

**R. W. DIRKS PETROLEUM ENGINEER, INC.**

OIL FIELD DRILLING &amp; PRODUCTION SUPERVISION

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## DRILLING SUMMARY

The purpose of this report is to briefly describe the drilling and completion procedures used in completing the geothermal resource project known as the Lackland AFB #1 in Bexar County, Texas.

This project was initiated on September 16, 1983 when a representative of R. W. Dirks Petroleum Engineer, Inc. met with location contractors and took bids on building the location site to satisfy the drilling rig requirements. C. F. Thomas & Co. was awarded the contract based on the best bid.

The location site was prepared on October 4, 1983 with no complications. The 13-3/8" surface pipe was delivered on October 8, 1983 before the rig was moved in. Since no rig equipment was available, pipe handling equipment had to be brought in at additional cost.

Conductor pipe was set and cemented in place on October 14 through October 15, 1983. A spud meeting was held in the offices of John Nepute with Lackland A.F.B. on October 15, 1983. All primary service companies were present along with representatives of Lackland A.F.B., University of Utah Research Institute, and R. W. Dirks Petroleum Engineer, Inc.

Magee-Poole Drilling Co. moved in and rigged up on location

On October 20, 1983. The well was spudded at 8:00 A.M., October 21, 1983. The first 24 hours resulted in 1034 feet of hole drilled. The 17½" surface hole reached TD at 2046 feet on day 5 of the project. The estimated time to drill this interval was 3 days. The additional 2 days could be attributed to several factors:

1. The formation was much harder and denser than anticipated which resulted in lower penetration rates and frequent bit trips.
2. The drilling contractor was using reconditioned bits instead of new ones, which resulted in shorter bit life.
3. Large diameter holes require more viscous drilling fluids for proper cutting removal, thus decreasing penetration rates.

The surface hole was logged by Dresser Atlas as planned. The 13-3/8" surface casing was run and cemented in place by Halliburton. Cement was circulated to surface with no complications.

The 13-3/8" casing head was welded in place and BOP's were installed and tested. On October 28, 1983, which was day 8 of the project, the casing and the casing shoe were tested to 1500 psi. The test was satisfactory, thus assuring zone isolation of the Edwards Aquifer.

The 12¼" intermediate interval was initiated on day 8 of the project. This interval reached TD of 3764 feet on day 13 of the project.

The estimated time to drill this interval was 3 days. The additional 3 days were the result of the same reasons mentioned previously. The well was logged and a 9-5/8" liner was run and cemented in place.

At this time, when the well bore was stable, the drilling fluid, which was a lignosulfonate system, was displaced, and a biodegradable polymer mud system was introduced.

On day 16 of the project, the target sand was penetrated and drilling the 8-3/4" hole began. It took 1½ days to drill the 364 feet of sand. It was estimated to take only 10 to 15 hours; however, hard formation was encountered and penetration rates were very low. TD was reached on day 17 of the project, which was November 6, 1983.

The well was logged. Miscommunication between Dresser-Atlas's offices in Victoria and Gonzales resulted in no temperature tool being sent out on the job when ordered, and a lack of experience with the tool resulted in additional delays.

After the logs were evaluated, the decision was made to run a Halliburton DST to evaluate the flow properties of the reservoir. The test indicated normal pressure with a high fluid level. At this time, it was decided to enlarge the hole to maximize fluid recovery.

The underreaming was estimated to take one day, when the project was designed; however, the actual underreaming took 4 days. This resulted in doubling the mud cost due to the fact that the polymer mud system was in the hole much longer than anticipated.

After the well bore was underreamed, the interval was washed with a 7½% HCl solution to clean the face of the formation. After the acid job, a stainless steel wire wrapped screened 7" liner was installed. Dowell rigged up and pumped a gravel pack slurry. The initial slurry was insufficient to effectively pack off. A second slurry was prepared, and the interval was successfully packed off on November 14, 1983, which was day 25 of the project. The rig was released at 7:00 A.M. on November 15, 1983. The Christmas tree assembly was installed and the rig equipment was moved off location.

On November 17, 1983, the location was cleaned up and prepared for a completion rig. The rig was rigged up on November 18, 1983, and Gearhart Logging Company attempted to run a cement bond log. There were malfunctions in both the logging tool and the logging panel.

After running the cement bond log, the next day, 2-3/8" tubing was run to 600 feet, and the well was jetted for 9 hours. Fesco was rigged up and recorded bottom hole pressure and temperature data.

The completion rig was released on November 20, 1983. All rental equipment and service companies were released. The location was cleaned up and restored with all pits covered. The well is currently shut in and waiting on completion evaluation.







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Lackland AFB

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LEASE \_\_\_\_\_ WELL NO. 1 FIELD \_\_\_\_\_ Bexar County, Tx.

DATE DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS

10-21-83		Present operation: Making up bit. Remarks: 18 hrs. rigging up Magee-Poole; 10 hrs. nipling up Conductor pipe, Moved 13-3/8 casing to pipe rack and measured same; 1 hr. ream mouse hole and drill rat hole; 2 hrs. pick up, make up Bottom hole assembly.
10-22-83	1034	Present operation: Drilling. Remarks: 1/2 hr. rig service 3 1/2 hrs. drilling; 1/2 hr. unplug flow line; 4 1/2 hrs. drilling; 1/2 hr. survey; 14 1/2 hrs. drilling.
10-23-83	1438	Present operation: Drilling. Remarks: 1/2 hr. rig service; 15 1/2 hrs. drilling; 1/2 hr. slug and survey; 2 1/2 hrs. TFB; 5 hrs. drilling.
10-24-83	1736	Present operation: Drilling. Remarks: 1/2 hr. rig service; 23 1/2 hrs. drilling. Background gas 12, Connection gas 0, Trip gas 0, Max. Gas 12, ROP 8.
10-25-83	1960	Present operation: Drilling. Remarks: 1/2 hr. rig service; 1/2 hrs. drilling; 1/2 hr. slug and survey; 3 hrs. TFB 3A,; 1/2 hr. ream from 1700' to 1745'; 19 hrs. drilling.
10-26-83	2046	Present operation: Circulate and condition. Remarks: 1/2 hr. rig service; 1 hr. drilling; 3 hrs. slug and TFB 4A; 4 1/2 hrs. drilling; 1/2 hr. short trip; 1 1/2 hrs. circulate and condition; 1/2 hr. slug and survey; 1 1/2 hrs. POH, laid down 2, 17 1/2" stabilizers; 1 1/2 hrs. rig up Dresser Atlas, TIH w/log tools. Tagged up @ 2043; 3 1/2 hrs. logging; 3 hrs. wireline coring; 2 1/2 hrs. rig down Dresser & TIH; 8 1/2 hrs. circulate and condition. Background gas 8 units, connection gas 0 units; trip gas 0 units; Max. Gas 8 units; ROP 7 units.
10-27-83	2046	Present operation: WOC. Remarks: 1 hr. circulating; 1 1/2 hrs. POH to run 13-3/8 casing; 1 hr. rig up casing crew; 3 1/2 hrs. wait on elevator bails; 8 hrs. ran 51 jts. 13-3/8 casing; 1/2 hr. rig up Halliburton; 1/2 hr. circulate and condition; 3 1/2 hrs. cement casing w/900 sks 85/15 Poz mix + 8% gel, 3% salt, mixed @ 12.7#/gel. Tailed in w/410 sks common cement. Mixed @ 15.6#/gal.; 4 1/2 hrs. WOC. Casing set @ 2043.
10-28-83		Present operation; Nipling up, Remarks; 2 hrs. wait on cement; 10 hrs, cut off 20' conductor + 13-3/8 surface casing. Weld on and test head to 1800 psi and held OK; 12 hrs. nipple up 13-5/8" BOP stack.
10-29-83	2379	Present operation: Drilling. Remarks: 4 hrs. finish nipling up and test BOP to 2000, Test OK; 1 hr. TIH and tag plug @ 1998; 1 hr. drill plug & 5' of new hole; 1/2 hr. test to 10 ppg, Test OK; 17 1/2 hrs. drilling. Mud Logger: Background gas 4 units, Max G 40 units. ROP 18
10-30-83	2742	Present operation: Drilling. Remarks: 1/2 hr. rig service; 5 1/2 hrs. drilling; 1 1/2 hrs. slug and survey; 4 hrs. TFB 2B, pick up 2 stabilizers; 2 hrs. ream stabilizers back to bottom; 11 1/2 hrs. drilling. Mud Logger: Background gas 3 units, connection gas 3 units, Trip gas 6 units, Max Gas 6 units, ROP 12'/hr.
10-31-83	2983	Present operation: Drilling. Remarks: 1/2 hr. rig service; 8 1/2 hrs. drilling; 3 1/2 hrs. TFB #3B; 11 1/2 hrs. drilling. Mud Logger: Background gas 3 units, Connection gas 0 units, Trip gas 0 units, Max Gas 4 units.
11-1-83	3273	Present operation: Drilling. Remarks: 1/2 hr. rig service; 23 1/2 hrs. drilling. Mud Logger: Background gas 4 units, Connection gas 0 units, Trip Gas 0 units, Max Gas 4 units.



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LEASE Lackland AFB WELL NO. 1 FIELD Bexar County, Texas

DATE DETAILS OF OPERATIONS, DESCRIPTIONS &amp; RESULTS

DATE	WELL NO.	DESCRIPTIONS & RESULTS
11-02-83	3707	Present operation; Drilling. Remarks; ½ hr. rig service; 8½ hrs. drilling; ½ hr. slug and survey; 4 hrs. TFB #4B; 10½ hrs. drilling. Mud Logger; Background gas 4 units, Connection gas 0 units, Trip Gas 0 units, Max Gas 4 units, ROP 22.
11-03-83	3764	Present operation: Running 9-5/8 liner. Remarks: 3 hrs. drilling. 1 hr. circulate bottoms up; ½ hr. 10 stands, short trip; 1½ hrs. circulate bottoms up; 1½ hrs. slug and survey; 1½ hrs. POH to log; 6½ hrs. log and temp. survey w/Dresser Atlas; 2 hrs. TIH and laid down 2 stabilizers; 1½ hrs. circulate and condition; 3 hrs. POH, laid down 2, 9" drill collars; 3 hrs. rig up to run 9-5/8 liner. Mud Logger: Background gas 4 units, Connection gas 0 units, Trip Gas 0 units, Max Gas 4 units, ROP 15.
11-04-83	3764	Present operation: WOC. Remarks: 1 hr. finish running 9-5/8 liner; 1 hr. rig down casing crew, rig up Halliburton; ½ hr. make up liner hanger; 2 hrs. TIH w/29 stands + 1 single of drill pipe and tag bottom; 1 hr. circulate bottoms up; ½ hr. set hanger @ 1837'; 2½ hrs. cement liner w/870 sks Class H w/4% gel. Liner set @ 3757. ½ hr. POH, 10 stands; ½ hr. reverse out; 1½ hrs. POH w/setting tool, laid down same; 1 hr. strap in hole w/BHA + 6 stands drili pipe: 12 hrs. WOC.
11-05-83	3766	Present operation: Cleaning mud tanks. Remarks; 2 hrs. WOC; ½ hr. TIH. Tag at 1401'; 1 hr. circulate while WOC; 2 hrs. drilling cement to 1756'; 3 hrs. circulate while WOC; 1 hr. drill cement to 1835' and tag top of liner at 1835'; 1½ hrs. circulate and condition; ½ hr. tests top to 10.1 mud - held fine; 1½ hrs. POH. Laid down 15 jts. drill pipe and pick up 8-3/4" bit; 1 hr. TIH to top liner and reamed out liner hanger; 1 hr. Finish in hole; 4 hrs. drill float equipment & 2' of new hole; 1 hr. test casing seat to 10.0 mud weight; 2 hrs. displace mud with fresh water; 1½ hrs. clean out mud tanks.
11-06-83	3973	Present operation: Drilling. Remarks; 2 hrs. wash mud tank; 4 hrs. build poly-mud; 12½ hrs. drilling; 3½ hrs. Trip bit 2-C, Laid down 4 jts. drill pipe; 1½ hrs. ream 3831-3955. ½ hr. drilling. Mud Logger: Background Gas 4 units; Max Gas 4 units. TOP 12.
11-07-83	4128	Present operation: Circulate and condition mud to log. Remarks; ½ hr. rig service; 3½ hrs. drilling; 2½ hrs. POH. Change bit, pick up 2 stabilizers and TIH w/BHA; 1 hr. cut and slip drill line; 1 hr. finish in hole; 2 hrs. ream from 3683-3998. Had under gauge hole from 3988-3998; 1 hr. drilling; ½ hr. circulating; 8 hrs. drilling; ½ hr. circulating; ½ hrs. 10 stands, short trip; 2 hrs. circulate and condition mud to log. Mud Logger: Background gas 4 units, Max Gas 4 units. ROP 15.
11-08-83	4128	Present operation; Test well w/Halliburton test tool. Remarks; 2 hrs. POH; 12½ hrs. rig up loggers, log w/Dresser Atlas Ran induction, compensated density, compensated neutron gamma ray plus temperature survey and shot 10 sidewall cores; 2½ hrs. wait on Halliburton test tools; 1½ hrs. pick and made up test tools; 2½ hrs. TIH, set packer @ 3707; 3 hrs. test well.
11-09-83	3788	Present operation: Underreaming. Remarks: 1½ hrs. test well w/Halliburton Test Tool; 3 hrs. chain out of hole; 2 hrs. TIH w/bit; 2½ hrs. circulate and condition; 2 hrs. strap out of hole; 2½ hrs. made up underreamer. TIH; 10½ hrs. underream.

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DRILLING RECORD

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LEASE Lackland AFB

WELL NO. 1 FIELD

Bexar County, Texas

DATE	DETAILS OF OPERATIONS, DESCRIPTIONS & RESULTS	
1-10-83	3856	Present operation: Underreaming. Remarks: 3 hrs. underreaming; 1 hr. circulate bottoms up; 2 hrs. POH, laid down underreamer; 5½ hrs. pick up underreamer #2 and inspect drill collars; 1 hr. finish in hole; 11½ hrs. underream.
1-11-83	3933	Present operation: Trip. Remarks: 2 hrs. underreaming; 1 hr. circulate out; 1½ hrs. POH; ½ hr. change cutters on underreamer; 1½ hrs. TIH w/reamer; 15½ hrs. reaming; 1½ hr. circulate bottoms up; ½ hr. POH.
1-12-83	3991	Present operation: Underreaming. Remarks: 2 hrs. TOH; 1½ hrs. TIH w/8½" bit; 2 hrs. wash and ream hole from 3933-4093; 1½ hrs. circulate and condition; 2 hrs. TOH; 2 hrs. pick up underreamer #4 & TIH; 13 hrs. underreaming.
11-13-83	3991	Present operation: Rig up to Pump Acid. Remarks: 1 hr. circulate and condition; 2 hrs. TOH w/underreamer; 2 hrs. TIH w/8½" bit and tag fill in rathole @ 4083; 1½ hrs. circulate and condition; 2 hrs. POH, 7 stands and wait on rathole fill; ½ hr. TIH and tag @ 4077; 1 hr. circulate and condition; 1½ hrs. POH to remove bit and bit sub; 2 hrs. TIH and tag @ 4077; 2 hrs. displace mud w/fresh water; 2 hrs. wash out mud tanks; 2½ hrs. POH, 1 stand to 3983. Spotted 36 cu. ft. sand; 2 hrs. POH to 9-4/8" casing and wait on sand to settle; ½ hr. TIH and tag sand @ 3993; 2' below 16" hole; ½ hr. rig up to flush water w/7½% HCl.
11-14-83	3991	Present operation: Gravel packing. Remarks: 1 hr. flushing water sand w/7½% HCl acid; ½ hr. POH; 5½ hrs. wait on elevator slips and lift nipple to pick up 7" screen. Handling tools furnished by Dowell unable to do job; 4 hrs. pick up 7" screen and 2-7/8" wash pipe; 1 hr. made up Dowell liner hanger and packer assembly; 4½ hrs. TIH w/screen; 2 hrs. set packer and hanger @ 3430, test annular side of packer w/1000 psi and held okay; 3½ hrs. gravel packing, unable to get gravel pack to screen out. 1 hr. made up additional 20 bbls. of gravel pack slurry.
11-15-83	3991	Present operation: Rig released @ 7:00 A.M. Remarks: 2½ hrs. finish gravel packing and reverse out; ½ hr. rig down Dowell; 2 hrs. POH w/setting tool; 1½ hrs. laid down 16 jts. tubing and set tool; 6 hrs. laid down drill collar and drill pipe; 11½ hrs. nipple down BOP, nipple up tree. Clean out mud tanks.
11-16-83		Remarks: Rig down Magee-Poole and return all rentals. SDFN.
11-16-83		Remarks: Prepare well sight for completion rig,
11-18-83		Present operation: Logging w/Gearhart. Remarks: 2½ hrs. wait on completion rig; 1½ hrs. rig up rig; 8 hrs. rig up Gearhart and run CBL gamma Ray. Had trouble w/tool and panel.
11-20-83		Remarks: 2 hrs. jet water well; 1 hr. rig up Fesco unit in hole w/temperature survey tool and bottom hole pressure tool; 9 hrs. jetting well w/Fesco in hole recording data.
11-21-83		Present operation: Rig released @ 2:30 P.M. Remarks: 1½ hrs. ran temperature survey w/Fesco; 4 hrs. jet well; ½ hr. POH. Laid down 15 jts. 2-3/8" tubing; 1½ hrs. rig down Released rig.
11-22-83		Remarks: Load out air compressor, water pumps, water line and 2, 200 bbls. tanks.
11-28-83		Remarks: Cleaned up and restored location - FINAL REPORT