

WELL HISTORY GEOTHERMAL

Operator: C.E. Exploration	Well Name & No.: 88-21 TCH
Field: Newberry KGRA County: Deschutes	Sec. 21 T. 21S R. 12E WB&M

<u>DATE</u>	<u>HISTORY</u>
05/10/95 to 05/11/95	Move in and rig up.
05/12/95	Hook up mud line and mix mud. Drill 12 ¼" hole 21' K.B. to G.L. (11'). Set and cement 11' of 10 ¾" conductor.
05/13/95	Start up and drill 8 ¾" hole from 21' to 31'. Secure rig for night.
05/14/95	Drilled 8 ¾" from 31' to 79'. Lost 25 BBLs mud at 50'. Had full circulation at 79'.
05/15/95	Drill 8 ¾" hole from 79' to 90'. Lost 20 BBLs mud at 90'. Mix mud volume. Drilled from 90' to 96'. Lost returns, approximately 40 BBLs. Mix mud volume. Repair hydr. pump. Start to drill. Lost returns. Plugged bit. Pumping pill. Pulled plugged string. Unplug bit. Drain mud lines and secure rig for night.
05/16/95	Mixed mud and LCM and pumped down hole. Mixed and pumped 10 BBLs cement. WOC. Mixed and pumped 45 BBLs LCM. Washed into 96'. Lost circulation after circulating on bottom. Pumped in 50 BBLs. Mixed and pumped 10 BBLs cement. Mixed with one sack CSH and one sack Kwik-seal and two cubic feet Perlite. WOC.
05/17/95	Feel for top of cement plug with 8 ¾" bit on three drill collars. Found hard cement. Drilled hard cement from 80' to 96'. Lost returns. Mixed five BBLs mud. Drilled from 96' to 112' with lost returns. Last 5" drilled with decrease in loss rate. Pulled drill collars. Mixed LCM and cement with CACL2. (Two sacks CSH, two sacks Kwik-seal, four cubic feet Perlite, one half sack CACL2). Displaced cement plug. CIP at 5:30.
05/18/95	Located top of cement at 99'. POH. Mixed 15 sacks Stuccolite with ½ sack hulls and ½ sack Kwik-seal with 80 gal. Water. Spotted cement at 01:30 hrs. Located top of plug at 95'. Unable to fill hole with high viscosity mud. Mixed plug #5. 20 sacks Portland cement, one sack hulls, one sack Kwik-seal, one sack Perlite and 3% CACL2. CIP at 08:00 hrs. WOC to 11:00 hrs. Filled hole with

5 ½ BBLs mud. WOC to 16:00 hrs. Located top of cement at 81'. Drilled cement from 81' to 112'. Drilled formation from 112' to 113'. Twisted off XO sub on top drill collars. Made up fishing tools. Recovered fish. Drilled 8 ¾" hole from 113' to 128'.

- 05/19/95 Drill 8 ¾" hole from 128' to 308'. Lost circulation at 260'. Pumped 30 BBLs LCM sweep. Regained returns. Drilled with full returns to 270'. Lost 10 BBLs mud. Drilled with full returns to 306'. Lost returns. Drilled to 308'.
- 05/20/95 Pumped Hi-Viscosity mud sweeps (30 BBLs). Regained circulation after 20 BBLs for a short time period. Lost circulation. With open ended 101 pipe hung at 307', displaced a balanced plug consisting of 20 sacks cement, one sack hulls, one sack Kwik-seal, one sack fiber and 3% CC. Theoretical fill = 85'. Attempted to fill hole after 5 hours with no success. Pumped two Gel-LCM, Hi-Viscosity mixes with no success. Estimate fluid level to be at 228'. Mixed a 184 gal. (4.5 BBL), Hi-Viscosity, 20 sacks Cal seal slurry. Displaced through open ended drill pipe hung at 306'. Surface samples very hard after three hours. Tagged top of Cal seal plug at 247'. Mixed Hi-Viscosity Gel sweep. Regained returns. Fluid dropped one foot in five minutes with pump shut down. Pulled open end 101 pipe. RIH with drilling assembly.
- 05/21/95 Drilled cement. Loss circulation plugs from 247' to 308'. Drilled formation from 308' to 309' pumping high viscosity drilling fluid. Lost returns. Mixed and pumped 4-500 gal. LCM mud sweeps. Unable to regain circulation. Pulled drilling assembly. Ran open end 101 tube to 309'. Mixed 20 sacks cement with CSH, Perlite, Fiber, 3% CACL2 and Kwik-seal. Displaced a balanced plug. CIP at 12 noon. Filled hole at 15:00 hrs. Drilled on plug, located at 239' at 17:00 hrs. Top 20' of plug, medium hard, 234' to 288' cement firm to hard. Lost circulation at 288'. Continued to drill hard cement to 309'. Drilled formation from 309' to 314'. Hole remained clean to 314' after drilling with no returns from 288'. Pulled drilling assembly. Ran 101 drill tube. Stopped at 295' on hard object. Pulled drill tube. Ran drilling assembly. Drilled and pushed rocks from 295' to 307'.
- 05/22/95 Pushed rocks to 314'. POH. RIH with 101 tube to 312'. Mixed 27 sacks cement with Perlite and 3% CACL2. CIP at 0600 hrs. plug #9. WOC. Tagged hard cement at 264' at 12 noon. Filled hole. Drilled hard cement to 272'. Lost circulation. Drilled hard cement to 290'. Conditioned surface mud system. Regained partial returns. Circulated and added LCM at 17:00 hrs. Unable to gain total returns. Pulled drilling assembly. Ran 101 tube to 290'. Mixed 20 sacks cement with LCM and 3% CACL2. CIP at 20:00 hrs. WOC. Ran drilling assembly to 140'. Filled hole.

- 05/23/95 WOC until 02:00 hrs. Drilled hard cement with full returns from 238' to 314'. Drilling formation at 07:30 hrs with full returns. Drilled 8 3/4" hole to 334'. Lost circulation. Attempted to drill below 334' without success due to fractured formation. Pumped mud sweep. Pulled drilling assembly. Ran 101 tube to 334'. Pumped 10 sacks cement/LCM slurry down tube. Pump failed. Remaining 10 sacks cement/LCM poured into hole after pulling 101 tube. CIP at 17:00 hrs. WOC. Attempted to fill hole with no success. Ran 101 tube to 334'. Hole filled following additional waiting period. Pulled 101 pipe.
- 05/24/95 Drilled cement from 320' to 334'. Drilled formation from 334' to 494' with losses as follows: 20 BBLs at 424', 20 BBLs at 434', 10 BBLs at 460', 10 BBLs at 470' and 20 BBLs at 492'.
- 05/25/95 Drilled to 510' with many losses from 334' to 510'. Displaced cement plug across losses. WOC. Got partial circulation with LCM. Feel for plug. No plug to 510'. Displaced additional cement plug with LCM. CIP at 19:00 hrs. WOC.
- 05/26/95 WOC plug 7 hrs. Filled hole. No drop. Ran 8 3/4" drilling assembly. Located plug at 395'. Drilled soft cement to 405' at 04:00 hrs. WOC to 05:00 hrs. Drilled firm cement to 500'. Wiped hole. Laid down 6" drill collars and 8 3/4" bit. Rigged up and ran 9 joints 7", 26#, K55 Buttress casing. Stopped at 405'. Unable to run below 405'. Lost circulation. Pulled and laid down 7" casing. Rigged down casing tongs.
***Note: Hole tight, with apparent ledges. Annulus packed off with material from previous LCM treatments restricting downward casing movement.**
- 05/27/95 Open 8 3/4" hole to 9 7/8" from surface to 87'. Small amount of sloughing at 45'. No mud loss.
- 05/28/95 Open and reamed 8 3/4" hole to 9 7/8" from 45' to 60'. Cuttings from cement and LCM plugs circulated out of hole. Continued to open and ream hole from 60' to 325'. No fluid loss.
- 05/29/95 Reamed and opened 8 3/4" hole to 9 7/8" from 325' to 500'. Circulated, wiped hole. Laid down 6" drill collars.
- 05/30/95 Rigged up casing tongs. Ran 11 joints 7", 26#, K-55 Buttress casing with Howco guide shoe on bottom of joint #1 and Howco insert baffle check between joints #1 and #2. Landed casing at 500.30' K.B. at 05:00 hrs. Mixed and pumped 50 sacks Premium with 1-1 Perlite, 40% SSA-1, 6.5% CFR3, 4% Gel and 1% CACL2. Followed by 61 sacks Premium cement with 40% SSA-1 and 0.65%

CFR3. Displaced with 17.6 BBLs H₂O. Bumped plug with 300 psi. Preceded mix with 5 BBLs H₂O, 6 BBLs Super flush and 5 BBLs H₂O. Had approximately 2 BBLs cement returns. Cement dropped in annulus. CIP at 07:30 hrs. Witnessed by Dennis Davis, BLM. WOC. Moved BOP's and accumulator. Repaired pill tank pump. Poured 5 BBLs cement/CACL₂ top cement job into annulus. Annulus filled to surface. WOC. Cleaned area under floor. Cut off 7" casing. Welded on 6" 5000# SOW flange. Installed flanges on mud cross.

- 06/01/95 Install and nipple up BOP's. Choke and kill system and pitcher nipple. Relocated mud pump and shaker pit. Tested 7 ¹/₁₆" 5000 psi hydril, LWS double Shaffer, choke and kill assembly, kelly cock, safety valves, pump and lines. Tested to 500 psi. Witnessed by BLM, Dennis Davis and Dan Wermiel of DOGAMI. Made up 6 ¹/₈" bit on 4 ³/₄" drill collars. RIH to 454' to wiper plug. Drilled wiper plug and check valve. Drilled cement out of shoe joint.
- 06/02/95 Drilled 6 ¹/₈" hole into cement at 505'. Performed leak-off test for Dennis Davis (BLM) and Dan Wermiel (DOGAMI). Mud weight =8.8 lbs./gal. Attempted to perform an 0.7 psi per ft. leak-off test with no success. Broke down hole with approximately a 0.5 psi gradient. Could no maintain surface pressure after initial 50 psi break. Lost approximately 5 BBLs mud. Attempted similar test at 519'. Pumped away 9 BBLs. Unable to build pressure. Lost 10 BBLs mud. Drilled to 522'. Lost all returns. Tests approved by Davis/Wermiel. POH with BHA. Ran 101 tube to 522'. Displaced a 20 sack cement CACL₂ plug from 522' across the 7" casing shoe. CIP at 05:15 hrs. Made rig repairs. WOC. Located top of cement at 337'. Drilled medium to hard cement from 337' to 522'. Drilled 6 ¹/₈" hole from 522' to 540' with no fluid loss. Laid down BHA. Made up directional drilling tools. Made up directional drilling assembly. RIH to 540'. Unable to operate mud motor due to gelation of drilling fluid. Circulated and condition mud. Mud motored and rotated from 540' to 550'. Survey at 540' = 1° South. Made repairs to mud system and hydraulics. Shakers flooding with flow above 130 GPM. Mud motor operation at minimum efficiency. Adding small amount of LCM to maintain circulation. Losses decreased. Drilled 6 ¹/₈" hole from 550' to 589'. Mud pumps failed. Changed heads and valves. Repaired pump.
- 06/03/95 Repaired mud pump. Drilled 6 ¹/₈" hole with Anadril mud motor from 589' to 684'. Main hydraulic motor overheated. Pull tools into 7" casing. Changed hydraulic motor. Drilled 6 ¹/₈" hole from 684' to 700' with full returns.

- 06/04/95 Drilled 6 1/8" directional hole with Anadril mud motor from 700' to 720'. Lost circulation. Mixed LCM and regained circulation. Mixed mud volume. Resumed drilling 6 1/8" hole from 720' to 904'.
- 06/05/95 Drilled 6 1/8" directional hole from 904' to 1154'.
- 06/06/95 Drilled 6 1/8" hole to 1224' with mud motor. Survey. POH. Laid down mud motor. Made up bit #7, reamer and stab. RIH. Ream from 500' to 594'.
- 06/07/95 Reamed mud motor run from 594' to 700' losing 15 BPH from 700' to 968' with no losses, stringing in LCM.
- 06/08/95 Reamed from 968' to 1188'. Lifting cable broke, pipe fell to 1198'. Work stuck pipe. Pipe parted. POH. Make up 6" mill. RIH. Mill on fish from 1093' to 1095'. Circulate and condition. POH.
- 06/09/95 Wait on fishing tools. Make up overshot, B/S, jars and intensifier. RIH. Attempt to work over fish. No good. POH. Lay down fishing tools. RIH with mill #2. Mill on fish to 1096'. POH. Make up fishing assembly. RIH. Latch onto fish. Work free. POH. Lay down fishing tools. Visual check of BHA. RIH with reaming BHA to 1178'. Circulate. Unload drill collars off truck. Ream from 1178' to 1198'.
- 06/10/95 Trip to pick up more drill collars for drilling weight. Ream from 1198' to 1224'. Drilled 6 1/8" hole from 1224' to 1357'. Short trip to 500', 7" casing shoe. Circulate and condition for casing. POH. Lay down 101 rods and drill collars.
- 06/11/95 POH. Lay down BHA. Ran 37 joints 11.6#, K-55, 4 1/2" casing. Shoe at 1345'. Insert at 1309'. Circulate casing with mud. Pump 20 BBLs super flush mix and pump 314 cubic ft. Head = Premium cement, 40% SSA-1, 35#/sx Spearlite, 0.5% Halad 322, 4% Gel, 0.1% WG17 and 12.45 PPG. Tail = 33 cubic ft. Premium cement, 40% SSA-1, 0.5% CFR-3 and 15.5 PPG. Displace with 20.8 BBLs H₂O. Bump plug 500 psi over Disp. Psi. CIP 10:35 hrs. WOC.
- 06/12/95 Cut off 7" wellhead. Cut and dress 4 1/2" casing. Weld on wellhead for 4 1/2" casing. Nipple up BOP. Mix 7.3 cubic ft. top job. Test BOP. Choke manifold valves. Leaked. Pipe rams and blind rams leaked. Repair choke valves to hold 1000 psi. Replace pipe ram rubbers, clean out stack and repair test pump.
- 06/13/95 Pick up core barrel and rods to 1522'. Drop inner barrel. String plugged with soft cement. POH wet. Clean out core barrel. Change blind ram rubbers and test. RIH with core barrel. Drill out plug and insert. Clean out cement to 1334'.

- 06/14/95 Core cement from 1334' to 1338'. Core barrel plugged. POH. Clear core barrel. Make up core bit #2. RIH. Clean out cement with coring tools to 1557'. Core from 1357' to 1365'. Change drilling fluid and clean pits. Core from 1357' to 1388'. Temperature 90° F.
- 06/15/95 Core with HQ from 1388' to 1512'. BHT 126° F.
- 06/16/95 Core from 1512' to 1617'. Lost returns at 1542'. Mix LCM and regained circulation. Temperature 121° F. on survey at 1607'. Flowline temperature 55° F.
- 06/17/95 Core from 1617' to 1728'. Lost circulation at 1698' losing 12 BPH at 1728'. POH and RIH with open ended pipe to 1728'. Set 100 lineal ft. cement plug with 2% CC. Lost circulation at 1708'. Core to 1728' with partial returns. Temperature 90° F. on survey at 1708'. Low temperature due to mud loss and mixing new mud.
- 06/18/95 Mix and pump 100 lineal ft. cement plug at 1728' for **lost circulation**. CIP at 03:00 hrs. POH and WOC. RIH and tag top of cement at 1609'. Clean out stringers from 1528' to 1609'. Clean out cement from 1609' to 1728'. Core 3.895" hole from 1728' to 1762' with no mud loss. Flowline temperature 60° F. at 19:00 hrs.
- 06/19/95 Core 3.895" hole from 1762' to 1856'. No mud loss. Temperature on survey at 1796' 132° F. Flowline temperature 56° F. (new mud).
- 06/20/95 Core 3.895" hole from 1856' to 1984'. No mud loss. Temperature on survey at 1903' 144° F. Temperature on survey at 2004' 164° F. Flowline temperature 70° F.
- 06/21/95 Core 3.895" hole from 1984' to 2106' with no mud loss. Flowline temperature 71° F. Temperature on survey at 2106' 168° F.
- 06/22/95 Core 3.895" hole from 2106' to 2218' with no mud loss. Flowline temperature 75° F. Temperature on survey at 2208' 184° F.
- 06/23/95 Core 3.895" hole from 2218' to 2238' with no mud loss. Trip for bit. Core 3.895" hole from 2238' to 2266' with no mud loss. Flowline temperature 78° F.
- 06/24/95 Core 3.895" hole from 2266' to 2403' with no mud loss. Test and calibrate H₂S monitors. Flowline temperature 80° F.
- 06/25/95 Core 3.895" hole from 2403' to 2536' with no mud loss. Flowline temperature 77° F.

- 06/26/95 Wipe hole to 1700'. Stage back in hole to clean and condition for mud rings. Core 3.895" hole from 2356' to 2648' with no mud loss. Survey at 2608'. Flowline temperature 77° F.
- 06/27/95 Core 3.895" hole from 2648' to 2858' with surveys. Flowline temperature 75° F. No losses.
- 06/28/95 Core 3.895" hole from 2858' to 3088' with surveys. Flowline temperature 72° F. No losses.
- 06/29/95 Core 3.895" hole from 3088' to 3248'.
- 06/30/95 Core 3.895" hole from 3248' to 3358'. Work to retrieve stuck inner barrel. Did not work free. POH. Lay down 10' core barrel. Pick up 20' core barrel and inner barrel. Flowline temperature 82° F. No losses.
- 07/01/95 Make up 20' core barrel. Stage in hole. Core barrel plugged at 3190'. Pull 6 stands. Pull inner barrel. Circulate and condition mud. Stage in hole to 3358'. Survey at 3358'. Core from 3358' to 3378'. Attempt to retrieve core. Spud through mud rings. Dump 10 BBLs mud and circulate to clear pipe. Core from 3378' to 3389'.
- 07/02/95 Core from 3389' to 3399'. Sandline broke while pulling inner barrel. Mud rings caused over pull. POH to retrieve core. Stage back in hole to 3399'. Core from 3399' to 3419'. Sandline broke pulling inner barrel. POH. Clean mud pits and mix mud. Stage in hole to 2419'. No losses. Flowline temperature 80° F.
- 07/03/95 Core from 3419' to 3429'. Work core barrel retrieving tool through mud rings and condition mud. Core from 3429' to 3449'. Pull inner barrel. Catcher pushed up in core barrel. POH. Service Core barrels. No mud losses. Flowline temperature 80° F.
- 07/04/95 Stage in hole to 3449'. Pump inner barrel down. Core from 3449' to 3489'. Wipe hole to 3385'. Lost 10 BBLs on short trip. Core from 3489' to 3509'. Survey at 3509'. GHT 295° F. Core from 3504' to 3545'. Losing approximately 7 BPH. Flowline temperature 80° F.
- 07/05/95 Stage in hole to 3449'. Pump inner barrel down. Core from 3449' to 3489'. Wipe hole to 3385'. Condition mud to lower torque. Core from 3545' to 3619'. Survey at 3619'. BHT 309° F. Change packing in swivel. Core from 3619' to 3669'. No mud losses. Flowline temperature 80° F.

- 07/06/95 Core from 3669' to 3709'. Run survey. Work on pump. Circulate. Lowered pipe to start drilling. Can't turn pipe and can't pick pipe back up. Work stuck pipe and circulate with full returns while waiting on mineral oil and pipe lax. Flowline temperature 80° F. Temperature at 3709', 318° F.
- 07/07/95 Spot 118 gal. of mineral oil and pipe lax. Covered 494' on bottom. Left 59 gal. in pipe. Work stuck pipe at 3709' moving fluid every hour. Temperature at 3709', 318° F.
- 07/08/95 Work stuck pipe moving mineral oil every hour. Pump air bubbles and work stuck pipe. Rig up Dia-Log. Freepoint pipe and back pipe off at 2483'. POH with 2483' of HCQ pipe. Pick up ten 3 1/8" drill collars, bumper sub, jars and spear. RIH to top of fish at 2483'. Spear into top of fish at 2483'. Jar on fish.
- 07/09/95 Jar on fish at 2483'. Fish moved 8". No movement on fish from 0200 hrs. to 0900 hrs. Get off fish. POH with spear laying down good HQ pipe. Lay down fishing tools. RIH with lower grade HQ. Try and screw into top of pipe at 2483'.
- 07/10/95 Try to screw into top of HQ pipe at 2483'. Can't get into top. POH. Pin end on pipe split. Lay down bad joint. RIH with good joint on bottom. Try to screw into top of pipe at 2483'. Won't screw in. POH. Put slight taper on end of bottom pipe to be screwed in. RIH to 2370'. Pipe won't go. POH and pick up used 3.895" core bit. RIH to 2370'. Wash, ream and RIH to top of HQ pipe at 2485'. Top of pipe was 2' lower than last time tagged. POH with core bit.
- 07/11/95 RIH with slightly tapered pipe on bottom. Set down on HQ pipe at 2485'. Try to turn and screw into pipe. No indication of pipe making up. Load and haul NQ pipe from staging area. Rig up to run NQ pipe. Back off HQ below table. RIH through HQ with NQ pipe to top of fish at 2485'. Mill through taper on bottom of HQ which was used to stag into fish with. **RIH picking up NQ pipe.**
- 07/12/95 RIH picking up NQ pipe to landing ring at 3685'. Drill out landing ring and 3.78" core bit on bottom of HQ. Made 2' of core. Pulled core. Slip segment lost on fishing job was recovered on top of core. Core another 3' of new core to 3716'. POH. Change pipe rams. Make up new core bit and core barrel. RIH to 3716'. Core from 3715' to 3740'.
- 07/13/95 Core and survey from 3740' to 3928'. Flowline temperature 73° F. BHT 336° F.

- 07/14/95 Core and survey from 3928' to 4128'. Flowline temperature 75° F. BHT 350° F.
- 07/15/95 Core and survey from 4128' to 4268'. Flowline temperature 75° F. BHT 348° F.
- 07/16/95 Core and survey from 4268' to 4448'. Flowline temperature 75° F. BHT 365° F.
- 07/17/95 Core and survey from 4448' to 4644'. Flowline temperature 75° F. BHT 378° F.
- 07/18/95 Core and survey from 4644' to 4749'. Trip for a new bit and lay down top stabilizer. Flowline temperature 85° F. BHT 382° F.
- 07/19/95 RIH. Ream from 4149' to 4749'. Core and survey from 4749' to 4824'. Flowline temperature 90° F. BHT 401° F.
- 07/20/95 Core and survey from 4824' to 4876'. Circulate and condition mud. POH. Lay down NQ pipe. Flowline temperature 90° F. BHT 411° F.
- 07/21/95 Lay down NQ pipe. Screw into HQ pipe at 16'. Unable to work pipe loose. Back out of HQ pipe at 16'. Rig up and run 2" tubing. Bottom of tubing set at 4855'. Nipple down BOE.
- 07/22/95 Nipple down BOE. Tear out rig and move off location.

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5/13/97