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RESULTS FROM EXPLORATORY DRILL HOLE UE2ce,
NORTHWEST YUCCA FLAT, NEVADA TEST SITE,
NEAR THE NASH EVENT

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Lawrence
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Results from Exploratory Drill Hole UE2ce
Northwest Yucca Flat, Nevada Test Site,
near the NASH Event

ABSTRACT

Exploratory drill hole UE2ce was drilled in January 1977 to determine geologic and geophysical characteristics of this site. This report presents geophysical logs, lithology, geologic structure, water table measurements, and physical properties for this drill hole. The data are then extrapolated to the NASH site, an event in U2ce, 55.6 m due north of UE2ce.

INTRODUCTION

On January 19, 1967 the NASH event, with a yield in the 20 to 200-kt range, was detonated in emplacement drill hole U2ce at the Nevada Test Site. Seismic signals from this event received at teleseismic stations (>2000 km) were considered anomalous when compared with other events. The Nuclear Monitoring Office (NMO) of the Advanced Research Projects Agency (ARPA) sponsored a program to determine the geologic and geophysical characteristics of selected locations that have demonstrated anomalous seismic signals. Exploratory hole UE2ce was drilled 55.6 m due south of U2ce as part of this program. Since the NASH event was conducted prior to the increased emphasis on obtaining geologic data, the purpose of this exploratory hole was to obtain physical property data that could be used to re-evaluate the NASH event.

This report describes the geologic and geophysical data obtained from drill hole UE2ce. These data will be extrapolated to describe the NASH site.

LOCATION

Drill hole UE2ce is located near the west central section of Area 2 in Yucca Flat, Nevada Test Site (Fig. 1). The Nevada state coordinates

Fig. 1. Location of UE2ce and surrounding drill holes in Area 2, Nevada Test Site.

are N265512.0 m E199614.0 m. Ground elevation is 1452.2 m above mean sea level. UE2ce is 55.6 m due south of U2ce. The holes are at the same elevation.

DRILLING HISTORY SUMMARY

UE2ce was spudded January 10, 1977, and completed January 25, 1977 at a depth of 502.9 m. The hole was drilled with a 0.66-m bit from 0-25 m, and a 0.31-m bit from 25 to 502.9 m (TD). Casing of 0.22 m was set from 0-495 m. No problems were encountered drilling this hole. Appendix A contains the detailed drilling history.

SAMPLES

Standard cutting samples were taken from 27.4 to 502.9 m (TD) at 3-m intervals. Hunt sidewall samples were taken at selected intervals from 15.7 to 335.3 m (below the surface conductor to the tuff-Paleozoic interface). The Paleozoic rocks were not sampled. The sidewall samples were tested for water content (by LLNL-N), grain density (by LLNL-N), and CO₂ content (by REECO-N). These measured parameters were used with bulk density values from the dual proximity density log to calculate porosity, saturation, and gas porosity at each sample horizon. Table 1 lists these data for sidewall samples.

In 1965, approximately 2 m (358-360 m) of conventional "bottom hole" Paleozoic core had been taken during drilling of the emplacement hole U2ce. Grain densities and CO₂ contents were recently measured on splits of this core at 358.4, 359.5, and 360.3 m. These are the last three samples listed in Table 1. But it was still necessary to obtain water content data in order to calculate the computed parameters at the Paleozoic core sample horizons. There was no possibility of obtaining the water data from the U2ce core because it hadn't been wrapped at the drill site. Luckily, there are some recent water content measurements on Paleozoic dolomite core from UE2co, about 2940 m southeast of U2ce, because the core from UE2co was immediately wrapped in rubber sleeves, water content measurements are representative of the in situ medium. The

Table 1. Sample data for UE2ce and UE2co.

SAMPLE DEPTH (M)	WATER CONTENT (WT %)	MEASURED			COMPUTED		
		BULK DENSITY (MG/M3)	GRAIN DENSITY (MG/M3)	CO2 CONTENT (WT %)	POROSITY (VOL %)	SATURATION (VOL %)	GAS POROSITY (VOL %)
45.7	7.6	1.17	2.69	0.10	25.8	65.6	8.9
61.0	7.6	1.36	2.71	0.10	19.9	56.1	0.7
75.4	7.9	1.08	2.71	0.10	25.9	53.6	12.4
91.4	7.9	1.09	2.70	0.70	27.2	45.6	14.8
106.7	7.7	1.27	2.69	0.65	21.9	77.1	3.0
116.9	7.7	1.29	2.69	0.70	38.1	32.8	25.6
121.9	8.0	1.58	2.66	0.50	45.7	29.3	32.3
125.9	8.0	1.44	2.68	0.55	49.4	18.3	41.0
131.1	23.0	1.35	2.42	*	57.2	55.0	25.8
137.2	15.9	1.62	2.41	*	44.3	37.4	18.8
146.5	15.3	1.74	2.41	*	40.1	37.4	11.1
158.5	15.3	1.74	2.42	*	38.4	70.1	11.5
170.7	14.0	1.41	2.31	*	52.3	40.1	31.3
178.8	18.0	1.43	2.40	*	51.0	50.8	25.1
185.9	17.7	1.39	2.39	*	*	*	*
195.1	22.9	1.47	2.46	*	51.1	62.2	20.5
201.2	18.6	1.64	2.40	*	44.4	69.6	13.9
207.3	19.9	1.85	2.58	*	41.7	69.7	4.9
213.4	11.1	1.73	2.50	*	38.9	43.3	19.5
220.6	11.1	1.67	2.51	*	42.5	44.3	23.7
226.6	14.4	1.52	2.45	*	44.5	51.8	21.5
232.7	17.9	1.63	2.46	*	45.3	65.5	17.3
238.8	16.6	1.55	2.44	*	46.9	64.4	22.1
243.9	16.6	1.55	2.44	*	43.3	65.5	16.7
255.9	11.1	1.68	2.46	*	41.9	74.9	13.8
265.2	13.2	1.75	2.45	*	37.2	68.6	3.1
271.3	13.2	1.75	2.45	*	39.7	68.6	3.1
274.4	16.6	1.64	2.54	*	38.8	68.6	3.1
289.6	23.0	1.89	2.46	*	41.3	68.6	3.1
301.8	13.2	1.86	2.44	*	39.9	68.6	3.1
310.9	23.0	1.86	2.44	*	37.1	68.6	3.1
317.0	13.2	1.74	2.44	*	39.9	68.6	3.1
323.1	13.2	1.74	2.44	*	39.9	68.6	3.1
329.2	11.0	1.77	2.49	*	37.7	68.6	3.1
333.8	11.0	1.97	2.81	20.60	37.6	68.6	3.1
335.3	12.0	2.03	2.73	24.10	34.6	70.1	10.3
*358.4	0.7	3.34	2.85	45.50	18.6	68.6	16.8
*359.5	0.7	2.85	2.85	45.50	20.4	68.6	16.8
*360.3	0.7	2.88	2.86	46.15	20.6	68.6	16.8

DEPTH LIMITS FOR INDIVIDUAL SAMPLES ARE 45.7M 360.2M
 BULK DENSITY IS WATER CORRECTED
 BULK-DENSITY VALUES LESS THAN 1.0 OR GREATER THAN 3.0 ARE DELETED

*Samples are from UE2ce and UE2co Paleozoic cores above the water table. Grain density and CO₂ content were measured on UE2ce samples; water content is from UE2co samples, located 2940 m SE of UE2ce; bulk density is from the dual proximity density log run in UE2ce.

similarity in the two cores allows the justification for using data from core taken from UE2co to be matched with data from core of U2ce to calculate porosity, saturation, and gas porosity. Both cores are from Paleozoic dolomite (dolostone) taken above the water table; grain densities from the core in UE2co are 2.86, 2.84, and 2.84 Mg/m³, and grain densities from the core in U2ce are 2.85, 2.84, 2.86 Mg/m³. Thus, the last three sample horizons in Table 1 have water data from UE2co core, grain density and CO₂ contents from U2ce core, and bulk density from the dual proximity density log run in UE2ce; porosity, saturation, and gas porosity are computed at the horizons from all these data.

Samples were examined for clay content by x-ray diffraction where conductivity values from the electric log were greater than 0.05 Siemens/m. This amounted to 12 samples from the Tunnel Beds tuff and the colluvium. Semiquantitative mineralogic results are shown in Table 2. Only the sample at 274.3 m indicated greater than 20% montmorillonite. All others contained less than 20% montmorillonite.

One sample from U2ce core at 359.5 m was also analyzed. It was composed of nearly pure dolomite, with 1/2% calcite.

GEOPHYSICAL LOGGING

Geophysical logs were run in UE2ce January 20-23, 1977. Table 3A lists the logs that were run. Figure 2 shows a standard plot of log and sample data used for containment evaluation. The gamma log is shown in Fig. 3.

Table 3B lists the geophysical logs from U2ce, taken in 1965.

Caliper Log

The drill hole reached maximum enlargement (0.635 m) at 337.8 m upon penetration of Paleozoic dolostone, and showed enlargement in the upper Paleozoic. This enlargement is probably due to a fractured and weathered upper Paleozoic surface.

Table 2. X-ray diffraction analyses: UE2ce.^a

Depth Ft. M	Sample Type	Montmoril- lonite	Illite- muscovite	Clinoptil- olite	Quartz	Cristo- balite	K & Na feldspar	Calcite	Doromite	Glass	Amphibole
850 259.1	Sidewall	>10 < 15	b		W	VW	M			W	
870 265.2	Sidewall	<10		10	MW	VW	MH			VW	
890 271.3	Sidewall				MW	VW	MH			W	
900 274.3	Sidewall	>25 < 35			MW	VW	W			VW	X
950 289.6	Sidewall	<10			M	VW	MH			VW	
990 301.8	Sidewall	<10			MW	VW	W			MW	
1020 310.9	Sidewall	<10			W	VW	MW			MW	
1040 317.0	Sidewall			<10	MW		W			MW	X
1060 323.1	Sidewall			<10	W	W	MW			MW	
1080 329.2	Sidewall	10	VW	>10 < 25	W		MW			W	
1095 333.8	Sidewall				W			H			
1100 335.3	Sidewall				MW			H	NH		
*1179.5 359.5	Core							1/2	H		

^a - The author performed the analyses^b - Blanks indicate mineral was not observed in analysis

H - High

M - Moderate(ly)

W - Weak

V - Very

X - Indicates presence, not amount

* - UE2ce

Fig. 2. Plot of sample and geophysical data from UE2ce.

Table 3A. Geophysical logs for UE2ce.

[illegible]

Table 3B. Geophysical logs for U2ce.

C	H	CALIFEP	1	65	-11	10	BIRDWELL	1215	1209	0	1207	0
C	H	CALIFEP	2	65	-11	13	BIRDWELL	1215	1215	20	1204	0
C	H	DIR GYRO	1	65	-11	10	SPERRY SUN	-0	-0	0	1205	0
C	H	NCITL	5	65	-11	17	BIRDWELL	1205	-0	30	200	0
C	H	NCITL	1	65	-11	15	BIRDWELL	1215	1199	800	1197	0
C	H	NCITL	2	65	-11	15	BIRDWELL	1215	1199	700	825	0
C	H	NCITL	3	65	-11	15	BIRDWELL	1215	-0	490	650	0
C	H	NCITL	4	65	-11	13	BIRDWELL	1215	1189	230	550	0
C	H	NCITL	5	65	-11	17	BIRDWELL	1215	1199	30	400	0
C	H	NCITL	6	65	-11	17	BIRDWELL	1215	1199	16	400	0
C	H	NCITL	7	65	-11	17	BIRDWELL	1215	1199	30	400	0
C	H	NCITL	8	65	-11	17	BIRDWELL	1215	1199	30	200	0
C	H	SAMPLE COR	1	65	-11	06	LLL-N	-0	-0	1176	1182	0
C	H	WL	1	65	-11	15	BIRDWELL	1205	-0	100	970	0
C	H	WL	2	65	-11	15	BIRDWELL	1205	-0	10	580	0
C	H	WL	1A	65	-11	15	BIRDWELL	1205	-0	100	810	0
C	H	WL	2A	65	-11	15	BIRDWELL	1205	-0	705	705	0
C	H	WL	3	65	-10	05	BIRDWELL	1215	1196	1100	1136	0
C	H	WL	3	65	-11	16	BIRDWELL	1215	1183	0	293	0
C	H	WL	4	65	-11	16	BIRDWELL	1215	-0	500	572	0

Fig. 3. Gamma log for UE2ce.

Sonic Velocity Logs

Two types of sonic logs were run. The DHAL was run above the water table (0-411 m), and the 3-D log below it (426-499 m). There is a 15-m separation over which no velocity data were recorded. Sound speed in the tuffs averages 2000 m/s, and 6000 m/s in the Paleozoic section.

Acoustic Impedance

Acoustic impedance was calculated from the product of the velocity logs and the dual proximity density log.

Density Log

A dual proximity density log was run. Computer corrections for proximity were made, and the log plotted. No data were obtained from 179 to 194 m due to proximity problems.

Conductivity

The electric induction log has been plotted as conductivity in Fig. 2. Twelve samples from the Tunnel Beds tuff and colluvium were examined for clay content where the conductivity is greater than 0.05 Siemens/m (resistivity of less than 20 Ω -m). Only the sample at 274.3 m indicated greater than 20% montmorillonite; all others contained less than 20% montmorillonite.

Sample Data

At 333.8 and 335.3 m on the CO₂ log, two points represent CO₂ contents of 20.8 and 24.1 wt%, respectively. X-ray analyses indicate calcite stringers in the colluvium, and dolomite in the sample at 335.3 m.

CO₂ contents were measured on three samples from the Paleozoic dolostone core from U2ce. The depths and contents are 358.4 m, 45.50% CO₂; 359.5 m, 45.65%; and 360.3 m, 46.15%. Pure dolomite contains 48% CO₂.

LITHOLOGY AND GEOLOGIC STRUCTURE

Lithology

The lithologic log for UE2ce is shown in Table 4. This log is based on cuttings, sidewall samples, and geophysical logs from the drill hole.

U2ce was drilled before the current emphasis on obtaining geologic data from drill holes. The only data that exist for this hole are a caliper log, cuttings, and 1.8 m of Paleozoic core. An attempt was recently made to form a lithologic log from these data. Unfortunately, the cuttings do not appear to be representative samples of the geologic units penetrated at drilling time. It does appear though, that the alluvium-tuff contact may be around 122 m and the tuff-Paleozoic contact may be around 345 m. The alluvium-tuff contact in UE2ce is at 126 m, and the tuff-Paleozoic contact is at 337 m, indicating relatively flat geologic units between the holes.

Geologic Structure

The east-west cross section shown in Fig. 4 includes U2ch, UE2ce, U2cc, and U2ck. There are bends in the section at each of these drill holes. Geologic units are all rather flat lying. A fault in the Paleozoic rocks east of U2cc is inferred from gravity data. The upward extent of this fault is not known. It may continue into the tuffs, and be responsible for the thicker tuffs to the east of it.

Dip of the geologic units was calculated by assuming that the contact surfaces could be approximated by planes, and then finding the least squares fit of a plane to the known lithologic contacts in the four drill holes. (The dip of the Grouse Canyon was determined using data from three holes, since U2cc did not penetrate the Grouse Canyon.) The above assumption is reasonable because these holes are located within a small area that has no known structural disruptions within the beds in question--alluvium, Paintbrush, and Grouse Canyon. Dips for this area are as follows: alluvium-- 6° , Paintbrush tuff-- 8° , and Grouse Canyon ash-fall-- 11° , all to the east.

Table 4. Lithologic log for UE2ce.

Depth (m)	Description
0 -126	Alluvium, silt (10%), tuffaceous sand (55-65%), tuffaceous and clastic gravel (20%) and pebbles (5-15%). Silt is red-brown. Gravel and pebbles are angular and approximately 10% welded tuff and 90% Paleozoic siltstone and quartzite. Caliche rinds are on clasts below 91 m and are especially abundant between 91 m and 107 m.
126-152	Tuff, Paintbrush, ash-fall, white to gray to buff; mostly coarse-grained pumice fragments with approximately 10% bronze biotite, 5% lithic fragments, and traces of amphibole and light glass blebs.
152-172	Tuff, Paintbrush, ash-fall, gray to buff; mostly coarse-grained pumice fragments with approximately 10% bronze biotite, less than 5% lithic fragments, and traces of glass blebs and amphiboles. This is the upper buff zone.
172-204	Tuff, Grouse Canyon, ash-fall, pearl gray to medium gray; mostly coarse-grained pumice fragments with less than 5% subangular tuffaceous lithic fragments; dark glass fragments in the upper portion and less than 5% dark glass blebs in the lower portion.
204-213	Tuff, Tunnel Beds, ash-fall, pearl gray; mostly coarse-grained pumice with approximately 5% amphiboles, 5% biotite, and a trace of subround tuffaceous lithic fragments.
213-232	Tuff, Tunnel Beds, slightly reworked ash-fall, light buff matrix with pearl gray pumice fragments; pumice fragments coarse-grained; matrix is fine-grained and vitric; approximately 5% biotite, 5% amphibole, and a trace of tuffaceous lithic fragments. This is the lower buff zone.

Table 4. Cont'd.

Depth (m)	Description
232-263	Tuff, Tunnel Beds, ash-fall tuff, light buff; subrounded, vitric and welded tuffaceous pebbles in a vitric and fine-grained matrix; tuffaceous sand and gravel; slightly argillized.
263-283	Tuff, Tunnel Beds, air-fall and slightly reworked, light gray to yellow-green; coarse-grained pumice in a crystalline matrix; approximately 5% tuffaceous lithic fragments and a trace of amphiboles; silicified nodules in upper portion.
283-313	Tuff, Tunnel Beds, ash-fall, light yellow-buff; white coarse-grained pumice fragments, slightly argillized yellow pumice fragments, a trace of dark glass blebs and a trace of tuffaceous lithic fragments.
313-227	Tuff, Tunnel Beds, ash-fall, light gray and buff; white, coarse-grained pumice fragments in a vitric fine-grained matrix; approximately 5-7% tuffaceous lithic fragments, 5% light to dark glass blebs, and approximately 5% biotite; some silicification.
327-330	Tuff, slightly welded and bedded ash-flow, white and buff; white coarse-grained pumice fragments; a trace of biotite, glass shards, and lithic fragments.
330-337	Colluvium, buff; highly argillized tuff and light gray, white, and orange-red limestone fragments.
337-412	Paleozoic dolostone, gray to black; some secondary calcite. Abundant brown soil, apparent fracture fill.
412-460	Paleozoic dolostone, white to buff.
460-503	Paleozoic dolostone, black to dark gray.

U2ce is not included in this cross section because it would be projected south to the actual location of UE2ce. Lithologic contacts indicate that U2ce and UE2ce would look almost identical in cross section, with an uncertainty of 8 m in geologic contacts.

WATER TABLE DEPTH

An objective in drilling UE2ce was to determine the water table depth (static water level) within the drill hole. The water table was measured at 434 m below ground surface in February 1982; this measurement makes it 97 m below the tuff-Paleozoic contact.

If one assumes that the static water level is continuous to the north, then the working point at U2ce was 70.2 m above the water table.

PHYSICAL PROPERTY DETERMINATIONS

Medium characteristics were calculated using geologic and geophysical data from UE2ce, grain densities and CO₂ contents from U2ce core, and water contents from UE2co core, centered at a depth of 363.8 m (Table 5). The working point depth in U2ce was 363.8 m. The medium characteristics calculated from all these data, centered at 363.8 m in UE2ce can be extrapolated to U2ce at the same stratigraphic horizon with an uncertainty of 1 m. Even with this uncertainty, the entire averaging interval is in Paleozoic dolostone.

HOLE STATUS

Exploratory hole UE2ce has been used for water level drawdown and radio nuclide measurements. It is currently instrumented.

SUMMARY

Exploratory drill hole UE2ce was spudded January 10, 1977 and completed January 25, 1977 at a total depth of 502.9 m. Sampling consisted of cuttings and Hunt sidewall samples. Geophysical logs

Table 5. Physical properties: UE2ce.

U2ce WP 363.8 m = 363.8 m in UE2ce

Averaging Radius 13.8 m

Averaging Interval 349.9-377.5 m

Working Point Parameters (363.8 m)

PARAMETER	MEAN VALUE	UNITS	NO. POINTS	STD DEV	ESTIMATED ERROR	DATA-RANGE	DEPTH-RANGE	AVERAGING METHOD	LOG-TYPE	RUN NO.
BULK DENSITY	2.46	MG/MG	86	0.20	0.12	1.88 TO 2.90	253.1 TO 377.5	INT	DENSITY DP	1
GRAIN DENSITY	2.85	MG/MG	93	0.01	0.01	2.84 TO 2.86	358.4 TO 360.3	NUM	SAMPLE	1.1
WATER CONTENT	1.0	VOL%	93	0.7	0.2	0.6 TO 1.6	358.4 TO 360.3	NUM	SAMPLE	1.1
POROSITY	14.4	VOL%	93	x	4.3	x TO x	348.9 TO 377.5	CALC	CALCULATED	
SATURATION	77.03	VOL%	93	x	8.6	x TO x	348.9 TO 377.5	CALC	CALCULATED	
GAS POROSITY	12.00	VOL%	93	x	4.4	x TO x	348.9 TO 377.5	CALC	CALCULATED	
CO2 CONTENT	45.9	WT%	93	0.3	0.2	45.5 TO 46.1	358.4 TO 360.3	NUM	SAMPLE	1.1
COMPOSITE VELOCITY	3564.	N/S	923	178.	178.	2451. TO 5137.	351.1 TO 374.9	INT	COMPOSITE	1.2.1
SEISMIC VELOCITY	x	N/S	0	x	0.	x TO x	0. TO 0.	INT		

Overburden Parameters (WP to surface averages)

BULK DENSITY	= 1.91	MG/M3	x = 0.10
COMPOSITE VELOCITY	= 1622	M/S	x = x.
SEISMIC VELOCITY	= x	M/S	x = 0.
GAS POROSITY	= x	VOL%	

BULK DENSITY IS WATER-CORRECTED

COMPUTED PARAMETERS ARE CALCULATED FROM AVERAGE MEASURED PARAMETERS

DATA TYPE	STARTING DEPTH	ENDING DEPTH
WATER CONT	45.7	360.3
DENSITY	29.9	496.4
DENSITY GR	45.7	360.3
CO2 CONTENT	45.7	360.3
VELOCITY	29.9	496.1

included caliper, sound speed (DHAL and 3D), density, electric induction (conductivity), and gamma. The alluvium-tuff contact is at 413 m, and the tuff-Paleozoic contact is at 337 m. The water table level is at 434 m below land surface. It is currently an instrumented drill hole.

Extrapolation of data gathered from UE2ce to the NASH site (U2ce), 55.6 m due north of UE2ce, shows that the NASH working point (363.8 m) was 64.2 m above the water table and 26.8 m below the Paleozoic surface. Physical property determinations from geologic and geophysical data gathered at UE2ce and supplemented with data from U2ce and UE2co are representative of those at U2ce, the NASH site.

ACKNOWLEDGMENTS

Drilling, sampling, and logging of UE2ce was directed by Lawrence Ramspott, and monitored by the Geology/Geophysics Division LLNL-Nevada. Geophysical logs were processed by the EG&G support group to the LLNL Geology and Geophysics Data Management Group. The lithologic log and cross section were constructed by Gloria De Paolis, formerly with Fenix and Scisson, Nevada. Nancy Howard critically reviewed this report.

Appendix A. Hole History Data for UE2ce.

Spud date: 1-10-77

Ground elevation: 1452.2 m

Complete date: 1-25-77

Total depth: 502.9 m

Circulating media: air-foam

Drilling Log

- 1-10-77 Moved in Auger rig #85134 and drilled 0.66 m hole from 0 to 19.2 m.
- 1-11-77 Drilled 0.66-m hole from 19.2 to 24.8 m. Ran 0.34-m O.D., 54.50# casing in the hole and set at 24.5 m. Moved out rig. Cemented annulus.
- 1-14-77 Hole suspended from 1-12-77 to 1-14-77. Moved in Ideco #37, rig #85116 and started rigging up.
- 1-15-77 Continued rigging up.
- 1-16-77 Completed rigging up. Drilled 0.31-m hole from 24.8 to 83.8 m using conventional circulation with air foam.
- 1-17-77 Drilled 0.31-m hole from 83.8 to 304.8 m.
- 1-18-77 Drilled 0.31-m hole from 304.8 to 385.6 m. Made trip for bit at 331.0 m.
- 1-19-77 Drilled 0.31-m hole from 385.6 to 461.2 m. Made trip for bit at 393.2 m.
- 1-20-77 Drilled 0.31-m hole from 461.2 to 502.9 m. Blew hole with air. Ran USGS fluid probe, fluid level at 436.5 m. Ran Birdwell caliper log to 502.3 m. Ran fluid density log, fluid level at 428.8 m. Ran density log to 501.4 m. Ran fluid density log, fluid level at 426.1 m. Ran induction log to 499.3 m.
- 1-21-77 Ran Birdwell 3-D and gamma logs to 499.9 m. Ran fluid density log, fluid level at 426.4 m. Ran dry hole acoustic log to 411.5 m.
- 1-22-77 Ran Hunt sidewall sample tool in the hole and took samples from 335.3 to 45.7 m. Ran Birdwell depth check to 502.0 m. Prepared to run casing.

- 1-23-77 Ran 0.22-m O.D. casing in the hole to 495.0 m. Bottom 6 joints were slotted with 0.01 x 0.15-m slots, 4 slots per 0.3 m. Dowell cement basket was set on joint #6 between stops from 420.0 to 421.8 m. Ran 0.04-m O.D. tubing in the annulus to 418.5 m. Laid down tubing. Ran Birdwell radioactive tracer log to 495.0 m.
- 1-24-77 Birdwell ran radioactive tracer log while pumping water in hole. Running 20-hp BJ pump on 0.06-m CS Hydril tubing with 0.06-m monitor line-welded to pump line.
- 1-25-77 Landed bottom of pump at 485.8 m. Rigged down and moved off. Hole completed 1-25-77.
- 5-18-77 Started up pump and pumped approximately 40 882.4 liters of water out of the hole.
- 5-19-77 Changed out flowmeters and ran hydrologic test; pumped 20 441.2 liters of water.
- 5-20-77 Ran hydrologic test; pumped 47 707.5 liters of water. Fluid level at start was 426.1 m and at end was 432.5 m.

Additional Work at UE2ce.

5-25-77 Started running 24-hr hydrologic test at 1350 hours.
Pumped 60 036.6 liters of water at 2400 hours.

5-26-77 Completed 24-hr water test at 1350 hours. Pumped a total of
52 2992.5 liters of water.

7-26-77 Rigged up water testing equipment and pumped hole as directed.

7-27-77 Continued pumping hole as directed.

7-28 to
7-29-77 Continued running water test as directed by USGS.

7-30 to
8-10-77 Continued pumping water as directed.

8-11 to
8-15-77 Continued monitoring water as directed.

8-25-80 Moved in Ideco #37, rig #85116, and started rigging up.

8-26-80 Rigged up. Pulled 0.06-m Hydril pump and monitor lines. Laid down
40 joints of pump line and 41 joints of monitor line.

8-27-80 Laid down 9 joints of pump, 8 joints of monitor lines and BJ pump.
Started in the hole with new BJ pump.

8-28-80 Run in BJ pump on 0.06-m Hydril tubing to 486.3 m and 0.06-m Hydril
tubing to 475.4 m for monitor line.

8-29-80 Hooked up and tested BJ pump. Rigged down and moved out.