nano, subangular to sub ounced cobbles; maximum size 150 mm; dry, pink, strong reaction with HCI.				
							(SW-SM)g	0.30	32.0 to 34.5 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 60% coarse to fine, subangular to subrounded sand; about 25% predominantly fine, hard, subangular gravel; about 15% nonplastic fines with quick dilatancy and low toughness;				
	35-								maximum size 45 mm; dry, gray, strong reaction with HCl. 34.5 to 43.7 tf POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subrounded gravel; about 40% coarse to fine, angular to subangular sand; trace of nonglastic fines; trace of hard, subangular cobbles;				
							(CB)22	00	maximum size 105 mm; dry, gray, strong reaction with HCI.				
	40						(GP)sc		{_  -  -  -				
								S.					
	45-						(SW-SM)g (GP-GM)s		43.7 to 44.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 60% coarse to fine, angular to subangular savin, about 30% predominantly fine, hard, subangular to subrounded gravel; about 10% nonplastic fines with quick dilatancy and low				
							(GP)s		446 to 455 th POORLY GRADED GRAVEL WITH SLIT AND SAND (GP-GM)s: About 55% predominantly fine, hard, subangular gravel; about 35% coarse to fine, subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 60 mm; dry, gray, strong reaction with HCI. 45.5 to 46.5 th WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 70%				

Figure 1.1-111. Geologic Log of Drill Hole UE-25 RF#42 (Sheet 1 of 3)

	G	EOL	.0G	IC L	OG	OF I	DRILL	НО	LE UE-25 RF#42	SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/4/2005 FINISHED: 5/5/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 118.9 BEDROCK	ountair 764,63 9 ft 75	1 Project 3.04 E 571,142 5.4 ft	STATE: Nevada GROUND ELEVATION: 3634.87 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	NG				<u> </u>		
NOTES	DEPTH	HARDNESS	<u>NDICES</u> 9NIDIAW	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	C AND PI	LASSIFICATION HYSICAL CONDITION
							(SM)g (SW)gc SM (GP)c (GP)s (GP-GM)s Tmbt1? Tmbt1		<ul> <li>coarse to fine, subangular sam gravel; about 10% nonplastic fi 10 mm; dry, pinkish gray, stro ds 5 to 50 8 r POORLY GRAD fine, hard, angular gravel; about subangular sand; about 30% p nonplastic fines; maximum sizz 50.8 to 52.1 ft SILTY SAND With subangular sand; about 30% p nonplastic fines; with quick dilat gray, strong reaction with HCL 52.1 to 56.9 ft WELL GRADED coarse to fine, subangular san gravel; about 5% nonplastic fines; with quick dilat subangular to suborounded grav to nonplastic fines; trace of hard, 63.0 to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft SILTY SAND Galo to 63.9 ft Galo to 70.0 ft galo to 71.8 ft SANDY SILT (M Iow toughness; those of hard, subar reaction with HCL 75.4 to 84.0 ft PRE-RAINER M Bedded tuff, norwelded, consil glass shards, and crystalized Very pale torwor. Contains 2 to fragments, 15 to 25% cacite for mar to 20% puncies, 11 to 45% thot fines; 11 to 20% orgstate. Tephra from 89.0 to 93.8 ft, no. 11 to 20% orgstate.</li> </ul>	<ul> <li>about 20% predominantly fine. hard, subangular meswith quick dilatancy and low loughness; maximum size greaction with HCI.</li> <li>ED GRAVEL WITH SAND (GP)s: About 60% coarse to it 35% coarse to fine, angular sand; about 5% 90 mm; dry, gray, no reaction with HCI.</li> <li>TH GRAVEL (SM)g: About 55% coarse to fine, stread and low bughness; maximum size 20 mm; dry.</li> <li>SAND WITH GRAVEL AND COBBLES (SW)gc: About 65% d; about 35% coarse to fine, subangular read-on with HCI.</li> <li>MP: About 70% coarse to fine, subangular sand; about 30% ancy and low bughness; trace of predominantly fine, hard, ster, at a down and the HCI.</li> <li>MP: About 70% coarse to fine, angular sand; about 35% carev; about 70% coarse to fine, angular sand; about 35% arave; about 70% coarse to fine, angular sand; about 35% arave; about 70% coarse to fine, angular sand; about 35% arave; about 70% coarse to fine, angular sand; about 35% arave; adown toughness; maximum size 10 mm; dry, gray.</li> <li>TH GRAVEL (SM)g. About 40% coarse to fine, angular sand; about 35% arave; adown toughness; maximum size 10 mm; dry, gray.</li> <li>CH GRAVEL WITH SAND (GP)s: About 65% coarse to argrave; about 35% coarse to fine, angular sand; about 37% argrave; about 35% coarse to fine, angular sand; about 37% argrave; about 35% coarse to fine, angular sand; about 37% argrave; about 35% coarse to 10%, about 40% coarses to argrave; about 35% coarse to 10%, about 40% nonplastic fines with quick dilatancy and 10w ingular to subangular grave; about 25% coarse to 13, apduar to subangular grave; about 25% coarse to 10%, about 10% nonplastic fines with quick dilatancy and 10w ingular cobbles; maximum size 10 mm; dry, gray, strong tes to fine, subangular grave; about 25% coarse to 14, about 10% nonplastic fines with quick dilatancy and 10w ingular to subangular grave; about 25% coarse to 10 to 30. It are scattered cobble size clasts of crystallized weided be fill.</li> <li>MESA TUFF EDDED TUFF (Tmbt)I: and the distingt a</li></ul>

Figure 1.1-111. Geologic Log of Drill Hole UE-25 RF#42 (Sheet 2 of 3)

	G	EOL	.OG		OG	OF I	DRILL	но	LE UE-25 RF#42 SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/4/2005 FINISHED: 5/5/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	iect: Rdina <sup>:</sup> L dep 'H to i	Yucca Mo TES: N 7 TH: 118.9 BEDROCK	ountair 764,63 9 ft 3: 75	Project STATE: Nevada 3.04 E 571,142 GROUND ELEVATION: 3634.87 ANGLE FROM HORIZONTAL: -90° 4.4 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER	ING					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	110						Tmbt1		<ul> <li>113.6 to 118.9 ft TIVA CANYON TUFF CRYSTAL-RICH MEMBER NONLITHOPHYSAL</li> <li>ZONE (Tpcm):</li> <li>Pyroclastic flow, densely welded, crystallized, reddish gray, dark reddish-gray, reddish-black.</li> <li>Contains 50 c5% pumoe, 10 to 15% crystal fragments of sanidine and plagioclase, less than 1% biotite, and pyroxene.</li> </ul>
			в	ΟΤΤΟΙ	MOFH	IOLE	Ipern		less than 1% biolife, and pyroxene.

Figure 1.1-111. Geologic Log of Drill Hole UE-25 RF#42 (Sheet 3 of 3)

	G	EOL	OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#43 SHEET 1 OF 2
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/16/2005 FINISHED: 5/17/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 110. BEDROCK	ountair 765,37 1 ft 5: 90	in Project STATE: Nevada 75.54 E 570,709.32 GROUND ELEVATION: 3669.90 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	GINEER INDICES DNICTEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Elathed combination water and pine truck with boom							(SP)gc		0.0 to 19.4 ft PAD FILL:     0.0 to 4.6 ft PAD FILL:     0.0 to 4.6 ft PAD FILL:     predominantly coarse to medium, subangular sand; about 45% coarse to line, hard,     subangular coales, hard, and the strength of th
for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services Drilling Method: Rotosonic	5						(GP)s		4.6 to 10.6 ft POORLY GRADED GRAVELE WITH SAND (GP)s: About 75% coarse to fine, hard, angular to subrounded gravel; about 25% coarse to fine, angular to subangular sand; trace of nonplastic fines with quick dilatancy and how toughness; moist, light yellowish brown, gray, weak to moderate reaction with HCL
Advance 8 in. casing as hole is cored 0.0 to 110.1 ft (TD). Drill string inside casing consists of 3½ in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit.							(SW)gc		10.6 to 13.0 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 70%     coarse to fine, angular to subangular sand; about 30% coarse to fine, hard, angular     to subangular gravel; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size     100 mm mole throws strong reaction with HCI
Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.00 to 110.1 ft (TD) Hole Completion: Back fill hole from 110.1 ft (TD) up to 0.00 ft (ground surface) with Bentonite Chips. Pull casing.	15 						(GP)sc		10.0 mm, moist, prown, strong reaction will rHJ.     13.0 to 28.1 tPOORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60%     coarse to fine, hard, subangular to subrounded gravel, about 40% coarse to fine,     angular to subrounded sand, trace of nonjastic fines; trace of hard, subangular cobbles;     maximum size 120 mm, moist, yellowish brown, yellowish tan, gray, strong reaction with HCI.     19.4 to 90.5 ft QUATERNARY ALLUVIUM (Qal):
	30						(SW)gc		28.2 to 47.0 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 60% coarse to fine, study and the study and the study of the stu
	45							Solo Alexand	47.0 to 68.7 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, angular to subangular sand; trace of nonghasic fines; trace of hard, subangular cobbles; maximum size 150 mm; dry, gray, tan, weak to strong reaction with HCI. Core removed from 64.2 to 65.5 ft.

Figure 1.1-112. Geologic Log of Drill Hole UE-25 RF#43 (Sheet 1 of 2)

	GEC	OLOG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#43 SHEET 2 OF 2
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/16/2005 FINISHED: 5/17/2005 DEPTH TO WATER: Not Encountered				PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO E	Yucca Mo TES: N 7 TH: 110. BEDROCK	ountair 765,37 1 ft K: 90	n Project STATE: Nevada '5.54 E 570,709.32 GROUND ELEVATION: 3669.90 ANGLE FROM HORIZONTAL: -90° 0.5 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	MAKDNESS NDICE		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
			вотто	M OF H	OLE	(GP)sc (SW)gc (GP)sc (GP)s CR (GP)s		<ul> <li>BS 1b 57 1f 18 tWELL GRADED SAND WITH GRAVEL AND COBBLES (SWggc: About 60% coarse to fine, angular to subangular sand; about 40% coarse to fine, had; subangular gravel; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 155 m; dry, gray, storag reaction with HC.</li> <li>T 18 to 25 ft 677 1f tWELL GRADED SAND WITH GRAVEL AND COBBLES (SWggc: About 60% coarse to fine, storagular south 40% coarse to fine, angular to subangular gravel; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 105 mm; dry, gray, storag reaction with HC.</li> <li>ES to 577 ft tWELL GRADED SAND WITH GRAVEL AND COBBLES (SWggc: About 60% coarse to fine, subangular south 40% coarse to fine, angular to subangular gravel; trace of nonplastic fines; trace of subangular cobbles; maximum size 100 mm; dry, very pale brown, strong reaction with HCI.</li> <li>EV to 88.4 th CORE REMOVED</li> <li>BS to 90.5 th 20.7 tGRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, subangular south 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular sand; about 40% coarse to fine, angular to subangular grave; about 40</li></ul>

Figure 1.1-112. Geologic Log of Drill Hole UE-25 RF#43 (Sheet 2 of 2)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#44 SHEET 1 OF 3													
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/18/2005 FINISHED: 5/23/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINAT L DEP <sup>-</sup> H TO E	Yucca Mo TES: N7 TH: 143.9 BEDROCK	n Project STATE: Nevada 8.81 E 570,828.46 GROUND ELEVATION: 3676.33 ANGLE FROM HORIZONTAL: -90° 08.0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung					
NOTES	DEPTH	HARDNESS	GINEER NDICES ONICITEM		% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION				
Purpose of Hole: Repository Facilities Geotechnical Investigations	-							20	0.0 to 26.8 ft PAD FILL:				
Repository Facilities dedictionical investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in casing as hole is cored 0.0 to 143.5 ft (TD). Drill string inside casing consists of 3/5 in single wall crill pipe with 6.163 in. Rotosonic Carbide buttonbit. Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in casing from 0.0 to 143.5 ft (TD) Hole Completion: Back fill hole from 143.5 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	5						(GP)sc	ALLANDER CONTRACTOR	0.0 to 31.0 ft PORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 70% coarse to fine, hard, angular to subangular gravel; about 30% coarse to fine, angular sand; trace of nonplastic fines, dry, light grav, grav, pink, weak to strong reaction with HCL.         TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; remainder minus 3 in.; maximum size 85 mm.				
	30-							200	26.8 to 108.0 ft QUATERNARY ALLUVIUM (Qal):				
	35						(GP-GM)s	Color Color	31.0 to 38.3 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: About 50% coarse to fine, hard, subangular gravel; about 40% coarse to fine, subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; dry, light brown, moderate reaction with HCI. Iron staining on gravel. TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; remainder minus 3 in.; maximum size 75 mm.				
	40						(SW)g	Concernation of the second sec	<ul> <li>38.3 to 39.0 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 75% coarse to fine, angular to subangular sand; about 20% predominantly fine, hard, angular gravel; about 5% nonplastic fines; maximum size 25 mm; dry. light brown, strong reaction with HCI.</li> <li>19.0 to 42.1 ft PORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard; subangular gravel; about 40% coarse to fine, angular to subangular sand; about 5% nonplastic fines; dry. light gray and pink, no to strong reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular cobbles; remainder minus 3 in; maximum size 90 mm.</li> </ul>				
								200	48.2 to 52.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 65% coarse to fine, angular to subangular sand; about 25% predominantly fine, hard,				

Figure 1.1-113. Geologic Log of Drill Hole UE-25 RF#44 (Sheet 1 of 3)

	G	EOL	OG	IC L	OG	OF	DRILL	но	DLE UE-25 RF#44 SHEET 2 OF 3	
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/18/2005 FINISHED: 5/23/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	iect: Rdina L Dep H to I	Yucca Mo TES: N TH: 143. BEDROCH	ountain 765,418 5 ft K: 10	in Project STATE: Nevada I18.81 E 570,828.46 GROUND ELEVATION: 3676.33 ANGLE FROM HORIZONTAL: -90° 108.0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung	
		EN	GINEERI INDICES	NG	Σ					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSIT	% CORE RECOVER	% RQD	[USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
	-						(SW-SM)		angular to subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 35 mm; dry, pinkish gray, weak reaction with HCI.	
	55   -   -						(GP)sc		S26 to 55.7 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 5 coarse to fine, hard, subangular gravel; about 45% coarse to fine, angular sand; trace of nonplastic fines; dry, pink, strong reaction with HCI. TOTAL SAMPLE (BY VOLUME); About 15% hard, subangular cobbles; remainder minus 3 in; maximum size 120 mm. 5.57 to 53.7 tw ELL GRADED SAND WITH GRAVEL AND COBBLES (SW)sc: About 50%	55% %
	60 - 1 - 1						(SW)gc		<ul> <li>coarse to fine, angular sand; about 45% coarse to fine, hard, angular gravel; about 5% nonplastic fines; ruce of hard, subangular cobbles; maximum size 80 mm; dry, pinkist gray, strong reaction with HCI.</li> </ul>	١
							(GP)sc		637 to 66.1 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About (     637 to 66.1 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About (     7 confermionally fee bard accuracy accuracy accuracy accuracy accuracy	30%
	65						(SW-SM)		<ul> <li>predominantly mile; hard; and guiar grave, about 40% costs to line; angular sand, trace of nonplastic fine; dry, light hown, moderate reaction with HC.</li> <li>TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular cobbles; maximum size 11</li> </ul>	0 mm;
	70 - 1 - 1							A C C C	<ul> <li>remainder minus 3 in.</li> <li>66.1 to 68.2 twelL. GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 55% coarse to fine, subangular sand; about 35% predominantly fine, hard, subangular gravel; about 10% nonplastic fines with HCI.</li> <li>68.2 to 10.1 of POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, and, and, are nonplastic fines with HCI.</li> <li>68.2 to 10.1 of POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, and any for nonplastic fines with the, strong reaction</li> </ul>	
	75						(GP)sc	ALLER REPAIRED FOR	with HCI. Core removed from 82 to 99.4 ft.           TOTAL SAMPLE (BY VOLUME): About 10% hard, drilled and angular to subangular cobbles; maximum size 95 mm; remainder minus 3 in.	
	105			-			(SW)gc		101.0 to 108.0 ft POORLY GRADED SAND WITH GRAVEL AND COBBLES (SW)ge: Abo 65% coarse to fine, angular to subangular sand; about 35% coarse to fine, subangular gravel; trace of nonplastic fines; trace of subangular cobbles; maximum size 125 mm; dry, pink, strong reaction with HCI.	ut
							Tpki		Pyroclastic flow, nonwelded, crystallized and partially silicified, white, 10 to 40% pumice,	

Figure 1.1-113. Geologic Log of Drill Hole UE-25 RF#44 (Sheet 2 of 3)



Figure 1.1-113. Geologic Log of Drill Hole UE-25 RF#44 (Sheet 3 of 3)

GEOLOGIC LOG OF DRILL HOLE UE-25 RF#45 SHEET 1 OF 3														
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/1/2005 FINISHED: 6/6/2005 DEPTH TO WATER: Not Encountered	PROJECT: Yucca Mountain Project STATE: Nevada COORDINATES: N 765,268.13 E 571,021.95 GROUND ELEVATION: 3650.02 TOTAL DEPTH: 125.5 ft ANGLE FROM HORIZONTAL: -90° DEPTH TO BEDROCK: 93.0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung													
NOTES	DEPTH	HARDNESS	NDICES NDICES		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC						
Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services	5						(GP)sc		0.0 to 7.3 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse fine, hard, subangular gravel; about 45% coarse to fine, angular to subangular sand; trace of nonplastic fines, trace of hard subangular cobbles; maximum size 130 mm; moist, reddish brown to light reddish brown, strong reaction with HCI.					
Drilling Method: Rotosonic Advance 8 in: casing as hole is cored 0.0 to Advance 8 in: casing consists of 325.5 ft (TD). Drill string inside casing consists of 326 in single wall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported	10   1   1   1						(SW)gc (GP)sc	A Color	7.3 to 9.1 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 55% coarse to fine, subangular sand; about 40% coarse to fine, hard, subangular gravel; about 5% nonplastic fines, trace of hard subangular cobbles; maximum size 80 mm; dy, light trown, moderate reaction with HCI.     9.1 to 16.6 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, hard, angular to subangular solution fines, diry, light reddish brown, moderate reaction with HCI.     TOTAL SAMPLE (RV VOLUME): About 5% hard, subangular cobbles; maximum size					
Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record:	15   -   -   -   -   -   -   -   -   -						(SW)gc		130 mm; remainder minus 3 in. 16.6 to 18.0 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 55% coarse to fine, angular to subangular sand; about 45% coarse to fine, hard, angular to subangular gravel, trace of nonplastic fines; dry, pinkish gray, strong reaction with HCI.					
8 in. casing from 0.00 to 125.50 ft (TD) Hole Completion: Back fill hole from 125.5 ft up to 0.00 ft (ground surface) with Bentonite Chips. Pull casing.	20						(GP)sc		TOTAL SAMPLE (BY VOLUME): About 15% hard, subangular cobbles; maximum size 110 mm; remainder minus 3 in. 18.0 to 28.1 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GPsc: About 60% coarse to fine, hard, subangular gravel; about 40% coarse to fine, and; usubangular sand; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 125 mm; dry, pink, no reaction with HCI.					
	30						(SW)g		28.1 to 31.6 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 65% coarse to fine, angular sand, about 35% predominantly fine, hard, angular gravel; trace of nonplastic fines; maximum size 60 mm; dry, pink, moderate reaction with HCI. 21.6 to 24.0 # DOOPLY GRADED GRAVEL WITH SAND (GPus: About 55%)					
							(GP)s	о С М	predominantly fine, hard, subangular gravel; about 45% coarse to fine, angular sand; trace of nonplastic fines, maximum size 70 mm, dry, pinklish gray, strong reaction with HCI. 44.0 to 35.2 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 65%					
	40						(GP)sc	1000 C	<ul> <li>coarse to fine, angular sand; about 25% predominantly fine, hard subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, pink, weak reaction with HCI.</li> <li>53 E to 425 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 45% coarse to fine, hard, subangular gravel; about 35% coarse to fine, subangular to angular sand; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular cobbles; maximum size 100 mm; dry, pink, strong reaction with HCI.</li> </ul>					
	45						(SW-SM)g (GP)sc		42.5 to 43.4 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 60% coarse to fine, subangular sand; about 30% predominantly fine, hard, subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 40 mm; dyi, pink, strong reaction with HCI. 43.4 to 46.4 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, angular to subangular sand; trace of nonplastic fines; dry, pink, strong reaction with HCI.					
									TOTAL SAMPLE. (BY VOLUME): About 15% hard, subangular cobbles; maximum size     Toomm: remainder minus 3 in:     46.4 to 58.0 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 50%					

Figure 1.1-114. Geologic Log of Drill Hole UE-25 RF#45 (Sheet 1 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HOI	LE UE-25 RF#45 SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/1/2005 FINISHED: 6/6/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	JECT: RDINA L DEP TH TO I	Yucca Mo TES: N 7 TH: 125.5 BEDROCK	untain 65,268 ft : 93.	Project STATE: Nevada 13 E 571,021.95 GROUND ELEVATION: 3650.02 ANGLE FROM HORIZONTAL: -90° 0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	ЭЕРТН	HARDNESS	GINEER		% CORE RECOVERY	% RQD	SEOLOGIC UNIT USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
							(SW)gc (GP)sc (SW-SM)gc (SW)gc (GP)sc (GP)sc (SW)g (GP)sc		<ul> <li>correct to fine, angular to subangular sand; about 45% coarse to fine, hard, aubangular cobbies; maximum size 115 mm; dry, pink to pinkish gray, weak to strong reaction with HCI.</li> <li>SS0 to 62.5 ft PCORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, subangular gravel; about 35% coarse to fine, subangular sate 135 mm; dry, pink, strong reaction with HCI.</li> <li>SS0 to 62.5 ft PCORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, angular to subangular gravel; about 35% coarse to fine, subangular sate 130 mm; dry, pink, strong reaction with HCI.</li> <li>SC1 to 71.7 ft WELL GRADED SAND WITH SLT, GRAVEL AND COBBLES (SW-SM)gc: About 65% coarse to fine, angular to subangular gravel; about 35% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular and angular subangular gravel; about 65% coarse to fine, angular to subangular and about 40% predominantly fine, hard, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, angular to subangular gravel; about 65% coarse to fine, hard, angular to subangular gravel; about 65% coarse to fine, hard, angular to subangular gravel; about 65% coarse to fine, hard, angular to subangular gravel; about 65% coarse to fine, hard, subangular cobbles; maximum size 130 mm; remainder minus 3 in.</li> <li>TA to 82.3 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (SP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 55% coarse to fine, hard, angular to subangular gravel; about 55% coarse to fine, hard, subangular gravel; about 55% coarse to fine, hard, angular to subangular gravel; about 55% coarse to fine, hard, s</li></ul>

Figure 1.1-114. Geologic Log of Drill Hole UE-25 RF#45 (Sheet 2 of 3)

	G	EOL	OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#45	SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/1/2005 FINISHED: 6/6/2005 DEPTH TO WATER: Not Encountered					PRO COO TOTA DEPT	JECT: RDINA AL DEP TH TO I	Yucca Mo TES: N 7 TH: 125.9 BEDROCK	ountain 765,268 5 ft 5: 93	Project 8.13 E 571,021.95 0 ft	STATE: Nevada GROUND ELEVATION: 3650.02 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	GINEEF NDICE: SNIGTEM		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	AND F	CLASSIFICATION HYSICAL CONDITION
	110- 		E	30TT0	M OF H	HOLE	Тркі			

Figure 1.1-114. Geologic Log of Drill Hole UE-25 RF#45 (Sheet 3 of 3)

	GE	EOL	.OG	IC L	OG	OF I	DRILL	LE UE-25 RF#46 SHEET 1 OF 2	
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/12/2005 FINISHED: 5/16/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 103.5 BEDROCK	untain 64,889 5 ft : 84	Project STATE: Nevada 9.91 E 570,602.74 GROUND ELEVATION: 3669.22 ANGLE FROM HORIZONTAL: -90° 4.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	SINEERII NDICES ONICIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole:	-						(GP)sc	90	- 0.0 to 27.2 ft PAD FILL
Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg	5						(GP-GM)so	10 0 0 0 0	0.0 to 1.5 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55%     predominantly fine, hard, angular to subangular gravel; about 40% coarse to fine,     subangular sand; about 5% nonplastic fines, trace of hard subangular cobbles; maximum     size 110 mm; dry, gray, strong reaction with HCL Pad fill.     15 to 7.7 # POORLY GRADED GRAVEL WITH SLT SAND AND COBBLES (GP-GM)sc:     About 55% predominantly fine, hard, angular to subangular gravel; about 30% coarse to fine,     angular sand; about 10% nonplastic fines with quick dilatancy and low toughness, trace of hard,     subangular cobbles; maximum size 100 mm; dry, gray, on creaction with HCL Pad fill.
Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 103.5 ft (TD). Drill string inside casing consists of 3½ in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported	10						(GP)sc	2000 C	7.7 to 20.3 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% predominantly fine, hard, angular to subangular gravely, about 40 to 45% coarse to fine, angular to subangular sand; trace to 5% nonpleastic fines; trace of hard, subangular cobbles; maximum size 90 mm; moist, light gray to light reddish brown, no to strong reaction with HCI. Pad fill.
Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing.	20							2000	
NA Casing Record:							(SW)g		<ul> <li>20.3 to 21.9 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 70% coarse to fine, subangular sand; about 25% predominantly fine, hard, subangular gravel; about 5% nonplastic fines; maximum size 60 mm; moist, gray, no reaction with HCL. Pad fill.</li> </ul>
Casing record: 8 in. casing from 0.00 to 103.5 ft (TD) Hole Completion: Back fill hole from 103.5 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	25						(GP)sc	See S	21.9 to 27.2 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, subangular gravel; about 40% coarse to fine, angular to subangular sand; about 5% nonplastic fines; trace of hard subangular cobbles; maximum size 100 mm; moist, gray, no reaction with HCI. Pad fill.
	30 30 40 45 						(GP)sc	A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A CAR A C	<ul> <li>27.2 to 84.2 ft QUATERNARY ALLUVIUM (Qai)</li> <li>27.2 to 49.0 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, angular to subangular gravel; about 40% coarse to fine, angular to subangular cobbles; maximum size 120 mm; moist, pink, light reddish brown, strong reaction with HCI.</li> <li>49.0 to 55.8 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 80% coarse to fine, angular to subangular sand; about 15% predominantly fine, hard, angular to subangular sand; about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 120 mm; moist, pink, light reddish brown, strong reaction with HCI.</li> </ul>
	55						(GP)s CR		<ul> <li>55.8 to 58.4 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 65%</li> <li>predominantly fine, hard, angular gravel, about 35% coarse to fine, subangular sand; trace of nonplastic fines; maximum size 75 mm; dry, pink, strong reaction with HC.</li> <li>58.4 to 59.8 ft CORE REMOVED</li> </ul>

Figure 1.1-115. Geologic Log of Drill Hole UE-25 RF#46 (Sheet 1 of 2)

	G	EOL	.0G	IC L	LE UE-25 RF#46 SHEET 2 OF 2				
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/12/2005 FINISHED: 5/16/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEF H TO	Yucca Mo TES: N 7 TH: 103.5 BEDROCK	untair 64,88 5 ft : 84	n Project STATE: Nevada 9.91 E 570,602.74 GROUND ELEVATION: 3669.22 ANGLE FROM HORIZONTAL: -90° 4.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	ОЕРТН	ARDNESS	SINEER INDICES ONICIAN	BU BUSITY	6 CORE RECOVERY	6 RQD	USCS]	BRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	65		B		MOFH	IOLE	(SW-SM)gr (GP-GM)sr Qc		<ul> <li>So to 46 ft WELL GRADED SAND WITH SILT GRADEL AND COBELES (GW-SNIgc: Abud 70% corace to fine, subargular south Abud 20% coraces to fine, hard, subargular gravet; about 10% norplastic fines with quick dilatancy and low toughness; trace of hard, subargular conducts; maximum size 80 mm; dry, pinkish grav and pink, strong reaction with HCI.</li> <li>Act to 50% corace to fine, shard, subargular gravet; about 35% coarse to fine, angular to subangular sort, about 10% norplastic fines with quick dilatancy and low toughness; trace of hard, subangular gravet; about 35% coarse to fine, angular to subangular sance, about 10% norplastic fines with quick dilatancy and low toughness; trace of hard, subangular gravet; about 35% coarse to fine, angular to subangular sance, about 10% norplastic fines with quick dilatancy and low toughness; trace of hard, subangular gravet; about 35% coarse to fine, angular to subangular sance, about 10% norplastic fines with quick dilatancy and low toughness; trace of hard, subangular coables; maximum size 130 mm; dry, pinkish gray and pink, strong reaction with HCI. Core removed from 68.3 to 69.5 ft.</li> <li>S3.0 b S4.2 ft COLLIVIUM (Oc):</li> <li>Primarity weathered and into movefed Tuff "X", caliche commented (strong neaction with HCI). Contains grave to coble-size fargements of Tuff "X" thit caliche coatings.</li> <li>S4.2 to 13.5 ft COMB PEAK (GNIMBERTE - TUFF "X" (Tpk)):</li> <li>Pyrodistic forw, nonvelded, crystallized, whith; 15 to 25% pumice, 1 to 3% volcanic lithic fragments, about 2% crystal fragments of altered feldspar, and rare quartz, biotite and hornberde.</li> </ul>

Figure 1.1-115. Geologic Log of Drill Hole UE-25 RF#46 (Sheet 2 of 2)

	GE	EOL	.OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#47 SHEET 1 OF 3				
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 7/12/2005 FINISHED: 7/13/2005 DEPTH TO WATER: Not Encountered		PROJECT: Yucca Mountain Project       STATE: Nevada         COORDINATES: N 765,746.68       E 571,076.62       GROUND ELEVATION: 3663.86         TOTAL DEPTH: 122.3 ft       ANGLE FROM HORIZONTAL: -90°         DEPTH TO BEDROCK: 97.0 ft       HOLE LOGGED BY: George Eatman         REVIEWED BY: Robert Lung											
NOTES Purpose of Hole: Repository Facilities Geotechnical Investigations Drill Equipment:	DEPTH	HARDNESS		FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT (USCS)	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION 0.0 to 90.0 ft QUATERNARY ALLUVIUM (Qai) 0.0 to 4.5 ft NO CORE RECOVERED				
GP24 400 RS (Sonic Drill Rig) Flatbad combination water and pipe truck with boom for moving drill pipe and casing. Driller Travis Osterberg Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 122.3 ft (TD). Drill string inside casing consists of 3% in. singlewall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions:	5						(GP)sc	A CONTRACTOR	<ul> <li>4.5 to 8.8 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60 to 75% coarse to fine, hard, angular to subangular gravel; about 20 to 35% coarses to 5% nonplastic lines; trace of hard subangular cobbles; maximum size 85 mm; dry, pink, weak to strong reaction with HCI. Caliche present.</li> <li>8.8 to 13.5 ft WELL GRADED SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: About 55% coarse to fine, subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; dry, pink, weak reaction with HCI. Caliche present.</li> <li>1.70 TAL SAMPLE (BY VOLUME): About 10% hard, angular cobbles; maximum size 145 mm; remember dave and subangular gravel; about 10% hard, angular cobbles; maximum size 145 mm;</li> </ul>				
The reported Difference of the second	20						(SM)g (GP)sc (SW-SM)g( (GP)s (SM)g	a control of a	13.5 to 15.7 ft SILTY SAND WITH GRAVEL (SM)g: About 65% coarse to fine, angular to subangular sand; about 20% predominantly fine, hard, angular gravel; about 15% nonplastic fines with quick dilatancy and low toughness; maximum size 60 mm; dry, pink, strong reaction with HCI. Caliche present. 15.7 to 18.2 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% predominantly fine, hard, angular gravel; about 35% coarse to fine, subangular sand; about 5% nonplastic fines; trace of hard, filled and subangular obles; maximum size 130 mm; dry, pinkish gray, strong reaction with HCI. Caliche present. 18.2 to 20.7 ft WELL GRADED GRAVEL WITH SILT GRAVEL AND COBBLES (GP)sc: About 60% predominantly fine, hard, angular to subangular sand; about 40% predominantly fine, hard, angular to subangular cobbles; maximum size 130 mm; dry, pinkish gray, strong reaction with HCI. Caliche present. 18.2 to 20.7 ft WELL GRADED GRAVEL WITH SILT GRAVEL AND COBBLES (SW-SM)ge: About 50% coarse to fine, angular to subangular gravel; about 40% predominantly fine, hard, angular to subangular cobbles; maximum size 80 mm; dry, pinkish gray, strong reaction with HCI. 20.7 to 21.7 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 70% predominantly fine, angular to subangular gravel; about 15% coarse to fine, angular sand; about 40% predominantly fine, hard, angular gravel; about 15% coarse to fine, angular to subangular gravel; about 25% coarse to fine, angular sand; about 5% coarse to fine, angular to subangular gravel; about 15% coarse to fine, angular to subangular gravel; about 15% coarse to fine, angular to subangular gravel; about 15% coarse to fine, angular sand; about 40% predominantly fine, hard, subangular gravel; about 15% coarse to fine, angular to subangular gravel; about 15% coarse to fine, angular to subangular gravel; about 15% coarse to fine, angular sand; about 40% predominantly fine, hard, subangular gravel; about 15%				
	30						(GP)sc (SW-SM)g (GP)sc		<ul> <li>pinkish gray, strong reaction with HCI.</li> <li>26.2 to 26.8 ft POORLY GRADED GRAVEL WITH SAND AND COBLES (GP)sc: About 55% predominantly fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; about 5% nonplastic fines; dry, pink, moderate reaction with HCI.</li> <li>TOTAL SAMPLE (BV VOLUME): About 10% hard, drilled and subrounded cobbles; maximum size 110 nm; remainder minus 3 in.</li> <li>28.6 to 31.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 50% coarse to fine, angular sand; about 10% nonplastic fines with nuck dilatancy and low toughness; maximum size 40 nm; dry, pink, no coarse to fore, angular sand; about 10% bangular grave; about 30% coarse to formathy coarse, hard, angular to subangular grave; about 5% coarse to formathy to coarse, hard, angular to subangular grave; about 5% coarse to for subangular grave; about 5% coarse to for subangular grave; about 5% coarse to for subangular grave; about 5% coarse to for subangular grave; about 5% coarse to for subangular grave; about 5% coarse to formathy to coarse, hard, angular to subangular grave; about 5% coarse to fine, angular sand; abo</li></ul>				
	40 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						(GP-GM)sc (SM)gc	Vor College and the College	<ul> <li>TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular cobbles; maximum size 100 mm; remainder minus 3 in.</li> <li>34.8 to 36.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 55% coarse to fine, angular to subangular sant about 35% predominantly fine, hard, angular to subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 65 mm; dry, pinkish gray, moderate reaction with HCI.</li> <li>36.6 to 40 9 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)se: About 50% predominantly fine, hard, angular to subangular grave; about 40% coarse to fine, angular sand; about 10% nonplastic fines with quick dilatancy and low toughness; dry, pinkish gray, weak reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; maximum size 150 mm; remainder minus 3 in.</li> <li>40.8 to 43.8 ft SILT SAND AMTH GRAVEL AND COBBLES (SM)gc: About 40% coarse to fine, angular sand; about 30% predominantly coarse, hard, angular to subangular grave; about 30% nonplastic fines with quick dilatancy and low toughness; dry, inght gray, weak reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; maximum size 130 mm; remainder minus 3 in.</li> <li>40.8 to 43.8 ft SILT SAND WITH GRAVEL AND COBBLES (SM)gc: About 40% coarse to fine, angular about 30% predominantly coarse, hard, angular to subangular grave; about 30% nonplastic fines with quick dilatancy and low toughness; dry, light gray, strong reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 15% hard, drilled and subangular cobbles; maximum size 130 mm; remainder minus 3 in.</li> <li>TOTAL SAMPLE (BY VOLUME): About 15% hard, drilled and subangular cobbles; maximum size 130 mm; remainder minus 3 in.</li> <li>TOTAL SAMPLE (BY VOLUME): About 15% hard, drilled and subangular cobbles; maximum size 130 mm; remainder minus 3 in.</li> <li>TOTAL SAMPLE (BY VOLUME): About 15% hard, drilled and subangular cobbles; maximum size 130</li></ul>				

Figure 1.1-116. Geologic Log of Drill Hole UE-25 RF#47 (Sheet 1 of 3)

	G	EOL	OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#47	SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 7/12/2005 FINISHED: 7/13/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	iect: Rdina L Dep Th to	Yucca Mo TES: N 7 TH: 122.3 BEDROCK	ountair 765,74 3 ft 3: 97	Project 6.68 E 571,076.62 .0 ft	STATE: Nevada GROUND ELEVATION: 3663.86 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER	ING						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	C AND PI	LASSIFICATION HYSICAL CONDITION
	-							20	<ul> <li>angular sand; about 10% nonp hard, subangular cobbles; max</li> </ul>	plastic fines with quick dilatancy and low toughness; trace of dimum size 105 mm; dry, pinkish gray, strong reaction with HCI.
	=						(SW)gc		51.9 to 54.1 ft WELL GRADED coarse to fine, angular sand; a	SAND WITH GRAVEL AND COBBLES (SW)gc: About 55% bout 40% predominantly fine, hard, angular gravel; so of bard, graving the other subscription cobbler; maximum circo
	55-						(SW-SM)g		80 mm; dry, light reddish brown 54.1 to 56.8 ft WELL GRADED About 55% coarse to fine, ang	n, moderate reaction with HCl. SAND WTH SILT GRAVEL AND COBBLES (SW-SM)gc: ular to subangular sand; about 35% predominantly
							(SM)g	241	<ul> <li>coarse, hard, angular to subar</li> <li>and low toughness; trace of ha</li> <li>85 mm; dry, pinkish gray, stror</li> <li>56.8 to 59.0 ft SILTY SAND W</li> </ul>	igular gravel; about 10% nonplastic fines with quick dilatancy rd, drilled and angular to subangular cobbles; maximum size ig reaction with HCI. TH GRAVEL (SMig: About 65% coarse to fine, angular
	60							Port of	to subangular sand; about 20% nonplastic fines with quick dilat strong reaction with HCI. 59.0 to 68.6 ft POORLY GRAD About 50% predominantly coa angular sand; about 10% nonp pinkish gray, strong reaction w	& predominantly fine, hard, angular gravel: about 15% ancy and low toughness; maximum size 20 mm; dy, pinkish gray, beD GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: rse, hard, angular gravel; about 40% coarse to fine, diastic fines with quick dilatancy and low toughness; dry, tith HCI.
	65						(GP-GM)s		TOTAL SAMPLE (BY VOLUM 120 mm; remainder minus 3 in	E): About 5% hard, subangular cobbles; maximum size
	1 3							i.d.	68.6 to 70.0 ft CORE REMOVE	Ð
	70						(GP)sc		70.0 to 87.5 ft POORLY GRAD to 65% predominantly fine to p about 30 to 45% coarse to fine fines; trace of hard, angular to no to strong reaction with HCI.	ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 50 redominantly coarse, hard, angular to subangular gravel; a gangular to subangular sand; trace to 5% nonplastic subangular cobbles; maximum size 130 mm; dry, pink, Core removed from 81.6 to 83.0 ft.
	80								87.5 to 90.0 ft POORLY GRAD	ED GRAVEL WITH SILT AND SAND (GP-GM)s: About 55%
	90-						(GP-GM)s		dry, pinkish gray, moderate rea 90.0 to 97.0 ft ALLUVIUM COL	har graver, about 55% coarse to fine, angular sand, h quick dilatancy and low toughness; maximum size 50 mm; action with HCI. LUVIUM (Qal Col):
	95						Qal/Col	0 0 0 0	pecded, write, sit and very in caliche cemented (strong reac up to 1 cm.	le sand size fragments of weided turf and lesser felsic crystals, tion with HCI), less than 10% densely welded tuff fragments
	100						Tmbt1	d 2 0 0 0	97.0 to 122.3 ft PRE-RAINIER Bedded tuff, norwelded, crysta and fracture coatings near top fragments of welded tuff or lav feldspar and quartz, less than	MESA TUFF BEDDED TUFF (Tmbt1): Illized, slightly clay allered, while and pinkish while, calcile veinlets of bed, 2 to 20% punice, less than 1 to 15% lithic a flow, less than 1 to 3% crystal fragments of sanidine, 1% biotite.

Figure 1.1-116. Geologic Log of Drill Hole UE-25 RF#47 (Sheet 2 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HO	LE UE-25 RF#47	SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 7/12/2005 FINISHED: 7/13/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO E	Yucca M TES: N TH: 122. BEDROCH	ountair 765,74 3 ft K: 97	n Project 16.68 E 571,076.62 7.0 ft	STATE: Nevada GROUND ELEVATION: 3663.86 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER	ING						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	AND	CLASSIFICATION PHYSICAL CONDITION
			в	OTTO	MOFH	OOLE	Tmbt1			

Figure 1.1-116. Geologic Log of Drill Hole UE-25 RF#47 (Sheet 3 of 3)

	G	EOL	.OG	IC L	OG	of I	DRILL	HO	LE UE-25 RF#48	SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/11/2005 FINISHED: 4/14/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 159.3 BEDROCK	ountair 765,47 3 ft 3: 11	n Project 4.33 E 571,386.99 13.3 ft	STATE: Nevada GROUND ELEVATION: 3653.64 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
BEGUN: 4/11/2005 FINISHED: 4/14/2005 DEPTH TO WATER: Not Encountered NOTES NOTES Purpose of Hole: Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Drille: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Drille: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Drille: GP24 300 RS (Sonic Drill Rig) Flatbed combined: Rotsoonic Advance 8 in. casing as hole is cored 0.0 to 159.3 ft (TD). Drill string inside casing consists of 3% in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: Back fill hole from 159.3 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	10	HARONESS	GINEERI NDICES 9NIOTIII M	ERACTURE DENSITY	% OOKE RECOVERY	UDEP H TO E	TH: 159.3 3EDROCK 3EDROCK 3EDROCK (GP) 350 (GP-GM)sc (GP-SM)sc (GP-SM)sc (GP-SM)sc (GP-SM)sc (GP-SM		O.0 to 113.3 ft QUATERNARY / O.0 to 113.3 ft QUATERNARY / O.0 to 2.2 ft SILTY SAND (SM); sand; about 15% nonplestic fin fine, hard, subangular to subrou subrounded sand; about 15% no present. 2.2 to 3.8 ft SILTY GRAVEL W to fine, hard, angular gravel; about to subrounded sand; about 15% nonplastic fine, hard, angular gravel; about subrounded sand; about 15% nonplastic fine, hard, angular gravel; about subrounded sand; about 5% no reaction with HCL 4.5 to 4.5 ft POORLY GRADEE predominantly fine, hard, angular subangular sand; about 5% no reaction with HCL 0.5 ft POORLY GRADEE predominantly fine, hard, subargular sand; about 10.2 to 15.6 ft POORLY GRADEE to subangular sand; about 5% no reaction with HCL 5.5 th OBS, predominantly fine, hard, subargular sand; about 10.2 to 15.6 ft POORLY GRADEE to gradient to subangular sand; about 10.2 to 15.6 ft POORLY GRADEE to gradient to subangular sand; about 10.2 to 15.6 ft POORLY GRADEE to gradient to subangular sand; about 10.2 to 15.6 ft POORLY GRADEE to subangular sand; about 30% trace of predominantly fine, hard, angular to subangular sand; about 10.2 to 15.6 ft POORLY GRADEE to subangular sand; about 30% to subangular sudarnut size 45 n 17.6 to 18.7 ft SILTY SAND (SI) subrounded cobbles; maximum 12.2 to 14.5 ft SULTY SAND (SI) subrounded sout 30% nonplastic fines reaction with HCL 18.7 ft SILTY SAND (SI) subrounded sout 30% nonplastic fines reaction with HCL 18.7 ft SILTY SAND (SI) subrounded sout 5% nonplastic fines reaction with HCL 23.3 ft POORLY GRADE reaction with HCL 23.3 ft POORLY GRADE 10% nonplastic fines with quick	ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung LASSIFICATION HYSICAL CONDITION ADDITI
	35 						(GP-GM)s SM (GP)s (SW)g (SW-SM)g (GP-GM)s		<ul> <li>Coalse to line, indrg: aliguiar jug</li> <li>T0% nonplastic fines with quick</li> <li>gray, strong reaction with HCI.</li> <li>23.8 to 24.3 ft WELL GRADED</li> <li>coarse to fine, angular to subangular gravel; a</li> <li>toughness; maximum size 40 m</li> <li>24.8 to 25.8 ft SiLT* SAND (Si</li> <li>sand; about 15% nonplastic fines with quick 20%</li> <li>nonplastic fines with quick dilat</li> <li>strong reaction with HCI.</li> <li>31.0 to Subangular gravel; a</li> <li>toughness; maximum size 40 m</li> <li>reaction with HCI.</li> <li>31.0 to Subangular gravel; a</li> <li>toughness; maximum size 40 m</li> <li>onoplastic fines with quick dilat</li> <li>strong reaction with HCI.</li> <li>31.0 to Subangular gravel; a</li> <li>toughness; maximum size 40 m</li> <li>oarse to fine, hard, angular to subangular gravel; a</li> <li>toughness; maximum size 40 m</li> <li>coarse to fine, hard, angular to subangular gravel; a</li> <li>subangular sand; about 10% m</li> <li>maximum size 25 mm, dry, gra</li> <li>subangular sand; about 10% m</li> <li>maximum size 25 mm, dry, gra</li> <li>about 25% nonplastic fines with predominantly fine, hard, subar</li> <li>reaction with HCI;</li> <li>33.4 to SI.3* 37 POORLY GRAD</li> </ul>	arter, about 20% observed to thire, angular sanitri, about dilatancy and low toughness; maximum size? To mm, dry, sand with SLT AND GRAVEL (SW-SM)g: About 65% gular sand; about 25% predominantly fine, hard, boot 10% nonplastic fines with quick dilatancy and low m, dry, gray, strong reaction with HCL. dilatancy and low toughness; trace of gular to subrounded gravel; maximum size 25 mm, dry, gray, the GRAVEL (SM)g: About 65% coarse to fine, angular by distribution of the strand stranger of the subrounded signal ro subrounded gravel; maximum size 25 mm, dry, gray, the GRAVEL (SM)g: About 65% coarse to fine, angular by distribution of the strand stranger of the subrounded subrounded gravel; maximum size 25 mm, dry, tan, SAND WITH SLT AND GRAVEL (SW-SM)g: About 70% subangular sand; about 20% coarse to fine, hard, but 10% nonplastic fines with quick dilatancy and low to the swith quick dilatancy and low toughness; y to tan, no reaction with HCl. DigAsted thes with quick dilatancy and low toughness; y to tan, no reaction with HCl. W; About 60% coarses to fine, angular to onplastic fines with quick dilatancy and low toughness; y to tan, no reaction with HCl. W; About 60% coarses to fine, hard, subangular sand; n quick dilatancy and low toughness; about 10% gular gravel; maximum size 70 mm, dry, gray, moderate ED GRAVEL WITH SAND (GP)s: About 70% coarse to

Figure 1.1-117. Geologic Log of Drill Hole UE-25 RF#48 (Sheet 1 of 3)

	G	EOL	.OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#48	SHEET 2 OF 3
FEATURE: Waste Handling Facility		PROJECT: Yucca Mountain Project							STATE: Nevada	
LOCATION: Midway Valley BEGUN: 4/11/2005 EINISHED: 4/14/2005					COOF		TES: N 7	765,47- 3.ft	I.33 E 571,386.99	GROUND ELEVATION: 3653.64
DEPTH TO WATER: Not Encountered					DEPT	н то	BEDROCH	6: 11	3.3 ft	HOLE LOGGED BY: George Eatman
										REVIEWED BY: Robert Lung
		EN	GINEER	RING						
			NDICES	È	ž					
NOTES				DENS	OVE		L		CL	ASSIFICATION
NOTES		ESS	Q	I'RE [	REC		00	υ	AND PH	IYSICAL CONDITION
	PTH	RDN		ACTL	CORE	RaD	SCS]	MPHI		
	ä	Ч	Ň	Ë	%	%	52	5		
	-						sw	*** ***	<ul> <li>sand; about 5% nonplastic fines</li> <li>37.3 to 39.0 ft WELL GRADED</li> </ul>	ar graver; about 25% coarse to fine, angular to subangular s; maximum size 60 mm, dry, gray, strong reaction with HCl.
	3	1					(SW)gc	····	<ul> <li>fine, angular to subangular san</li> <li>gravel; trace of nonplastic fines;</li> </ul>	; about 35% coarse to fine, hard, angular to subangular ; maximum size 45 mm, dry, light brown and tan, no to strong
	-						(0.1.)50		reaction with HCl. 39.0 to 41.2 ft WELL GRADED	SAND WITH SILT AND GRAVEL (SW-SM)g: About 65%
	55-	1					(SW-SM)		<ul> <li>coarse to fine, angular to subar angular to subangular gravel; al toughnoon movimum gize 25 m</li> </ul>	igular sand; about 25% predominantly fine, hard, bout 10% nonplastic fines with quick dilatancy and low
	-								41.2 to 50.0 ft POORLY GRADI	ED GRAVEL WITH SILT AND SAND (GP-GM)s: About 55% subangular gravel: about 35% coarse to fine.
								è.C	<ul> <li>angular to subangular sand; ab toughness; maximum size 50 m</li> </ul>	out 10% nonplastic fines with quick dilatancy and low nm, dry, gray, strong reaction with HCl.
	60-						(GP)s	0	<ul> <li>50.0 to 53.0 ft WELL GRADED</li> <li>subangular sand; about 5% coa</li> </ul>	SAND (SW): About 90% coarse to fine, angular to arse to fine, hard, angular to subangular gravel; about 5%
								$\circ$	53.0 to 53.3 ft WELL GRADED	130 mm, dry, tan, strong reaction with HCI. SAND WITH GRAVEL AND COBBLES (SW)gc: About 55% pular sand: about 40% predominantly line, bard
	=							¢	<ul> <li>angular gravel; about 5% nonpl maximum size 140 mm, dry, ligi</li> </ul>	lastic fines; trace of subangular to subrounded cobbles; ht gray, weak to moderate reaction with HCl.
							(SW)g		<ul> <li>53.3 to 56.8 ft WELL GRADED coarse to fine, angular to subar</li> </ul>	SAND WITH SILT AND GRAVEL (SW-SM)g: About 60% ngular sand; about 30% coarse to fine, hard, angular
	-00								<ul> <li>to subangular gravel; about 10%</li> <li>maximum size 45 mm, dry, grav</li> <li>56 8 to 62 1 ft POORLY GRAD</li> </ul>	% nonplastic tines with quick dilatancy and low toughness; y, strong reaction with HCI. ED GRAVEL WITH SAND (GD): About 55% coarse to
	-							a S	<ul> <li>fine, hard, subangular to subrou subrounded sand: about 5% no</li> </ul>	unded gravel; about 40% coarse to fine, subangular to inplastic fines: maximum size 60 mm, drv. tan, strong
	3							è.	reaction with HCl. 62.1 to 67.0 ft WELL GRADED	SAND WITH GRAVEL (SW)g: About 70% coarse to
	70-						(GP)s	0	fine, angular to subangular san gravel; about 15% nonplastic fir	d; about 15% coarse to fine, hard, angular to subangular es with quick dilatancy and low toughness; maximum size
	1 3							00	<ul> <li>67.0 to 72.3 ft POORLY GRADI</li> <li>fine hard angular to subangula</li> </ul>	ED GRAVEL WITH SAND (GP)s: About 55% coarse to ar gravel: about 40% coarse to fine, angular to subangular
	-						(SW-SM)		<ul> <li>sand; about 5% nonplastic fines</li> <li>72.3 to 72.6 ft WELL GRADED</li> </ul>	s; maximum size 55 mm, dry, tan, strong reaction with HCI. SAND WITH SILT AND GRAVEL (SW-SM)g: About 70%
	75-								<ul> <li>coarse to fine, angular to subar angular to subangular gravel; al</li> </ul>	ngular sand; about 20% predominantly fine, hard, bout 10% nonplastic fines with quick dilatancy and low
							(SW)ac		<ul> <li>tougnness; maximum size 35 m</li> <li>72.6 to 80.0 ft WELL GRADED</li> <li>coarrie to fine, angular to subar</li> </ul>	Im, dry, gray, strong reaction with HCI. SAND WITH GRAVEL AND COBBLES (SW)gc: About 70%
									angular to subangular gravel; a subrounded cobbles; maximum	sout 5% nonplastic fines; trace of hard, subangular to size 120 mm, dry, light brown, strong reaction with HCl.
	-								-	
	80-							9	- 80.0 to 84.7 ft POORLY GRADI	ED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc.
	3						(GP-GM)s	5	About 50% coarse to fine, hard sand; about 10% nonplastic fine	, angular gravel; about 40% coarse to tine, angular es with quick dilatancy and low toughness; trace of hard, loc: maximum gize 90 mm du, gray, strang reaction with HCI
	-							Å.		ins, maximum size oo min, ary, gray, salong reaction warrior.
	85-							oR		A: About 75% coarse to fine, subangular to subrounded
	-						SM		<ul> <li>sand; about 25% nonplastic fine predominantly fine, hard, suban</li> </ul>	es with quick dilatancy and low toughness; trace of gular to subrounded gravel; maximum size 70 mm, dry, tan,
	=	1							<ul> <li>strong reaction with HCl.</li> <li>87.7 to 89.1 ft CORE REMOVED</li> </ul>	D
		1							- 89.1 to 94.2 ft WELL GRADED	- SAND WITH GRAVEL (SW)a: About 50% coarse to
	90	1							fine, angular sand; about 45% o nonplastic fines; maximum size	coarse to fine, hard, angular gravel; about 5% 65 mm, dry, tan, strong reaction with HCl.
	-	1					(SW)g		-	
	3						L		-	
	95-						(GM)s	0.0	94.2 to 96.3 ft SILTY GRAVEL angular to subangular gravel; a	WITH SAND (GM)s: About 40% coarse to fine, hard, bout 35% coarse to fine, angular to subangular sand; about
									25% nonplastic fines with quick gray, strong reaction with HCI.	dilatancy and low toughness; maximum size 50 mm, dry,
	=								to 80% coarse to fine, angular to	J SAND WITH GRAVEL AND COUBLES (SW)gc: About 70 to subrounded sand; about 15 to 25% coarse to fine, avel: about 5% nonnegatic fines: trace of hard drilled and
	100-							الموني	angular cobbles; maximum size removed from 97.2 to 99.0 ft.	a 140 mm, dry, tan and light tan, strong reaction with HCl. Core
	- 100						(SW)gc		-	
	=						. ,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		-	
	3								-	
	105-	1							-	
	3	1					(SW-SM)		- 106.1 to 106.9 ft WELL GRADE	D SAND WITH SILT AND GRAVEL (SW-SM)g: About 65%
	-	ł					CR		<ul> <li>about 25% predominantly fine,</li> <li>with guick dilatancy and low tou</li> </ul>	hard, subangular gravel; about 10% nonplastic fines ghness; maximum size 15 mm; dry. grav. strong reaction with HCI.
									106.9 to 108.5 ft CORE REMOV	/ED

Figure 1.1-117. Geologic Log of Drill Hole UE-25 RF#48 (Sheet 2 of 3)

	G	EOL	.OG	IC L	OG (	OF	DRILL	но	DLE UE-25 RF#48 SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/11/2005 FINISHED: 4/14/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	iect: Rdina Il dep Th to	Yucca M TES: N 'TH: 159 BEDROC	ountair 765,47 .3 ft K: 1 <sup>,</sup>	n Project STATE: Nevada Y4.33 E 571,386.99 GROUND ELEVATION: 3653.64 ANGLE FROM HORIZONTAL: -90° 13.3 ft HOLE LOGGED BY: George Eatman
									REVIEWED BY: Robert Lung
NOTES	рертн	HARDNESS	SINEER NDICES 9NIG13A		% CORE RECOVERY	% RQD	d [uscs]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	110-	1						687	
	115 120 120 125 130 130 135 135 145 145 155 155 155						(GP)sc		111.1 to 113.8 TOORLY GRADED GRAVEL WITH SAND AND COBBLES (GPus: About 6% subargular sub., about 5% norphasite (ines; tradout 35% coarts to fine; angular 50 subargular sub., about 5% norphasite (ines; tradout 35% coarts to fine; angular 50 subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% subargular sub., about 60% sub., about 60% sub., about 60% subargular sub., about 60% sub.,
			В	SOTTO	M OF H	IOLE			

Figure 1.1-117. Geologic Log of Drill Hole UE-25 RF#48 (Sheet 3 of 3)

	G	EOL	.OG		OG	DLE UE-25 RF#49 SHEET 1	OF 3			
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/6/2005 FINISHED: 4/11/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 142.9 BEDROCK	ountain 766,058 9 ft 7: 11	in Project STATE: Nevada 58.84 E 571,421.14 GROUND ELEVATION: 3668.78 ANGLE FROM HORIZONTAL: -90° 112.9 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung	
NOTES	DEPTH	HARDNESS	SINEER NDICES ONICIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
Purpose of Hole: Repository Facilities Geotechnical Investigations	-						SM		0.0 to 112.9 ft QUATERNARY ALLUVIUM (Qal)	
Poil Equipment: OP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom tor moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 14/2.9 ft (TD). Drill string inside casing consists of 3½ in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported	5 10 11						(GP)sc	00000000000000000000000000000000000000	Out to 22 f SILTY SAND (SM): About 85% coarse to fine, subangular to subro- sand; about 15% nonplastic fines with quick dilatancy and low toughness, trace predominantly fine, hard, subangular to subrounded gravel; maximum size 90 n reaction with HCI, Grass and rods present. topsoil. 22 to 14.4 ft POORLY GRADED GRAVEL WITH SAND AND COBELES (GP) coarse to fine, hard, augular to subrounded gravel; about 40% coarse to fine, angular to subangular sand; about 5% nonplastic fines; trace of hard, subangu maximum size 80 mm; dry, gray, pink, strong reaction with HCI.	unded 3 of m; dry, brown, no sc: About 55% lar cobbles;
Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.0 to 142.9 ft (TD) Hole Completion: Back fill hole from 142.9 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	15						<u>(SW-SM)</u> (GP)sc		14.4 to 14.8 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: A angular to subangular sand; about 35% predominantly fine, hard, angular to subangular grave; about 10% nonplastic fines with quick dialatory and low tou maximum size 35 mm; dry, gray, strong reaction with HCL. 14.8 to 23.0 ft POCRLV (GRADED GRAVEL WITH SAND AND COBILES (GP coarse to fine, hard, angular to subangular grave); about 40% coarse to fine, angular to subangular, sand; about 5% nonplastic fines; trace of hard, subang maximum size 120 mm; dry, pink to reddish yellow, strong reaction with HCL	bout 55% ghness; <b>)sc:</b> About 55% Jlar cobbles;
	25						(SW)g		23 0 to 36 0 f WELL GRADED SAND WTH GRAVEL (SWg: About 70% coar fine, angular to subounded sand; about 30% coarse to fine, hard, angular to gravel; trace of nonplastic fines with quick dilatancy and low toughness; maxim dry, gray, pink, no to strong reaction with HCI.	se to ubrounded um size 75 mm;
	40						(GP)sc (SW)g (GP)s (SW)g (SW-SM)g		<ul> <li>36.0 to 40.5 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; about 5% nonplastic fines; trace of hard, subangu maximum size 115 mm; dry, pink, gray, no reaction with HCl.</li> <li>40.5 to 42.0 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 70% coarse to fine, subangular sand; about 25% predominantly fine, subangular gravel; about 60% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, henderate reaction with HCl.</li> <li>47.0 to 43.5 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 65% coarse to fine, subangular to subangular sand; about 30% coarse to fine, henderate reaction with HCl.</li> <li>47.0 to 43.5 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW)g; A coarse to fine, angular to subangular sand; about 30% coarse to fine, henderate reaction with HCl.</li> <li>47.0 to 43.5 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW)g; A coarse to fine, angular to subangular sand; about 30% predominantly fine, har subangular gravel; about 10% nonplastic fines; maximum size 70 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30% coarse to fine, hard, subangular gravel; about 10% nonplastic fines; maximum size 70 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick 30 mm; dr), gray, strome stick</li></ul>	Jsc: About 55% lar cobbles; rse to 15% oarse to sand; trace se to gravel; about to strong bout 60% d; ghness;

Figure 1.1-118. Geologic Log of Drill Hole UE-25 RF#49 (Sheet 1 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#49 SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/6/2005 FINISHED: 4/11/2005					PROJ COOF TOTA	ECT: RDINA L DEP	Yucca Mo TES: N 7 TH: 142.9	ountair 766,05 9 ft	n Project STATE: Nevada 58.84 E 571,421.14 GROUND ELEVATION: 3668.78 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encountered					DEPT	н то і	BEDROCK	: 11	12.9 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER	ING					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	60 						(SW)g (SW)gc (SW)gc (SW)g (GP)s (SW)gc (SW)gc		<ul> <li>48.5 to 51.3 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 70% coarse to fine, angular to subbangular sand; about 25% coarse to fine, angular to subbangular gravel; about 5% nonplastic fines; maximum size 85 mm; dry; gray, strong reaction with HCL 51.3 to 51.8 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 70% coarse to fine, subangular to subbrounded gravel; about 10% protoinantly fine, hard, subangular to subbrounded gravel; about 10% protoinantly fine, subangular to subbrounded gravel; about 10% protoinantly fine, subangular to subbrounded gravel; about 10% protoinantly fine, subangular to subbrounded gravel; about 10% nonplastic fines with word psilength and quick dilatancy; maximum size 15 mm; dry; gray; strong reaction with HCL 51.8 to 57.3 ft WELL GRADED SAND WITH GRAVEL AND COBELES (SW)ge: About 65% coarse to fine, angular to subangular sand; about 30% predominantly fine, hard, about 65% coarses to fine, angular to subangular sand; about 30% predominantly fine, hard, angular to subangular gravel; about 10% nonplastic fines with quick dilatancy; maximum size 115 mm; dry; gray; strong reaction with HCL.</li> <li>57.3 to 57.7 ft WELL GRADED SAND WITH GRAVEL (SW)gi: About 60% coarse to fine, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular gravel; about 10% coarse to fine, hard, gualar to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% predominantly fine, hard, suba</li></ul>
	80						(SW)gc (GP)s		fine, subangular sand: about 5% predominantly fine, hard, angular to subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 45 mm; dry, gray, strong reaction with HCI.     77.1 to 800 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)ge: About 60% coarse to fine, angular to subangular sand; about 35% coarse to fine, hard, angular to subangular gravel, about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 85 mm; dty, no to strong reaction with HCI.     80.0 to 81.7 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, hard, subangular gravel; about 45% coarse to fine, subangular sand; trace of nonplastic fines; maximum size 90 mm; dry, pink, no reaction with HCI.     81.7 to 80.0 tt 60% coarse to fine, hard, subangular sand; trace of nonplastic fines; maximum size 90 mm; dry, pink, no reaction with HCI.     81.7 to 80.0 tt 60% coarse to fine, hard, subangular sand; trace of nonplastic fines; maximum size 90 mm; dry, pink, no reaction with HCI.
	90						(GP)s		<ul> <li>me, anguar to subangular sand; about 3% predominantly line, hard, angular to subangular gravel; about 5% nonplastic fines; maximum size 65 mm; dry, pink, gray, nonplastic fines; maximum size 65 mm; dry, pink, gray, nonplastic fines; maximum size 65 mm; dry, pink, gray, nonplastic fines; maximum size 65 mm; dry, gray, weak reaction with HCI.</li> <li>88.0 to 90.7 it POORLY GRADED GRAVEL WITH SCADE (GP)s: About 80% coarse to fine, hard; angular to subangular gravel; about 20% coarse to fine, angular to subangular size 65 mm; dry, gray, weak reaction with HCI.</li> <li>90.7 to 94.2 it WELL GRADED SAND WITH GRAVEL (SW)g: About 70% coarse to</li> </ul>
							(SW)g		<ul> <li>fine, subangular sand: about 25% predominantly fine, hard, angular to subangular gravel;</li> <li>about 5% nonplastic fines; maximum size 45 mm; dry, gray, moderate to strong reaction</li> <li>with HCI.</li> </ul>
	95						(GP)sc	Stort Burn Burns	<ul> <li>94.2 to 105.1 ft POORLY CRADED CRAVEL WITH SAND AND COBBLES (GP)sc: about 55% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, angular to subangular sail; trace of nonplastic fires; trace of hard, subangular cobbles; maximum size 100 mm, dy, pink, pinkish white, strong reaction with HCI. Core removed from 95.1 to 96.7 ft.</li> </ul>
							(SW)gc		105.1 to 110.5 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 70% coarse to fine, subangular and: about 25% coarse to fine, hard, angular to subangular, gravel; about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 90 mm; dry, gray, strong reaction with HCI. Core removed from 106.6 to 108.3 ft.

Figure 1.1-118. Geologic Log of Drill Hole UE-25 RF#49 (Sheet 2 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HO	LE UE-25 RF#49	SHEET 3 OF 3
FEATURE: Waste Handling Facility					PROJ	ECT:	Yucca M	ountair	Project	STATE: Nevada
BEGUN: 4/6/2005 FINISHED: 4/11/2005					TOTA	L DEP	TES: N TH: 142.	766,05 9 ft	8.84 E 571,421.14	ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encountered					DEPT	н то і	BEDROCI	<b>K: 1</b> 1	2.9 ft	HOLE LOGGED BY: George Eatman
										REVIEWED BY: Robert Lung
		EN	GINEER	RING						
				ISITY	/ERY					
NOTES		ω.		DEN	ECO		LINN C			
	E	DNES	DING	CTURI	ORE R	g	s]	PHIC	7.4.8.1	
	DEP.	HARI	WEL	FRAG	% CC	% R0	GEO	GRA		
	110-									ED SAND WITH GRAVEL (SWIg: About 60% coarse to
	-						(SW)g	. 8. 9	fine, angular to subangular sa gravel; about 5% nonplastic fi	ne; about 35% coarse to fine, hard, angular to subangular nes; maximum size 100 mm; dry, gray, strong reaction
	1 3			1					<ul> <li>with HCl.</li> <li>112.9 to 142.9 ft PRE-RAINIE</li> <li>Bedded tuffs interbedded with</li> </ul>	R MESA TUFF BEDDED TUFF (Tmbt1):
	115-								The bedded tuff is nonwelded of ash and very fine to mediur	poorly consolidated, locally cemented, white, light gray, composed n sand size crystal fragments, 5 to 15% pumice (locally 25%),
									rare to 1% volcanic lithic tragr reworked. The tephra is nonwelded, vitric	nents. Portions of the bedded tuff is probably
	120							900 1000	98% pumice, rare to 15% lithi shards and fragments, 1 to 2%	fragments, less than 1% to abundant vitric 6 crystal fragments of quartz and sanidine, rare biotite.
	-								-	
	1 3							. · ·	-	
	125									
	1 -								-	
	1 3						Tmbt1		-	
	130-								-	
	1 3	1						, coc		
	1 -								-	
	135-	1							-	
	1 3									
	-									
	140-	1							-	
									-	
	-	-	В	 IOTTO	M OF H	IOLE				

Figure 1.1-118. Geologic Log of Drill Hole UE-25 RF#49 (Sheet 3 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HO	LE UE-25 RF#50 SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/14/2005 FINISHED: 4/19/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 155.9 BEDROCK	ountain 765,785 5 ft 5: 12	1 Project STATE: Nevada 5. E 571,698.02 GROUND ELEVATION: 3656.26 ANGLE FROM HORIZONTAL: -90° 23.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	GINEERI NDICES DNICIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in casing as hole is cored 0.0 to 103.5 ft (TD). Drill string inside casing consists of 3% in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported Drilling Fluid:	5						(GP)sc	0000000000000	0.0 to 123.2 ft QUATERNARY ALLUVIUM (Qai)     0.0 to 14.3 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65%     coarse to fine, hard, angular to subrounded sand; about 5% nonplastic fines; trace of hard drilled cobles;     maximum size 150 mm; moist, reddish brown, light reddish brown, light gray, moderate to mostly     strong reaction with HCI. Some organic materials present near the top.
Small antionics of similing adduces were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.0 to 155.5 ft (TD)	20						SW (GP)sc	1000 C	subangular sand; about 10% predominantly fine, hard, subangular gravel; trace of nonplastic fines; maximum size 30 mm; moist, pink, strong reaction with HCl. <b>16.5 to 21.0 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc</b> : About 80% coarse to fine, hard, angular gravel; about 20% coarse to fine, angular to subangular sand; trace of nonplastic fines; moist, reddish brown, moderate reaction with HCl. TOTAL SAMPLE (BY VOLUME): About 10% hard, drilled cobbles; maximum size 130 mm; remainder minus 3 in.
Hole Completion: Back fill hole from 155.5 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	25						(SW)g		21.0 to 26.5 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 60% coarse to fine, angular to subangular sand; about 40% predominantly fine, hard, angular to subangular gravel; trace of nonplastic fines; maximum size 40 mm; moist, reddish brown, light gray, no to strong reaction with HCI.
	30-						(GP)s		26.5 to 30.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% predominantly fine, hard, angular to subangular gravel; about 45% coarse to fine, angular to subangular sand; trace of nonplastic fines; maximum size 50 mm; moist, light reddish brown, no reaction with HCI.
	35 -						(SW)g (GP)s		<ul> <li>30.0 to 31.2 tt WELL GRADED SAND WITH GRAVEL (\$\SM)g: About 55\% coarse to fine, angular to subangular sand, about 45\% predominantly fine, hard, angular to subangular gravel; trace of nonplastic fines; maximum size 65 mm; moist, light reddish brown, no reaction with HCI.</li> <li>31.2 to 37.8 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 60\% predominantly fine, hard, angular to subangular gravel; about 40\% coarse to fine, angular to subangular sand; trace of nonplastic fines; maximum size 50 mm; moist, reddish brown, weak reaction with HCI.</li> </ul>
	40						(SW)g (GP)s (SW)g		<ul> <li>37.8 to 39.1 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 55% coarse to fine, subangular to subrounded sand; about 45% predominantly fine, hard, angular to subrounded sand; about 45% predominantly fine, hard, angular to subrounded sand; about 55% coarse to fine, hard, angular to subrounded gravel; itabout 56% coarse to fine, hard, angular to subrounded gravel; about 36% coarse to fine, hard, angular to subrounded gravel; about 30% coarse to fine, hard, angular to subrounded gravel; about 30% coarse to fine, hard, angular to subrounded gravel; about 30% coarse to fine, hard, angular to subrounded gravel; about 30% coarse to fine, hard, angular to subrounded gravel; about 5% nonplastic fines; maximum size 70 mm; dry to moist, link, light gray, light reddish brown, store reaction with HCI.</li> <li>41.8 to 44.6 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 55% coarse to fine, angular to subangular gravel; about 5% nonplastic fines; maximum size 45 mm; moist, light gray, pink, no to strong reaction with HCI.</li> </ul>
							(GP)sc	000	44.6 to 51 0t POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60%     coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine,     angular to subangular sand; about 55% nonplastic fines; moist, pink, light reddish brown, light     gray, strong reaction with HCI.     TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular to subrounded cobbles;     maximum size 85 mm; remainder minus 3 in.

Figure 1.1-119. Geologic Log of Drill Hole UE-25 RF#50 (Sheet 1 of 3)

	G	EOL	.OG	IC L	OG	OF	DRILL	НО	OLE UE-25 RF#50 SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/14/2005 FINISHED: 4/19/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEP H TO I	Yucca M TES: N TH: 155. BEDROCH	ountain 765,78 5 ft K: 12	ain Project STATE: Nevada 785. E 571,698.02 GROUND ELEVATION: 3656.26 ANGLE FROM HORIZONTAL: -90° 123.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	ING					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
							(SW)g		51.0 to 54.5 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 70% coarse to     fine, angular to subangular sand, about 30% predominantly fine, hard, angular to subangular     gravei; trace of nonplastic fines; maximum size 25 mm; moist, pinkish gray, light reddish brown,     strong reaction with HCI.
	55						(GP)s	0.0.0.0 0.0000	<ul> <li>54.5 to 60.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, hard, subangular gravel; about 45% coarse to fine, subangular to subrounded sand; trace of nonplastic fines; maximum size 45 mm; moist, pinkish gray, strong reaction with HCI.</li> </ul>
	60								
	65						(SW)g		<ul> <li>But to 6/.5 tt WELL GRADED SAND WITH GRAVEL (SWI)g: About 70% coarse to fine, anyular to subangular sand; about 25% predominantly line, hard, anyular to subangular gravel; trace to 5% nonplastic fines; maximum size 40 mm; moist, light gray, pink, pinkish gray, strong reaction with HCI.</li> </ul>
	-						(GP)s	è.Ç	67.5 to 68.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 60% coarse to
							(SW)g	0.0	<ul> <li>tine, hard, angular gravel; about 35%, coarse to fine, angular to subangular sand; about 5%</li> <li>nonplastic fines; maximum size 65 mm; moist, light gray, strong reaction with HCl.</li> <li>68.0 th 69.5 ft WFL   GRADED SAND WITH GRAVEL (SW0r 3 bout 55% coarse to bound 55%)</li> </ul>
							(GP)s	0.00	<ul> <li>box arous intracts of bars with a solution of the</li></ul>
	75						(SW)gc		with HCI. Y 23 to 60.0 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)ge: About 70% coarse to fine, angular to subrounded sand, about 25% predominantly fine, hard, angular to subangular gravel; about 5% nonplastic fines; moist, pinkish gray, strong reaction with HCI. TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular cobbles; maximum size 120 mm;
	80-								remainder minus 3 in.     remainder minus 3 in.     Solution 2010 Sector
							(GP)sc	No.	<ul> <li>predominantly line, hard, angular to subangular gravel; about 40% coarse to line, angular to subangular sand; trace of nonplastic fines; moist, pink, strong reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 10% hard, subangular cobbles; maximum size 85 mm; remainder minus 3 in.</li> </ul>
	85-						(SW)g		48.8 to 88.2 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 80% coarse to ine, angular to subangular sand, about 15% predominantly line, hard, angular to subangular gravel: about 5% nonplastic fines; maximum size 25 mm; moist, pink, light gray, strong reaction with HCI.
	90-						(GP)s	0.00	88.2 to 91.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 60% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; trace of nonplastic fines; maximum size 45 mm; moist, pink, light gray, strong reaction with HO.
	95						(SW)gc		91.0 to 112.8 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SMyc:: About 65% coarse to fine, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular gravel; about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 120 mm; moist, pinking ray, pinki, light ray, weak to strong reaction with HCl. Core removed from 91.6 to 93.1 ft, and from 105.4 to 107.2 ft.

Figure 1.1-119. Geologic Log of Drill Hole UE-25 RF#50 (Sheet 2 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#50 SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/14/2005 FINISHED: 4/19/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO E	Yucca Mo TES: N TH: 155. BEDROCH	ountair 765,78 5 ft 4: 12	in Project STATE: Nevada '85. E 571,698.02 GROUND ELEVATION: 3656.26 ANGLE FROM HORIZONTAL: -90° 123.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	NG					
NOTES	рертн	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT UUSCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	110								
							(GP)s		112.8 to 115.8 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 60% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; trace of nonplastic fines; maximum size 80 mm; moist, pink, strong reaction with HCI.
	120						(SW)g		<ul> <li>115.8 to 120.4 ft WELL GRADED SAND WITH GRAVEL (SW0)g: About 70% coarse to fine, angular to subangular sand; about 25% coarse to fine, hard, angular to subangular gravel; about 5% nonplastic fines; maximum size 50 mm; moist, gray, strong reaction with HCL. Core removed from 116.5 to 118.2 ft.</li> </ul>
				-			(SM)g (GP)s (SW)g	000	120.4 to 121.4 ft SILTY SAND WITH GRAVEL (SM)g: About 45% coarse to fine, angular to subangular sand; about 40% coarse to fine, hard, angular to subangular gravel; about 15% nonplastic fines with quick dilatancy and fow toughness; maximum size 45 mm; moist, light gray, strong reaction with HCI. 121.4 ft 0122.0 ft POCRLY GRADEE GRAVEL WITH SAND (GP)s: About 70%
	125 		В		M OF H	OLE	Tmbt1		<ul> <li>121.4 TÖ 122.6 IP POČRLY GRADED GRAVEL WITH SAND (GP)s: About 70% coarse to fine, hard, angular gravel about 30% coarse to fine, angular to subangular sand; trace of nonplastic fines; maximum size 90 mm; moist, grav, strong reaction with HCI.</li> <li>122.0 TO 122.6 TWELL GRADED SAND WITH GRAVEL (SWIG): About 50% coarse to fine, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular and; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 30% coarse to fine, hard, angular to subangular sand; about 50% conflaction (Fine).</li> <li>122.2 to 155.5 th PRE-RAINER MESA TUFF BEDDED TUFF (Tmbt): Bedded tuffs with tephras.</li> <li>The bedded tuffs in nonwelded, partially consolidated, vitric, with zones of intense clay alteration, very piale brown and white, 10 to 40% pumice, 3 to 50% crystal fragments of quartz and sanidine.</li> <li>The tephra is nonwelded, portly to partially consolidated, vitric, with some possibly reworked zones, very friable locally, light brown, pale brown, pink, and white, 2 to 40% pumice, ash with less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 1 to 10% feisic crystal fragments, less than 10% or 10 to 15% locally of volcanic glass tragments, less than 1 to 10% feisic crystal fragments, less than 10% or 10% locally feisic crystal fragments, less than 10% or 10% locally feisicrystal fragments, less than 10% or 10% lo</li></ul>

Figure 1.1-119. Geologic Log of Drill Hole UE-25 RF#50 (Sheet 3 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#51 SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/29/2005 FINISHED: 3/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>-</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 156. BEDROCH	ountain 766,31 7 ft K: 12	in Project STATE: Nevada 113.71 E 571,672.09 GROUND ELEVATION: 3671.96 ANGLE FROM HORIZONTAL: -90° 128.4 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	рертн	HARDNESS	GINEER NDICES ONICIAN		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole:         Repository Facilities Geotechnical Investigations         Drill Equipment:         GP24 300 K (Sonic Drill Rig)         Flatbed combination water and pipe truck with boom for moving drill pipe and casing.         Drille:         Travis Osterberg         Boart Longvaer Drill Services         Drilling Method:         Rotosonic         Advance 8 in casing as hole is cored 0.0 to 156.7 ft (TD).         Drilling Conditions:         Not Reported         Drilling Conditions:         Not Reported         Drilling Fluid:         Small amounts of drilling additives were added to help in advancing casing.         Fluid Loss Interval:         NA         Casing Record:         Bin. casing from 0.0 to 156.7 ft (TD)         Hole Completion:         Back fill hole from 16.7 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.							(GM)sc SM (GP)sc (GP-GM)s (GP-GM)s	La de la restrictione de la contractione de	<ul> <li><b>0.0 to 128.4 ft QUATERNARY ALLUVIUM (Gal)</b></li> <li><b>0.0 to 28.6 ft SILTY GRAVEL WITH SAND AND COBBLES (GM)sc:</b> About 50% coarse to fine, hard, angular to subrounded gravel; about 35% coarses to fine, hard, angular to subrounded gravel; maximum size 110 mm; dy, light reddish brown, pink, no reaction with HCI near top of hole, to strong reaction with depth.</li> <li><b>26.6 to 26.9 ft SILTY SAND (SM)</b>; About 55% coarse to fine, subangular to subrounded cobbles; maximum size at 100 mm; dy, light reddish brown, pink, no reaction with HCI near top of hole, to strong reaction with depth.</li> <li><b>26.6 to 26.9 ft SILTY SAND (SM)</b>; About 55% coarse to fine, subangular to subrounded sand; and substantiation of the subangular to subrounded gravel; about 05% proformantly fine, hard, subangular to subrounded gravel; about 05% proformantly fine, hard, subangular to subrounded gravel; about 05% coarse to fine, subangular to subrounded sand; about 40% nonplastic fines; trace of hard, subrounded cobbles; maximum size 80 mm, dy, pink, no reaction with HCI.</li> <li><b>39.4 to 42.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)</b>;: About 70% coarse to fine, hard, angular to subrounded gravel; about 05% coarse to fine, hard, maximum size 80 mm, dy, pink, no reaction with HCI.</li> <li><b>39.4 to 42.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)</b>;: About 70% coarse to fine, hard, angular to subrounded gravel; about 05% coarse to fine, hard, musimum size 80 mm, dy, pink, no reaction with HCI.</li> <li><b>39.4 to 42.6 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)</b>;: About 70% coarse to fine, hard, angular to subrounded sand; thou 20% coarse to fine, hard, angular to subrounded sand; thou 20% coarse to fine, hard, no reaction with HCI.</li> <li><b>30.4 to 42.6 ft WELL GRADED GRAVEL WITH SILT AND GRAVEL (SW-SM)</b>;: About 70% coarse to fine, hard, angular to subrounded sand; thou 10% nonplastic fines; trace of hard, subrounded cobbles; maximum size 30 mm, dy, pink, no reaction with HCI.</li> <li><b>30.4 to 42.6 ft WELL GRADED G</b></li></ul>
							(UNI)S		E dry, pink, strong reaction with HCl.

Figure 1.1-120. Geologic Log of Drill Hole UE-25 RF#51 (Sheet 1 of 3)

	G	EOL	.OG		OG	OF	DRILL	но	LE UE-25 RF#51 SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/29/2005 FINISHED: 3/31/2005 DEPTH TO WATER: Not Encountered					PRO. COOI TOTA DEPT	JECT: RDINA AL DEF TH TO	Yucca Mo TES: N 7 TH: 156.7 BEDROCK	untain 66,31: ft : 12	Project STATE: Nevada 8.71 E 571,672.09 GROUND ELEVATION: 3671.96 ANGLE FROM HORIZONTAL: -90° 8.4 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		ENG	SINEERI NDICES	NG					
NOTES	DEPTH	HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
							(GP)s		50.0 to 55.1 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 65% coarse to fine, hard, angular gravel; about 30% coarse to fine, subangular to subrounded sand; about 5% nonplastic fines; maximum size 75 mm; dry, pink, strong reaction with HCI.
							(SM)g		55.1 to 60.4 ftSILTY SAND WITH GRAVEL (SM)g: About 50% coarse to fine, angular to subrounded sand; about 35% prodominantly fine, hard, angular to subrounded sand; about 15% nonplastic fines with quick dilatancy and low toughness; maximum size 65 mm; dry, pink, strong reaction with HCI.
							(GP-GM)s		60.4 to 63.2 ft POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 60% coarse to fine, hard, subangular to subrounded gravel; about 30% coarse to fine, subangular to subrounded sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 85 mm, dry, pink, strong reaction with HCI. 63.2 to 65.6 ft SILTY GRAVEL WITH SAND (GM)s: About 60% coarse to fine, hard, angular to subangular gravel; about 25% coarse to fine, subangular to subrounded sand;
							(GP-GM)s		double to be not to be a well ( double contained and now long mess, maximum size 70 mm, dry, pink, strong reaction with HCI.      66.5 to 68.5 ft POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 50% predominantly fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subrounded sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 65 mm; dry, pink, strong reaction with HCI.     each are a fine and the sub-GRADET SAND with size 1 AND CRADET ( SAND SAND CRADET)
	70						(GM)s		coarse to fine, subangular to subrounded sand; about 20% coarse to fine, hard, subangular to subrounded gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 90 mm; dty, pink, strong reaction with HCI. 700 to 74.8 ft SLITY GRAVEL WITH SAND (GMB); about 45% coarse to fine, hard, subangular to subrounded gravel; about 35% coarse to fine, subangular to subrounded sand; about 20% nonplastic fines with quick dilatancy and low toughness; maximum size 40 mm; dty, pinkish gray; strong reaction with HCI.
	75						SM (SW)g		74.8 to 75.4 ft SILTY SAND (SM): About 75% coarse to fine, subangular to subrounded sand; about 25% nonplastic fines with quick dilatancy and low toughness; trace of predominantly fine, hard, subangular gravel; maximum size 60 mm; dry, light gray, strong reaction with HC.
	80-						(SW-SM)go		75.4 to 77.6 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 65% coarse to fine, subangular to subrounded sand; about 30% coarse to fine, hard, angular to subrounded gravel; about 5% nonplastic fines; maximum size 85 mm; dry, pink, strong reaction with HCI. 77.6 to 86.5 ft WELL GRADED SAND WITH SILT GRAVEL AND COBBLES (SW-SMice:
	-						(GP)s	$\tilde{O}$	About 60% coarse to fine, angular to subrounded sand; about 30% coarse to fine, hard, angular to subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subrounded cobbles; maximum size 115 mm; dry, pink, strong reaction with HCI.     80 5 to 85 5 ft POORT V GRADED GRAVEL WITH SAND (GPLs: About 55% coarse to
	85-						<u>(SW-SM)g</u>		bit down for the context for Motion of Metric Market (Metric Andrew Context)     fine, hard, angular to subangular gravel; about 40% coarse to fine, subangular to     subrorunded sand; about 5% nonplastic fines; maximum size 130 mm; dry, pink, light reddish     brown, no reaction with HCI.     So to 85.9 ft POORLY GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 50%
							(GM)s (SW)g		Coatse to life, subangular gravel; about 25% nonplastic fines with quick dilatancy and low toughness; maximum size 35 mm; dry, pinkish gray, strong reaction with HCI. 85 9 to 67.7 kILTY GRAVEL WITH SAND [GM]s: About 40% predominantly fine, hard, angular to subangular gravel; about 35% coarse to fine, angular to subangular sand;
	90						(GM)s	<u>6-8</u> 6:	about 25% nonplastic times with quick dilatancy and low toughness, maximum size or mm; dry, pinkish gray, strong reaction with HCl. 87,7 to 90.3 ft WELL GRADED SAND WITH GRAVEL (SW)g; About 75% coarse to fine, subangular to subrounded sand; about 20% predominantly fine, hard, angular to subangular gravel; about 5% nonplastic fines; maximum size 60 mm; dry, light gray, strong
	95						(GP-GM)so		<ul> <li>reaction with HCI.</li> <li>90.3 to 90.9 fSILTY GRAVEL WITH SAND (GM)s: About 70% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, subangular to subrounded sand;</li> <li>about 15% nonplastic fines with quick dilatancy and low loughness; maximum size 50 mm; dry, light gray, strong reaction with HCI.</li> </ul>
							(SM)g	<u>, 1 ≪ 5</u> 2 ( <del>- 1</del> <del>2</del>	90.9 to 95.2 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: About 50% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subrounded cobbles; maximum size 85 mm; dry, pinkish gray, strong reaction with HCI.
	100-						(GP)s	0.0	952 to 95.4 f SILTY SAND WITH GRAVEL (SM)g: About 60% coarse to fine, angular to subangular sand; about 25% predominantly fine, hard, angular to subangular gravel; about 15% nonplastic fines with quick dilatancy and low toughness; maximum size 35 mm; dry, light gray, strong reaction with HCl. 95.4 to 96.6 POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GMIser)
	105-						(GM)s SM		About 60% coarse to fine, hard, angular to subangular gravel; about 30% coarse to fine, angular to subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular cobles; maximum size 80 mm; dry, pink, strong reaction with HCI. 96.6 to 97.7 f SILTY SAND WITH GRAVEL (SM): About 50% coarse to fine, angular
							(GM)s (SW-SM)g		to subangular sand; about 25% coarse to fine, hard; subangular gravel; about 25% coarse to fine, hard; subangular gravel; about 25% ononplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, light gray, strong reaction with HCI. 97.7 to 102.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine and and and to ubbounded downed about 15%.
	-						(GM)s	Ĭ	<ul> <li>sand; trace of nonplastic fines; maximum size 105 mm; dry, pinkish gray, strong reaction with HCI.</li> </ul>

Figure 1.1-120. Geologic Log of Drill Hole UE-25 RF#51 (Sheet 2 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	LE UE-25 RF#51 SHEET :	3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/29/2005 FINISHED: 3/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO E	Yucca Mo TES: N 7 TH: 156.7 BEDROCK	ountair 766,31 7 ft 5: 12	Project     STATE: Nevada       3.71     E 571,672.09     GROUND ELEVATION: 3671.96       ANGLE FROM HORIZONTAL: -90°     ANGLE FROM HORIZONTAL: -90°       28.4 ft     HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung	1
		EN	GINEERI	NG						
NOTES	рертн	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
	110 115 120 125 125 135 135 140 145 140 155 155 155		E		M OF H	OLE	(SM)g (GM)s SM (GM)sc (SM)g (GP-GM)s (GP-GM)s		<ul> <li>Core removed rom 100.4 to 101.4 ft.</li> <li>102.0 to 103.3 ft SLITY GRAVEL WTH SAND (GM)s: About 40% predominal hard, angular to subangular gravel, about 30% nonplastic fines with quick dilating and a sand; abox 40% predominantly fine, hard, subangular gravel, maximum size 15 mm; dry, lig reaction with HCl.</li> <li>103.7 to 107.4 ft SLITY GRAVEL WTH SAND (GM)s: About 55% coarse to fine, angular to subangular gravel; about 30% coarse to fine, angular t</li></ul>	Inity fine, atancy and low size 60 mm; oughness; trace phylophess; trace arsand; about 80 mm; dy, gr. About 60% ard, ard low fine, hard, unded sand; n size 65 mm; fine, hard, unded sand; n size 65 mm; fine, hard, t15% m; dry, pinkish gray, oughness; trace mm; dry, light gray, fine, hard, t15% m; dry, light gray, oughness; trace mm; dry, light gray, ut 50% ; about 20% igular Care removed from fine, iney and low h; maximum <b>3Mys:</b> About 65% h; about 15% m; dry, light fine, hard, tine,

Figure 1.1-120. Geologic Log of Drill Hole UE-25 RF#51 (Sheet 3 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HO	DLE UE-25 RF#52 SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/31/2005 FINISHED: 4/5/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 184.7 BEDROCK	untair 66,55 ′ft : 16	ain Project STATE: Nevada 557.02 E 571,914.65 GROUND ELEVATION: 3672.37 ANGLE FROM HORIZONTAL: -90° 164.7 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	GINEERI INDICES ONICIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Repository Facilities Geotechnical Investigations	-						(GP)sc	20 40	0.0 to 164.7 ft QUATERNARY ALLUVIUM (Qai)     0.0 to 2.9 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55%
Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing	-						(SW)g		<ul> <li>coarse to fine, angular to subangular gravel; about 45% coarse to fine, angular to subangular sand; trace of nonplastic fines; dry, reddish brown, moderate reaction with HCI.</li> <li>Topsoil with organic material.</li> </ul>
Driller: Travis Osterberg	5								TOTAL SAMPLE (BY VOLUME): About 20% hard, subangular cobbles; maximum size
Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 184.7 ft (TD). Drill string inside casing consists of	10						(GP-GM)so		2.9 to 5.4 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 55% coarse to fine, subangular sand; about 45% predominantly fine, hard, subangular gravel; trace of nonplastic fines; maximum size 65 mm (ry), light redition brown, moderate reaction with HCI. Some organic material present. 5.4 to 11.0 ft POORLY (GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc:
3½ in .single wall dill ippe with 6.163 in. Kotosonic Carticle button bit. Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: Ellia contine form 0.00 in 184.7.6 (CD)	15 						(GP)sc	2010 00 00 00 00 00 00 00 00 00 00 00 00	About 50% coarse to time, hard, angular gravel; about 40% coarse to time, angular sand; about 10% nonptasic times with quick dilatancy and low toughness; trace of hard, subangular cobbles; maximum size 110 mm; dry, pink, weak reaction with HCI. 110 to 24.2 PPORLY (GRADED GRAVEL WITH SAND AND COBELES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, angular to subangular sand; about 3% nonplastic fines; trace of hard, subangular cobbles; maximum size 130 mm; dry, light reddish brown, pink, no reaction with HCI.
Hole Completion: Back fill hole from 184.7 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	25						(SW)g		24.2 to 30.7 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 80% coarse to fine, angular sand, about 20% predominantly fine, hard, angular gravel; trace of nonplastic fines; maximum size 50 mm; dry, pink, no reaction with HCL
	25						(GP)sc	ACC 8	30.7 to 35.2 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, angular sand; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 120 mm; dry, light reddish brown, no reaction with HCI.
	33						(GP-GM)so	A COS	35.2 to 40.3 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: About 60% coarse to fine, hard, angular gravel; about 30% coarse to fine, angular sand; about 10% nonplasic fines with quick dilatance yand low toughness; trace of hard, subangular cobbles; maximum size 110 mm; dry, pinkish gray, no reaction with HCI.
	40						(GP)sc	8000	40.3 to 44.5 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular gravel; about 35% coarse to fine, angular sand; trace of nonplastic fines; dry, pink, strong reaction with HCI.  TOTAL SAMPLE (BY VOLUME): About 5% hard, subrounded cobbles; maximum size 150 mm; remainder minus 3 in.
	45						(SW-SM)g		44.5 to 50.3 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 65% coarse to fine, angular sand; about 25% predominantly fine, hard; angular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 55 mm; dry, pinkish gray, moderate reaction with HCI.
								A Cook	50.3 to 61.6 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, angular to subangular sand; trace of nonglastic fines; trace of hard, subangular cobbles; maximum size 170 mm; dry, light reddish brown, pink, weak to strong reaction with HCl.

Figure 1.1-121. Geologic Log of Drill Hole UE-25 RF#52 (Sheet 1 of 3)
EX.DUE: Wash industring Fourier LOCATION: Markey Waley BEGUR: 301/305 FRUSHER: 450205         PROJECT: Years Machanin Properts TOTAL DEPTH 18/17 M         STATE: Roads         STATE: Roads           DEPTH 70 MATTER: INF Provide Company         DEPTH 70 MATTER: INF Provide Company         STATE: Roads         STATE: Roads           NOTES         Inf Provide Company         Inf Provide Company         STATE: Roads         STATE: Roads           NOTES         Inf Provide Company         Inf Provide Company         State Provide Company         State Provide Company           NOTES         Inf Provide Company         Inf Provide Company         Inf Provide Company         State Provide Company         State Provide Company           NOTES         Inf Provide Company         Inf Provide Company         Inf Provide Company         Inf Provide Company         State Provide Company		G	EOL	.OG	IC L	OG	OF	DRILL	HO	LE UE-25 RF#52	SHEET 2 OF 3
NOTES         Implement Big         Implement Big <td>FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/31/2005 FINISHED: 4/5/2005 DEPTH TO WATER: Not Encountered</td> <td></td> <td></td> <td></td> <td></td> <td>PROJ COOF TOTA DEPT</td> <td>IECT: RDINA L DEP H TO I</td> <td>Yucca M TES: N TH: 184. BEDROCH</td> <td>ountair 766,55 7 ft K: 16</td> <td>n Project 7.02 E 571,914.65 94.7 ft</td> <td>STATE: Nevada GROUND ELEVATION: 3672.37 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung</td>	FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/31/2005 FINISHED: 4/5/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEP H TO I	Yucca M TES: N TH: 184. BEDROCH	ountair 766,55 7 ft K: 16	n Project 7.02 E 571,914.65 94.7 ft	STATE: Nevada GROUND ELEVATION: 3672.37 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES         Image: State of the stat			EN	GINEERI	NG						
60       0         61       0         62       0         63       0         70       0         70       0         70       0         70       0         70       0         70       0         70       0         71       0         72       0         73       0         74       0         75       0         76       0         77 <td< td=""><td>NOTES</td><td>DEPTH</td><td>HARDNESS</td><td>WELDING</td><td>FRACTURE DENSITY</td><td>% CORE RECOVERY</td><td>% RQD</td><td>GEOLOGIC UNIT</td><td>GRAPHIC</td><td>C AND P</td><td>CLASSIFICATION HYSICAL CONDITION</td></td<>	NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	C AND P	CLASSIFICATION HYSICAL CONDITION
115 138.0 ft. TOTAL SAMPLE (BY VOLUME): About 10% hard, angular to subangular cobbles; maximum size 170 mm; remainder minus 3 in.		60 65 70 75 75 80 90 90 100 1105 1105 1105						(GP)sc (SW-SM)sc (GP)sc (GP-GM)s CR	CONSIGNATION STATES STATES STATES STATES STATES STATES STATES STATES STATES STATES STATES STATES STATES STATES	<ul> <li>61.6 to 68.4 ft WELL GRADET About 50% coarse to fine, ang hard, angular gravel; about 10 trace of hard, subangular cobit sites of hard, subangular cobit sites of hard, subangular cobit angular to subangular sand, a strong reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUM 150 mm; remainder minus 3 in 150 mm; remainder minus</li></ul>	PSAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: Jular to subangular sand; about 40% predominantly fine, % nonplastic fines with quick dilatancy and low toughness; ales; maximum size 150 mm; dry, pinkish gray, no reaction with HCI. INTERCENT AND AND COBBLES (GP)sc: About ular to subangular gravel; about 30% coarse to fine, bout 5% nonplastic fines; dry, pink, pinkish gray, weak to IE): About 5% hard, subangular cobbles; maximum size ************************************

Figure 1.1-121. Geologic Log of Drill Hole UE-25 RF#52 (Sheet 2 of 3)

	GE	EOL	OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#52 SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 3/31/2005 FINISHED: 4/5/2005 DEPTH TO WATER: Not Encountered		PROJECT: Yucca Mountain Project COORDINATES: N 766,557.02 E 571 TOTAL DEPTH: 184.7 ft DEPTH TO BEDROCK: 164.7 ft							in Project STATE: Nevada 57.02 E 571,914.65 GROUND ELEVATION: 3672.37 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		ENG	SINEERII NDICES	NG					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	(USCS)	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
			В		M OF H	OLE	(GP)sc CR (SM)g (GM)sc CR (GP-GM)s (GP-GM)s	States and the second s	H2L 143.81 CORE REMOVED         May 152.37 B.112.37 B.

Figure 1.1-121. Geologic Log of Drill Hole UE-25 RF#52 (Sheet 3 of 3)

	G	EOI	_OG	IC L	OG	OF I	DRILL	но	<b>LE UE-25 RF#53</b> SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/20/2005 FINISHED: 4/25/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 160.6 BEDROCK	untain 66,03 ft : 13	n Project STATE: Nevada 39.7 E 571,947.85 GROUND ELEVATION: 3661.30 ANGLE FROM HORIZONTAL: -90° 38.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES Purpose of Hole: Repository Facilities Geotechnical Investigations	DEPTH	HARDNESS	IGINEERI INDICES SNIGTIAN		% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS] (DS-GC)	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg	5						(GP)sc	A South	Ou to 20 ft POORLY GRADED GRAVEL WITH CLAY AND SAND (GP-GC)s: About 50%     coarse to fine, hard, subangular gravel; about 40% coarse to fine, angular sand;     about 10% fines of low plasticity, with slow dilatancy and medium toughness; maximum size     70 mm; dry, light reddish brown, no reaction with HCI. Topsoil with organic material.     20 to 27 # POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65%     coarse to fine, hard, subangular gravel; about 35% coarse to fine, subangular     sand; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 110 mm; dry,     pinkish gray, strong reaction with HCI.
Boart Longyear Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 160.6 ft (TD). Drill string inside casing consists of 3% in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit.	10						(SW-SM)go (GP)sc	S Sur	About 55% coarse to fine, angular sand; about 35% coarse to fine, hards, own-simple: About 55% coarse to fine, angular sand; about 35% coarse to fine, hards, angular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular cobbies; maximum size 110 mm; dry, pink, stong reaction with HCL 11.0 to 16.8 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular gravel; about 35% coarse to fine, angular sand; trace of nonplastic fines; dry, light reddish brown, no reaction with HCL TOTAL SAMPLE (BY VOLUME); About 5% hard, subangular cobbles: maximum size 90 mm;
Dilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: Baing Record:	20						(SW-SM)g (GP)sc		remainder minus 3 in. 16.8 to 17.8 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 65% coarse to fine, subangular sand; about 25% predominantly fine, hard, subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, pink, weak reaction with HCL 17.8 to 26.3 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular sand; trace of nonplastic fines; dry, pink, weak reaction with HCL 0.000 fine, hard, angular to subangular gravel; about 40% coarse to fine, angular sand; trace of nonplastic fines; dry, pink, weak reaction with HCL
Hole Completion: Back fill hole from 160.6 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	25						FILL (GP)sc (SM)g (GP-GM)sc		13 mm; remainder minus 3 in.     13 mm; remainder minus 3 in.     26.3 to 27.1 ft FiLL     27.1 to 28.9 ft PORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60%     coarse to fine, hard, subangular gravel; about 55% coarse to fine, angular sand;     about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 95 mm; dry,     pinkish gray, no reaction with HCI.     28.3 to 29.9 ft SILTY SAND WITH GRAVEL (SM)g: About 65% coarse to fine, angular     sand; about 20% coarse to fine, hard, angular usbangular gravel; about 15%
	35						(SM)gc (SW-SM)gc SM	A CONT	<ul> <li>Inolpassic finites with quick dilataticy and low oblightness, finalitiatis size 30 finit, gry, pinks in gray, no reaction with HCI.</li> <li>293 to 31.0 ft POORLY GRADED GRAVEL WITH SLIT SAND AND COBBLES (GP-GM)sc:</li> <li>About 55% coarse to fine, hard, angular gravel; about 35% coarse to fine, angular sand; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular cobbles; maximum size 100 mm; dry, pink, stong reaction with HCI.</li> <li>31.0 to 34.0 ft SLITY SAND WITH GRAVEL AND COBBLES (SM)ge: hard, angular to subangular gravel; about 15% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular gravel; about 15% nonplastic fines with quick dilatancy and low toughness; trace of hard, subangular solbes; maximum size 95 mm; dry, light reddish horwn, strong reaction with HCI.</li> <li>34.0 to 38.7 ft WELL GRADED SAND WITH SLIT GRAVEL AND COBBLES (SW-SM)ge:</li> </ul>
	45						(SW)gc FILL (SW-SM)gg (SM)g (GM)sc FILL		About 55% coarse to time, angular sand; about 35% coarse to time, hard, angular gravel; about 10% nonplastic lines with quick dilatancy and low toughness; dry, pinkish gray, no reaction with HCI.     TOTAL SAMPLE (BY VOLUME): About 55% hard, subangular cobbles; maximum size 120 mm; remainder minus 3 in. <b>38.7 to 40.7 ft SILTY SAND (SM)</b> : About 75% coarse to fine, angular sand; about 15% nonplastic lines with quick dilatancy and low toughness; about 10% coarse to fine, hard, angular to subangular gravel; maximum size 70 mm; dry, pink, no reaction with HCI. <b>40.7 to 40.1 ft MELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc</b> : About 50% coarse to fine, angular sand; about 45% coarse to fine, hard, angular gravel; about 5% nonplastic lines; time of hard, subangular cobbles; maximum size 120 mm; dry, light reddish brown, no reaction with HCI. <b>43.0 to 43.81 FILL 44.0 to 43.81 FILL 45.0 to 43.81 FILL</b>
	55						(GP)sc (SM)g		<ul> <li>TOTAL SAMPLE (BY VOLUME): About 5% in runnable in res with quick dilatancy and low toughness; dry, pinktsh gray, strong reaction with HCI.</li> <li>TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; maximum size 120 mm; remainder minus 3 in.</li> <li>47.8 bd.7 ft SLTY SAND WITH GRAVEL (SM)g: About 60% coarse to fine, angular to subangular sand; about 25% nonplastic fines with quick dilatancy and low toughness; about 15% predominantly fine, hard, angular gravel; maximum size 35 mm; dry, pinkish gray, weak reaction with HCI.</li> </ul>

Figure 1.1-122. Geologic Log of Drill Hole UE-25 RF#53 (Sheet 1 of 3)

	G	EOL	OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#53	SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/20/2005 FINISHED: 4/25/2005 DEPTH TO WATER: Not Encountered	PROJECT: Yucca Mountain Project COORDINATES: N 766,039.7 E 571,947.85 TOTAL DEPTH: 160.6 ft DEPTH TO BEDROCK: 138.2 ft									STATE: Nevada GROUND ELEVATION: 3661.30 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	ING						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	C AND PI	LASSIFICATION HYSICAL CONDITION
	65 70 75 80 85 90 90						(GM)sc FILL (GP-GM)s FILL (GP-GM)s (GP)sc FILL (GP)sc FILL		about 15% nonplastic fines with subangular cobbies; maximum 51,7 to 53.9 ft FILL 53.9 to 52.1 FDORLY GRAD coarse to fine, hard, angular to angular sand; about 5% nonpl 95 mm; dry, pirk, no reaction v 56.2 to 59.3 ft SILTY SAND Wi sand; about 35% coarse to finu quick dilatancy and low toughn 59.3 to 61.3 ft FILL coarse to fine, hard; angular to about 15% nonplastic fines will reaction with HCL to 70.1 ft FDORLY GRAD About 50% coarse to fine, hard fine, angular sand; about 10% (light redish brown, no to stron TOTAL SAMPLE (BY VOLUM remainder minus 3 in. 70.1 to 71.1 ft FILL 71.1 to 75.3 ft: PDORLY GRAD About 50% predominantly fine 30% coarse to fine, hard; angular to 31.2 coarse to fine, angl, and and wo toughness; dry, light g TOTAL SAMPLE (BY VOLUM maximum size 110 mm; remail 82.1 to 82.3 ft FILL 23.3 kt 81.2 NORLY GRAD coarse to fine, hard; angular to subangular sand; angular (BY VOLUM maximum size 110 mm; remail 82.1 to 82.3 ft FILL 82.3 to 84.8 ft PDORLY GRAD coarse to fine, hard; angular to subangular sand; sand to for fonplas	h quick dilatancy and low toughness; trace of hard, size 115 mm; dry, light reddish brown, no reaction with HCL EP GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% subangular gravel; about 35% coarse to fine, angular stic fines; trace of hard, subangular cobbles; with HCL HG GRAVEL (SM)g: About 50% coarse to fine, angular e, hard, angular gravel; about 15% nonplastic fines with ess; maximum size 70 mm; dry, pink, no reaction with HCL WITH SAND AND COBBLES (GM)sc: About 50% subangular gravel; about 15% nonplastic fines; with quick dilatancy and low toughness; dry, pinkins grav, weak E): About 20% hard, subangular cobbles; maximum size et GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: 4, angular to subangular gravel; about 40% coarse to nonplastic fines with quick dilatancy and low toughness; dry, greaction with HCL. E): About 20% hard, drilled cobbles; maximum size 175 mm; DED GRAVEL WITH SILT, SAND AND COBBLES (GP-GM)sc: to coarse to fine, hard, angular subangular gravel; about dr; about 10% nonplastic fines with quick dilatancy ray, pinkish grav, no to strong reaction with HCL. E): About 15% hard, drilled and subangular gravel; about dr; about 10% nonplastic fines with quick dilatancy angular gravel; about 30% coarse to fine, fider minus 3 in. ED GRAVEL WITH SILT, SAND AND COBBLES (GP-GM)sc. to coarse to fine, hard, angular to subangular gravel; about dr; about 10% nonplastic fines with quick dilatancy ary, pinkish grav, no to strong reaction with HCI. E): About 15% hard, drilled and subangular cobbles; more minus 3 in. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% subangular gravel; about 30% coarse to fine, hard minus 3 in. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% subangular gravel; about 35% coarse to fine, there minus 3 in.
	100 105 115 125 125						(GP-GM)s FILL CR FILL (GP-GM)s CR (GP-GM)s FILL (GP)s CR (GP)sc CR (GP)sc		TOTAL SAMPLE (BY VOLUM maximum size 130 mm; menai 84 to 66 ft POORLY GRAD About 50% coarse to fine, hart subangular sand; about 10% n of hard, subangular cobbles; m 86 to 87 6f FILL 87.6 to 92.0 ft POORLY GRAD coarse to fine, hard, angular to angular sand; about 5% norphi TOTAL SAMPLE (BY VOLUM remainder minus 3 in. 92.0 to 96.1 ft FILL 96.6 to 95% coarse to fine, hard and; about 10% nonplastic moderate reaction with HCI. 100 mm; remainder minus 3 in 98.9 to 99.6 ft FILL 102.0 to 103.1 ft POORLY GRAD 98.9 to 199.6 ft FILL 103.0 to 103.1 ft POORLY GRA coarse to fine, hard, angular to angular to subangular sand; at to uginas; maximum size 50 r 103.1 to 104.8 ft FILL 104.8 to 109.4 ft POORLY GR 65% coarse to fine, hard, angular to angular sand; about 5% nonpli 109.4 to 109.4 ft POORLY GR 60% coarse to fine, hard, angular to angular sand; about 5% nonpli 111.1 to 116.3 ft POORLY GR 60% coarse to fine, hard, angular to 101.1 to 122.7 ft POORLY GR 65% coarse to fine, hard, angular to 122.7 ft POORLY GR 55% coarse to fine, hard, angular 55% coarse to fine, hard, angular to 122.7 ft POORLY GR 55% coarse to fine, hard, angular 55% coarse to fine, hard, angular 55% coarse to fine, hard, angular to 122.7 ft POORLY GR	<ul> <li>E): About 20% hard, drilled and subangular cobbles; (nder minus 3 in.</li> <li>E): About 20% hard, drilled and subangular cobbles; (subangular gravel; about 40% coarse to fine, omplastic fines with quick dilatancy and low toughness; trace havinum size 130 mm; dry, pinkish gray, strong reaction with HCL.</li> <li>E): DGRAVEL WITH SAND AND COBBLES (GP-Sec: About 60% subangular gravel; about 35% coarse to fine, very astic fines; dry, pink, strong reaction with HCL.</li> <li>E): About 5% hard, subangular cobbles; maximum size 95 mm;</li> <li>ED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sec: d, angular gravel; about 25% coarse to fine, angular es with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low toughness; dry, pinkish gray,</li> <li>E): About 10% hard, subangular cobbles; maximum size 95 with quick dilatancy and low 96 monglastic fines with quick dilatancy and low 97 minus 3 in.</li> <li>E): About 15% hard, drilled and subangular cobbles; 98 more action with HCL.</li> <li>E): About 15% hard, drilled and subangular cobbles; 99 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action with quick 90 more action</li></ul>

Figure 1.1-122. Geologic Log of Drill Hole UE-25 RF#53 (Sheet 2 of 3)

	G	EOL	OG	IC L	OG	OF I	DRILL	HC	LE UE-25 RF#53	SHEET 3 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/20/2005 FINISHED: 4/25/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 160.0 BEDROCK	ountaii 766,03 6 ft 5: 1:	n Project 9.7 E 571,947.85 38.2 ft	STATE: Nevada GROUND ELEVATION: 3661.30 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	ДЕРТН	HARDNESS	SINEERI NDICES DNICTES	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	C AND PI	LASSIFICATION HYSICAL CONDITION
	135 140 155 155 160		В	ΟΤΤΟΝ	M OF H	OLE	RE-DRILL (GP)sc Gc		about 5% nonplastic fines; traci pickish gray, strong reaction w 122.7 to 123.9 ft FILL 123.8 to 128.2 ft POORLY GR, to fine, hard, subangular grave nonplastic fines; maximum size 126.2 to 127.8 ft CORR ERMO 127.8 to 123.6 ft POORLY GR, GP-GM)sc: About 60% coarse; coarse to fine, angular sand; a low foughness, dry, pinkish gr TOTAL SAMPLE (BY VOLLM maximum size 165 mm; remail 132.6 to 135.6 ft R-BORLY GR, 55% coarse to fine, angular to suba pinkish gray, strong reaction w TOTAL SAMPLE (BY VOLLM size 130 nt COLLUVIUM size 130 ntm; remainder minue 137.6 to 160.6 ft RAINTER MES Volcanic tuff, nonweided, virtic fragments), while, 20 to 35% c, cystal fragments of sandine, cemented at top of unit from 1	<ul> <li>a of hard, subrounded cobbles; maximum size 85 mm; dry, in HCi.</li> <li>ACED GRAYEL WITH SAND (GP)s: About 65% coarse i, about 30% coarse to fine, angular sand; about 5% or may dry, pinkish gray, strong reaction with HCI.</li> <li>YED GRAYEL WITH SILT SAND AND COBELES to fine, hard, angular to subangular gravel; about 30% bout 10% nonplastic fines with quick dilatancy and y, strong reaction with HCI.</li> <li>E) About 10% hard, drilled and subangular gravel; about 40% ngular sand; about 5% nonplastic fines with quick dilatancy and y, strong reaction with HCI.</li> <li>E) About 10% hard, drilled and angular cobbles; maximum ingular sand; about 5% nonplastic fines with with quick dilatancy and y, strong reaction with HCI.</li> <li>E) About 10% hard, drilled and angular cobbles; maximum is in:</li> <li>ADED GRAVEL WITH SAND AND COBELES (GP)sc: About fanity coarse, hard, angular to subangular gravel; about 40% ngular sand; about 5% nonplastic fines; until the caliche and magnetic.</li> <li>E) About 10% hard, drilled and angular cobbles; maximum is in:</li> <li>D) To yo consolidated (Droken by drilling process into sand size and magnetic.</li> <li>M UTE (Tm):</li> <li>p. pody consolidated (Droken by drilling process into sand size and guartz, less than 1% biotite. Caliche 38.0 to 139.0 ft, strong reaction with HCI.</li> </ul>

Figure 1.1-122. Geologic Log of Drill Hole UE-25 RF#53 (Sheet 3 of 3)

	GI	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#54 SHEET 1 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/25/2005 FINISHED: 4/27/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 196.3 BEDROCK	ountair 766,27 7 ft :: 18	in Project STATE: Nevada 78.9 E 572,190.12 GROUND ELEVATION: 3661.64 ANGLE FROM HORIZONTAL: -90° 83.0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	SINEERI NDICES ONICIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	(USCS)	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole:								90	L 0.0 to 183.0 ft QUATERNARY ALLUVIUM (Qal)
Repository Facilities deolectrinical investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services	5						(GP)sc	Juc North	0.0 to 8.0 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, subangular to subrounded gravel, about 35% coarse to fine, angular to subangular sand; about 5% nonplastic fines; trace of hard, diniled and subangular cobbles; maximum size 115 mm; moist near surface to dry at depth, strong brown to light yellowish brown, strong reaction with HCI.
Drilling Method: Rotosonic Advance 8 in. casing as hole is cored 0.0 to 196.7 ft (TD). Drill string inside casing consists of 3% in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit.	10-						(SW)gc		8.0 to 12.5 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 50% coarse to fine, angular to subangular sand; about 45% coarse to fine, hard, subangular gravel, about 5% nonplastic fines with no dry strength and quick dilatancy; trace of hard, subrounded cobbles; maximum size 125 mm, dry, light brownish gray, no reaction with HCL.
Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to	15-						(GP-GM)s	0.00	12.5 to 15.5 ft POORLY GRADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 50% predominantly fine, hard, subangular gravel; about 40% coarse to fine, subangular sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 65 mm, dry, yellow, no reaction with HCl.
help in advancing casing.							(GP)s	0.0	15.5 to 17.0 ft POORLY GRADED GRAVEL WITH SAND (GP)s: About 65% coarse to     fine, hard, subangular to subrounded gravel; about 35% coarse to fine, angular to
Fluid Loss Interval: NA	-						(SW)g		subangular sand, trace of nonplastic fines; maximum size 75 mm; dry, very pale brown, moderate reaction with HCl.
Casing Record: 8 in. casing from 0.0 to 196.7 ft (TD) Hole Completion: Back fill hole from 196.7 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	20						(GP)sc	Sec. All	17.0 to 17.9 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 65% coarse to fine, angular sand; about 30% predominantly fine, hard, subangular gravel; about 5% nonplastic fines; maximum size 35 mm; dry, very pale brown, moderate reaction with HCL. 17.9 to 24.8 ft PORLY GRADED GRAVEL WITH SAND AND COBELS (GP)se: Xout 55% coarse to fine, hard, subangular gravel; about 35% coarse to fine, subangular sand; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 105 mm; dry, very pale brown, moderate reaction with HCL
	25-						(GM)s		24.8 to 27.5 ft SILTY GRAVEL WITH SAND (GM)s: About 45% predominantly fine, hard, subangular gravel; about 40% coarse to fine, subangular sand; about 15% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, light gray, etrone receitor with but
	30 -						(GP)sc	A CUS	27.5 to 31.6 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 50% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, subangular sand; about 55% nonplastic fines; trace of hard, subangular cobbles; maximum size 100 mm; dry, very pale brown, no reaction with HCI.
	35 1 1 1 1 1						(SW-SM)g		Als to 41.0 ft WELL GRADED SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: About 60% coarse to fine, angular to subangular santi about 25% coarse to fine, hard, angular to subangular gravel; about 15%, nonplastic fines with quick dilatancy and low toghness; trace of hard; subangular cobbles; maximum size 110 mm; dry, white, light gray, pale brown, and light olive gray, no to strong reaction with HCI.
	40						(GP)sc		41.0 to 47.7 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 50% coarse to fine, hard, angular to subangular gravel; about 45% coarse to fine, angular to subangular sand; about 5% nonplastic fines; trace of hard, drilled and subangular cobbles; maximum size 140 mm; dry, pale yellow, no to weak reaction with HCI.
								<u>s</u>	<ul> <li>coarse to fine, hard; subangular gravel; about 35%</li> <li>coarse to fine, kard; subangular gravel; about 35% coarse to fine, subangular</li> <li>sand; about 10% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm;</li> </ul>

Figure 1.1-123. Geologic Log of Drill Hole UE-25 RF#54 (Sheet 1 of 4)

	G	EOL	.OG	IC L	OG	OF	DRILL	но	LE UE-25 RF#54	SHEET 2 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/25/2005 FINISHED: 4/27/2005 DEPTH TO WATER: Not Encountered		PROJECT: Yucca Mountain Project COORDINATES: N 766,278.9 E 572,190.12 TOTAL DEPTH: 196.7 ft DEPTH TO BEDROCK: 183.0 ft								STATE: Nevada GROUND ELEVATION: 3661.64 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	gineeri Indices	NG						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLA AND PHY	ASSIFICATION YSICAL CONDITION
	-							0.0	<ul> <li>dry, pale yellow, strong reaction w</li> </ul>	vith HCI.
							(SM)g (GP)sc		52.2 to 54.1 ft SILTY SAND WITH to subangular sand; about 20% p nonplastic fines with quick dilatan brownish gray, strong reaction with 54.1 to 63.7 ft POORLY GRADEL coarse to line, hard; angular to su angular to subangular sand; trace subrounded obbies; maximum si reaction with HCI.	I GRAVEL (SM)g: About 60% coarse to fine, angular redominantly fine, hard, subangular gravel, about 10% by and low toughness, maximum size 50 mm; dry, light th HC. D GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% ubangular gravel; about 40% coarse to fine, e of nonplastic fines; trace of hard, drilled and subangular to ize 120 mm; dry, light gray and pale yellow, weak to strong
	70						SM (GP)sc	0000 C	69.7 to 70.5 ft SILTY SAND (SM): nonplastic fines with quick dilatan fine, hard, angular to subangular ( HCl. 70.5 to 75.3 ft POORLY GRADEE coarse to fine, hard, subangular g sand; trace of nonplastic fines; tra ight olive gray, strong reaction with the sub- tight olive gray. Strong reaction with the sub- stand; trace of nonplastic fines; tra- light olive gray, strong reaction with the sub- stand; trace of nonplastic fines; tra- light olive gray, strong reaction with the sub- stand; trace of nonplastic fines; tra- light olive gray, strong reaction with the sub- stand; trace of nonplastic fines; trace of n	: About 70% coarse to fine, subangular sand; about 20% cy and low toughness; about 10% predominantly gravel; maximum size 20 mm; dry, light gray, strong reaction with <b>0 GRAVEL WITH SAND AND COBBLES (GP)sc:</b> About 70% gravel; about 30% coarse to fine, subangular ace of hard, subangular cobbiles; maximum size 100 mm; dry, th HCl.
	80						(GP)sc	0000	<ul> <li>As to fAs the SIL H SAND (SM) sand; about 15% nonplastic fines predominantly fine, hard, angular gray, strong reaction with HCI.</li> <li>76.3 to 81.6 ft POORLY GRADEE coarse to fine, hard, subangular sand; about 5% nonplastic fines; dry, pale yellow, moderate reactic</li> </ul>	About 80% coarse to tine, angular to subangular with quick dilatancy and low toughness; about 5% to subangular gravef, maximum size 45 mm; dry, light brownish <b>D GRAVEL WITH SAND AND COBBLES (GP)sc:</b> About 55% gravel; about 40% coarse to fine, subangular trace of hard, subangular cobbles; maximum size 130 mm; n with HCI.
	85						(SW-SM)g		<ul> <li>81.6 to 82.6 ft WELL GRADED 3; coarse to fine, subangular sand; gravel; about 10% nonplastic fine; 20 mm; dvi, pinkish grav; strong r 82.6 to 88.0 ft POORLY GRADE coarse to fine; hard; subangular g sand; frace of nonplastic fines; tra- pinkish gray, moderate reaction w</li> </ul>	AND WITH SILT AND GRAVEL (SW-SMM): About 70% about 20% predominantly fine, hard, subangular s with quick dilatancy and low toughness; maximum size reaction with HCI. D GRAVEL WITH SAND AND COBBLES (GP)sc: About 70% gravel; about 30% coarse to fine, subangular coobbles; maximum size 150 mm; dry, with HCI.
	90						(SW-SM)g	SUP-OVE-	<ul> <li>88.0 to 90.5 ft WELL GRADED 3; coarse to fine, subangular sand; gravel; about 10% nonplastic fine 45 mm; dry, pitkish gray, modera 90.5 to 93.3 ft POORLY GRADEL coarse to fine, hard, angular to s angular to subangular sand; abou maximum size 130 mm; dry, pink</li> </ul>	AND WITH SILT AND GRAVEL (SW-SM)g: About 70% about 20% predominantly fine, hard, subangular use with quick dilatancy and low toughness, maximum size the reaction with HCI. O GRAVEL WITH SAND AND COBBLES (GP)sc: About 70% ubangular gravel; about 25% coarse to fine, at 5% nonplastic fines; trace of hard, subangular cobbles; and light gray, no to strong reaction with HCI.
	95						(SW-SM)g (GP)sc		95.3 to 97.0 ft WELL GRADED S. coarse to fine, subangular sand; gravel; about 10% nonplastic fine 60 mm; dry, pinkist grav, modera 97.0 to 100.4 ft POORLY GRADE 60% coarse to fine, hard, subang sand; about 5% nonplastic fines; dry, nipk strong macritica with LP	AND WITH SILT AND GRAVEL (SW-SM)g: About 50% about 40% predominantly fine, hard, subangular s with quick dilatancy and low toughness; maximum size the reaction with HCI. D GRAVEL WITH SAND AND COBLES (GP)sc: About jular gravel; about 35% coarse to fine, subangular trace of hard, angular cobbles; maximum size 120 mm; 1
	105						(SW)gc (GP)sc	Rocker and	<ul> <li>100.4 to 102.5 ft WELL GRADED</li> <li>coarse to fine, subangular sand;</li> <li>gravel; about 5% nonplastic fines</li> <li>dry, pinkish gray, strong reaction</li> <li>102.5 to 107.2 ft PORTLY GRAD</li> <li>75% coarse to fine, hard, angular</li> <li>subangular sand; trace of nonplas</li> <li>120 mm; dry, pink, strong reaction</li> </ul>	SAND WITH GRAVEL AND COBBLES (SW)gc: About 55% about 35% coarse to line, hard, subangular (race of hard, subangular cobbles; maximum size 85 mm; with HCI. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About FD GRAVEL WITH SAND AND COBBLES (GP)sc: About sto fines; frace of hard, subangular cobbles; maximum size with HCI.
							(SW-SM)g	0	107.2 to 108.0 ft WELL GRADED coarse to fine, subangular sand; a gravel; about 10% nonplastic fine:	SAND WITH SILT AND GRAVEL (SW-SM)g: About 70% about 20% predominantly fine, hard, subangular s with quick dilatancy and low toughness; maximum size

Figure 1.1-123. Geologic Log of Drill Hole UE-25 RF#54 (Sheet 2 of 4)

	G	EOL	.0G	IC L	OG	OF	DRILL	но	LE UE-25 RF#54	SHEET 3 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/25/2005 FINISHED: 4/27/2005 DEPTH TO WATER: Not Encountered		PROJECT: Yucca Mountain Project COORDINATES: N 766,278.9 E 572,190.12 TOTAL DEPTH: 196.7 ft DEPTH TO BEDROCK: 183.0 ft								STATE: Nevada GROUND ELEVATION: 3661.64 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	gineer Indices	NG						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	C AND P	CLASSIFICATION HYSICAL CONDITION
	110-						(GP)sc (SM)g	0.00	30 mm; dry, pinkish gray, stroi 108.0 to 110.9 ft POORLY GR 85% coarse to fine, hard, ang subangular sand; trace of non	ng reaction with HCI. ADED GRAVEL WITH SAND AND COBBLES (GP)sc: About ular to subargular gravel; about 15% coarse to fine, plastic fines; dry, pinkish gray, strong reaction with HCI.
							(GP)sc		TOTAL SAMPLE (BY VOLUM cobbles; maximum size 150 m 110.9 to 111.9 f stILTY SAND subangular sand; about 25%, nonplastic fines with quick dila strong reaction with HCI. 111.9 to 118.0 ft POORLY GR 60% coarse to fine, hard, ang angular to subangular sand; a with HCI.	IE: About 20% hard, drilled, and subangular to subrounded im; remainder minus 3 in. WITH GRAVEL (SM)g: About 60% coarse to fine, seredominantly fine, hard, subangular gravel; about 15% fancy and low toughness, maximum size 50 mm, dry, pinkish gray, ADED GRAVEL WITH SAND AND COBBLES (GP)sc: About ular to subangular gravel; about 35% coarse to fine, bout 5% nonplastic fines; dry, pinkish gray, strong reaction
	120						CR (SW)gc SM		TOTAL SAMPLE (BY VOLUM 140 mm; remainder minus 3 in 118.0 to 119.0 ft SILTY SAND angular to subangular sand; a gravel; about 20% nonplastic 110 mm; dry, light gray, mode 119.0 to 120.7 ft CORE REMC 120.7 to 124.4 ft WELL GRAD	(E): About 5% hard, subangular cobbles; maximum size WITH GRAVEL (SM)g: About 60% coarse to fine, bout 20% predominantly fine, hard, angular to subangular fines with quick dilatancy and low toughness; maximum size rate reaction with HCI. VED ED SAND WITH GRAVEL AND COSELSS (SW)gc: About 55% to your approximation of the subangular states and the subang
	130						(GP)sc	AUCHON CONTRACT	<ul> <li>coarse to fine, angular to sub- to subangular gravel; trace of maximum size 150 mm; dry, ii)</li> <li>124.4 to 124.9 ft SILTV SAND 15% nonplastic fines with quic predominantly fine, hard, ang strong reaction with HCI.</li> <li>124.3 to 143.7 ft POORLY GR 60% coarse to fine, hard, ang angular to subangular sand; it reaction with HCI. Core remo</li> <li>TOTAL SAMPLE (BY VOLUM maximum size 150 mm; rema</li> </ul>	angular sand; about 45% coarse to fine, hard; angular nonplastic fines; trace of hard; dilled and subangular cobbles; ght brown, strong reaction with HCL. (SM): About 75% coarse to fine, subangular sand; about k dilatancy and low toughness; about 10% lar to subangular gravel; maximum size 85 mm; dry, light gray, ADED GRAVEL WITH SAND AND COBBLES (GP)sc: About ular to subangular gravel; about 40% coarse to fine, ace of nonplastic fines; dry, light brown to pinkish gray, weak ved from 128.0 to 129.3 ft. IE): About 15% hard; drilled and subangular cobbles; inder minus 3 in.
							CR (GP-GM)s		143.7 to 145.6 ft CORE REMC 143.5 to 145.6 ft CORE REMC 145.5 to 147.0 ft POORLY GR	DVED ADED GRAVEL WITH SILT SAND AND COBBLES to fine, hard, angular to subangular gravel; about 40%
							(GP)sc	CON DUC	<ul> <li>coarse to fine, angular to sub- dilatancy and low toughness;</li> <li>strong reaction with HCI.</li> <li>147.0 to 155.9 ft POORLY GR 60% coarse to fine, hard, ang angular to subangular sand; a maximum size 110 mm; dry, li</li> <li>153.1 to 154.2 ft.</li> </ul>	angular sand; about 10% nonplastic fines with quick race of hard, subangular cobbles; maximum size 140 mm; dry, pink, ADED GRAVEL WITH SAND AND COBELES (GP)sc: About lart lo subangular gravel; about 35% coarse to fine, bout 5% nonplastic fines; trace of hard, subangular cobbles; ght brown, no reaction with HCI. Core removed from
	160						(SW-SM)		155.9 to 156.7 ft WELL GRAD coarse to fine, angular to subs subangular gravel; about 10% maximum size 60 mm; drv, pi 156.7 to 165.5 ft POORLY GR 65% coarse to fine, hard, ang fine, angular to subangular sa reaction with HCI. TOTAL SAMPLE (BY VOLUM maximum size 150 mm; rema	IED SAND WITH SILT AND GRAVEL (SW-SM)g: About 65% angular sand; about 25% predominantly fine, hard, nonplastic fines with quick dilatancy and low toughness; kish gray, no reaction with HC. ADED GRAVEL WITH SAND AND COBBLES (GP)sc: About luar to subangular grave; about 25 to 30% coarse to nd; about 5% nonplastic fines; dry, pink, weak to strong IE): About 45% hard, drilled and subangular cobbles; inder minus 3 in.
	165						CR (SM)g		165.5 to 166.7 ft CORE REMC 166.7 to 167.4 ft SILTY SAND angular to subangular sand; a gravel; about 15% nonplastic	WED WITH GRAVEL (SM)g: About 65% coarse to fine, bout 20% predominantly fine, hard, angular to subangular lines with quick dilatancy and low toughness; maximum size

Figure 1.1-123. Geologic Log of Drill Hole UE-25 RF#54 (Sheet 3 of 4)

	G	EOL	.0G	IC L	OG	OF I	DRILL	. HO	DLE UE-25 RF#54 SHEET 4 OF 4	
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 4/25/2005 FINISHED: 4/27/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEP H TO I	Yucca M TES: N TH: 196. BEDROCI	ountain 766,27 7 ft K: 18	in Project STATE: Nevada 78.9 E 572,190.12 GROUND ELEVATION: 3661.64 ANGLE FROM HORIZONTAL: -90° 183.0 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung	
		EN	GINEERI	NG						
NOTES	рертн	HARDNESS	DNICES	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION	
	170 						(GP)sc	Nov Nov Color South	<ul> <li>To mm; dry, pinkish gray, strong reaction with HCI.</li> <li>167.4 to 183.0 ft PORKUT GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, angular to subangular sand; about 3% nonplastic fines; dry, pink, moderate to strong reaction with HCI. Core removed 175.2 to 177.1 ft.</li> <li>TOTAL SAMPLE (BY VOLUME): About 25% hard, drilled and subangular cobbles; maximum size 200 mm; remainder minus 3 in.</li> </ul>	:
	185 						Tmr		18.30 to 196.7 ft RAINER MESA TUFF (Tmr): Injinitoritie, norweided, poorly consolidated, partially crystallized, white, 20 to 30% pumice, 2 to 3% thit ic fragments of velicled turk (10 to 20% crystal fragments of quartz, sanidine, and plagloclase, less than 1% biotite.	
			E	OTTO	M OF H	IOLE				

Figure 1.1-123. Geologic Log of Drill Hole UE-25 RF#54 (Sheet 4 of 4)

FEATURE: Waste Handling Facility         PROJECT: Yucca Mountain Project         STATE: Nevada           LOCATION: Midway Valley         COORDINATES: N 765,112.32 E 571,531.31         GROUND ELEVATION: 3642.22	
BEGUN: 6/1/2005     FINISHED: 6/6/2005     TOTAL DEPTH: 154.2 ft     ANGLE FROM HORIZONTAL: -90°       DEPTH TO WATER: Not Encountered     DEPTH TO BEDROCK: 110.2 ft     HOLE LOGGED BY: George Eatman       REVIEWED BY: Robert Lung     REVIEWED BY: Robert Lung	
NOTES	
Purpose of Hole:	
GP24 300 RS (Sonic Drill Rig)     Faltbed combination water and pipe truck with boom     Faltbed combination water and pipe truck with boom     Tortal SAMPLE (RV VOI LIME): About 15% hard subacrular cohles: maximum size	%
Driller:	c: /,
Drilling Method: Rotsonic Advance 8 in. casing as hole is cored 0.0 to 154.2 ft (TD). Drill string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in. Sincle wall drill object this follows for the string inside casing consists of 3% in.	
button bit.  Drilling Conditions: Not Reported  15  United to 15  United	ith HCI. 55%
Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing.	I
Fluid Loss Interval: NA Conting Record:	
Casing from 0.0 to 154.2 ft (TD)         -           Hole Completion:         -           Back fill hole from 154.2 ft up to 0.0 ft         25-	
(ground surface) with Bentonite Chips. Pull casing. (SM)g (SM)g (SP-GM)s (GP-GM)	h gray,
30 30 30 30 30 30 30 30 30 30 30 30 30 3	55%
angular sand; about 5% nonplastic fines; trace of hard, subangular cobbles; maximum siz 85 mm; dry, pinkish gray, strong reaction with HCI. 35	e
40 - 40.2 to 47.0 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM) About 65% coarse to fine, hard, angular gravel; about 20% coarse to fine, angular sand; about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness; trace of hard, and about 10% nonplastic fines with quick dilatancy and low toughness (trace of	sc:
(SM)g     47.0 to 47.9 ft SILTY SAND WITH GRAVEL (SM)g: About 55% coarse to fine, angular sand; about 30% predominantly fine, hard, angular gravel; about 15% nonplastic fines of the quick dilatancy and low toughness; maximum size 30 mm, dry, pinkish gray, strong re with HC.       50     50	action
About 60% coarse to fine, hard, angular to subangular gravel; about 30% coarse to fine, angular sand; about 10% nonplastic fines with quick dilatancy and low toughness; traine, angular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray, strong reaction with quick dilatancy and low toughness in the subangular cobbles; maximum size 90 mm; dry, pinkish gray	ce HCI.

Figure 1.1-124. Geologic Log of Drill Hole UE-25 RF#55 (Sheet 1 of 3)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	LE UE-25 RF#55	SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/1/2005 FINISHED: 6/6/2005 DEPTH TO WATER: Not Encountered		PROJECT: Yucca Mountain Project COORDINATES: N 765,112.32 E TOTAL DEPTH: 154.2 ft DEPTH TO BEDROCK: 110.2 ft							n Project 2.32 E 571,531.31 10.2 ft	STATE: Nevada GROUND ELEVATION: 3642.22 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI INDICES	NG						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	( AND F	CLASSIFICATION PHYSICAL CONDITION
	1 3									D SAND WITH SILT AND GRAVEL (SW-SM)g: About 50%
	60						(SW-SM)	0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0	<ul> <li>coarse to fine, angular to sub- to sub-angular gravel; about 1</li> <li>maximum size 65 mm, dy, p</li> <li>61.0 to 64.3 ft POORLY GRA</li> <li>fine, hard, angular to sub- ang nonplastic fines; maximum si</li> </ul>	angular sand; about 40% coarse to tine, hard; angular 0% nonplastic fines with quick dilatancy and low boughness, ink, strong reaction with HCI. DED CRAVEL WITH SAND (CP)s: About 65% coarse to ular gravel; about 35% coarse to fine, angular sand; trace of ze 55 mm; dry; pink, strong reaction with HCI.
	65						(SW)g	0	64.3 to 67.1 ft WELL GRADE fine, angular sand; about 409 nonplastic fines; maximum si	D SAND WITH GRAVEL (SW)g: About 55% coarse to % coarse to fine, hard, angular to subangular gravel; about 5% ze 65 mm: drv, strong reaction with HCl.
							(GP)sc	ÅÇ.	67.1 to 71.1 ft POORLY GRA coarse to fine, hard, angular angular sand; about 5% non	DED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% to subangular gravel; about 30% coarse to fine, lastic fines; dry, pink, strong reaction with HCl.
	70						(6)// 61/1		TOTAL SAMPLE (BY VOLU size 125 mm; remainder min 71.1 to 73.9 ft WELL GRADI	ME): About 5% hard, drilled and subangular cobbles; maximum us 3 in. ED SAND WITH SILT AND GRAVEL (SW-SM)g: About 50%
	75						(500-500)		<ul> <li>coarse to fine, angular sand;</li> <li>10% nonplastic fines with qui</li> <li>pinkish gray, strong reaction</li> <li>73.9 to 95.0 ft POORLY GRA</li> <li>coarse to fine, hard angular</li> </ul>	about 40% coarse to fine, hard, angular graver; about ck dilatancy and low toughness; maximum size 60 mm; dry, with HCI. DED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% to subacquide cravel: about 40% coarse to fine
	80						(GP)sc		coarse to line, nard, angular     angular sand; trace of nonple     size 125 mm; dry, pink, pinki	to subangular graver, about 40% coarse to line, sito fines; tree of hard, drilled and subangular cobbles; maximum sh gray, strong reaction with HCI. Core removed from 82.3 to 83.7 ft.
							CR		95.0 to 96.7 ft CORE REMO	/ED
	100						(GP-GM)s		<ul> <li>96.7 to 100.3 ft POORLY GR</li> <li>coarse to fine, hard, subangu</li> <li>about 10% nonplastic fines w</li> <li>dry, pink, strong reaction with</li> </ul>	ADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 50% Jar gravel; about 35% coarse to fine, angular sand; ith quick dilatancy and low toughness; maximum size 65 mm; HCI.
							(SW-SM)	Net of the of the solution	100.3 to 110.2 ft WELL GRA coarse to fine, angular sand; gravel, about 10% nonplastic 30 mm; dry, pink, strong read	DED SAND WITH SILT AND GRAVEL (SW-SM)g: About 50% about 40% coarse to fine, hard, angular to subangular fines with quick dilatancy and two toughness; maximum size tion with HCI. Core removed from 106.3 to 108.0 ft.
	115						Tmbt1	Š	<ul> <li>Inva to rever if PTRC-FAINE</li> <li>Bedded tuff, nonvelded, loca very pale brown, 2 to 15% put fif, 2 to 25% crystal fragmer</li> <li>hornblende, and magnetite, 2 1100, 0 to 13.0 it consists of ragments of quartz, feldspar</li> <li>less than 1% lithic fragments</li> </ul>	It altered, locally reworked, crystallized, white, pinkish white, pink, mice, 1 to 15% lithic fragments of crystallized wielded to 15% lithic fragments of crystallized wielded acide to evented ask and 5 to 20% sitt to very fine sand size and crystallized welded tuff, with less than 1% pumice and

Figure 1.1-124. Geologic Log of Drill Hole UE-25 RF#55 (Sheet 2 of 3)



Figure 1.1-124. Geologic Log of Drill Hole UE-25 RF#55 (Sheet 3 of 3)

	GE	EOL	.OG	IC L	OG	OF I	DRILL	но	LE UE-25 RF#56	SHEET 1 OF 5
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/6/2005 FINISHED: 7/7/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N7 TH: 416.9 BEDROCK	ountain 765,439 9 ft K: 12	Project 9.36 E 571,857.22 9.9 ft	STATE: Nevada GROUND ELEVATION: 3646.81 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES Purpose of Hole: Repository Facilities Geotechnical Investigations Pull Equipment	DEPTH	HARDNESS	SINEERII NDICES SNIGTIAN	FRACTURE DENSITY	% CORE RECOVERY	% RQD	B GEOLOGIC UNIT M [USCS]	C C GRAPHIC	CI AND Ph 0.0 to 129.7 ft: QUATERNARY 0.0 to 0.7 ft: QUATERNARY event divide 20% concert bit for	LASSIFICATION HYSICAL CONDITION ALLUVIUM (Qai).
Repository Facilities decidennical investigations Drill Equipment: GP24 300 RS (Sonic Drill Rig) Flatted combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longyear Drill Services Drilling Method: Advance 8 in. casing as hole is cored 0.0 to 337.4 ft. Advance 8 in. casing as hole is cored 0.0 to 337.4 ft. Advance 8 in. casing as hole is cored 0.0 to 337.4 ft. 1018 string inspace ver to 4 in. coring system with 4.56 in. Rotesonic Carbide button bit. Advance 6 in. casing as hole is cored from 337.4 to 416.9 ft (TD). Drilling Cruditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 0.0 to 337.4 ft. 6 in. casing from 31.6 yf tup to 0.0 ft. (ground surface) with Bentonite Chips. Pull casing.	5						(GP)sc (SW)gc (SP)gc (SW)gc (GP)sc (GP)sc (SW-SM)g (GP-GM)s (GP-SC)	No 6 to the structure of the fail of the structure of the	0.0 to 0.7 ft SILTY SAND WITH     sand; about 30% coarse to fine     with quick dilatancy and low tou     reaction with HCI.     0.7 to 1.7.1 ft POORLY GRADE     Coarse to fine, hard, angular to     angular to subangular sand; ab     yellow, moderate reaction with     TOTAL SAMPLE (BY VOLUME     size 120 mm; remainder minus     subangular sand; ab     yellow, moderate reaction with     it for a size of nonplastic fines     ingravel; about 5% more     subangular sand; about 5% more     subangular sand; about 5% more     to TOTAL SAMPLE (BY VOLUME     maximum size 140 mm; remainder     minus     subangular sand; about 5% more     to TOTAL SAMPLE (BY VOLUME     maximum size 176 mm; remaind     to TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     to fine, angular sand; about 5%, more     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonplastic fines;     subangular sand; thore of nonplastic     ToTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore of nonp     TOTAL SAMPLE (BY VOLUME     maximum size 120 mm; remainder     zubangular sand; thore to 5% nonplastic fines; dup land     size 120 mm; remainder minus     S1 to 52.4 th 57.7 th POORLY GRAD     coarse to fine, hard, angular to     size 120 mm; remainder minus     S1 to 52.4 th S1.7 SAND     maximum size 120 mm; remainder minus     S1 to 52.4 th S1.7 th POORLY GRAD     coarse to fine, hard, angular to 5%     nonplastic fines; dup land     size 120 mm; remainder minus     S1 to 52.4 th S1.7	I GRAVEL (SM)g: About 40% coarse to fine, subangular , hard, subangular gravel; about 30% nonplastic fines giness; maximum size 50 mm; dy, light redisib horow, weak D GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% subangular gravel; about 40% coarse to fine, out 5% nonplastic fines; dy, light redisib brown, redisib HCI. Appears iron stained. ;; About 5% hard, drilled and subangular cobbles; maximum 3 m SAND WITH GRAVEL AND COBBLES (GP)sc: About 60% bout 40% coarse to fine, hard, angular to subangular ; about 45% coarse to fine, angular to subangular cobbles; maximum size 130 mm; dry, ion with HCI. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 50% avel; about 45% coarse to fine, angular to mplastic fines; dry, pink, moderate reaction with HCI. ; About 10% hard, drilled and subangular cobbles; der minus 3 in. ED SAND WITH GRAVEL AND COBBLES (SP)gc: About 55% ; about 40% coarse to fine, angular to mplastic fines; dry, pink, strong reaction with HCI. ;; About 10%, hard, drilled and subangular cobbles; der minus 3 in. SAND WITH GRAVEL (SW)g: About 60% coarse to predominantly fine, hard, angular to subangular to set 60 mm; dry, pinkkis gray, strong reaction with HCI. ;; About 20% hard, drilled and subangular cobbles; der minus 3 in. SAND WITH GRAVEL (SW)g: About 60% coarse to predominantly fine, hard, angular to subangular to set 60 mm; dry, pinkkis gray, strong reaction with HCI. ;; About 20% hard, drilled and subangular cobbles; der minus 3 in. SAND WITH GRAVEL (AND COBBLES (SP)sc: About 5% sout 40% coarse to fine, angular to lastic fines; dry, pinkish gray, strong reaction with HCI. ;; About 20% hard, drilled and subangular cobbles; der minus 3 in. SAND WITH GRAVEL AND COBBLES (SP)sc: About 5% sout 40% coarse to fine, angular sand; about horderate reaction with HCI. ;; About 3% hard, drilled and subangular cobbles; der minus 3 in. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 5% sout 40% coarse to fine, angular sand; about h gray, strong reaction with HCI. ;; About 5%
	60 65 70 70 70						(SW-SM)		T7 to 46.3 ft WELL GRADED     Abott 50% coarse to fine, angl     hard, angular to subangular gris     toughness; dry, pink, strong ree     TOTAL SAMPLE (BY VOLUME     125 mm; remainder minus 3 in,     46.3 to 48.6 ft POORLY GRAD     coarse to fine, hard, subangular     usubangular sand; about 10% n     maximum size 90 mm; dry, pink     48.6 to 62.7 ft POORLY GRAD     coarse to fine, hard, angular to     angular to subangular cand; the subangular cand; about 10% n     angular to subangular cand; the subangular cand; the subangular cand; the subangular cand; the subangular to suba	SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: ular to subangular sand; about 40% coarse to fine, wel; about 10% nonplastic fines with quick dilatancy and low action with HCI. E): About 10% hard, subangular cobbles; maximum size ED GRAVEL WITH SILT AND SAND (GP-GM)s: About 50% ur gravel; about 40% coarse to fine, angular to onplastic fines with quick dilatancy and low to optiastic about 40% coarse to fine, angular to ED GRAVEL WITH SAID AND COBBLES (GP)sc: About 55% subangular gravel; about 40% coarse to fine, size 120 mm; dry, pink, weak to strong reaction with HCI. SAND WITH SLIT AND GRAVEL [SW-SM)gc: About 60% ngular sand; about 30% coarse to fine, hard, angular

Figure 1.1-125. Geologic Log of Drill Hole UE-25 RF#56 (Sheet 1 of 5)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	LE UE-25 RF#56	SHEET 2 OF 5
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 6/6/2005 FINISHED: 7/7/2005					PROJ COOF TOTA	IECT: RDINA <sup>:</sup> L DEP	Yucca Mo TES: N TH: 416.	ountair 765,43 9 ft	n Project 9.36 E 571,857.22	STATE: Nevada GROUND ELEVATION: 3646.81 ANGLE FROM HORIZONTAL: -90°
DEPTH TO WATER: Not Encountered					DEPT	Н ТО І	BEDROCH	K: 12	29.9 ft	HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	NG						
NOTES	ЕРТН	ARDNESS	ELDING	RACTURE DENSITY	CORE RECOVERY	ROD	EOLOGIC UNIT	RAPHIC	C AND P	LASSIFICATION HYSICAL CONDITION
		Ĩ	3	Ē	%	%	02	् ज	to subangular gravel: about 10	0% nonplastic fines with quick dilatancy and low toughness:
	80 85 90 95 100 1105 1110 1115 1115 1115						<u>SM</u> (SW-SM)g (GP-GM)s (GP)s (GP)sc (SM)g (GP-GM); <u>CR</u> (SW-SM)g		<ul> <li>64.3 to 73.2 ft POORLY GRAD</li> <li>66.3 to 73.2 ft POORLY GRAD</li> <li>coarse to fine, hard, angular 1</li> <li>angular sand; about 5% nonp</li> <li>TOTAL, SAMPLE (BY VCLUM)</li> <li>maximum size 120 mm, rema</li> <li>73.2 to 75.3 ft WELL GRADEI</li> <li>coarse to fine, angular sand;</li> <li>subangular gravel; about 10%</li> <li>maximum size 55 mm, dry, pi</li> <li>75.3 to 76.8 ft WELL GRADEI</li> <li>fine, subgular sand;</li> <li>subangular gravel; about 10%</li> <li>mongular sand;</li> <li>subangular gravel;</li> <li>about 30% nonplastic fines;</li> <li>maximum size 55 mm, dry, pi</li> <li>76.8 to 77.6 ft SLLT SAND (5</li> <li>sand; about 30% nonplastic fines;</li> <li>maximum size 51 mm, remainder minu</li> <li>77.6 to 81.2 ft WELL GRADEI</li> <li>About 50% coarse to fine, angular to subangular gravel;</li> <li>tograhess; dry, pinkisi gray.1</li> <li>TOTAL SAMPLE (BY VCLUM)</li> <li>86.1 ft POORLY GRAM</li> <li>About 50% coarse to fine, hard, angure and; about 10% nonplastic fine, angular to subangular gravel;</li> <li>about 50% coarse to fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angular to subangular gravel;</li> <li>about 50% coarse to fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure and; about 10% nonplastic fine, hard, angure to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; about 10% nonplastic fine, angular to subangular gravel; abou</li></ul>	<ul> <li>JED GRÄVEL WITH SAND AND COBBLES (GP)sc: About 65% j subangular gravel; about 30% coarse to fine, astic fines; dry, pink, strong reaction with HCI.</li> <li>LE): About 10% hard, drilled and subangular cobbles; neder minus 3 in.</li> <li>JSAND WITH SLT AND GRAVEL (SW-SNg: About 60% about 30% percention with HCI.</li> <li>JSAND WITH SLT AND GRAVEL (SW-SNg: About 60% about 30% percention with HCI.</li> <li>JSAND WITH GRAVEL (SW)g: About 50% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, hard, angular to subangular gravel; about 15% coarse to fine, angular to subangular gravel; about 10% hard, drilled and subangular cobbles; maximum is a sit.</li> <li>JSAND WITH SLT GRAVEL AND COBBLES (SW-SMgc: jular to subangular gravel; about 40% coarse to fine, angular to subangular and, about 40% coarse to fine, angular gravel; about 40% coarse to fine, angular gravel; about 40% coarse to fine, angular to subangular and (about 40% coarse to fine, angular to subangular and; about 40% coarse to fine, angular to subangular and low toughness; tace of hard, angular grave; about 40% coarse to fine, angular to subangular and (about 40% coarse to fine, angular to subangular and (about 40% coarse to fine, angular to subangular and (about 40% coarse to fine, angular to subangular and (about 50% coarse to fine, angular to subangular and (about 50% coarse to fine, angular to subangular grave; about 35% coarse to fine, angular to subangular to subangular grave; about 35% coarse to fine, thard, a</li></ul>
							(GP)sc (SW)g CR (GP-GM): Tmr		angular to subangular sand; a gravej; about 15% nonplastici 80 mm; dry, pink, strong read 110.0 to 114.4 ft POORLY GR coarse to fine, hard, angular 1 angular to subangular sand; a subangular sand; a 114.4 to 115.1 ft CORE HEM 116.1 to 115.1 ft CORE HEM 116.1 to 115.6 it WELL GRAD About 50% coarse to fine, and hard; angular to subangular gi toughness; dry, pinkish gray; 1 COTAL SAMPLE (BY VOLUM maximum size 140 mm; rema 117.6 to 124.4 ft POORLY GR 70% coarse to fine, hard, ang angular to subangular sand; a with HC. TOTAL SAMPLE (BY VOLUM maximum size 125 mm; rema 124.4 to 125.4 ft WELL GRAD fine, angular to subangular sand; a with HC. TOTAL SAMPLE (BY VOLUM maximum size 125 mm; rema 124.4 to 125.4 ft WELL GRAD fine, angular to subangular sand; a about 5% nonplastic fines; me 125.4 to 125.9 ft COCRE HEM 5.0 % pumice, less than 1 20% crystal fragments of qua 149.0 to 226.0 ft: PRE-RANIME Interbedded ignimbrite, bedde The ignimbrite is nonwelded, 1 pumice, 1 to 3% illibic fragments of qua 149.0 to 226.0 ft: PRE-RANIME interbedded ignimbrite, bedde The fallout tephra is nonwelded crystal fragments of quart, si 0 x03% pumice, less than 1 crystal fragments of quart, si	bout 25% predominantly line, hard, angular to subangular ines with quick dilatancy and two toughness; maximum size ion with HCI. ADED GRAVEL WITH SILT AND SAND (GP-GM)s: About 50% 5 subangular gravel; about 40% coarse to line, bout 10% nonplastic lines with quick dilatancy and low mmm. Jug and the subangular could be subangular could be the subangular sand; about 40% coarse to fine, sivel; about 10% nonplastic lines with quick dilatancy and low strong reaction with HCI. ED SAND WITH SILT GRAVEL AND COBELES (SW-SM)gc: jular to subangular sand; about 40% coarse to fine, sivel; about 10% nonplastic lines with quick dilatancy and low strong reaction with HCI. ED: About 20% hard, drilled and subangular cobbles; inder minus 3 in. ADED GRAVEL WITH SAND AND COBELES (GP)sc: About 14T to subangular gravel; about 25% coarse to fine, bout 5% nonplastic lines; dry, pinkish gray, strong reaction tell: About 10% hard, drilled and subangular cobbles; inder minus 3 in. ADED GRAVEL WITH GRAVEL (SW)g: About 55% coarse to find; about 40% predominantly fine, hard, subangular gravel; bout 5% nonplastic lines; strong reaction with HCI. YED GRAVEL WITH GRAVEL (SW)g: About 55% coarse to find; about 40% predominantly fine, hard, subangular gravel; bout 5% nonplastic lines; strong reaction with HCI. SAD UTH GRAVEL (SW)g: About 55% coarse to fine, bout about 40% predominantly fine, hard, subangular gravel; bout to subangular gravel; about 40% coarse to fine, bout bangular gravel; about 40% coarse to fine, bout about 40% predominantly fine, hard, subangular gravel; bout to gravel; about 40% coarse to fine, bout coarse and and dine, less than 1% biotite. SA TUFF (Tm): SA TUFF (Tm): SA TUFF (Tm): welded, with; locally altered, locally poorty consolidated, pinkish white, try, plagicolase and sandine, less than 1% biotite. SA TUFF BEDDED TUFF (Tmbt1): d uff and fallout tephra. Sedded, with; locally altered, pink, white, 15 to 40% ts of welded utf, less than 1 to 2% glass fragments, juartz, sandine and plagicolase, less than 1% biotite. Strong

Figure 1.1-125. Geologic Log of Drill Hole UE-25 RF#56 (Sheet 2 of 5)

	G	EOL	.OG	IC L	OG	OF I	DRILL	HO	LE UE-25 RF#56	SHEET 3 OF 5
FEATURE: Waste Handling Facility					PROJ	ECT:	Yucca M	ountair	Project	STATE: Nevada
LOCATION: Midway Valley BEGUN: 6/6/2005 EINISHED: 7/7/2005					COOF	RDINA'	TES: N TH: 416	765,43 0 ft	9.36 E 571,857.22	
DEPTH TO WATER: Not Encountered					DEPT	н то і	BEDROCH	<: 12	9.9 ft	HOLE LOGGED BY: George Eatman
										REVIEWED BY: Robert Lung
		EN	GINEERI INDICES	NG						
				ΥTI8	ΞRΥ					
NOTES				DEN	COVI		INIT			CLASSIFICATION
		NESS	DN D	TURE	RERE		ogic	밀	AND F	SHISICAL CONDITION
	DEPT	HARD	MELD	FRAC	% CO	% RQ	GEOL	GRAP		
	165							. * .		
	170									
	13									
	175-							, ope		
	=									
	180									
									-	
	105									
	190-									
	1 3							, Solo		
	195-						Tmbt1			
	1 3									
	200-							· ·	-	
									-	
	205									
	1 3									
	210-									
	1 3							1000		
	215								-	
	220							· ·	-	
	220									
	225								 226.0 to 249.2 ft: POST TUF	F "X" BEDDED TUFF (Tokbt):
	1 3								Bedded tuff, nonwelded, clay lithic fragments of welded tuf	altered, pink, very pale brown, 3 to 20% pumice, 2 to 5% f, quartz absent. From 226.0 to 228.5 ft may be an incipient paleosol.
	230-								-	
	1 3							•	-	
	235-								-	
							Tpkbt			
	240									
	3									
	245									
	250								249.2 to 392.7 ft: COMB PEA	AK IGNIMBRITE - TUFF "X" (Tpki):
							Tpki		249.2 to 255.6 ft: Ignimbrite, the upper nonwelded vitric zo	nonwelded, vitric, slightly altered, pink, 3 to 5% pumice. This is one of Tpki.

Figure 1.1-125. Geologic Log of Drill Hole UE-25 RF#56 (Sheet 3 of 5)

FEATURE Watch Housing Figure         PROJECT: Vocas Marcas Regist         THE Reade:         PROJECT: Vocas Marcas Regist         PROJECT: Vocas Ma		G	EOL	.OG	IC L	OG	OF I	DRILL	. HO	LE UE-25 RF#56	SHEET 4 OF 5
LOCATION         Medical Elevation         Medicalevation         Medical Elevation         Medic	FEATURE: Waste Handling Facility					PROJ	ECT:	Yucca M	ountaiı	n Project	STATE: Nevada
Liston routine         Disput fields         Disput fields <thdisput fields<="" th="">         Disput f</thdisput>	LOCATION: Midway Valley					COOF	RDINA	TES: N	765,43	9.36 E 571,857.22	GROUND ELEVATION: 3646.81
INOTES         Image: Control of the second sec	DEPTH TO WATER: Not Encountered					DEPT	L DEP H TO F	TH: 416. SEDROCI	.9π ≺∙ 1:	29 9 ft	ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman
NOTES         Bootstand								52511001			REVIEWED BY: Robert Lung
NOTES         Image: state in the stat			EN	GINEERI	NG						
NOTES         NOTES <th< td=""><td></td><td></td><td></td><td>INDICES</td><td><b>≻</b></td><td>~</td><td></td><td></td><td></td><td></td><td></td></th<>				INDICES	<b>≻</b>	~					
NOTES         NOTES <th< td=""><td></td><td></td><td></td><td></td><td></td><td>OVER</td><td></td><td>Ę</td><td></td><td></td><td></td></th<>						OVER		Ę			
Set         Bool         Bool <thb< td=""><td>NOTES</td><td></td><td>ss</td><td>0</td><td>E E</td><td>RECO</td><td></td><td></td><td></td><td>AND P</td><td>HYSICAL CONDITION</td></thb<>	NOTES		ss	0	E E	RECO				AND P	HYSICAL CONDITION
Image: Second		H	SDNE	DIX	CTU	ORE	B	CS]	APHIC		
285         2		GEF	HAF	ME	R.	%	% E	GEC	В	_	
280         380         380         381         383         383         383         383         383         383         383         383         383         383         383          383          383		255								<ul> <li>255.6 to 392.7 ft: Pyroclastic f white and pale brown, 15 to 3</li> </ul>	low, nonwelded, crystallized, locally altered, white, pinkish 0% pumice, 2 to 5% lithic fragments of welded tuff, 1 to 2%
		1 3								crystal fragments of quartz an	d feldspar, less than 1% of biotite, hornblende and magnetite.
		260									
		1 =							••		
		265									
		200									
		270								-	
286- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 280- 300-											
200 200 200 200 200 200 200 200		275								<u>-</u>	
		280							••		
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296- 300-		230								-	
		295									
								Tpki			
		300-									
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		325								<u>-</u>	
		330-									
		1 3									
		335							•		
		340									
		10-10-2									

Figure 1.1-125. Geologic Log of Drill Hole UE-25 RF#56 (Sheet 4 of 5)



Figure 1.1-125. Geologic Log of Drill Hole UE-25 RF#56 (Sheet 5 of 5)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	LE UE-25 RF#58 SHEET 1 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: FINISHED: 5/11/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 150.7 BEDROCK	ountain 63,06 7 ft :: 13	1 Project STATE: Nevada 1.43 E 571,072.57 GROUND ELEVATION: 3667.70 ANGLE FROM HORIZONTAL: -90° 34.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	DEPTH	HARDNESS	Sineeri Ndices Snigtam	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Purpose of Hole: Repository Facilities Geotechnical Investigations	-						(GP)s	0.0	0.0 to 134.2 ft QUATERNARY ALLUVIUM (Qai)
Drill Equipment:         GP24 300 RS (Sonic Drill Rig)         Flatbed combination water and pipe truck with boom for moving drill pipe and casing.         Driller:         Travis Osterberg         Boart Longyear Drill Services         Drilling Method:         Rotosonic         Advance 8 in. casing as hole is cored 0.0 to 150.7 ft (TD). Drill string inside casing consists of 3½ in. single wall drill pipe with 6.163 in. Rotosonic Carticle Dutton bit.         Drilling Conditions:         Drilling Fluid:         Small amounts of drilling additives were added to help in advancing casing.	5						(SW)gc		<ul> <li>00 to 2.8 th POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, hard, subangular to subrounded sand; trace of nonplastic lines; maximum size 115 mm; moist, brown, strong reaction with HCI. Topsoil.</li> <li>28 to 19.6 th WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 65% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular to subangular sand; about 30% coarse to fine, angular cobbles; maximum size 125 mm; dry to moist, light brown, gray, strong reaction with HCI.</li> </ul>
NA Casing Record:	20							200	19.6 to 24.7 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55%
8 in. casing from 0.0 to 150.7 ft (TD)	-						(GP)sc	200	angular to subangular sand; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 170 mm; dry, light brown, strong reaction with HCl.
Back fill hole from 150.7 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing.	30						(SM)g (GP)sc	Volto De Color Color	24.7 to 25.6 ft SILTY SAND WITH GRAVEL (SM)g: About 65% coarse to fine, subangular sand, about 20% nonplastic fines with quick dilatancy and low toughness; about 15% predominantly fine, hard, angular to subangular gravel; maximum size 70 mm; dry, gray, strong reaction with HCI. 25.6 to 45.5 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, angular to subangular sand; trace to 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 130 mm; dry, light brown, gray, strong reaction with HCI.
	40 40 45 45 45 45 45 45 45 45 45 45 45 45 45							A Start Start Start	45.5 to 80.6 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SWige: About 60% coarse to fine, angular to subangular sand; about 40% coarse to fine, hard, angular to subangular gravel; trace of nonplastic fines; trace of hard, subangular cobbles; maximum size 130 mm; dry, light brown, gray, tan, no to strong reaction with HCI.

Figure 1.1-126. Geologic Log of Drill Hole UE-25 RF#58 (Sheet 1 of 3)

	GEC	LOG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#58 SHEET 2 OF 3
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: FINISHED: 5/11/2005 DEPTH TO WATER: Not Encountered				PROJ COOF TOTA DEPT	iect: Rdina <sup>-</sup> L dep <sup>-</sup> 'H to e	Yucca Mo TES: N TH: 150. BEDROCH	ountair 763,06 7 ft K: 13	in Project STATE: Nevada 61.43 E 571,072.57 GROUND ELEVATION: 3667.70 ANGLE FROM HORIZONTAL: -90° 134.2 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		INDICES	ING S					
NOTES	DEPTH HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	60 60 70 75 80 90 95 100 105 100 110 110 110 110 120					(SW)gc SM (SW)gc CR (SM)gc (SW-SM); SM		80.6 to 81.5 ft SLLTY SAND (SM): About 70% coarse to fine, subangular sand; about 20% norphasic fines with quick dilutancy and low loaghness; about 10% predominant)         80.6 to 81.5 ft SLLTY SAND (SM): About 70% coarse to fine, subangular sand; about 20% norphasic fines with quick dilutancy and low loaghness; about 10% predominant)         81.6 to 91.3 ft WELL GRADED SAND WITH GRAVEL AND COBLES (SM)ge: About 70% coarse to fine, angular to subangular sand; about 30% coarse to fine, hard; aubangular cobbles; maximum size 10 mm; dry, gray, strong reaction with HC.         91.3 to 92.6 ft CORE REMOVED         22.6 to 102.0 ft SLLTY SAND WITH GRAVEL AND COBLES (SM)ge: About 50% coarse to fine, subangular gravel; about 30% coarse to fine, hard; aubangular cobbles; maximum size 10 mm; dry, gray, strong reaction with HC.         91.4 to 92.6 ft CORE REMOVED         22.6 to 102.0 ft SLLTY SAND WITH GRAVEL AND COBLES (SM)ge: About 50% coarse to fine, subangular gravel; about 50% coarse to fine, subangular gravel; about 50% coarse to fine, hard; subangular gravel; about 50% coarse to fine, subangular gravel; about 50% coarse to fine, subangular gravel; about 50% coarse to fine, hard; subangular gravel; about 10% prophetic fines with quick dilationcy and low toughness; maximum size 10 mm; dry, gray, strong reaction with HC.         102.0 to 10.7 ft NVELL GRADED SAND WITH SLT AND CRAVEL (SW SM)g; About 60% coarse to fine, hard; subangular gravel; about 10% prophetic fines with quick dilation of tou toughness; maximum size 50 mm; dry, gray, strong reaction with HC.         102.0 to 10.7 ft NVELL GRADED SAND WITH SLT AND CRAVEL (SW SM)g; About 60% coarse to fine, angular to subangular gravel; hou toughness; maximum size 50 mm; dry, gray, strong reaction with HC.

Figure 1.1-126. Geologic Log of Drill Hole UE-25 RF#58 (Sheet 2 of 3)



Figure 1.1-126. Geologic Log of Drill Hole UE-25 RF#58 (Sheet 3 of 3)

	GI	EOL	OG	IC L	OG	OF	DRILL	HOL	<b>E UE-25 RF#59</b> SHEET 1 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/25/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP	Yucca Mo TES: N7 TH: 179.0 BEDROCH	ountain   762,347 0 ft 3: 155	Project STATE: Nevada 29 E 571,406.69 GROUND ELEVATION: 3664.55 ANGLE FROM HORIZONTAL: -90° .3 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES Purpose of Hole:	DEPTH	HARDNESS	GINEERI INDICES SNIGTEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	C GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION 0.0 to 154.8 ft QUATERNARY ALLUVIUM (Qai)
Repository Facilities Geotechnical Investigations Drill Equipment: GP24 200 S (Sonic Drill Rig) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Daile Boart Longyear Drill Services Driller: Drillen: Dr	5						(GP)sc		0.0 to 8.6 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, subangular gravel; about 40% coarse to fine, angular sand; trace to 5% nonplastic fines; trace of hard, filled and angular to subangular cobbles; maximum size 130 mm; dry, reddish brown, light reddish brown, weak to moderate reaction with HCI.
Actosonic Advance 8 in. casing as hole is cored 0.0 to 179.0 ft (TD). Drill string inside casing consists of 3½ in. single wall drill pipe with 6.163 in. Rotosonic Carbide button bit.	10						(SW-SM)g		8.6 to 12.0 ft WELL GRADED SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: About 55% coarse to fine, subangular sand; about 35% coarse to fine, hard, subangular gravel; about 10% nonplastic fines with quick dilatancy and low toughness; dry, reddish yellow, strong reaction with HCI.
Drilling Conditions: Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.0 to 179.0 ft (TD) Hole Completion: Back fill hole from 179.0 ft (TD) up to 0.0 ft (ground surface) with Bentonite Chips. Pull casing	20 20 30 30 4 30 4 1 5 5 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1						(GP)sc		TOTAL SAMPLE (BY VOLUME): About 5% hard, drilled and subangular cobbles; maximum size 170 mm; remainder minus 3 in. 12.0 to 31.9 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 3% coarses to fine, angular to subangular sand; trace to 5% nonplastic fines; dry, pink, light reddish brown, moderate to strong reaction with HCI. TOTAL SAMPLE (BY VOLUME): About 5% hard, subangular cobbles; maximum size 145 mm; remainder minus 3 in.
	25						(SW)g		31.9 to 34.8 ft WELL GRADED SAND WITH GRAVEL (SW)g: About 50% coarse to fine angular sand about 45% coarse to fine hard subangular gravel about 5% nonplastic fines ma imum si e 60 mm dry pink strong reaction with HCL
	40 41 45						(GP)sc	20000000000000	34.8 to 45.5 tt POORLY GRAPED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular or subangular grave); about 35% coarse to fine, angular sand; about 5% nonplastic fines; trace of hard, subangular cobbles maximum size 120 mm; dry, pink, strong reaction with HCI.
							(SW)gc		45.5 to 52.5 ft WELL GRADED SAND WITH GRAVEL AND COBBLES (SW)gc: About 50% coarse to fine, angular sand; about 45% coarse to fine, hard, subangular gravel; about 5% nonplastic fines; trace of hard, subangular cobbles; maximum size 95 mm; dry, pink, no reaction with HCI.

Figure 1.1-127. Geologic Log of Drill Hole UE-25 RF#59 (Sheet 1 of 4)

	G	EOL	.OG	IC L	OG	OF I	DRILL	НО	LE UE-25 RF#59	SHEET 2 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/25/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 179.0 BEDROCK	ountair 762,34 0 ft K: 15	Project ST. 7.29 E 571,406.69 GR 5.3 ft HO RE	ATE: Nevada COUND ELEVATION: 3664.55 GLE FROM HORIZONTAL: -90° LE LOGGED BY: George Eatman VIEWED BY: Robert Lung
		EN	GINEERI NDICES	NG						
NOTES	DEPTH	HARDNESS	MELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT	GRAPHIC	CLAS AND PHYS	SIFICATION ICAL CONDITION
	-								-	
	60 60 67 67 70						(GP)sc	1.2.6.4.0.0.0.1.0.0.0.0.0.0.0.0.0.0.0.0.0.0.0	52.5 to 72.0 ft POORLY GRADED G coarse to fine, hard, angular to suba angular sand; trace to 5% nonplastic TOTAL SAMPLE (BY VOLUME): Ab 120 mm; remainder minus 3 in.	RAVEL WITH SAND AND COBBLES (GP)sc: About 65% ngular gravel; about 30% coarse to fine; fines; dry, pink, pinkish gray, strong reaction with HCI. out 10% hard, subangular cobbles; maximum size
	70						(SW-SM)g (GP-GM)s	<u>170 170 170 17130</u> 0	72.0 to 73.6 ft WELL GRADED SANI coarse to fine, angular sand; about 4 gravel; about 10% nonplastic fines wi 40 mm; dry, pinkish gray, strong reac 73.6 to 82.2 ft POORLY GRADED G coarse to fine, hard, angular to suba angular sand; about 10% nonplastic 1 size 70 mm; dry, pinkish gray, strong	D WITH SILT AND GRAVEL (SW-SM)g: About 50% 0% coarse to fine, hard, angular to subangular th quick dilatancy and low loughness; maximum size tion with HCI. RAVEL WITH SILT AND SAND (GP-GM)s: About 60% ngular gravel; about 30% coarse to fine, fines with quick dilatancy and low toughness; maximum reaction with HCI.
	85 -						(SW-SM)g	A CO CO	<ul> <li>82.2 to 83.5 ft WELL GRADED SANT coarse to fine, angular sand; about 31 10% nonplastic fines with quick dilata pinkish gray, moderate reaction with 83.5 to 88.1 ft POORLY GRADED GI 60% coarse to fine, hard, angular gr of nonplastic fines; trace of hard, sub reddish brown, moderate reaction will</li> </ul>	D WITH SILT AND GRAVEL (SW-SM)g: About 60% 0% coarse to fine, hard, angular gravel; about ney and low toughness; maximum size 30 mm, dry, HCI. RAVEL WITH SAND AND COBBLES (GP)sc: About avel; about 40% coarse to fine, angular sand; trace angular cobbles; maximum size 105 mm; dry, light th HCI.
	90						(GM)s (GP-GM)s (SM)gc		88.1 to 89.5 ft SILTY GRAVEL WITH angular to subangular gravel, about nonplastic fines with quick dilatancy a gray, strong reaction with HCI. 89.5 to 92.0 ft POORLY GRADED Gf coarse to fine, hard, angular gravel; 10% nonplastic fines with quick dilata pinkish gray, moderate reaction with 92.2 to 93.5 ft SILTY SAND WITH GF coarse to fine, angular to subangular	SAND (GM)s: About 45% coarse to fine, hard, 40% coarse to fine, angular sand; about 15% and low toughness; maximum size 25 mm; dry, pinkish RAVEL WITH SILT AND SAND (GP-GM)s: About 50% about 40% coarse to fine, angular sand; about nocy and low toughness; maximum size 70 mm; dry, HCI. RAVEL AND COBBLES (SM)gc: About 45% sand; about 40% coarse to fine, hard, angular to
	95						(SW)gc		Juangular graver, about 15% nonple- pinkish grav, moderate to strong react TOTAL SAMPLE (BY VOLUME): Ab- cobbies; maximum size 150 mm; ren 95.5 to 100.0 ft WELL GRADED SAM 55% coarse to fine, angular sand; ab gravel; about 5% nonplastic fines; tra 120 mm; dry, pink, weak to moderate 120 nm; dry, pink, weak to moderate	usine inners winn quick diatancy and low toughness; dry, ction with HCl. out 10% hard, drilled, and angular to subangular hainder minus 3 in. <b>ID WITH GRAVEL AND COBBLES (SW)gc:</b> About out 40% coarse to fine, hard, angular to subangular ice of hard, subangular cobbles; maximum size reaction with HCl.
	105						(GP)sc	Color Color	<ul> <li>101.9 to 105.8 ft POORLY GRADED 55% coarse to fine, hard, angular to angular sand; about 5% nonplastic fil TOTAL SAMPLE (BV VOLUME): Ab maximum size 120 mm; remainder m 105.8 to 111.6 ft POORLY GRADED (SP-SM)gc: About 60% coarse to me fine, hard, angular to subangular grav</li> </ul>	GRAVEL WITH SAND AND COBBLES (GP)sc: About subangular gravel; about 40% coarse to fine, nes; dry, pink, weak to moderate reaction with HCl. out 10% hard, drilled and subangular cobbles; inus 3 in. SAND WITH SILT GRAVEL AND COBBLES dium, angular sand; about 25% predominantly we; about 15% nonplastic fines with quick
	=	]					(SP-SM)ge		<ul> <li>dilatancy and low toughness; maximu with HCl.</li> </ul>	um size 190 mm; dry, light gray, moderate reaction

Figure 1.1-127. Geologic Log of Drill Hole UE-25 RF#59 (Sheet 2 of 4)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#59 SHEET 3 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/25/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	IECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 179. BEDROCK	ountair 762,34 0 ft 3: 15	in Project STATE: Nevada 147.29 E 571,406.69 GROUND ELEVATION: 3664.55 ANGLE FROM HORIZONTAL: -90° 155.3 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEERI	ING S					
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	(USCS)	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	110-								TOTAL SAMPLE (BY VOLUME): About 45% hard, drilled cobbles; maximum size 190 mm; remainder minus 3 in.
	115-						(GP)sc	Solution Solution	111.6 to 118.9 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 65% coarse to fine, hard, angular to subangular gravel; about 30% coarse to fine, angular subangular cobbles; maximum size 105 mm; dry, pink, pinkish gray, strong reaction with HCI. Core removed from 113.1 to 115.1 ft.
	120						(GP-GM)s	6-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0-0	118.9 to 122.4 ft POORLY GRADED GRAVEL WITH SILT SAND AND COBBLES (GP-GM)sc: About 55% coarse to fine, hard, angular to subangular grave; about 35% coarse to fine, angular sand; about 10% nonplastic fines with low dry strength, uick dilatancy and low toughness; trace of hard, angular to subangular cobbles; maximum size 115 mm; dry, pink; strong reaction with HCI. 122.4 to 139.7 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular grave; about 40% coarse to fine, angular sand: about 10% consistence dry night, individe name, not strong reaction with
	125 						(GP)sc	NOVED OF OUT OUT OF	Tanguar sano, about by horpsate lines; dry, pink, pink pink gray, no to strong reaction with HCL Core removed from 131.9 to 133.5 ft.      TOTAL SAMPLE (BY VOLUME): About 5% hard, drilled and angular to subangular cobbles; maximum size 175 mm; remainder minus 3 in.
	140  145 145 150						(SW-SM)	Nove Our Deversion	139.7 to 141.8 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 50% coarse to fine, angular sand; about 40% coarse to fine, hard, angular to subangular gravel; about 10% nonpalsit fines with HCI. 141.8 to 154.8 ft POORTY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 60% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, hard, angular to subangular gravel; about 35% coarse to fine, hard, angular to subangular cobbles; maximum size 120 mm; dry, pink, strong reaction with HCI. Core removed from 145.4 to 147.4 ft.
	155 			-			Qc Tpcy Tpcm		<ul> <li>154.8 to 155.3 ft COLLUVIUM (Qc):</li> <li>Colluvium consists of welded tuff fragments (red), gravel to cobble size in a caliche matrix (very pale brown).</li> <li>155.3 to 156.3 ft TUFF OF PINYON PASS (Tpcy):</li> <li>Prycolastic flow, parially to moderately welded, urstallized, dusky red, 1 to 2% pumice, 5 to 15% ithic fragments of moderately welded tuff, 5% crystal fragments of sanidine and lesser plagioclase. (%) biolite and lesser homblende and pyroxene.</li> <li>156.3 to 179.0 ft TVA CANYON TUFF CRYSTAL-RICH NONLTHOPHYSAL ZONE (Tpcrn):</li> <li>Pyroclastic flow, pravieded near top increasing to densely welded with depth, mostly crystallized, but vitric locally, very pale brown, pink, reddish brown, and very dark gray, pumice 2 to 15%, less than 1% lithic fragments of sanidine and plagioclase, less than 1 to 2% biolite, pyroxene, homblende, and magnetite.</li> </ul>

Figure 1.1-127. Geologic Log of Drill Hole UE-25 RF#59 (Sheet 3 of 4)

	G	EOL	OG	IC L	OG	OF I	DRILL	HO	LE UE-25 RF#59	SHEET 4 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/25/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	iect: Rdina <sup>*</sup> IL dep <sup>*</sup> 'H to e	Yucca Mo TES: N 7 TH: 179.0 BEDROCH	ountaii 762,34 0 ft K: 1!	n Project 7.29 E 571,406.69 55.3 ft	STATE: Nevada GROUND ELEVATION: 3664.55 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES	рертн	HARDNESS	SINEERI NDICES DNICITEM	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	C AND P	CLASSIFICATION HYSICAL CONDITION
			B		0 %	IOLE	Tpern			

Figure 1.1-127. Geologic Log of Drill Hole UE-25 RF#59 (Sheet 4 of 4)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	OLE UE-25 RF#60 SHEET 1 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/23/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N 7 TH: 195.6 BEDROCK	ountain 761,66 6 ft 5: 14	ain Project STATE: Nevada 567.27 E 571,808.8 GROUND ELEVATION: 3650.09 ANGLE FROM HORIZONTAL: -90° 144.5 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
NOTES Purpose of Hole: Repository Facilities Geotechnical Investigations	DEPTH	HARDNESS			% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	C GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
Repository Facilities Geotechnical Investigations Drill Equipment: GP24 300 RS (Sonic Drill Rg) Flatbed combination water and pipe truck with boom for moving drill pipe and casing. Driller: Travis Osterberg Boart Longvaer Drill Services Drilling Method: Rotosonic Advance 8 in. casing as hole is cored. 0.0 to 173.0 ft. 6.163 in. Rotosonic Carbide button bit. Drilling the casing consists of 3% in. single wall drill pipe. Change over to 4 in. coring system. Advance 8 in. casing as hole is drilled. 173.0 to 195.6 ft (TD). 4.56 in. Rotosonic Carbide button bit. Drilling Conditions: Not Reported Drilling Fluid: Small amounts of drilling additives were added to help in advancing casing. Fluid Loss Interval: NA Casing Record: 8 in. casing from 0.0 to 173.0 ft 6 in. casing from 172.96 to 195.6 ft (TD). Hole Completion: Back fill hole from 195.6 ft (TD) up to 0.0 ft (ground surface) with Bentionite Chips. Pull casing.							(GP)sc (GP-GM)sc (GP-GM)sc (GP)sc (GP-GM)s		<ul> <li>0.0 to 10.0 ft POORLY GRADED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% coarse to fine, hard, angular to subangular gravel; about 40% coarse to fine, hard, angular to subangular sind; about 50% nonplastic fines; trace of hard, angular to subangular cobbles; maximum size 130 mm; dry, light reddish brown, pink, weak to strong reaction with HCI.</li> <li>10.0 to 10.8 ft SILTY SAND WITH GRAVEL (SM)g; About 55% coarse to fine, angular start about 30% predominantly fine, hard, angular to subangular gravel; about 15% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, pink and to 10% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, and to 10.8 to 10.8 th SILTY SAND ED GRAVEL WITH SILT SAND AND COBELES (GP-GM)sc: About 50% nonplastic fines with quick dilatancy and low toughness; maximum size 50 mm; dry, angular to subangular gravel; about 30% coarse to fine, angular to subangular gravel; about 30% coarse to fine, angular to subangular gravel; about 30% coarse to fine, angular to subangular gravel; about 30% coarse to fine, angular to subangular disk dilatancy and low toughness; trace of hard; angular to subangular disk dilatancy and low toughness; trace of hard; angular gravel; about 10% coarse to fine, angular to subangular disk dilatancy and low toughness; trace of hard; angular to subangular gravel; about 25% coarse to fine, angular so thangular gravel; about 25% coarse to fine, angular so thangular gravel; about 25% coarse to fine, angular so thangular gravel; about 25% coarse to fine, angular so subangular gravel; about 25% coarse to fine, angular so thangular to subangular gravel; about 25% coarse to fine, angular so subangular gravel; about 25% coarse to fine, angular so subangular gravel; about 25% coarse to fine, angular so subangular gravel; about 25% coarse to fine, angular so subangular gravel; about 25% coarse to fine, angular to subangular gravel; about 25% coarse to fine, angular so thangular gravel; about 25% coarse to f</li></ul>
	30 						(GP)s (SW-SM)g (GP)s (GP)sc (SW-SM)g (GP)sc		<ul> <li>predominantly fine, hard, subangular gravel; about 40% coarse to fine, angular sand; about 10% nonplastic fines; mix quick dilatancy and low toghness; maximum size 40 mm; dry, light reddish brown, moderate to strong reaction with HCI.</li> <li>26.1 to 25.0 ft POORLV GRADED GRAVEL WITH SAND (GP)s: About 50% coarse to fine, angular to subangular gravel; about 45% coarse to fine, angular sand; about 5% nonplastic fines; mix min, dry, light reddish brown, weak to moderate reaction with HCI.</li> <li>28.0 to 30.2 ft WELL GRADED SAND WITH SILT AND GRAVEL (SW-SM)g: About 55% coarse to fine, angular sand; about 35% predominantly fine, hard, angular gravel; about 40% coarse to fine, angular sand; about 35% predominantly fine, hard, angular gravel; about 10% nonplastic fines; with quick dilatancy and to bughness; maximum size 70 mm; dry, pink, weak to moderate reaction with HCI.</li> <li>30.2 to 31.5 nt POORLY GRADED GRAVEL WITH SAND (GP)s: About 55% coarse to fine, angular to subangular gravel; about 40% coarse to fine, angular sand; about 5% nonplastic fines; maximum size 70 mm; dry, light reddish brown, weak reaction with HCI.</li> <li>31.5 to 33.6 nt NELL GRADED SAND WITH SILT GRAVEL AND COBLES (SW-SM)ge: About 50% coarse to fine, angular to subangular gravel; about 10% nonplastic fines; maximus size 70 mm; dry, pink, maximus; as 20 mm; dry, pink, maximus; as 20 mm; dry, pink, maximus; as 20 mm; dry, pink, more angular to subangular gravel; about 10% nonplastic fines; thace of hard; angular to subangular gravel; about 10% nonplastic fines; thace of hard; angular to subangular gravel; about 10% nonplastic fines; thace of hard; angular to subangular gravel; about 10% nonplastic fines; trace of hard; angular to subangular gravel; a fine; draw and; about 30% cores to fine, angular to subangular gravel; about 30% nonplastic fines; trace of hard; angular gravel; a fine; gravel; about 5% nonplastic fines; trace of hard; angular gravel; about 5% nonplastic fines; trace of hard; angular gravel; ab</li></ul>

Figure 1.1-128. Geologic Log of Drill Hole UE-25 RF#60 (Sheet 1 of 4)

	G	EOL	OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#60	SHEET 2 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/23/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA <sup>T</sup> L DEP H TO F	Yucca Mo TES: N 7 TH: 195.6 BEDROCK	ountair 761,66 6 ft 7: 14	n Project 17.27 E 571,808.8 144.5 ft	STATE: Nevada GROUND ELEVATION: 3650.09 ANGLE FROM HORIZONTAL: -90° HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER	ling						
NOTES	DEPTH	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	GEOLOGIC UNIT [USCS]	GRAPHIC	C AND P	LASSIFICATION HYSICAL CONDITION
							(GP)sc (GP)sc (GP-GM)si (GP-GM)si (GP)s (GP)sc (GP)sc (SM)g (GP)sc (SW)gc (GP)sc		<ul> <li>58.0 to 60.0 ft WELL GRADEE About 55% coarse to fine, ang subrounded gravel; about 10% pink, weak to moderate readic TOTAL SAMPLE (BY VOLUM remainder minus 3 in.; maximum 60.0 to 66.0 ft POORLY GRAD coarse to fine, hard, angular to angular samit; about 5% nonpl TOTAL SAMPLE (BY VOLUM minus 3 in.; maximum size 105 mm. 67.6 to 68.5 ft POORLY GRAD Lobut 60% coarse to fine, ang to subangular gravel; about 10 dry, pink, weak reaction with H TOTAL SAMPLE (BY VOLUM minus 3 in.; maximum size 105 mm. 67.6 to 68.5 ft POORLY GRAD Coarse for fine, angular sand; a low toughness; dry, pink, no to TOTAL SAMPLE (BY VOLUM 3 in.; maximum size 105 mm. 67.6 to 68.5 ft POORLY GRAD Coarse for fine, hard, angular to sand; about 30% nonplastic fine predominantly fine, hard, angular coarse to fine, hard, angular to sand; about 5% nonplastic fine, hard, angular coarse to fine, hard, angular to sand; about 30% nonplastic fine, hard, angular coarse to fine, hard, angular to sand; about 30% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fine, angular sand; about 5% nonplastic fing redominantly fine, hard, angular sand; about 35% nonplastic fing angular sand; about 5% nonplastic fing angular sand; about 5% nonplasti</li></ul>	SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: in ronplastic fines with quick dilatancy and low toughness; dry, n with HCI. IE) About 15% hard, angular to subangular cobbles; im size 80 mm. ED GRAVEL WITH SAND AND COBBLES (GP)sc: About 55% subangular gravel; about 40% coarse to fine, astic fines; dry, pinksh gray, strong reaction with HCI. IE) RAVEL WITH SAND AND COBBLES (GP)sc: About 55% subangular gravel; about 40% coarse to fine, astic fines; dry, pinksh gray, strong reaction with HCI. IE) About 5% hard, angular to subangular cobbles; remainder nm. SAND WITH SILT GRAVEL AND COBBLES (SW-SM)gc: iplar sand; about 30% predominantly fine, hard, angular % nonplastic fines with quick dilatancy and low toughness; ICI. IE) About 5% hard, subangular cobbles; remainder minus PD GRAVEL WITH SILT SAND AND COBBLES to fine, hard, angular to subangular gravel; about 35% about 10% nonplastic fines with quick dilatancy and weak reaction with HCI. IE) About 5% hard, subangular cobbles; remainder minus TH GRAVEL (SM)g: About 55% coarse to fine, angular weak reaction with HCI. IED GRAVEL WITH SAND AND COBBLES (GP)s: About 60% ubangular gravel; about 35% coarse to fine, angular sy, trace of hard, subangular cobbles; maximum size 85 mm; HCI. IED GRAVEL WITH SAND AND COBBLES (GP)s: About 60% ubangular gravel; about 35% coarse to fine, angular sy, trace of hard, subangular cobbles; maximum size 85 mm; HCI. IED GRAVEL WITH SAND AND COBBLES (GP)se: About 60% subangular gravel; about 35% coarse to fine, angular sy, trace of hard, subangular cobbles; maximum size 85 mm; HCI. IED GRAVEL WITH SAND AND COBBLES (GP)se: About 60% subangular gravel; about 35% coarse to fine, angular to angimum size 100 mm; dry, light gray, strong ED GRAVEL WITH SAND AND COBBLES (GP)se: About 60% subangular gravel; about 35% coarse to fine, angular to splastic fines; trace of hard, angular to subangular cobbles; its my argue; maximum size 350 mm; dry, light gray
							(GP)sc	Dol a	105.9 to 108.9 ft POORLY GR 70% coarse to fine, hard, angu angular sand; about 5% nonpl 105 mm; dry, pink, strong read	ADED GKAVEL WITH SAND AND COBBLES (GP)sc: About ular to subangular gravel; about 25% coarse to fine, astic fines; trace of hard, subangular cobbles; maximum size ction with HCI.

Figure 1.1-128. Geologic Log of Drill Hole UE-25 RF#60 (Sheet 2 of 4)

	G	EOL	.OG	IC L	OG	OF I	DRILL	но	DLE UE-25 RF#60 SHEET 3 OF 4
FEATURE: Waste Handling Facility LOCATION: Midway Valley BEGUN: 5/23/2005 FINISHED: 5/31/2005 DEPTH TO WATER: Not Encountered					PROJ COOF TOTA DEPT	ECT: RDINA L DEP H TO I	Yucca Mo TES: N TH: 195. BEDROCH	ountain 761,66 6 ft K: 14	n Project STATE: Nevada 67.27 E 571,808.8 GROUND ELEVATION: 3650.09 ANGLE FROM HORIZONTAL: -90° 44.5 ft HOLE LOGGED BY: George Eatman REVIEWED BY: Robert Lung
		EN	GINEER NDICES	ring S					
NOTES	рертн	HARDNESS	WELDING	FRACTURE DENSITY	% CORE RECOVERY	% RQD	[USCS]	GRAPHIC	CLASSIFICATION AND PHYSICAL CONDITION
	110 						(GP-GM)s (GP-SM)g (GP)sc (GP)sc (GP)sc (GP)sc Sandstone Tpki	A CONTRACTOR CONTRACTOR OF CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACTOR CONTRACT	<ul> <li>No 102 to 112.5 ft WELL GRADED SAND WITH SILT GRAVEL AND COBBLES (SW-SMge: About 10% complexits fines with quick dialatory and low toughness; these of hard, angularie to subangular activity of 100 mm; dry, pinking gray, strong reaction with HCI.</li> <li>112.5 to 117.3 ft POORLY GRADED GRAVEL WITH SILT AND SAND (GP-CM)s: About 50% cores to fine, hard, angular gravel; about 40% cores to fine, angular son; about 60% cores to fine, angular son; about 60% cores to fine, angular son; about 70% nonplastic fines; dry, pinking gray, no to weak machine gravel; about 40% nonplastic fines; dry, pinking gray, no to weak machine to the final dry quarker to subangular gravel; about 40% cores to fine, angular son; about 50% cores to fine, angular son; about 50% cores to fine, angular son; about 20% hard; drilde and subangular cobbles; remained minus 31 n; maximum size 130 mm.</li> <li>113.10 to 120.6 ft WELL GRADED SAND WITH SLIT GRAVEL AND COBELES (GF)sc: About 60% cores to fine, angular son; about 40% cores to fine, angular son; about 50% cores to fine, angular son; about 40% cores to fine, angular son; about 50% cores to fine, angular son; about</li></ul>

Figure 1.1-128. Geologic Log of Drill Hole UE-25 RF#60 (Sheet 3 of 4)

GEOLOGIC LOG OF DRILL HOLE UE-25										SHEET 4 OF 4	
FEATURE: Waste Handling Facility PROJECT: Yucca Mountain								Project	STATE: Nevada		
BEGUN: 5/23/2005 FINISHED: 5/31/2005	COORDINATES: N 761,66 TOTAL DEPTH: 195.6 ft						TES: N / TH: 195/	761,66 6 ft	7.27 E 571,808.8	ANGLE FROM HORIZONTAL: -90°	
DEPTH TO WATER: Not Encountered	DEPTH TO BEDROCK: 14						BEDROCH	<: 14	4.5 ft	HOLE LOGGED BY: George Eatman	
										REVIEWED BY: Robert Lung	
	ENGINEERING										
			E E	SITY	ERY		L .				
NOTES				DEN			INU				
	Ŧ	NES	DING	TURE	RER	0	00010	HC	AND F	ITISICAL CONDITION	
	DEPT	HARD	WELD	FRAG	% CO	% RQ	GEOL	GRAF			
	170-								-		
	-						Tpki		-		
		175					• •				
								- 176.1 to 188.8 ft POST-TIVA 0	CANYON TUFF BEDDED TUFF (Tpbt5):		
	3								Bedded tuff, tephra and ignimb		
	120								fine sand size felsic crystal fra	gments and tuff fragments, 3 to 15% pumice.	
									179.7 to 184.3 ft: Tephra, non pumice, 5% crystal fragments	welded, partially clay altered, vitric, very pale brown, 20% of biotite and sanidine with rare magnetite.	
	3						Tpbt5	000	184.3 to 187.0 ft: Ignimbrite, no pumice obscured or absent, 3	onwelded, moderately indurated, clay altered, reddish-yellow, % crystal fragments of biotite, less than 1% crystal	
									<ul> <li>fragments of sanidine and other 187.0 to 188.8 ft; Sample removements</li> </ul>	er minerals, 2% lithic fragments.	
	185-							·. ·	sample interval.		
								<b>.</b>	188.8 to 195.6 ft TUFF OF PIN Ignimbrite, partially to densely	188.8 to 195.6 ft TUFF OF PINYON PASS (Tpcy): Ignimbrite, partially to densely welded, pink, gray, black, 5 to 10% pumice, less than 1%	
	190-								<ul> <li>volcanic lithic fragments, 5 to minor pyroxene.</li> </ul>	10% crystal fragments of sanidine and biotite with	
	1 -						Трсу	4			
	3										
	195-							-			
		BUTTOM OF HOLE									
	1										

Figure 1.1-128. Geologic Log of Drill Hole UE-25 RF#60 (Sheet 4 of 4)



Figure 1.1-129. Repository Facilities Borehole and Test Pit Locations

Source: Buesch and Lung 2008, Figure 1.



Figure 1.1-130. Alluvium Thickness Contour Map of Midway Valley

NOTE: Not all boreholes from the 2006-2007 drilling program are shown. Figure only shows the 2006-2007 boreholes used to construct the alluvium thickness contour map.

Source: SNL 2008a, Figure 6.2-4.



Figure 1.1-131. Comparison of Original and Updated Shear Modulus and Hysteretic Damping Curves for Tuff

NOTE: LMT = lower mean tuff; UMT = upper mean tuff.

Source: BSC 2008c, Figure 6.4.4-10.



Figure 1.1-132. Comparison of Original and Updated Shear Modulus and Hysteretic Damping Curves for Surface GROA Alluvium

NOTE: LMA = lower mean alluvium; UMA = upper mean alluvium.

Source: BSC 2008c, Figure 6.4.4-19.



Figure 1.1-133. 2004 and 2007 Smoothed Surface GROA Base Case V<sub>S</sub> Profiles for Tuff NOTE: Below 1,300 ft all three South of Exile Hill Fault Splay Base Case profiles are shown in blue. Source: BSC 2008c, Figure 6.4.2-94.



Figure 1.1-134. Spectral Analysis of Surface Waves Surveys in the Vicinity of the Repository Block NOTE: Nevada State Plane coordinates.

Source: BSC 2008c, Figure 6.4.2-6.



Figure 1.1-135. Comparison of 2004 and 2007 Smoothed Repository Block Base Case  $V_S$  Profiles Source: BSC 2008c, Figure 6.4.2-93.



Figure 1.1-136. Individual Profiles and Statistical Analysis of 24 Spectral Analysis of Surface Wave Tests Performed Around the Mountain Area

Source: SNL 2008a, Figure 6.3-2.


Figure 1.1-137. Individual Profiles and Statistical Analysis of 18 Spectral Analysis of Surface Wave Tests Performed Around the Mountain Area

Source: SNL 2008a, Figure 6.3-3.



Figure 1.1-138. Distribution of  $V_S$  Velocities from Spectral Analysis of Surface Wave Testing by Geologic Unit

Source: SNL 2008a, Figure 6.3-9.



Figure 1.1-139. Distribution of Spectral Analysis Of Surface Wave Velocities by Underground Geologic Units

Source: SNL 2008a, Figure 6.4-14.



Figure 1.1-140. Comparison of V<sub>S</sub> Ranges between Surface and Tunnel Spectral Analysis of Surface Wave Test Sites Based on Geologic Units

Source: SNL 2008a, Figure 6.4-18.



Source: BSC 2002b, Figure 43; Charles B. Reynolds & Associates 1985, Enclosure 1.





Map Compiled by BSC/TPI on May 4, 2004 Map Projection: Nevada State Plane, Central Datum: NAD27

Figure 1.1-141. Location of Pre-2004 Geophysical Surveys Relative to the Surface Geologic Repository Operations Area





NOTE: Nevada State Plane Coordinates

Source: SNL 2008a, Figure 6.2-7.



Figure 1.1-143. Individual Profiles and Statistical Analyses of 18 Spectral Analysis of Surface Waves Tests Performed in the Vicinity of the Surface GROA

Source: SNL 2008a, Figure 6.2-15.



Figure 1.1-144. Individual Profiles and Statistical Analyses of Spectral Analysis of Surface Waves Tests Performed at Surface GROA Without Site NPF 28 and Without Bottom Portions of V<sub>S</sub> profiles for Sites NPF 2 and 14 and NPF 3 and 9 below 900 ft

Source: SNL 2008a, Figure 6.2-17.





- Test Alcove
- Borehole
- Test Pits
- Trenches

Map Compiled by BSC/TPI on April 27, 2004 Map Projection: Nevada State Plane, Central Datum: NAD27





- Figure 1.1-146. Variation of Shear Wave Velocity with Total Unit Weight of the Thirty-Three Tuff Specimens from Stratigraphic Units below Tiva Canyon Tuff; V<sub>S</sub> Measured at the Unconfined State in the Resonant Column Test
- NOTE: Group 1: Very low density specimens from Yucca Mountain Tuff (Tpy and Tpbt3) and Pah Canyon Tuff (Tpp and Tpbt2). Group 2: Low density specimens from Calico Hills Formation (Tac), Prow Pass Tuff (Tcp), Bullfrog Tuff (Tcb), and Tram Tuff (Tct). Group 3: Medium density specimens from Topopah Spring Tuff crystal-rich, lithophysal (Tptrl); Topopah Spring Tuff crystal-poor, upper lithophysal (Tptpul); and Topopah Spring Tuff crystal-rich, nonlithophysal (Tptrn); Topopah Spring Tuff crystal-poor, middle nonlithophysal (Tptpmn); Topopah Spring Tuff crystal-poor, middle nonlithophysal (Tptpv); Prow Pass Tuff (Tcp); and Bullfrog Tuff (Tcb). Specimens marked with asterisks were cored from larger specimens and had fewer surface lithophysae.

Source: SNL 2008a, Figure 6.5-6.



- Figure 1.1-147. Summary Profile of Shear Wave Velocity versus Depth from Free-Free Resonant Column Tests
- NOTE: SASW = spectral analysis of surface waves.
- Source: SNL 2008a, Figure 6.5-60.



Figure 1.1-148. Summary Profile of Unconstrained Compression Wave Velocity versus Depth from Free-Free Resonant Column Tests

Source: SNL 2008a, Figures 6.5-65.



Figure 1.1-149. Summary Profile of Constrained Compression Wave Velocity versus Depth from Free-Free Resonant Column Tests

Source: SNL 2008a, Figure 6.5-69.



Figure 1.1-150. Summary Profile of Material Damping Ratio in Shear versus Depth from Free-Free Resonant Column Tests

Source: SNL 2008a, Figure 6.5-73.



Figure 1.1-151. Summary Profile of Material Damping Ratio in Unconstrained Compression versus Depth from Free-Free Resonant Column Tests

Source: SNL 2008a, Figure 6.5-74.



Figure 1.1-152. Miocene and Post-Miocene Basaltic Vent Locations in the Yucca Mountain Region



Figure 1.1-153. Locations of Boreholes Used for Characterizing Subsurface Mineralogy

Source: BSC 2004j, Figure 4-1.



Figure 1.1-154. Yucca Mountain Repository Proposed Land Withdrawal Area

NOTE: E-MAD = Engine Maintenance, Assembly, and Disassembly; R-MAD = Reactor Maintenance, Assembly, and Disassembly; RMSF = Radioactive Material Storage Facility.



Figure 1.1-155. Yucca Mountain Structures and Facilities