DRILLING HISTORY

CORE HOLE DC-8

HANFORD, WASHINGTON

OCTOBER, 1978

MASTER

Prepared for Rockwell Hanford Operations
A Prime Contractor to the U.S. Department of Energy
Under Contract Number EY-77-C-06-1030

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Contract Number EY-76-C-06-2175

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INTRODUCTION

Core hole DC-8 was completed in August, 1978 by Boyles Brothers Drilling Company, Spokane, Washington, under subcontract to Fenix & Scisson, Inc. The hole was cored for the U.S. Department of Energy and the Rockwell Hanford Operations' Basalt Waste Isolation Program. Fenix & Scisson, Inc. furnished the engineering, daily supervision of the core drilling activities, and geologic core logging for hole DC-8.

Core hole DC-8 is located on the Hanford Site near the Wye Barricade and 50 feet northwest of rotary hole DC-7. The Hanford Site coordinates for DC-8 are North 14,955.94 feet and West 14,861.92 feet. Coordinates for DC-8 are North 14,955.94 feet and West 14,861.92 mean sea level. Core hole DC-8 location is depicted in Figure 1.

The purpose of core hole DC-8 was to core drill vertically through the basalt and interbed units for stratigraphic depth determination and core collection, and to provide a borehole for hydrologic testing and cross-hole seismic shear and pressure wave velocity studies with rotary hole DC-7. The total depth of core hole DC-8 was 4,100.5 feet. Core recovery exceeded 97 percent of the total footage cored.

CORING SUMMARY

Boyles Brothers Drilling Company utilized a Chicago Pneumatic Type 50 coring rig to drill core hole DC-8. Mobilization of the rig began March 1, 1978. Demobilization of the rig was completed on August 6, 1978. The coring progress curve of hole DC-8 is shown in Figure 2.

The Chicago Pneumatic core drilling rig was assembled over 6-5/8-inch outside diameter casing set at 687 feet from ground level (the 6-5/8-inch casing had been previously set by a cable tool drilling rig). Casing (4-1/2-inch outside diameter) was run with a diamond casing shoe and drilled to 689 feet. Coring operations commenced March 9, 1978 using NC oversize (3.937-inch outside diameter and 2.400-inch inside diameter) diamond core bits. Recovered core indicated that bedrock had not been penetrated by the cable tool drilling rig. The 4-1/2-inch casing was pulled from the hole and a 5-5/8-inch diameter rock bit was used to drill from 702 feet to 718 feet. The open hole section (from 687 to 718 feet) was cemented, the cement was core drilled, and the 4-1/2-inch casing was rerun. Coring operations resumed at 718 feet (all depths recorded in this report are those from ground level).

The NC oversize hole was cored to a depth of 1,612 feet. The average footage per core bit was 128 feet. Table I is the bit record for core hole DC-8 (all tables in this report follow the text).

The 4-1/2-inch casing was pulled from the hole and reaming of the hole began March 31, 1978. The hole was reamed to a 4.95-inch diameter to enable 4-1/2-inch casing to be placed and cemented at 1,612 feet. Twelve diamond reamers (single shouldered crown) 4.95 inches in diameter were used to ream the hole from 710 to 1,612 feet.

Intermediate casing (4-1/2-inch outside diameter and 4-inch inside diameter) was run and cemented at 1,612 feet with 110 cubic feet of Type II neat cement. After the cement was displaced with 92 cubic feet of water, the circulating pressure was increased to 900 pounds per square inch (this pressure is the maximum possible pressure for the pumps utilized). Five hundred sixty-four feet of cement remained inside the casing and was drilled out with rock bits. The cementing details are presented in Table II.

From the intermediate casing set at 1,612 feet, NC oversize hole was cored to a depth of 2,734 feet. Partial circulation returns (50 percent) were observed while drilling from 1,730 feet to 1,765 feet and total lost circulation was observed at 1,830 feet. While coring from 1,930 feet to 1,973 feet, total lost circulation was observed. However, fluid returns of the hydroxyethylcellulose drilling mud were observed from a 2-inch pipe outlet connected to the 9-5/8-inch casing flange (located between the 9-5/8-inch casing and the 13-3/8-inch casing) of borehole DC-7. Hole DC-7 was previously completed and is located approximately 50 feet from DC-8 at ground level.

From examination of gyroscopic deviation surveys performed in October, 1978 in both DC-7 and DC-8 and based upon the surface coordinates of the two holes, the horizontal separation of the holes between 1,600 feet and 2,000 feet of depth is approximately 24 feet. Several brecciated flows exist within this depth interval. Apparently the crosshole communication route was within one of these brecciated flows, most likely the flow at 1,830 feet where complete lost circulation began. With the addition of particulate lost circulation material to the drilling mud, up to 30 percent of the fluid returned to surface in the DC-8 annulus and the remaining mud returned to surface in the DC-7 13-3/8 x 9-5/8-inch annulus while coring continued to 2,734 feet.

NX size (3.500-inch outside diameter and 3.062-inch inside diameter) casing was run to 2,734 feet and cemented on June 21, 1978. Type II neat cement (125 cubic feet) was used to cement the casing. The cementing details are presented in Table II. During pumping of the cement and during its displacement, mud returns were observed from the casing annulus of hole DC-7 and not from the DC-8 annulus. Cement returns to surface were not observed. Approximately 22 hours after the displacement of the cement, a circulation hose was connected to the 2-inch pipe outlet on the 9-5/8-inch casing flange on the DC-7 well head. Mud was pumped into the 13-3/8-inch x 9-5/8-inch annulus of hole DC-7 at a rate of 30 gallons per minute. A total volume of 2,000 gallons was pumped. The maximum and final circulating pressure was 250 pounds per square inch. During pumping of this mud, the casing pressure and outer casing

annulus in hole DC-8 were monitored; there was no communication seen at surface in hole DC-8.

NX size (3.032-inch outside diameter and 1.875-inch inside diameter) core bits were used to drill 41 feet of cement out of the casing. NX size hole was drilled from the casing to the total depth of DC-8, 4,100.5 feet. Including the 41 feet of cement drilled from the casing, the average footage of the NX bits was 189 feet per bit, excluding six bits used for oriented coring. The complete bit record, including bits used for oriented coring, is presented in Table I.

No significant coring problems were encountered while drilling to 4,100.5 feet. A 25 percent loss of mud returns began while coring at 2,819.5 feet and continued while coring to 3,450 feet. At 3,450 feet complete lost circulation was observed and continued during coring to total depth, with the exception of partial returns at 3,920 to 4,000 feet. The static fluid level remained within a few feet of surface during coring operations from 3,450-4,100 feet.

As previously stated in the Introduction, the percentage core recovery exceeded 97 percent. The coring record of all core runs is presented in Table III. The interval cored for each core run presented in the coring record was measured by the driller. The record of oriented coring is given in Table IV. The mud record of the daily mud properties recorded while drilling from the 4-1/2-inch casing depth of 1,612 feet to the total depth of 4,100.5 feet is presented in Table V. Service companies and equipment suppliers who participated in the successful drilling of core hole DC-8 are listed in Table VI.

ORIENTED CORING SUMMARY

Eleven oriented cores were cut in hole DC-8 to facilitate future determination of inclination and direction of remanent magnetism of the basalts and to determine the true strike directions of fractures intersecting the oriented cores.

Oriented coring was directed by Christensen Diamond Products, U.S.A. personnel using the Christensen-Hugel orienting core barrel and method with a Sperry-Sun magnetic multishot camera instrument.

Standard lengths of oriented core runs were 10 feet; some were necessarily shorter due to core wedging and blockage in the inner barrel. In each oriented core run, drilling was carried out in increments of two feet. After a maximum of two feet of drilling, the drill was shut down to allow undisturbed photography of the compass within the survey instrument for a period of five minutes. Photos of the compass are automatically taken at 1-minute intervals throughout the entire procedure.

Eleven oriented core runs were made in six different flows of the Grande Ronde Basalt. Oriented cores were taken in the Umtanum flow, in three flows above it, and in two flows below it. Six of the oriented core runs were successful (located in five different flows) and five of the runs were unsuccessful. The positions and results of the oriented core runs are summarized in Table IV.

GEOLOGIC SUMMARY

Hole DC-8 was drilled to a depth of 4,100.5 feet near the Wye Barricade and 50 feet northwest of hydrologic hole DC-7, which was drilled to 4,099 feet.

The beginning portion of DC-8, from surface to 690 feet, was drilled by cable tool methods under the supervision of Fenix & Scisson, Inc. drilling specialists. From 702 to 718 feet, the hole was drilled with a rock bit by Boyles Brothers Drilling Company using their CP-50 core drill. It was determined the hole at 690 feet was not in bedrock but only in a large basalt boulder. From 690 to 702 and from 718 to 4,100.5 feet, the hole was core drilled under the supervision of Fenix & Scisson, Inc. drilling specialists and all core was geologically logged by Fenix & Scisson, Inc. well site geologists. Overall core recovery from the 718-4,100.5 foot interval was 97.4 percent.

Core logging data were recorded on two Rockwell Hanford Operations' forms and one Fenix & Scisson-Hanford Operations' form. Lithology was described on a 1 inch = 20 foot scale form entitled Bore Hole Lithology Log from 700 to 2,674 feet and on a 1 inch = 4 foot scale form entitled Geologic Log from 2,674 to 4,100.5 feet. Detailed information on fractures was recorded on the Basalt Core Geomechanical Data form to facilitate future entry on punch cards and eventual computer data processing. Copies of these records have been placed in the files of Hanford Operations and Fenix & Scisson, Inc. The core is presently stored in the 2101-M Building within the 200 East Area on the Hanford Site. All core was photographed in color by the Fenix & Scisson, Inc. well site geologist after removal from the core barrel into a core trough and again in color in the core boxes by Pacific Northwest Laboratory personnel. Copies of the core photographs are filed in the Basalt Waste Isolation Program Library at the Columbia Bank Building in Richland.

STRATIGRAPHY

The general stratigraphy of the Pasco Basin is shown in Figure 3 and stratigraphic units penetrated by hole DC-8 are depicted in Figure 4. The cable tool portion of DC-8 (0-690 feet) penetrated, from top to bottom, glaciofluvial sediments and the Ringold Formation (clay, silt, sand, and conglomerate).

Although no lithologic description exists for the cuttings from this interval of DC-8, information on this section is available in records from hole DC-7, located 50 feet southeast of DC-8 and from Well No. 15-15A, located approximately 150 feet west of DC-7, and Well No. 15-15B, located 32 feet north of 15-15A. For the geologic description of Well No. 15-15A, refer to ARH-C 14, Volume 1, Sample Descriptions and Summary Logs of Selected Wells Within the Hanford Reservation by W. K. Summers and Associates.

The top of the basalt bedrock lies within the 690-718-foot interval. Drilling operations indicate the top occurs at 702 feet.

From 718 to 4,100.5 feet, DC-8 was core drilled through basalt flows of the Columbia River Basalt Group, which are interlayered with a number of sedimentary interbeds. Preliminary identification of stratigraphic units was accomplished by energy nondispersive X-ray analysis of samples from pertinent basalt flows. Samples were cut into slabs with a diamond saw and compared with the appropriate standard samples.

Coring was started in the Elephant Mountain Member of the Saddle Mountains Basalt and continued downward through the remainder of that formation, the Wanapum Basalt, and into the Grande Ronde Basalt. Coring Operations were completed at 4,100.5 feet, which is 277.5 feet below the base of the Umtanum unit.

The stratigraphic sequence of basalt flow units and interbeds encountered in DC-8 is generally similar to that found in other Pasco Basin deep boreholes.

The Umtanum basalt unit was found to be 263.5 feet thick in the 3,559.5-3,823-foot interval.

A low K₂O, TiO₂, high MgO, CaO basalt horizon is found immediately below the Umtanum. The remanent magnetism in this flow is very poor,

therefore reducing the reliability of all data relating to the use of the magnetometer.

Summarized descriptions of all units penetrated by core drilling from 718 to 4,100.5 feet are given in Table VII.

STRUCTURE

From a regional structural standpoint, hole DC-8 is located in the central portion of the Pasco Basin and is believed to be at or near the lowest point of the Cold Creek syncline.

Because of the general irregularity of flow contacts, no conclusive formational dip was discernible; however, it appears that the strata intersected by DC-8 are relatively flat lying.

No evidence of faulting, such as mylonite, gouge, or displacement was noted in the detailed core logging.

Most of the basalt flows exhibit similar internal structural features. An individual flow commonly includes an altered flow top zone consisting of either altered basalt breccia or altered vesicular basalt, overlying a massive basalt, which is generally subdivided into an entablature zone above and a colonnade zone below.

The flow top zones are often porous, usually poorly indurated and are generally cut by very few fractures. The top of the entablature zone immediately below the flow top is usually characterized by the presence of abundant vesicles, vugs, and amygdules that decrease downward in size and frequency. Low-angle fractures are relatively common in the upper entablature. Proceeding downward, the low-angle fractures become less common, and high-angle and sinusoidal type fractures become more prominent, although these latter types appear with less frequency than those of low angle. No clear-cut distinction or contacts between entablature and colonnade zones can be identified in the cores, in contrast to the observation of weathered outcrops where the two are usually readily distinguishable by eye, but attempts have been made to distinguish the two in the geologic logs.

The "poker chip" fracturing that was frequently observed below 2,910 feet in hole DC-6, drilled seven miles north of DC-8, was only sporadically encountered in DC-8. Occasional "poker chipping" began as shallow as 2,870 feet in DC-8 and was irregularly observed through the

Umtanum unit. The "poker chipped" intervals occur only in aphanitic glassy basalt in DC-8 and are adjacent to, and intermixed with, cored pieces up to four feet long.

In the opinion of the Fenix & Scisson, Inc. geologic staff, the "poker chip" fracturing phenomenon is probably due to stress relief caused by the coring process. When the rock is overcored, the stress acting upon it is drastically reduced. Hence, the rock expands slightly, but due to its brittle nature is unable to remain intact and splits apart at regular short intervals. Horizontal joints are quite common in colonnade columns seen in weathered basalt outcrops, but these are more widely spaced than some of the "poker chips" in DC-8 cores. The undisturbed rock in places from which the "poker chipped" cores were drilled is not believed to be cut by such fractures.

A new 1 inch = 4 feet Geologic Log form was put into use when DC-8 had reached a depth of 2,674 feet. From this point downward, a Rock Quality Designation (RQD) of the cores was measured and recorded on the new form. The RQD is a rapid method for describing the relative structural quality of a rock mass. The RQD measurement gives values reflective of the structural competency of the rock in terms of open fractures in the rock. The RQD is determined by summing up the cumulative lengths of all pieces of sound core greater than four inches long, dividing this total by the length of the core run, and multiplying by 100. The general correlation between RQD values and the rock quality description is given below.

<u>RQD Index</u>	<u>Rock Quality Description</u>
90-100	Excellent
75-90	Good
50-75	Fair
25-50	Poor
0-25	Very Poor

ROCK DESCRIPTION

Table VII shows the depth positions of stratigraphic units penetrated by hole DC-8 and gives summarized descriptions of all individual basalt

flows and interbeds. The assignment of strata to various formation members is based upon preliminary data. The names of flows and interbeds are in accordance with the Pasco Basin Stratigraphic Nomenclature chart of Rockwell Hanford Operations published in May, 1978.

With the commencement of use of the new 1 inch = 4 feet Geologic Log form from the 2,674-foot depth point downward in hole DC-8, a more precise definition of descriptive terms was adopted and lithologic logging was performed in somewhat greater detail than in the overlying interval.

Definitions of terms used to describe the state of alteration of the rock and the average fracture spacing are given here in the overlying interval.

1. State of Alteration - Rock is assigned to one of the following five subdivisions:
 - Unaltered - No visible sign of alteration;
 - Slightly altered - Alteration developed on open discontinuity surfaces, but only slight or no effects are noted within the rock mass;
 - Moderately altered - Alteration extends throughout the rock mass, but the rock is not friable;
 - Highly altered - Alteration extends throughout the rock mass and the rock material is partly friable;
 - Completely altered - Rock is wholly decomposed and in a friable condition; texture and structure may or may not be preserved.
2. Average fracture spacing - Rock is described according to the following classification:

<u>Spacing Designation</u>	<u>Average Fracture Spacing</u>
Very wide	Greater than 10 feet
Wide	3-10 feet
Moderately close	1-3 feet
Close	0.2-1 foot
Very close	Less than 0.2 foot

HYDROLOGIC OBSERVATIONS

Observation of the loss or gain of drilling fluid and water during drilling operations gives some very useful crude information on the permeability of rock formations encountered and the presence of artesian pressured aquifers. Within the stratigraphic section penetrated by hole DC-8, all of the sedimentary interbeds and the flow top units of most of the basalt flows are highly porous and some have variable primary permeability. The dense portions of the basalt flows have very low porosity, little or no primary permeability, and, in some cases, may exhibit variable secondary (fracture) permeability.

No artesian flows to surface were noted from DC-8, but a number of permeable horizons were indicated by the loss of drilling fluid at various points. Most of the significant fluid losses appear to have occurred in brecciated basalt flow tops. Following is a summary of the major fluid losses noted, with mention of the rock units believed responsible for the losses.

Drilling fluid loss of 100 percent occurred from 832-860 feet in the massive basal basalt of the Elephant Mountain flow and the upper portion of the Rattlesnake Ridge interbed. Lost circulation material was added to the drilling fluid and partial circulation was restored. Fluid loss of 10 to 50 percent was reported through the 860-1,220-foot interval.

Total loss of drilling fluid occurred at 1,220 feet in the Cold Creek interbed and was partially regained by the addition of lost circulation material. All circulation was again lost at 1,282 feet at the top of the Umatilla Member flow top breccia. Circulation losses were reduced to about 25-40 percent by adding more lost circulation material.

Casing (4-1/2-inch outside diameter) was set through the Mabton interbed into the Wanapum Basalt at 1,621 feet and full return of drilling fluid was obtained.

Fifty percent lost circulation was reported through the 1,730-1,765-foot interval in Wanapum Basalt. Total circulation was lost at

1,830 feet in the flow top breccia of what is believed to be the Roza Member of the Wanapum Formation. Much of the circulation was restored by adding lost circulation material. Total fluid loss occurred again around 1,930 feet and this condition persisted to 1,973 feet, at which point fluid was observed coming to the surface in hole DC-7 in the annulus between the 13-3/8-inch and 9-5/8-inch casings.

It is surmised that the hole-to-hole fluid communication from DC-8 to DC-7 occurred within the basalt flow top breccia layer that exists in DC-8 in the 1,806-1,837-foot interval. Spacing between holes at that depth was determined to be approximately 24 feet.

Partial circulation was again restored by adding lost circulation material to the drilling fluid and from 1,973 to 2,734 feet fluid losses were 10-75 percent and averaged around 50 percent.

At 2,734 feet, drilling operations were suspended to allow hydrologic testing by the consulting group of Lawrence Berkeley Laboratory. Tests were conducted June 14-20, 1978 in the 1,710-2,700-foot interval using packer assemblies. The objective of the tests was to determine hydraulic conductivity of the confined intervals. Data obtained are being evaluated by Rockwell Hanford Operations' hydrologists and conclusions are not available at this time.

NX casing was then set and cemented through the Vantage Member interbed, into the Grande Ronde Basalt at 2,734 feet. Drilling was resumed with full circulation, which persisted to 2,819.5 feet.

Drilling fluid loss was again reported at 2,819.5 feet in a flow breccia of the third flow encountered in the Grande Ronde Basalt. Throughout the 2,819.5-3,450-foot interval fluid losses of 10 to 50 percent were reported.

At a depth of 3,450 feet total fluid loss was observed in the seventh Grande Ronde flow breccia encountered. This loss continued until the completion of DC-8 at 4,100.5 feet with the exception of the 3,920-4,000-foot interval when up to 5 percent of the drilling fluid returned to the surface. From 3,450 to 4,100.5 feet, it was estimated that the drilling fluid was returning to within 100-150 feet of the surface.

A thorough understanding of the hydrologic conditions in the open hole portion of DC-8 (2,734-4,100.5 feet) will not be possible until the completion of planned future hydrologic test work.

GEOPHYSICAL LOGGING

Exploration Data Consultants, Inc. (EDCON) of Denver, Colorado performed geophysical logging of available open hole portions of hole DC-8 on two separate occasions, prior to setting NX casing and at the completion of the hole. Logs run were magnetic-susceptibility, resistivity-induced-polarization, and sonic. The following intervals were logged:

June 13-14, 1978	1,612-2,734 feet;
October 24, 1978	2,734-4,100.5 feet (less a few feet at the bottom).

Holosonics, Inc. of Richland, Washington is scheduled to conduct hole-to-hole seismic shear and pressure wave velocity measurements between holes DC-7 and DC-8 in November, 1978.

FIGURE 1

SITE MAP, HOLE DC-8

FIGURE 2

CORING PROGRESS CURVE, CORE HOLE DC-8

FIGURE 4

AS-BUILT DIAGRAM, CORE HOLE DC-8

TABLE I
BIT RECORD

HOLE: DC-8

CONTRACTOR: BOYLES BROTHERS DRILLING COMPANY

DATE	RUN NO.	DEPTH (FT.)		FOOTAGE	SIZE (IN.)	TYPE	SERIAL NO.	REMARKS
		IN	OUT					
3-9	1	687.0	689.0	2.0	4-5/8	Cone	AA90492	Tri-cone-Rock bit
3-9	2	689.0	702.0	13.0	3.937	Core	6S54843	Re-run
3-10	3	687.0	689.0	2.0	5-5/8	Cone	AA59543	Tri-cone-Rock bit
3-14	4	689.0	716.0	27.0	5-5/8	Cone	AA59544	Tri-cone-Rock bit
3-15	5	716.0	718.0	2.0	4-5/8	Cone	AA90492	Re-run #1
3-15	6	718.0	815.0	97.0	3.937	Core	7S18666	47.30 ct.wt.-25 s.p.c.
3-16	7	815.0	1008.0	193.0	3.937	Core	7S34242	47.30 ct.wt.-25 s.p.c.
3-17	8	1008.0	1087.5	79.5	3.937	Core	7S18665	47.31 ct.wt.-25 s.p.c.
3-21	9	1087.5	1193.0	105.5	3.937	Core	7S60889	25.16 ct.wt.-40 s.p.c.
3-22	10	1193.0	1282.0	89.0	3.937	Core	7S34238	47.80 ct.wt.-25 s.p.c.
3-24	11	1282.0	1381.0	99.0	3.937	Core	8S13144	47.17 ct.wt.-25 s.p.c.
3-28	12	1381.0	1612.0	231.0	3.937	Core	8S9033	47.70 ct.wt.-25 s.p.c.
3-31	1R	710.0	727.0	17.0	4.950	Ream	8S01887	48.56 ct.wt.-25 s.p.c.
3-31	2R	727.0	747.5	20.5	4.950	Ream	8S04435	93.57 ct.wt.-15 s.p.c.
4-4	3R	747.5	952.0	204.5	4.950	Ream	8S09020	134.45 ct.wt.-10 s.p.c.
4-6	4R	952.0	1057.0	105.0	4.950	Ream	8S09019	134.45 ct.wt.-10 s.p.c.
4-10	5R	1057.0	1150.0	93.0	4.950	Ream	8S04436	93.57 ct.wt.-15 s.p.c.
4-11	6R	1150.0	1189.0	39.0	4.950	Ream	8S04437	No tag-10 s.p.c.
4-12	7R	1189.0	1295.0	106.0	4.950	Ream	8S09021	134.45 ct.wt.-10 s.p.c.
4-17	8R	1295.0	1344.0	49.0	4.950	Ream	8S17646	93.11 ct.wt.-15 s.p.c.
4-19	9R	1344.0	1353.0	9.0	4.950	Ream	8S17645	93.11 ct.wt.-15 s.p.c.
4-19	10R	1340.0	1612.0	-	3-7/8	Cone	157120	Clean fill from pilot hole
4-20	11R	1353.0	1388.0	35.0	4.950	Ream	8S18052	132.78 ct.wt.-10 s.p.c.
4-24	12R	1388.0	1413.0	25.0	4.950	Ream	8S19527	133.79 ct.wt.-10 s.p.c.
4-25	13R	1413.0	1608.0	195.0	4.950	Ream	8S19562	134.33 ct.wt.- s.p.c.
4-28	14R	1608.0	1612.0	-	3-3/4	Cone	45950	Clean fill from pilot hole
4-28	15R	1608.0	1612.0	4.0	4.950	Ream	8S19562	Re-run #13R
5-3	16R	1048.0	1610.0	562.0	3-3/4	Cone	45950	Re-run #14R-Drill cement
5-4	13	1610.0	1623.0	13.0	3.937	Core	7S60892	25.16 ct.wt.-40 s.p.c.
5-4	14	1623.0	1770.0	147.0	3.937	Core	8S13145	47.80 ct.wt.-25 s.p.c.

R=Run Numbers for Reaming Operation

TABLE I (continued)

BIT RECORD

HOLE: DC-8CONTRACTOR: BOYLES BROTHERS DRILLING COMPANY

DATE	RUN NO.	DEPTH (FT.)		FOOTAGE	SIZE (IN.)	TYPE	SERIAL NO.	REMARKS
		IN	OUT					
5-8	15	1770.0	2003.0	233.0	3.937	Core	8S15570	48.44 ct.wt. - 25 s.p.c.
5-12	16	2003.0	2034.0	31.0	3.937	Core	8S9032	47.17 ct.wt. - 25 s.p.c.
5-13	17	2034.0	2194.0	160.0	3.937	Core	8S06637	25.03 ct.wt. - 40 s.p.c.
5-18	18	2194.0	2466.0	272.0	3.937	Core	8S06638	25.03 ct.wt. - 40 s.p.c.
6-2	19	2466.0	2491.0	25.0	3.937	Core	8S06639	25.03 ct.wt. - 40 s.p.c.
6-5	20	2491.0	2504.3	13.3	3.937	Core	8S06640	25.03 ct.wt. - 40 s.p.c.
6-6	21	2504.3	2638.8	134.5	3.937	Core	8S15571	48.44 ct.wt. - 25 s.p.c.
6-8	22	2638.8	2684.9	46.1	3.937	Core	8S06636	25.03 ct.wt. - 40 s.p.c.
6-9	23	2684.9	2734.0	49.1	3.937	Core	8S13143	47.80 ct.wt. - 25 s.p.c.
6-23	24	2693.0	2754.0	61.0	3.032	Core	7S29029	No tag; drilled 41' cement
6-24	25	2754.0	2922.5	168.5	3.032	Core	8S14054	Matrix impregnated set
6-27	26	2922.5	2942.2	19.7	3.032	Core	7S48961	Oriented Coring
6-27	27	2942.2	2953.0	10.8	3.032	Core	8S136483	Oriented Coring
6-28	28	2953.0	2961.5	8.5	3.032	Core	8S16585	27.97 ct.wt. - 15 s.p.c.
6-28	29	2961.5	3125.0	163.5	3.032	Core	8S14054	Re-run #25
6-30	30	3125.0	3133.3	8.3	3.032	Core	8S16585	Re-run #28; oriented coring
7-6	31	3133.3	3143.3	10.0	3.032	Core	8S09644	Oriented Coring
7-6	32	3143.3	3282.8	139.5	3.032	Core	8S22360	37 ct.wt. impregnated
7-11	33	3282.8	3518.0	235.2	3.032	Core	8S22355	37 ct.wt. impregnated
7-14	34	3518.0	3527.0	9.0	3.032	Core	6S48522	23.62 ct.wt. - orient. coring
7-14	35	3527.0	3662.0	135.0	3.032	Core	8S22361	impregnated setting
7-19	36	3662.0	3672.0	10.0	3.032	Core	6S48522	Re-run #34 orient. coring
7-20	37	3672.0	3733.5	61.5	3.032	Core	8S22361	Re-run #35 impregnated
7-24	38	3733.5	3743.5	10.0	3.032	Core	6S48522	Re-run #34 orient. coring
7-25	39	3743.5	3900.0	156.5	3.032	Core	8S22361	Re-run #35 impregnated
7-27	40	3900.0	3905.5	5.5	3.032	Core	7S42100	25s.p.c. - Oriented coring
7-28	41	3905.5	4062.0	156.5	3.032	Core	8S22361	Re-run #35 impregnated
8-2	42	4062.0	4072.0	10.0	3.032	Core	7S42100	Re-run #40 orient. coring
8-2	43	4072.0	4100.5	28.5	3.032	Core	8S22362	impregnated setting

R=Run Numbers for Reaming Operation

TABLE II

CEMENTING DETAILS

	<u>5-2-78</u>	<u>6-21-78</u>
Casing size (in.)	4.5	NX-3.5
Casing depth (ft.)	1,612	2,734
Cement utilized	Type II	Type II
Cement volume (cu. ft.)	110	125
Displacement volume (cu. ft.)	92	140
Slurry yield (cu. ft./sack)	1.47	1.47
Slurry weight (lb./gal.)	14.5	14.5
Admixtures	-	-
Displacement method	Positive Displacement	Positive Displacement
Cement stages	1	1
Wait on cement time (hr.)	24	37

TABLE III
CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
3-09	2	1	689.0	693.0	4.0	3.0	75	105	4.0	3.0	
3-09	2	2	693.0	695.0	2.0	1.5	75	30	6.0	4.5	
3-10	2	3	695.0	696.0	1.0	1.3	130	40	7.0	5.8	
3-10	2	4	696.0	697.0	1.0	1.0	100	15	8.0	6.8	
3-10	2	5	697.0	698.0	1.0	1.0	100	15	9.0	7.8	
3-10	2	6	698.0	699.0	1.0	1.0	100	15	10.0	8.8	
3-10	2	7	699.0	700.0	1.0	1.6	160	95	11.0	10.4	
3-10	2	8	700.0	701.0	1.0	0.0	0	25	12.0	10.4	
3-10	2	9	701.0	702.0	1.0	0.0	0	15	13.0	10.4	Rock Bits 702 -718 FT.
3-15	1	10	718.0	728.0	10.0	9.6	96	80	23.0	20.0	Bit Trip
3-15	2	11	728.0	733.0	5.0	5.0	100	25	28.0	25.0	
3-15	2	12	733.0	743.0	10.0	10.0	100	100	38.0	35.0	
3-15	2	13	743.0	753.0	10.0	10.1	101	85	48.0	45.1	
3-15	2	14	753.0	763.0	10.0	10.0	100	45	58.0	55.1	
3-16	2	15	763.0	771.0	8.0	6.0	75	40	66.0	61.1	
3-16	2	16	771.0	775.0	4.0	4.5	113	35	70.0	65.6	
3-16	2	17	775.0	785.0	10.0	10.1	101	115	80.0	75.7	
3-16	2	18	785.0	793.0	8.0	8.0	100	60	88.0	83.7	
3-16	2	19	793.0	798.0	5.0	5.0	100	20	93.0	88.7	
3-16	1	20	798.0	808.0	10.0	10.0	100	80	103.0	98.7	
3-16	1	21	808.0	815.0	7.0	7.0	100	60	110.0	105.7	Bit Trip
3-16	1	22	815.0	825.0	10.0	9.8	98	60	120.0	115.5	
3-16	1	23	825.0	831.0	6.0	6.0	100	30	125.0	121.5	
3-16	1	24	831.0	841.0	10.0	9.0	90	75	136.0	130.5	Lost Returns-Pump LCM
3-16	2	25	841.0	845.0	4.0	4.0	100	55	140.0	134.5	
3-16	2	26	845.0	853.0	8.0	7.8	97	55	148.0	136.0	Partial Returns
3-17	2	27	853.0	863.0	10.0	9.9	99	25	158.0	143.2	
3-17	2	28	863.0	873.0	10.0	9.7	97	90	168.0	151.0	90% Returns
3-17	1	29	873.0	883.0	10.0	10.0	100	60	178.0	161.0	
3-17	1	30	883.0	893.0	10.0	9.0	90	60	188.0	170.0	
3-17	1	31	893.0	903.0	10.0	9.1	91	40	198.0	179.4	
3-17	1	32	903.0	913.0	10.0	10.0	100	40	208.0	189.4	
3-17	1	33	913.0	923.0	10.0	10.0	100	35	218.0	199.4	
3-17	1	34	923.0	933.0	10.0	9.0	90	30	228.0	208.4	
3-17	1	35	933.0	943.0	10.0	10.0	100	50	238.0	218.4	
3-17	1	36	943.0	953.0	10.0	9.8	98	45	248.0	228.2	
3-17	1	37	953.0	963.0	10.0	10.0	100	60	258.0	238.2	
3-17	1	38	963.0	973.0	10.0	10.0	100	45	268.0	248.2	
3-17	1	39	973.0	983.0	10.0	10.0	100	15	278.0	258.2	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
3-17	2	40	983.0	993.0	10.0	10.1	101	70	288.0	268.3	
3-17	2	41	993.0	1003.0	10.0	10.0	100	80	298.0	278.3	
3-17	2	42	1003.0	1008.0	5.0	5.0	100	40	303.0	283.3	Bit Trip
3-20	1	43	1008.0	1015.0	7.0	6.4	91	30	310.0	289.7	
3-20	1	44	1015.0	1023.0	8.0	8.2	103	45	318.0	297.9	60-70% Returns
3-20	2	45	1023.0	1033.0	10.0	10.0	100	115	328.0	307.9	
3-20	2	46	1033.0	1041.5	8.5	8.5	100	100	336.5	316.4	
3-20	2	47	1041.5	1051.5	10.0	10.2	102	95	346.5	326.6	
3-21	1	48	1051.5	1061.6	10.1	10.1	100	65	356.6	336.7	
3-21	1	49	1061.6	1066.6	5.0	5.0	100	40	361.6	341.7	
3-21	1	50	1066.6	1075.0	8.4	8.2	98	65	370.0	349.9	
3-21	1	51	1075.0	1085.0	10.0	10.0	100	80	380.0	359.9	
3-21	1	52	1085.0	1087.5	2.5	2.4	96	20	382.5	362.3	Bit Trip
3-21	1	53	1087.5	1093.0	5.5	3.5	64	40	388.0	365.8	
3-21	2	54	1093.0	1103.0	10.0	10.0	100	80	398.0	375.8	
3-21	2	55	1103.0	1113.0	10.0	10.0	100	75	408.0	385.8	
3-21	2	56	1113.0	1119.0	6.0	6.4	107	85	414.0	392.2	
3-22	2	57	1119.0	1129.0	10.0	9.8	98	100	424.0	402.0	
3-22	2	58	1129.0	1139.0	10.0	10.0	100	95	434.0	412.0	
3-22	2	59	1139.0	1149.0	10.0	10.0	100	95	444.0	422.0	
3-22	1	60	1149.0	1157.4	8.4	8.4	100	140	452.4	430.4	
3-22	1	61	1157.4	1167.5	10.1	10.1	100	80	462.5	440.5	
3-22	1	62	1167.5	1173.0	5.5	5.6	102	45	468.0	446.1	
3-22	1	63	1173.0	1183.0	10.0	9.9	99	65	478.0	456.0	
3-22	2	64	1183.0	1193.0	10.0	10.0	100	145	488.0	466.0	Bit Trip-Lost Returns
3-23	2	65	1193.0	1203.0	10.0	9.8	98	170	498.0	475.3	
3-23	1	66	1203.0	1213.0	10.0	6.7	67	105	508.0	482.5	
3-23	1	67	1213.0	1218.0	5.0	2.1	42	40	513.0	484.5	
3-23	1	68	1218.0	1220.0	2.0	2.8	140	25	515.0	497.4	
3-23	1	69	1220.0	1227.0	7.0	6.9	97	90	522.0	494.2	Lost Returns
3-23	1	70	1227.0	1230.0	3.0	3.0	100	45	525.0	497.2	
3-23	1	71	1230.0	1238.0	8.0	8.0	100	80	533.0	505.2	
3-23	2	72	1238.0	1245.0	7.0	7.5	107	130	540.0	512.7	
3-23	2	73	1245.0	1248.5	3.5	3.5	100	50	543.5	516.2	
3-23	2	74	1248.5	1253.0	4.5	2.5	56	60	548.0	518.7	
3-24	2	75	1253.0	1256.5	3.5	2.8	80	45	551.5	521.5	
3-24	2	76	1256.5	1258.0	1.5	1.5	100	20	553.0	523.0	
3-24	2	77	1258.0	1268.0	10.0	10.0	100	145	563.0	533.0	
3-24	2	78	1268.0	1278.0	10.0	9.3	93	120	573.0	541.3	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
3-24	1	79	1278.0	1282.0	4.0	3.7	93	60	577.0	545.0	Bit Trip-Lost Returns
3-24	1	80	1282.0	1286.0	4.0	4.2	105	60	581.0	549.2	
3-24	1	81	1286.0	1293.0	7.0	6.9	99	75	588.0	556.1	
3-24	2	82	1293.0	1303.0	10.0	10.0	100	150	598.0	566.1	
3-25	2	83	1303.0	1313.0	10.0	10.0	100	230	608.0	576.1	
3-25	2	84	1313.0	1318.0	5.0	3.7	74	140	613.0	579.8	
3-27	1	85	1318.0	1326.5	8.5	10.0	118	130	621.5	589.8	
3-27	1	86	1326.5	1333.0	6.5	7.0	108	95	628.0	596.8	
3-27	2	87	1333.0	1343.0	10.0	10.1	101	130	638.0	606.9	75% Returns
3-27	2	88	1343.0	1353.0	10.0	10.0	100	135	648.0	616.9	
3-28	2	89	1353.0	1363.0	10.0	10.0	100	135	658.0	626.9	
3-28	2	90	1363.0	1373.0	10.0	10.0	100	170	668.0	636.9	
3-28	1	91	1373.0	1381.0	8.0	8.3	104	200	676.0	645.2	Bit Trip
3-28	2	92	1381.0	1391.0	10.0	9.9	99	130	686.0	655.1	
3-29	2	93	1391.0	1401.0	10.0	10.0	100	160	696.0	665.1	
3-29	2	94	1401.0	1410.5	9.5	10.0	105	145	705.5	675.1	
3-29	1	95	1410.5	1420.5	10.0	9.9	99	120	715.5	685.0	
3-29	1	96	1420.5	1430.5	10.0	9.7	97	90	725.5	694.7	60% Returns
3-29	1	97	1430.5	1440.5	10.0	10.0	100	70	735.5	704.7	
3-29	1	98	1440.5	1450.5	10.0	10.0	100	65	745.5	714.7	
3-29	1	99	1450.5	1460.5	10.0	10.1	101	70	755.5	724.8	
3-29	2	100	1460.5	1470.6	10.1	10.1	100	90	765.6	734.9	
3-29	2	101	1470.6	1480.7	10.1	10.1	100	70	775.7	745.0	
3-29	2	102	1480.7	1490.7	10.0	10.0	100	75	785.7	755.0	
3-30	2	103	1490.7	1500.7	10.0	10.0	100	90	795.7	765.0	
3-30	2	104	1500.7	1510.6	9.9	9.9	100	110	805.6	774.9	
3-30	2	105	1510.6	1520.5	9.9	9.0	91	5	815.5	783.9	
3-30	2	106	1520.5	1530.5	10.0	9.3	93	65	825.5	793.2	
3-30	1	107	1530.5	1540.5	10.0	4.1	41	70	835.5	797.3	
3-30	1	108	1540.5	1549.0	7.5	10.2	136	40	843.0	807.5	
3-30	1	109	1549.0	1553.0	5.0	0.0	0	25	848.0	807.5	
3-30	1	110	1553.0	1559.0	6.0	10.0	167	20	854.0	817.5	
3-30	1	111	1559.0	1567.5	8.5	8.2	96	75	862.5	825.7	
3-30	1	112	1567.5	1573.0	5.5	6.0	109	65	868.0	831.7	
3-30	1	113	1573.0	1583.0	10.0	10.0	100	85	878.0	841.7	
3-30	2	114	1583.0	1593.0	10.0	9.4	94	100	888.0	851.1	
3-30	2	115	1593.0	1602.0	9.0	10.0	111	90	897.0	861.1	
3-30	2	116	1602.0	1612.0	10.0	10.0	100	115	907.0	871.1	Beam Hole-Set Casing
5-04	2	117	1612.0	1613.0	1.0	0.6	60	120	908.0	871.7	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
5-04	1	118	1613.0	1623.0	10.0	10.0	100	140	918.0	881.7	Bit Trip
5-04	1	119	1623.0	1633.0	10.0	10.1	101	150	928.0	891.8	
5-04	1	120	1633.0	1643.0	10.0	9.9	99	110	938.0	901.7	
5-04	1	121	1643.0	1653.0	10.0	9.1	91	150	948.0	910.8	
5-04	2	122	1653.0	1663.0	10.0	10.0	100	105	958.0	920.8	
5-04	2	123	1663.0	1673.0	10.0	10.2	102	110	968.0	931.0	
5-05	2	124	1673.0	1683.0	10.0	10.1	101	150	978.0	941.1	
5-05	2	125	1683.0	1693.0	10.0	10.1	101	100	988.0	951.2	
5-05	1	126	1693.0	1703.5	10.5	10.1	96	130	998.5	961.3	
5-05	1	127	1703.5	1713.5	10.0	10.1	101	125	1008.5	971.4	
5-05	1	128	1713.5	1723.5	10.0	10.0	100	115	1018.5	981.4	
5-05	1	129	1723.5	1733.5	10.0	10.1	101	105	1028.5	991.5	50% Returns
5-05	1	130	1733.5	1744.0	10.5	9.9	94	150	1039.0	1001.4	
5-05	2	131	1744.0	1750.0	6.0	5.2	87	65	1045.0	1006.6	
5-05	2	132	1750.0	1760.0	10.0	10.0	100	160	1055.0	1016.6	
5-06	2	133	1760.0	1770.0	10.0	10.0	100	135	1065.0	1026.6	Bit Trip
5-08	1	134	1770.0	1780.0	10.0	9.6	96	65	1075.0	1036.2	
5-08	1	135	1780.0	1789.5	9.5	10.3	108	160	1084.5	1046.5	
5-08	2	136	1789.5	1799.5	10.0	10.1	101	150	1094.5	1056.6	
5-08	2	137	1799.5	1810.0	10.5	10.2	97	180	1105.0	1066.8	
5-09	2	138	1810.0	1820.0	10.0	10.1	101	150	1115.0	1076.9	
5-09	2	139	1820.0	1830.0	10.0	9.4	94	120	1125.0	1086.3	Lost Returns - Pump LCM
5-09	1	140	1830.0	1834.0	4.0	3.0	75	45	1129.0	1089.3	
5-09	1	141	1834.0	1837.0	3.0	1.0	33	50	1132.0	1090.3	90% Returns
5-09	1	142	1837.0	1847.0	10.0	10.1	101	155	1142.0	1100.4	
5-09	1	143	1847.0	1854.0	7.0	6.7	96	90	1149.0	1107.1	
5-09	2	144	1854.0	1864.0	10.0	10.0	100	145	1159.0	1117.1	
5-09	2	145	1864.0	1874.0	10.0	9.9	99	160	1169.0	1127.3	
5-10	2	146	1874.0	1883.0	9.0	9.0	100	170	1178.0	1136.3	
5-10	2	147	1883.0	1893.0	10.0	10.0	100	165	1188.0	1146.3	
5-10	1	148	1893.0	1903.0	10.0	10.0	100	100	1198.0	1156.0	
5-10	1	149	1903.0	1913.0	10.0	10.0	100	100	1208.0	1166.0	
5-10	1	150	1913.0	1922.5	9.5	9.5	100	90	1217.5	1175.5	
5-10	1	151	1922.5	1932.5	10.0	10.0	100	95	1227.5	1185.5	
5-10	2	152	1932.5	1942.5	10.0	10.1	101	100	1237.5	1195.6	Mud Returns from DC-7
5-10	2	153	1942.5	1952.8	10.3	10.1	98	150	1247.8	1205.7	Lost Returns - DC-8
5-11	2	154	1952.8	1963.0	10.2	10.1	99	150	1258.0	1215.8	
5-11	2	155	1963.0	1973.0	10.0	10.1	101	140	1268.0	1225.9	
5-12	2	156	1973.0	1983.0	10.0	10.0	100	180	1278.0	1235.9	Lost Returns DC-8 - Pump LCM

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
5-12	1	157	1983.0	1993.0	10.0	10.1	101	140	1288.0	1246.0	
5-12	1	158	1993.0	2003.0	10.0	9.5	95	105	1298.0	1255.5	Bit Trip
5-12	1	159	2003.0	2013.0	10.0	1.0	10	160	1308.0	1256.5	70% Returns
5-12	2	160	2013.0	2021.5	8.5	3.5	41	150	1316.5	1260.0	
5-12	2	161	2021.5	2029.5	8.0	3.9	49	160	1324.5	1263.9	
5-13	2	162	2029.5	2034.0	4.5	13.0	289	115	1329.0	1276.9	Bit Trip
5-13	1	163	2034.0	2043.0	9.0	10.0	111	195	1338.0	1286.9	70% Returns
5-15	1	164	2043.0	2053.0	10.0	10.0	100	115	1348.0	1296.9	
5-15	1	165	2053.0	2063.2	10.2	10.2	100	110	1358.2	1307.1	
5-15	1	166	2063.2	2073.5	10.3	10.2	99	115	1368.5	1317.3	
5-15	1	167	2073.5	2076.0	2.5	2.5	100	45	1371.0	1319.8	50% Returns
5-16	1	168	2076.0	2086.2	10.2	10.2	100	125	1381.2	1330.0	
5-16	1	169	2086.2	2094.0	7.8	8.1	104	100	1389.0	1338.1	
5-16	1	170	2094.0	2104.0	10.0	10.2	102	150	1399.0	1348.3	
5-17	2	171	2104.0	2114.0	10.0	10.2	102	125	1409.0	1358.5	
5-17	2	172	2114.0	2124.0	10.0	10.2	102	160	1419.0	1368.7	
5-17	2	173	2124.0	2134.0	10.0	9.8	98	110	1429.0	1378.5	
5-17	1	174	2134.0	2144.0	10.0	10.2	102	85	1439.0	1388.7	
5-17	1	175	2144.0	2154.0	10.0	9.9	99	135	1449.0	1398.6	
5-17	1	176	2154.0	2164.0	10.0	10.1	101	95	1459.0	1408.7	
5-17	1	177	2164.0	2174.0	10.0	10.1	101	95	1469.0	1418.8	
5-17	2	178	2174.0	2184.0	10.0	9.9	99	135	1479.0	1428.7	
5-17	2	179	2184.0	2189.5	5.5	5.2	95	75	1484.5	1433.9	
5-17	2	180	2189.5	2192.0	2.5	2.8	112	70	1487.0	1436.7	
5-18	2	181	2192.0	2194.0	2.0	2.0	100	45	1489.0	1438.7	Bit Trip
5-18	1	182	2194.0	2197.0	3.0	3.0	100	70	1492.0	1441.7	
5-18	1	183	2197.0	2207.0	10.0	9.8	98	100	1502.0	1451.5	
5-18	1	184	2207.0	2214.0	7.0	7.2	103	75	1509.0	1458.7	
5-26	1	185	2214.0	2224.0	10.0	10.0	100	120	1519.0	1468.7	
5-26	1	186	2224.0	2234.0	10.0	10.0	100	125	1529.0	1478.7	30% Returns
5-26	2	187	2234.0	2244.0	10.0	10.1	101	100	1539.0	1488.8	
5-26	2	188	2244.0	2254.0	10.0	9.9	99	125	1549.0	1498.7	
5-27	2	189	2254.0	2264.0	10.0	10.1	101	125	1559.0	1508.8	
5-27	2	190	2264.0	2274.0	10.0	9.9	99	140	1569.0	1518.7	
5-30	1	191	2274.0	2284.0	10.0	10.1	101	145	1579.0	1528.8	
5-30	1	192	2284.0	2294.0	10.0	9.9	99	120	1589.0	1538.7	
5-30	1	193	2294.0	2304.1	10.1	10.1	100	135	1599.1	1548.8	
5-30	2	194	2304.1	2314.1	10.0	10.0	100	160	1609.1	1558.8	
5-30	2	195	2314.1	2324.2	10.1	10.1	100	165	1619.2	1568.9	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
5-31	2	196	2324.2	2334.2	10.0	10.0	100	145	1629.2	1578.9	
5-31	1	197	2334.2	2344.2	10.0	10.0	100	160	1639.2	1588.9	
5-31	1	198	2344.2	2354.0	9.8	9.1	93	110	1649.0	1598.0	
5-31	1	199	2354.0	2364.0	10.0	10.0	100	100	1659.0	1608.0	
5-31	1	200	2364.0	2374.0	10.0	10.0	100	125	1669.0	1618.0	
5-31	1	201	2374.0	2384.0	10.0	10.0	100	135	1679.0	1628.0	
5-31	2	202	2384.0	2394.0	10.0	10.0	100	115	1689.0	1638.0	
5-31	2	203	2394.0	2404.0	10.0	10.0	100	200	1699.0	1648.0	
6-01	2	204	2404.0	2414.0	10.0	10.0	100	155	1709.0	1658.0	
6-01	1	205	2414.0	2424.0	10.0	10.0	100	185	1719.0	1668.0	
6-01	1	206	2424.0	2434.0	10.0	10.1	101	195	1729.0	1678.1	
6-01	1	207	2434.0	2444.0	10.0	10.0	100	145	1739.0	1688.1	
6-01	2	208	2444.0	2454.0	10.0	9.8	98	180	1749.0	1697.9	
6-02	1	209	2454.0	2460.0	6.0	6.2	103	150	1755.0	1704.1	
6-02	2	210	2460.0	2470.0	10.0	10.0	100	135	1765.0	1714.1	
6-02	2	211	2470.0	2480.0	10.0	10.0	100	105	1775.0	1724.1	
6-05	1	212	2480.0	2489.0	9.0	8.5	94	90	1784.0	1732.6	
6-05	1	213	2489.0	2491.0	2.0	2.5	125	75	1786.0	1735.1	Bit Trip
6-05	1	214	2491.0	2491.0	0.0	0.0	0	15	1786.0	1735.1	
6-06	2	215	2491.0	2501.0	10.0	10.2	102	150	1796.0	1745.3	
6-06	2	216	2501.0	2504.3	3.3	3.0	91	65	1799.3	1748.3	Bit Trip
6-06	1	217	2504.3	2514.0	9.7	10.0	103	180	1809.0	1758.3	
6-06	2	218	2514.0	2519.0	5.0	5.0	100	110	1814.0	1763.3	
6-06	2	219	2519.0	2525.0	6.0	6.0	100	105	1820.0	1769.3	
6-07	2	220	2525.0	2534.0	9.0	9.0	100	190	1829.0	1778.3	
6-07	1	221	2534.0	2544.0	10.0	10.0	100	200	1839.0	1788.3	
6-07	1	222	2544.0	2554.0	10.0	10.0	100	145	1849.0	1798.3	
6-07	1	223	2554.0	2564.0	10.0	10.0	100	145	1859.0	1808.3	
6-07	1	224	2564.0	2567.5	3.5	3.3	94	30	1862.5	1811.6	
6-07	2	225	2567.5	2574.0	6.5	6.8	105	160	1869.0	1818.4	
6-07	2	226	2574.0	2584.1	10.1	10.1	100	145	1879.1	1828.5	
6-08	2	227	2584.1	2594.0	9.9	9.9	99	195	1889.0	1838.3	75% Returns
6-08	1	228	2594.0	2604.0	10.0	10.0	100	95	1899.0	1848.3	
6-08	1	229	2604.0	2614.0	10.0	10.0	100	90	1909.1	1858.4	
6-08	1	230	2614.0	2624.0	9.9	10.0	101	80	1919.0	1868.4	
6-08	1	231	2624.0	2634.0	10.0	10.0	100	90	1929.0	1878.4	
6-08	1	232	2634.0	2638.8	4.8	4.8	100	110	1933.8	1883.2	Bit Trip
6-09	2	233	2638.8	2648.8	10.0	10.0	100	130	1943.8	1893.2	
6-09	1	234	2648.8	2654.0	5.2	5.2	100	55	1949.0	1898.4	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
6-09	1	235	2654.0	2663.9	9.9	9.9	100	120	1958.9	1908.3	
6-09	1	236	2663.9	2674.0	10.1	10.1	100	165	1969.0	1918.4	
6-09	1	237	2674.0	2684.0	10.0	9.7	97	120	1979.0	1928.1	
6-09	1	238	2684.0	2684.9	0.9	0.9	100	30	1979.9	1929.0	Bit Trip
6-09	1	239	2684.9	2687.0	2.1	2.1	100	100	1982.0	1931.1	
6-12	1	240	2687.0	2694.0	7.0	7.6	109	105	1989.0	1938.7	
6-12	1	241	2694.0	2704.1	10.1	10.1	100	125	1999.1	1948.8	
6-12	1	242	2704.1	2714.0	9.9	9.9	100	110	2009.0	1958.7	
6-12	1	243	2714.0	2724.0	10.0	10.0	100	105	2019.0	1968.7	
6-12	2	244	2724.0	2734.0	10.0	10.0	100	120	2029.0	1978.7	Set 4X Casing
6-23	2	245	2734.0	2742.0	8.0	7.9	99	70	2037.0	1986.6	
6-24	2	246	2742.0	2751.0	9.0	8.8	98	60	2046.0	1995.4	
6-24	2	247	2751.0	2754.0	3.0	3.4	113	60	2049.0	1998.8	Bit Trip
6-24	1	248	2754.0	2764.7	10.7	10.2	95	115	2059.7	2009.0	
6-24	2	249	2764.7	2772.0	7.3	0.0	0	90	2067.0	2009.0	
6-24	2	250	2772.0	2775.0	3.0	8.9	297	45	2070.0	2017.9	
6-24	2	251	2775.0	2784.0	9.0	10.3	114	95	2079.0	2028.2	
6-24	2	252	2784.0	2792.0	8.0	8.3	104	80	2087.0	2036.5	
6-24	2	253	2792.0	2802.0	10.0	10.1	101	75	2097.0	2046.6	
6-25	1	254	2802.0	2812.0	10.0	9.8	98	90	2107.0	2056.4	80% Returns
6-25	1	255	2812.0	2822.5	10.5	6.8	65	120	2117.5	2063.2	
6-25	1	256	2822.5	2832.5	10.0	9.7	97	75	2127.5	2072.9	
6-25	1	257	2832.5	2834.5	2.0	1.4	70	40	2129.5	2074.3	
6-25	2	258	2834.5	2844.5	10.0	10.0	100	75	2139.5	2084.0	
6-25	2	259	2844.5	2852.5	8.0	8.9	111	70	2147.5	2093.2	
6-25	2	260	2852.5	2862.5	10.0	10.0	100	75	2157.5	2103.0	
6-25	2	261	2862.5	2872.5	10.0	10.0	100	30	2167.5	2113.2	
6-25	2	262	2872.5	2882.5	10.0	10.0	100	95	2177.5	2123.2	
6-25	1	263	2882.5	2890.4	9.9	9.9	100	95	2187.4	2133.1	
6-25	1	264	2892.4	2899.7	7.3	7.3	100	95	2194.7	2140.4	
6-25	1	265	2899.7	2909.9	10.2	10.2	100	95	2204.9	2150.6	
6-25	1	266	2909.9	2912.5	2.6	3.3	127	45	2207.5	2153.9	
6-26	2	267	2912.5	2922.5	10.0	9.5	95	100	2217.5	2163.4	Bit Trip
6-27	2	268	2922.5	2932.5	10.0	10.0	100	160	2227.5	2170.4	Oriented Core
6-27	1	269	2932.5	2942.2	9.7	4.5	46	130	2237.2	2177.9	Bit Trip
6-27	1	270	2942.2	2943.0	0.8	0.7	88	15	2238.0	2178.6	Oriented Core
6-27	2	271	2943.0	2953.0	10.0	9.1	91	135	2248.0	2187.7	Bit Trip
6-28	2	272	2953.0	2954.0	1.0	0.5	50	45	2249.0	2188.2	
6-28	1	273	2954.0	2961.5	7.5	2.0	27	120	2256.5	2190.2	Bit Trip

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
6-28	1	274	2961.5	2965.3	3.8	3.7	97	40	2260.3	2193.9	
6-28	1	275	2965.3	2972.5	7.2	7.6	106	70	2267.5	2201.5	
6-28	1	276	2972.5	2982.5	10.0	10.1	101	60	2277.5	2211.6	
6-28	1	277	2982.5	2992.5	10.0	9.9	99	60	2287.5	2221.5	
6-28	2	278	2992.5	3002.5	10.0	10.0	100	60	2297.5	2231.5	
6-28	2	279	3002.5	3012.5	10.0	9.9	99	60	2307.5	2241.4	
6-28	2	280	3012.5	3022.5	10.0	10.0	100	70	2317.5	2251.4	
6-29	2	281	3022.5	3032.5	10.0	9.9	99	65	2327.5	2261.3	
6-29	2	282	3032.5	3042.5	10.0	10.0	100	65	2337.5	2271.3	
6-29	2	283	3042.5	3052.5	10.0	10.0	100	70	2347.5	2281.3	
6-29	1	284	3052.5	3062.5	10.0	10.0	100	70	2357.5	2291.3	
6-29	1	285	3062.5	3072.5	10.0	10.0	100	70	2367.5	2301.3	
6-29	1	286	3072.5	3082.5	10.0	9.9	99	80	2377.5	2311.2	
6-29	1	287	3082.5	3092.5	10.0	10.1	101	80	2387.5	2321.3	
6-29	1	288	3092.5	3102.5	10.0	10.0	100	90	2397.5	2331.3	
6-29	1	289	3102.5	3112.5	10.0	7.8	78	80	2407.5	2339.1	
6-29	2	290	3112.5	3122.5	10.0	6.1	61	120	2417.5	2345.2	
6-30	2	291	3122.5	3125.0	2.5	2.6	104	30	2420.0	2347.8	Bit Trip
6-30	1	292	3125.0	3133.3	8.3	8.3	100	170	2428.3	2356.1	Bit Trip; Oriented Core
7-06	1	293	3133.3	3143.3	10.0	10.0	100	255	2438.3	2366.1	70% Returns; Oriented Core
7-07	2	294	3143.3	3144.3	1.0	0.7	70	30	2439.3	2366.8	
7-07	2	295	3144.3	3147.0	2.7	0.0	0	60	2442.0	2366.8	
7-07	2	296	3147.0	3148.5	1.5	0.8	53	30	2443.5	2367.6	
7-07	1	297	3148.5	3155.5	7.0	7.0	100	65	2450.5	2374.6	
7-07	1	298	3155.5	3156.5	1.0	0.7	70	20	2451.5	2375.3	
7-07	1	299	3156.5	3158.5	2.0	2.0	100	35	2453.5	2377.0	
7-10	1	300	3158.5	3158.2	9.7	9.7	100	130	2463.2	2387.0	
7-10	1	301	3158.2	3192.5	14.3	13.3	97	85	2477.5	2400.1	
7-10	1	302	3182.5	3202.1	19.6	19.6	100	80	2497.1	2420.5	
7-10	2	303	3202.1	3213.0	10.9	11.2	103	35	2508.0	2431.7	
7-11	2	304	3213.0	3225.0	12.0	11.0	92	80	2520.0	2442.7	
7-11	2	305	3225.0	3237.0	12.0	10.7	99	55	2532.0	2453.4	
7-11	1	306	3237.0	3242.5	5.5	6.1	111	50	2537.5	2459.5	80% Returns
7-11	1	307	3242.5	3262.5	20.0	20.1	101	50	2557.5	2479.6	
7-11	1	308	3262.5	3282.5	20.0	19.9	100	30	2577.5	2499.5	
7-11	1	309	3282.5	3282.8	0.3	0.7	233	15	2577.8	2500.2	Bit Trip
7-11	2	310	3282.8	3299.8	17.0	15.7	92	210	2594.9	2515.9	
7-12	2	311	3299.8	3319.8	20.0	20.0	100	90	2614.9	2525.9	
7-12	1	312	3319.8	3321.8	2.0	2.0	100	30	2616.8	2537.9	

TABLE III (continued)

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY		CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%		FEET CORED	CORE REC'D	
7-12	1	313	3321.8	3324.8	3.0	3.0	100	25	2619.8	2540.9	
7-12	1	314	3324.8	3342.0	17.2	17.5	102	160	2637.0	2558.4	
7-12	1	315	3342.0	3362.5	20.5	20.1	98	150	2657.5	2578.5	
7-12	2	316	3362.5	3382.5	20.0	20.0	100	110	2677.5	2598.5	
7-12	2	317	3382.5	3402.5	20.0	20.0	100	190	2697.5	2618.5	
7-13	2	318	3402.5	3419.5	17.0	17.0	100	195	2714.5	2635.5	
7-13	2	319	3419.5	3439.5	20.0	19.0	95	140	2734.5	2654.5	
7-13	1	320	3439.5	3443.5	4.0	3.7	93	30	2738.5	2658.2	
7-13	1	321	3443.5	3450.8	7.3	7.3	100	50	2745.8	2665.5	Lost Returns
7-13	1	322	3450.8	3458.0	7.2	7.5	104	55	2753.0	2673.0	
7-13	1	323	3458.0	3478.0	20.0	19.6	98	140	2773.0	2692.5	
7-13	2	324	3478.0	3498.0	20.0	19.4	97	190	2793.0	2712.0	
7-14	2	325	3498.0	3518.0	20.0	20.0	100	240	2813.0	2732.0	Bit Trip
7-14	1	326	3518.0	3527.0	9.0	9.0	100	150	2822.0	2741.0	Bit Trip; Oriented Core
7-14	2	327	3527.0	3547.0	20.0	20.0	100	205	2842.0	2761.0	
7-15	2	328	3547.0	3567.0	20.0	17.7	89	200	2862.0	2778.7	
7-17	1	329	3567.0	3582.0	15.0	15.0	100	130	2877.0	2793.7	
7-17	1	330	3582.0	3602.0	20.0	20.0	100	135	2897.0	2813.7	Lost Returns
7-17	1	331	3602.0	3622.0	20.0	20.0	100	220	2917.0	2833.7	
7-18	1	332	3622.0	3642.0	20.0	20.0	100	180	2937.0	2853.7	
7-18	1	333	3642.0	3662.0	20.0	20.0	100	190	2957.0	2873.7	Bit Trip
7-19	1	334	3662.0	3672.0	10.0	10.0	100	130	2967.0	2883.7	Bit Trip; Oriented Core
7-20	1	335	3672.0	3682.0	10.0	10.0	100	105	2977.0	2893.7	
7-20	1	336	3682.0	3694.0	12.0	11.5	96	100	2989.0	2905.2	
7-20	1	337	3694.0	3702.0	8.0	8.0	100	120	2997.0	2910.2	
7-21	1	338	3702.0	3722.0	20.0	20.0	100	260	3017.0	2930.2	
7-21	1	339	3722.0	3730.0	8.0	8.0	100	105	3025.0	2941.2	
7-21	1	340	3730.0	3735.5	5.5	5.5	100	15	3029.5	2944.7	Bit Trip
7-24	1	341	3735.5	3745.5	10.0	9.7	98	195	3039.5	2954.5	Oriented Core
7-25	1	342	3745.5	3762.5	17.0	16.5	103	220	3057.5	2974.0	
7-25	12	343	3762.5	3780.5	18.0	17.0	100	230	3077.5	2994.0	
7-26	2	344	3780.5	3802.0	21.5	19.7	92	235	3097.0	3010.7	
7-26	2	345	3802.0	3821.0	19.0	18.3	99	160	3116.0	3031.9	Lost Returns
7-26	1	346	3821.0	3841.0	20.0	20.0	100	175	3136.0	3051.9	
7-26	1	347	3841.0	3844.0	3.0	3.0	100	45	3139.0	3054.9	
7-26	2	348	3844.0	3851.0	7.0	6.5	101	90	3146.0	3063.4	
7-26	2	349	3851.0	3862.0	11.0	10.2	93	110	3157.0	3073.6	
7-26	2	350	3862.0	3870.0	8.0	8.0	100	35	3165.0	3081.6	Lost Returns
7-27	2	351	3870.0	3882.0	12.0	12.0	100	115	3177.0	3092.6	

CORING RECORD

DATE	SHIFT	CORE NO.	INTERVAL			RECOVERY			CORE TIME MIN	CUMULATIVE		REMARKS
			FROM	TO	FT.	FT.	%	FEET CORED		CORE REC'D		
7-27	1	352	3882.0	3896.0	14.0	13.0	93	135	3191.0	3106.6		
7-27	1	353	3896.0	3900.0	4.0	4.0	100	40	3195.0	3110.6	Bit Trip	
7-27	2	354	3900.0	3902.0	2.0	1.0	50	40	3197.0	3111.6		
7-27	2	355	3902.0	3905.5	3.5	3.0	86	50	3200.5	3114.6	Bit Trip; Oriented Core	
7-28	1	356	3905.5	3911.5	6.0	6.5	108	80	3206.5	3121.1		
7-28	1	357	3911.5	3922.5	11.0	11.3	103	120	3217.5	3132.4		
7-28	1	358	3922.5	3936.5	14.0	13.5	96	85	3231.5	3145.9		
7-28	2	359	3936.5	3945.9	9.4	7.7	82	65	3240.9	3153.5		
7-29	2	360	3945.9	3956.5	10.6	9.7	92	65	3251.5	3163.3	Lost Returns	
7-31	1	361	3956.5	3962.5	6.0	8.0	133	75	3257.5	3171.3		
7-31	1	362	3962.5	3982.5	20.0	20.0	100	195	3277.5	3191.3		
7-31	2	363	3982.5	3994.0	11.5	9.0	78	110	3289.0	3200.3		
8-01	2	364	3994.0	4002.0	8.0	11.0	138	120	3297.0	3211.3		
8-01	2	365	4002.0	4006.0	4.0	3.0	75	50	3301.0	3214.3	Lost Returns	
8-01	2	366	4006.0	4011.0	5.0	1.0	20	70	3306.0	3215.3		
8-01	1	367	4011.0	4022.0	11.0	11.0	100	240	3317.0	3226.3		
8-01	2	368	4022.0	4042.0	20.0	19.9	100	350	3337.0	3246.2		
8-02	2	369	4042.0	4062.0	20.0	20.1	101	355	3357.0	3266.3	Bit Trip	
8-02	1	370	4062.0	4072.0	10.0	9.8	98	180	3367.0	3276.1	Bit Trip; Oriented Core	
8-03	2	371	4072.0	4080.5	8.5	8.5	100	140	3375.5	3284.6		
8-03	1	372	4080.5	4100.5	20.0	20.0	100	240	3395.5	3304.6	Lost Returns	
CORE DIAMETER = 2 1/4" FROM INTERVALS 589.0 - 702.0 FEET AND 718.0 - 2734.0 FEET												
CORE DIAMETER = 1 1/2" FROM INTERVAL 2734.0 - 4100.5 FEET												
ALL CORE DEPTH INTERVALS WERE DETERMINED BY BOYLES BROTHERS DRILLING COMPANY DRILLERS												
THESE DEPTHS WERE MEASURED TO GROUND LEVEL												

TABLE IV
ORIENTED CORING RECORD

ORIENTED CORE RUN NO.	SEQUENTIAL CORE RUN NO.	INTERVAL FT.	LENGTH OF RUN FT.	CORE RECOVERED FT.	REMARKS
1	268	2,922.5-2,932.5	10.0	10.0	NOT USABLE, CAMERA MALFUNCTION.
2	269	2,932.5-2,942.2	9.7	4.5	NOT USABLE, MISLATCH DUE TO DEFECTIVE EQUIPMENT.
3	271	2,943.0-2,953.0	10.0	9.1	NOT USABLE, CAMERA MALFUNCTION.
4	292	3,125.0-3,133.3	8.3	8.3	NOT USABLE, CAMERA MALFUNCTION.
5	293	3,133.3-3,143.3	10.0	10.0	USABLE.
6	326	3,518.0-3,527.0	9.0	9.0	USABLE.
7	334	3,662.0-3,672.0	10.0	10.0	USABLE, UMTANUM.
8	341	3,733.5-3,743.5	10.0	9.8	USABLE, UMTANUM.
9	354	3,900.0-3,902.0	2.0	1.0	NOT USABLE, ROCK BADLY BROKEN.
10	355	3,902.0-3,905.5	3.5	3.0	USABLE.
11	370	4,062.0-4,072.0	10.0	9.8	USABLE.

TABLE V

MUD RECORD

<u>Date</u> <u>1978</u>	<u>Weight</u>	<u>Viscosity</u>		<u>Yp</u>	<u>Gels</u> <u>(10 sec/10 min)</u>	<u>pH</u>
		<u>Sec</u>	<u>Pv</u>			
4-28	8.6	45	17	2	1/1	9.5
5-04	8.4	35	9	12	0/1	9.5
5-05	---	34	9	10	0/1	9.5
5-08	8.5	38	13	20	1/2	9.0
5-09	8.6	66	26	46	3/6	9.5
5-10	8.5	55	16	27	2/3	9.5
5-11	8.5	56	16	28	2/3	9.5
5-12	8.5	84	33	66	3/6	9.5
5-13	8.5	58	18	29	2/3	9.0
5-15	8.5	55	16	27	1/2	9.5
5-16	8.5	60	19	30	2/3	9.0
5-17	8.5	60	18	29	2/3	9.0
5-18	8.5	59	18	29	2/3	9.0
5-30	8.5	65	23	46	2/3	9.0
5-31	8.4	51	19	29	2/2	9.0
6-01	8.4	51	19	29	2/2	9.0
6-02	8.4	56	17	27	2/3	9.5
6-05	8.4	53	16	24	2/3	9.5
6-06	8.4	37	12	26	1/2	9.0
6-07	8.4	43	16	22	2/3	9.5
6-08	8.4	46	16	25	2/3	9.0
6-09	8.4	42	16	22	2/3	9.5
6-12	8.5	43	16	22	2/3	9.5
6-24	8.4	44	17	28	2/3	9.0
6-26	8.4	36	11	15	1/1	9.5
6-27	8.4	29	7	6	0/1	9.0
6-28	8.4	29	7	6	0/1	9.0
6-29	8.4	31	8	7	1/1	9.0
6-30	8.4	31	6	9	1/1	9.0
7-06	8.4	26	6	2	0/0	8.5
7-07	8.4	27	1	4	0/0	8.5

TABLE V (continued)

MUD RECORD

<u>Date</u> <u>1978</u>	<u>Weight</u>	<u>Viscosity</u>		<u>Yp</u>	<u>Gels</u> <u>(10 sec/10 min)</u>	<u>pH</u>
		<u>Sec</u>	<u>Pv</u>			
7-10	8.4	36	10	14	1/2	9.0
7-11	8.4	35	7	8	1/1	9.0
7-12	8.4	36	7	8	1/1	9.0
7-13	8.4	32	8	7	1/1	9.0
7-14	8.4	37	15	11	1/1	9.0
7-17	8.4	35	7	8	1/1	9.0
7-18	8.4	38	8	10	1/1	9.0
7-19	8.4	29	3	4	0/1	9.0
7-20	8.4	33	10	2	0/1	9.0
7-21	8.4	36	12	8	---	9.0
7-24	8.4	37	13	8	0/1	8.5
7-25	8.4	38	13	8	0/1	8.5
7-26	8.3	30	6	10	0/1	9.0
7-27	8.4	35	5	8	1/1	9.0
7-28	---	42	14	22	1/2	9.0
7-31	8.4	33	10	2	0/1	8.5
8-01	8.4	36	10	6	0/1	8.5
8-02	8.5	41	15	23	1/1	8.5
8-03	8.4	35	10	14	0/1	8.5

TABLE VI

SERVICE COMPANIES AND EQUIPMENT SUPPLIERS

Boyles Brothers Drilling Company, Spokane, Washington -
Core rig, water truck, and casing.

Christensen Diamond Products, U.S.A., Salt Lake City, Utah -
Reamers and oriented coring.

Drilling Fluid Specialists, Inc., El Segundo, California -
Mud products and services.

J. A. Jones Construction Services Company, Richland, Washington -
Site construction.

Monarch Machine Shop, Pasco, Washington -
Cap plate.

Western Building Supply Company, Pasco, Washington -
Cement.

TABLE VII
GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Hanford (Informal)	(0 - ?)		Glaciofluvial sediments.	
	Contact not identified.			
Ringold	(? - 702 Assumed)		Clay, silt, sand, gravel, and conglomerate.	
	Contact not identified.			
Saddle Mountains	Elephant Mountain (702 - Assumed - 845)	2nd Flow Present (702 assumed 751)	702 - 718	Assumed basalt drilled with rock bit.
			718 - 732	Basalt, vesicular (20%), unaltered.
			732 - 743	Basalt, unaltered, medium phaneritic.
			743 - 746 746 - 751	Basalt, 5% vesicles. Basalt, unaltered, medium phaneritic.
		1st Flow Present (751 - 845)	751 - 770	Basalt flow breccia, 3 ft. of cindery scoria- ceous clasts grading to clasts of dense vesicular basalt with light green clay matrix, rubbly.
			770 - 780	Basalt, vesicular (10%), low-angle fractures and rubble, aphanitic.
			780 - 832 832 - 845	Basalt, high-angle frac- tures, dense, aphanitic. Basalt, scattered vesicl- es, less than 1 mm (1/32 in.).
		Rattlesnake Ridge Mem- ber (Inter- bed) 845 - 918	845 - 918	Brown and green silty claystone with some hori- zontal calcareous band- ing. Few lenses of con- glomerate and sandstone.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Saddle Mountains	Pomona (918-1083)	1st Flow (918-1083)	918 - 920	Basalt breccia, glassy and cindery.
			920 - 930	Basalt, reddish gray, 10-15% vesicles, finely phaneritic.
			930 - 944	Basalt, unaltered, high-angle fractures filled with green clay, large plagioclase phenocrysts.
			944 - 962	Basalt, unaltered, vugs to 3 cm (1-1/4-in.) lined with green clay, few amygdules.
			962 - 1044	Basalt, unaltered, dense, aphanitic, columnar fractures white plagioclase phenocrysts <3 mm (1/8 in.).
			1044 - 1058	Basalt, dense, frequent hairlines, plagioclase and pyroxene phenocrysts.
			1058 - 1082	Basalt, some flow banding, finely phaneritic, scattered vesicles.
			1082 - 1083	Basalt, 10% vesicles, <2 mm (1/16 in.).
		Selah Member (Interbed) (1083 - 1098)	1083 - 1098	Well-indurated baked brown sandstone becoming a coarse green sandstone downward.
	Esquatzel (1098-1207)	1st Flow (1098-1207)	1098 - 1112	Basalt flow breccia, vesicular clasts, green clay matrix, competent.
			1112 - 1117	Basalt, aphanitic, rubbly.
			1117 - 1164	Basalt, aphanitic, dense, sinusoidal fractures, frequent white plagioclase clots to 5 mm (1/4 in.).
			1164 - 1206	Basalt, aphanitic, few plagioclase clots, sinusoidal fractures.
			1206 - 1207	Basalt, aphanitic, 1% small vesicles.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Saddle Mountains		Cold Creek (Interbed) (1207-1282)	1207 - 1210	Baked dark green sandstone.
			1210 - 1228	Dark green sandy sandstone.
			1228 - 1282	Conglomerate of basalt, with zones of green sand, basalt and quartz matrix.
	Umatilla (1282-1505)	1st Flow (1282-1505)	1282 - 1286	Basalt flow breccia, green clay matrix.
			1286 - 1308	Basalt, aphanitic with 10% vugs up to 60 mm (2-3/8 in.) diameter.
			1308 - 1362	Basalt, aphanitic, frequent entablature type fractures.
			1362 - 1505	Basalt, aphanitic, dense with hairline fractures, some ground water alteration on fractures.
		Mabton Member (Interbed) (1505-1569)	1505 - 1569	Green lithified sandstone and light green silty clay.
	Wanapum	10 Flows present here (1569-2683.3)	10th Flow (1569-1697)	1569 - 1597
1597 - 1612				Basalt, finely phaneritic, vesicular and amygdaloidal.
1612 - 1697				Basalt, medium to coarsely phaneritic with abundant plagioclase phenocrysts high-angle fractures.
9th Flow (1697-1789)			1697 - 1703.5	Basalt flow breccia.
			1703.5 - 1733.5	Basalt, diktytaxitic up to 20% vesicles, few small baked zones.
		1733.5 - 1789	Basalt, medium phaneritic moderately fractured.	

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Wanapum		8th Flow (1789 - 2000.5)	1789 - 1806	Basalt flow breccia, altered basalt and rubble porphyritic, large plagioclase crystals.
			1806 - 1837	Basalt flow breccia, weathered and altered to a dark red color, few scattered vugs.
			1837 - 2000.5	Basalt, fine to medium phaneritic dense, abun- dant large clots plagio- clase crystals, few minor broken zones, 1889-1891 ft. two 90° fractures with slicken- sides.
		Squaw Creek Member In- terbed (2000.5 - 2003)	2000.5 - 2003	Banded tuff and ash, little brecciation,
		7th Flow (2003 - 2034)	2003 - 2013	Flow rubble, 10% recovery.
			2000.5 - 2034	Basalt, vesicular and vuggy. Basalt, medium phaneritic moderately fractured.
		6th Flow (2034 - 2101)	2034 - 2060.5	Basalt flow breccia, highly altered vesicular clasts.
			2060.5 - 2076	Basalt, aphanitic with 10% vesicles and amyg- dules, fractured.
			2076 - 2101	Basalt, finely phaneritic, dense.
		5th Flow (2101 - 2217)	2101 - 2120	Basalt flow breccia, ves- icular clasts with green clay matrix.
			2120 - 2123	Basalt, vesicular, aphan- itic.
			2123 - 2146	Basalt, aphanitic, frac- tured, 5% amygdules and vugs.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.			
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION
Wanapum			2146 - 2164 Basalt, finely phaneritic, few fractures.
			2164 - 2217 Basalt, aphanitic, some flow banding and amygdules.
		4th Flow	2217 - 2219 Basalt, breccia, altered to clay.
			2219 - 2228 Basalt, large plagioclase phenocrysts, 20% vesicles.
			2228 - 2242 Basalt, medium phaneritic, abundant plagioclase phenocrysts.
			2242 - 2246 Basalt, 20% vesicles.
			2246 - 2250 Basalt, medium phaneritic, large plagioclase clots.
			2250 - 2251 Basalt, highly altered.
			2251 - 2261 Basalt, vesicles (10-35%).
			2261 - 2277.5 Basalt, medium phaneritic, scattered plagioclase phenocrysts up to 7 mm (1/4 in.).
			2277.5 - 2279 Basalt, altered and vesicular.
			2279 - 2286.5 Basalt, aphanitic with 25% vesicles and vugs.
			2286.5 - 2294 Basalt, finely phaneritic, scattered plagioclase clots.
			2294 - 2306 Basalt, slightly altered 25% vesicles and vugs.
			2306 - 2319 Basalt flow breccia, slightly altered, some white clay.
			2319 - 2338 Basalt, finely phaneritic scattered plagioclase phenocrysts up to 5 mm (1/4 in.).
		3rd Flow (2338 - 2439.5)	2338 - 2339 Basalt, black altered.
			2339 - 2374 Basalt, 10% vugs and vesicles.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.			
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION
Wanapum			2374 - 2400 Basalt, finely phaneritic, scattered vugs to 3.5 mm (1-3/8 in.) diameter.
			2400 - 2425 Basalt, finely phaneritic slightly fractured.
			2425 - 2439.5 Basalt, 15% vesicles.
		2nd Flow (2439.5 - 2603.6)	2439.5 - 2441 Basalt flow breccia, slightly altered.
			2441 - 2483 Basalt, finely phaneritic with 0-15% vesicles and vugs, less than 5 mm (1/4 in.).
			2483 - 2504 Basalt, medium phaneritic with platioclase phenocrysts 3.5 mm (-3/8 in.).
			2504 - 2554 Basalt, aphanitic, moderate to highly fractured.
			2554 - 2603 .6 Basalt, aphanitic, few colonnade-type fractures dense.
		1st Flow (2603.6 - 2683.3)	2603.6 - 2605 Basalt flow breccia, altered.
			2605 - 2628 Basalt, finely phaneritic, fractured, less than 10% vugs and amygdules filled with quartz or clay.
			2628 - 2640 Basalt, finely phaneritic, some poker chipping up to 18/ft.
			2640 - 2683.3 Basalt, finely phaneritic, few colonnade fractures.
		Vantage Member (Interbed) 2683.3 - 2685.8	2683.3 - 2685.8 Lithic tuff, dark brown, highly altered basalt.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Grande Ronde	Upper 14 Flows Penetrated (2685.8 - 4100.5) Base of Formation Not Reached.	14th Flow (2685.8 - 2752.5)	2685.8 - 2688	Basalt, moderate to highly altered, 15% vesicles and vugs.
			2688 - 2694	Basalt, unaltered, vesicular.
			2695 - 2704	Basalt, finely phaneritic some flow banding.
			2704 - 2713	Basalt moderately altered, 15% vugs, some rubble zones.
			2713 - 2720	Basalt, medium phaneritic, few fractures.
			2720 - 2725	Basalt, some alteration, few vugs with white SiO ₂ .
			2725 - 2729	Basalt, moderately weathered, 40% vesicles and vugs, to 4 mm (1/8 in.).
			2729 - 2752.5	Basalt, slightly altered, moderately fractured, diktytaxitic.
		13th Flow (2752.5 - 2812)	2752.5 - 2764.6	Basalt, highly altered flow breccia, abundant blue-green clay.
			2764.5 - 2779	Basalt, slightly altered, 1% vugs and amygdules to 2 cm (3/4 in.) with SiO ₂ .
			2779 - 2792	Basalt, slightly altered, fractured, finely phaneritic, flow banding.
			2792 - 2812	Basalt, slightly altered, very few fractures.
		12th Flow (2812-2966)	2812 - 2822.5	Basalt flow breccia, highly altered, vesicular clasts (15% vesicles).
			2822.5 - 2841.5	Basalt, moderately fractured aphanitic, 2% vugs flow unit breccia 2839.5-2840.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.			
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION
Grande Ronde			2841.5 - 2900 Basalt, aphanitic, up to 10% vugs and vesicles up to 17/ft. poker chips.
			2900 - 2932.5 Basalt, aphanitic, colonnade fractures.
			2932.5 - 2966 Basalt, aphanitic, low-angle fractures and poker chips.
		11th Flow (2966 - 3032.5)	2966 - 2967.5 Basalt, flow unit breccia, moderately altered, gray-green.
			2967.5 - 2997.5 Basalt, medium phaneritic 15% vugs up to 1.5 cm. (5/8 in.) diameter with light green clay and quartz.
			2997.5 - 3032.5 Basalt, medium phaneritic, dense.
		10th Flow	3032.5 - 3040 Basalt, 20% vugs and vesicles up to 2 cm (3/4 in.) some filled with green clay.
			3040 - 3073.9 Basalt flow breccia, oxidized clasts with green clay matrix.
			3073.9 - 3125 Basalt, moderately fractured aphanitic.
			3125 - 3198.8 Basalt, aphanitic, frequent zones of poker chips, some flow banding.
			3198.8 - 3225 Basalt, aphanitic, colonnade fractures, few tiny vesicles at 3224 ft.
		9th Flow (3225 - 3297)	3225 - 3236.4 Basalt flow breccia, highly altered, and decomposed clasts, gray-green.
			3236.4 - 3256 Basalt, medium phaneritic with 10% vugs to 2 cm (3/4 in.).
			3256 - 3297 Basalt, finely phaneritic, poker chips 3276.5-3282.5 ft.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.			
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION
Grande Ronde		8th Flow (3297 - 3334.5)	3297 - 3302 Basalt flow unit breccia, moderately altered. 3302 - 3318 Basalt, moderately altered with 5% vugs to 2.5 cm (1 in.). 3318 - 3334.5 Basalt slightly altered, some rubble, aphanitic, 2% vesicles at contact.
		7th Flow (3334.5 - 3422)	3334.5 - 3342 Basalt flow breccia moderately altered. 3342 - 3374.5 Basalt, moderately altered, 10% amygdules and vesicles. 3374.5 - 3422 Basalt, aphanitic, moderately fractured, poker chips 3402.5 to 3406.0; 5% vesicles.
		6th Flow	3422 - 3459 Basalt flow breccia, moderately altered, clasts up to 1 foot long, dense, gray color. 3459 - 3527 Basalt, moderately fractured with few poker chip zones, finely phaneritic. 3527 - 3559.5 Basalt, aphanitic, few fractures, some flow banding.
		Umtanum Upper Unit 5th Flow (3559.5 - 3801)	3559.5 - 3567 Basalt flow breccia, highly altered, vesicular clasts, dark green clay matrix. 3567 - 3579 Basalt, some breccia, moderately altered, few one-foot zones with 5% vesicles. 3579 - 3582 Basalt, aphanitic, moderately fractured. 3582 - 3602 Basalt flow breccia, moderately altered, clasts of altered vesicular basalt, few vugs to 5 cm (2 in.).
	Low MgO		

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.			
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION
Grande Ronde			3602 - 3649 Basalt flow breccia, slight alteration, SiO_2 cementation of clasts, few vugs.
			3649 - 3694 Basalt, moderately fractured, aphanitic, scattered poker chips and rubble zones.
			3694 - 3801 Basalt, aphanitic, moderately fractured, some rubble zones and poker chipping (8-12/ft.).
		Umtanum Lower Unit 4th Flow (3801-3823)	3801 - 3807 Basalt flow breccia, moderately altered, no distinct clasts.
			3807 - 3823 Basalt, slightly altered, aphanitic, moderately fractured with rubble zones.
	Low K_2O Unit II	3rd Flow (3823 - 3907.5)	3823 - 3841 Basalt, medium to coarsely phaneritic, 10% amygdules.
			3841 - 3907.5 Basalt, medium to coarsely phaneritic, entablature type fractures.
	Low K_2O Unit I	2nd Flow (3907.5 - 3960)	3907.5 - 3911.5 Basalt flow unit breccia, moderately altered, indistinct breccia clasts.
			3911.5 - 3924 Basalt, medium phaneritic, moderately fractured, scattered amygdules and vesicles.
			3924 - 3940 Basalt flow breccia, moderately altered, vesicular clasts, dense and "muddy" 3933.5 - 3936.5.
			3940 - 3960 Basalt, moderately fractured, medium phaneritic with white plagioclase phenocrysts.

TABLE VII (continued)

GEOLOGIC CORE LOG

DEPTH INTERVALS IN FT.				
FORMATION	MEMBER	INDIVIDUAL FLOW OR INTERBED	DESCRIPTION	
Grande Ronde	Low MgO	1st Flow (3960 - 4100.5)	3960 - 4019	Basalt, aphanitic, very rubbly and poker chipped (12/ft.), 5% white amygdules.
		Base of flow not reached	4019 - 4062	Basalt, aphanitic, very dense and few fractures, scattered amygdules.
		Base of for- mation not reached.	4062 - 4080.5	Basalt, aphanitic, rubble and poker chips.
			4080.5 - 4100.5	Basalt, aphanitic, moderately fractured, poker chips infrequent.

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