

GTHT - ____002____

**WELL
EE-1**

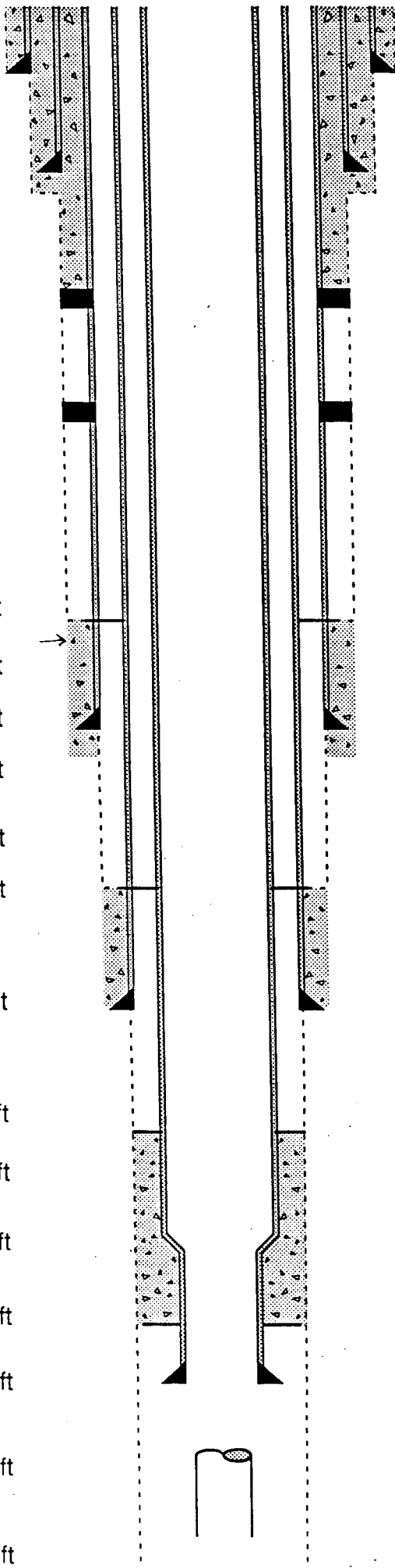
Tom Turner / Injection application for
EE-1 / LANL —

OK w/ R. A. on pit disposal
c.c. to OED env. group. via WJL.

★ Fix GT-2 / bottom plug, perf & squeeze,
Fix. ~~7~~ 7 5/8 - parted @ 1021

KB Depths

25 ft
270 ft
580 ft
600 ft
790 ft
1783 ft
1905 ft
2100 ft
2401 ft
2431 ft
2600 ft
3350 ft
4640 ft
6420 ft
7700 ft
7936 ft
8600 ft
9020 ft
9599 ft
9747 ft
10,053 ft



KB 8711 ft - GL 8696 ft

48" hole drilled to 10' GL

30" culvert SA 10' GL with 10 yards concrete

10 3/4" casing parted at 270' - cemented four times with a total of 500 sacks

20" 94# H-40 BT&C casing SA 580' with 830 ft³ cement

26 1/2" hole drilled to 600'

**Wellbore Diagram
for EE-1
9-22-81**

13 3/8" stage collar

13 3/8" stage collar cemented without returns
Cement lost to LC zone

Lost circulation zone in 17 1/2" hole

Calculated top of cement on first stage
recementing of 13 3/8" casing
Top of Precambrian

13 3/8" 54.5# k-55 ST&C casing SA 2432" with
225 sacks of cement on recementing
17 1/2" hole drilled to 2600'

Lost circulation zone in 12 1/4" hole

Top of cement per CBL on cementing of
10 3/4" casing

10 3/4" 45.5# K-55 BT&C casing SA 6420 with
300 ft³ cement

Top of cement per CBL at 7700' on cementing
of 8 5/8x7 5/8" casing

Lost circulation zone in 9 7/8" hole

Bottom of 8 5/8" 32# k-55 LT&C casing
Top of 7 5/8" 26.4# N-80 Hydril casing

Bottom of cement per CBL at 9020'

7 5/8" 26.4# N-80 Hydril casing SA 9599'
with 240 ft³ and recemented with 180 ft³

Top of fish (5 1/2" casing and inflatable packers)

TD of 9 5/8" hole (cleaned out with 6 3/4" bit)

ATTACHMENT 1.A.
OIL CONSERVATION DIVISION

Form G-103
Adopted 10-1-74
Revised 10-1-78

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

2040 S. Pacheco
SANTA FE, NEW MEXICO 87501

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SUNDRY NOTICES AND REPORTS
ON
GEOTHERMAL RESOURCES WELLS

Federal Land Use
Agreement

5. Indicate Type of Lease
State ☐ Fee ☐
5.a State Lease No.

Do Not Use This Form for Proposals to Drill or to Deepen or Plug Back to a Different Reservoir. Use "Application For Permit -" (Form G-101) for Such Proposals.)

1. Type of well Geothermal Producer <input type="checkbox"/> Temp. Observation <input type="checkbox"/> Low-Temp Thermal <input type="checkbox"/> Injection/Disposal <input checked="" type="checkbox"/>	7. Unit Agreement Name Fenton Hill
2. Name of Operator Los Alamos National Laboratory	8. Farm or Lease Name
3. Address of Operator P.O.Box 1663 Los Alamos, NM 87545	9. Well No. EE-1
4. Location of Well Unit Letter <u>1,463</u> Feet From The <u>East</u> Line and <u>1,501</u> Feet From The <u>North</u> Line, Section <u>13</u> Township <u>19N</u> Range <u>2E</u> NMPM.	10. Field and Pool, or Wildcat
15. Elevation (Show whether DF, RT, GR, etc.) 8,695'	12. County Sandoval

16. Check Appropriate Box To Indicate Nature of Notice, Report or Other Data

NOTICE OF INTENTION TO:		SUBSEQUENT REPORT OF:	
PERFORM REMEDIAL WORK <input type="checkbox"/>	PLUG AND ABANDON <input checked="" type="checkbox"/>	REMEDIAL WORK <input type="checkbox"/>	ALTERING CASING <input type="checkbox"/>
TEMPORARILY ABANDON <input type="checkbox"/>	CHANGE PLANS <input type="checkbox"/>	COMMENCE DRILLING OPNS. <input type="checkbox"/>	PLUG & ABANDONMENT <input type="checkbox"/>
PULL OR ALTER CASING <input type="checkbox"/>		CASING TEST AND CEMENT JOB <input type="checkbox"/>	
OTHER <input type="checkbox"/>		OTHER _____	

17. Describe Proposed or completed Operations (Clearly state all pertinent details, and give pertinent dates, including estimated date of starting any proposed work) SEE RULE 203.

Set cement retainer at 8,800', set cement plug from 8,800' to casing shoe at 9,599', set 200 linear foot plug on top of retainer. Fill hole with 40 vis mud. Tag cement top. Cut 8-5/8" casing at 6,500' and remove. Set 200 linear foot cement plug from 6,300-6,500'. Set cement retainer just above cement plug in 10-3/4" casing and set 200 linear foot above retainer. Fill hole with 30-40 vis mud. Tag cement top. Run CBL to verify cement in 10-3/4" x 13-3/8" annulus - perf and squeeze if needed. Set 100 linear foot cement plugs at 2,000' intervals up to 1,000'. Set cement plug from 800-1,000'. Set 50 linear foot plug at surface. Cut off casings 6' below ground level and weld plate with well name on top. Cover wellhead.
See attached detailed procedures and casing schematic.

It is estimated that this proposed work may start in mid-July, 1996.

18. I hereby certify that the information above is true and complete to the best of my knowledge and belief.

SIGNED James A. Allwright TITLE EES-4 GROUP LEADER DATE 6/24/96

APPROVED BY

DISTRICT SUPERVISOR

11/4/96

ATTACHMENT 1.B.

Los Alamos National Laboratory
Fenton Hill Hot Dry Rock Test Site
Preliminary Well Abandonment Procedure
Well: EE-1

ThermaSource, Inc.

4-2-96 Revision 2

Pertinent Well Data

1. Well Completed 9-22-81
2. Total Depth 9-5/8" hole to 10,053'.
3. Combination string of 7-5/8" and 8-5/8" casing run from 9599' to surface. 7-5/8" 26.4 ppf, N-80 hydril casing from 8600' to 9599'. 8-5/8" 32 ppf, K-55, LT&C casing run from 8600' back to surface. Cemented annulus from 7700' to 9020'.
4. 10-3/4" 45.5 ppf, K-55 Buttress casing run from 6420' back to surface. Cemented annulus from 4640' to 6420'. Hole in 10-3/4" casing due to parted casing at 270' and cemented four times with 500 sacks of cement.
5. 13-3/8" 54.5 ppf, K-55, ST&C casing run from 2432' back to surface. Cemented annulus from 2100' to 2432' and 790' up to surface.
6. 20" 94 ppf, H-40, Buttress casing run from 580' back to surface and cemented from 580' to surface.
7. 30" conductor cemented in a 48" hole to 25'.
8. Fish left in 9-5/8" open hole from 9747' to total depth consisting of 5-1/2" casing and inflatable packer.

Time Sequence of Operations

- | | |
|----------|--|
| 24 hours | 1. Rig up on well and nipple up appropriate blow out preventer stack. Test stack and complete rig up operations. |
| 18 hours | 2. Pick up 6-3/4" bit and run in hole picking up drill pipe. Check for bridges and obstructions. Run in to bottom of 7-5/8" casing at 9599'. |

ATTACHMENT 1.B. (cont'd)

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Fenton Hill HDR
EE-1 Well Abandonment
4-2-96 Revision 2
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- 8 hours 3. Pull out of hole with bit and pick up cement retainer on drill pipe and run in hole with same to 9500'.
- 4 hours 4. Set cement retainer in 7-5/8" at approximately 8800' a depth based on the results of CBL and pull off of same. Stab back into retainer and pump below retainer with water. Then mix and pump enough cement to fill the 7-5/8" casing from the retainer to the shoe of the 7-5/8" casing below the retainer. Displace all cement below retainer, pull out of retainer and prepare to set cement plugs on top of retainer.
- 10 hours 5. Mix and pump enough cement to fill 7-5/8" casing from 8800' up to 8600'. Pull up and wait on cement for 8 hours. Mix and pump 30 to 40 vis. gel mud to fill hole. Run in hole and tag top of cement to verify proper location of cement plug.
- 12 hours 6. Pull out hole and pick up 8-5/8" casing cutter and run in hole with same. Cut 8-5/8" casing at 6500'. Pull out of hole with cutter.
- 24 hours 7. Pull and lay down 8-5/8" casing from 6500', approximately 80' below the shoe of the 10-3/4" casing, if casing pulls free if casing does not pull free then rig up to run cement bond log and free point indicator. If casing is not free in open hole then verify from logs that formations do not contain usable water the cut 8-5/8" at the top free point and proceed ahead with cut and pull 8-5/8" casing.
- 10 hours 8. Pick up 9-7/8" bit and 10-3/4" casing scrapper. Run in hole and check casing for bridges or obstructions in the 10-3/4" casing. Run into casing to 8-5/8" casing stub with open ended drill pipe and set cement plug in open hole from top of 8-5/8" casing stub up inside 10-3/4" casing..
- 8 hours 9. Pull out of hole with bit and pick up 10-3/4" 45.5 ppf casing cement retainer and run in hole with same. Set retainer slightly above cement plug. Disengage from retainer and pull up

ATTACHMENT 1.B. (cont'd)

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above retainer.

- 10 hours 10. Mix and pump cement to fill 10-3/4" casing from retainer up 200'. Pull out of cement and wait on cement for 8 hours. While waiting on cement circulate and mix mud filling 10-3/4 casing with 30 to 40 vis gel mud. Run in hole and tag top of cement to verify proper location of cement.
- 6 hours 11. Run cement bond log on 10-3/4" casing to verify cement in annulus of 10-3/4" and 13-3/8".
- 4 hours 12. If cement is located in annulus the proceed ahead with abandonment. Set 200 linear feet cement plugs in the mud left in the wellbore every 2000' from the bottom cement plug set on top of the cement retainer to the surface.
- 2 hours 13. Set final cement plug from 50' up to surface.
- 18 hours 14. Nipple down blow out preventer stack. Cut and remove all casing strings to below ground level. Weld metal plate on top of all casing strings with well name welded into plate.
- 18 hours 15. Nipple down and rig up to move to next well.

172 hours (7.17 days) Total Time on Location

KB Depths

25 ft

270 ft

580 ft

600 ft

790 ft

1783 ft

1905 ft

2100 ft

2401 ft

2431 ft

2600 ft

3350 ft

4640 ft

6420 ft

7700 ft

7936 ft

8600 ft

9020 ft

9599 ft

9747 ft

#6

#5

#4

#4

#3

800

3000

21000

4000

4100

6100

6300

Plug #2

8 5/8

6500 Pull

CBL Log

Plug #1

TD of 0.5/8" hole (cleared out with 6 3/4" bit)

Los Alamos National Laboratory
Fenton Hill Hot Dry Rock Test Site
Preliminary Well Abandonment Procedure
Well: EE-1

ThermaSource, Inc.

4-2-96 Revision 2

Pertinent Well Data

1. Well Completed 9-22-81
2. Total Depth 9-5/8" hole to 10,053'.
3. Combination string of 7-5/8" and 8-5/8" casing run from 9599' to surface. 7-5/8" 26.4 ppf, N-80 hydril casing from 8600' to 9599'. 8-5/8" 32 ppf, K-55, LT&C casing run from 8600' back to surface. Cemented annulus from 7700' to 9020'.
4. 10-3/4" 45.5 ppf, K-55 Buttress casing run from 6420' back to surface. Cemented annulus from 4640' to 6420'. Hole in 10-3/4" casing due to parted casing at 270' and cemented four times with 500 sacks of cement.
5. 13-3/8" 54.5 ppf, K-55, ST&C casing run from 2432' back to surface. Cemented annulus from 2100' to 2432' and 790' up to surface.
6. 20" 94 ppf, H-40, Buttress casing run from 580' back to surface and cemented from 580' to surface.
7. 30" conductor cemented in a 48" hole to 25'.
8. Fish left in 9-5/8" open hole from 9747' to total depth consisting of 5-1/2" casing and inflatable packer.

Time Sequence of Operations

- | | |
|----------|--|
| 24 hours | 1. Rig up on well and nipple up appropriate blow out preventer stack. Test stack and complete rig up operations. |
| 18 hours | 2. Pick up 6-3/4" bit and run in hole picking up drill pipe. Check for bridges and obstructions. Run in to bottom of 7-5/8" casing at 9599'. |

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- 8 hours 3. Pull out of hole with bit and pick up cement retainer on drill pipe and run in hole with same to 9500'.
- 4 hours 4. Set cement retainer in 7-5/8" at approximately 8800' a depth based on the results of CBL and pull off of same. Stab back into retainer and pump below retainer with water. Then mix and pump enough cement to fill the 7-5/8" casing from the retainer to the shoe of the 7-5/8" casing below the retainer. Displace all cement below retainer, pull out of retainer and prepare to set cement plugs on top of retainer.
- 10 hours 5. Mix and pump enough cement to fill 7-5/8" casing from 8800' up to 8600'. Pull up and wait on cement for 8 hours. Mix and pump 30 to 40 vis. gel mud to fill hole. Run in hole and tag top of cement to verify proper location of cement plug.
- 12 hours 6. Pull out hole and pick up 8-5/8" casing cutter and run in hole with same. Cut 8-5/8" casing at 6400'. Pull out of hole with cutter.
- 24 hours 7. Pull and lay down 8-5/8" casing from 6500', approximately 80' below the shoe of the 10-3/4" casing, if casing pulls free if casing does not pull free then rig up to run cement bond log and free point indicator. If casing is not free in open hole then verify from logs that formations do not contain usable water the cut 8-5/8" at the top free point and proceed ahead with cut and pull 8-5/8" casing.
- 10 hours 8. Pick up 9-7/8" bit and 10-3/4" casing scrapper. Run in hole and check casing for bridges or obstructions in the 10-3/4" casing. Run into casing to 8-5/8" casing stub with open ended drill pipe and set cement plug in open hole from top of 8-5/8" casing stub up inside 10-3/4" casing..
- 8 hours 9. Pull out of hole with bit and pick up 10-3/4" 45.5 ppf casing cement retainer and run in hole with same. Set retainer slightly above cement plug. Disengage from retainer and pull up

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above retainer.

- 10 hours 10. Mix and pump cement to fill 10-3/4" casing from retainer up 200'. Pull out of cement and wait on cement for 8 hours. While waiting on cement circulate and mix mud filling 10-3/4 casing with 30 to 40 vis gel mud. Run in hole and tag top of cement to verify proper location of cement.
- 6 hours 11. Run cement bond log on 10-3/4" casing to verify cement in annulus of 10-3/4" and 13-3/8".
- 4 hours 12. If cement is located in annulus the proceed ahead with abandonment. Set cement plug from 1000' up to 800'.
- 2 hours 13. Set final cement plug from 50' up to surface.
- 18 hours 14. Nipple down blow out preventer stack. Cut and remove all casing strings to below ground level. Weld metal plate on top of all casing strings with well name welded into plate.
- 18 hours 15. Nipple down and rig up to move to next well.

172 hours (7.17 days) Total Time on Location

Los Alamos National Laboratory
Fenton Hill Hot Dry Rock Test Site
Preliminary Well Abandonment Procedure
Well: EE-2A

ThermaSource, Inc.

4-2-96 Revision 2

Pertinent Well Data

1. Original EE-2 was drilled with an 8-3/4" bit to a total depth of 15,292'.
2. 9-5/8" casing set in the original EE-2 to a total depth of 11,571'. 9-5/8" casing was originally cemented from 6458' up to 2403' and from 9692' upward to unknown depth. Perforations in the 9-5/8" casing were cemented at depths of 209' and 883'. Bridge (Ball sealers, gravel and sand on production 9-5/8" casing screw-in sub located at 916'.
3. EE-2A was sidetracked out of 9-5/8" casing at a depth of 9692'. Existing bottom of 9-5/8" casing at 9692'. Bottom of original hole was adequately abandoned with cement and sand plugs.
4. 7" liner hung and cemented in sidetrack 8-3/4" hole from 9470' to a total depth of 10775'.
5. 7" tieback casing cemented inside 9-5/8" casing from 9470' back to surface.
6. 13-3/8" casing set to a total depth of 2583'. 13-3/8" casing was cemented with an external casing packer set at 1759' up inside the 20" casing. 13-3/8" was then cemented from 1759' to the surface.
7. 20" casing set to a total depth of 1776' and cemented to unknown depth.
8. Top of precambrian granite located at 2405', up inside 13-3/8" casing.

Time Sequence of Operations

- 18 hours 1. Rig up on well and nipple up appropriate blow out preventer stack. Test stack and complete rig up operations.

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Fenton Hill HDR
EE-2A Well Abandonment
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- 24 hours 2. Pick up 6-1/8" bit and run in hole picking up drill pipe. Check for bridges and obstructions. Run in to bottom of 7" casing at 10,775'.
- 5 hours 3. Pull out of hole with 6-1/8" drill bit and lay down same. Pick up 7" casing cement retainer.
- 5 hours 4. Run in hole with cement retainer and set same in 7" casing at 10,675'. Disengage from retainer and pull up above retainer.
- 10 hours 5. Mix and pump cement to fill 200 linear feet above retainer to 10,475'. Pull out of cement and wait 8 hours. While waiting on cement mix and circulate 30 to 40 vis. gel mud to fill hole. Tag top of cement to verify proper location of cement.
- 8 hours 6. Pull up and set 100 linear feet cement plug every 2500' in the 7" casing up to a top plug at 2683'. Close pipe rams and pressure test casing to 500 psi. If casing tests good proceed ahead with abandonment, if casing does not hold pressure then locate leaks and repair same with cement.
- 4 hours 7. Mix and pump cement to fill 200 linear feet of 7" casing from 2683, to 2483'. Pull out of cement and pull up to 50'.
- 2 hours 8. Mix and pump cement to fill 50 linear feet of 7" casing from 50' to surface.
- 18 hours 9. Nipple down blow out preventer stack. Cut and remove all casing strings to below ground level. Weld metal plate on top of all casing strings with well name welded into plate.
- 18 hours 10. Nipple down and rig up to move to next well.

112 hours (4.67 days) Total Time on Location

Los Alamos National Laboratory
Fenton Hill Hot Dry Rock Test Site
Preliminary Well Abandonment Procedure
Well: EE-3A

ThermaSource, Inc.

4-2-96 Revision 2

Pertinent Well Data

1. EE-3A was originally completed on May 14, 1986.
2. 9-5/8" casing was originally set in the original EE-3 at a total depth of 10,374'. EE-3 was originally drilled to 13,933' on 8-7-81. EE-3 was adequately abandoned and EE-3A was sidetracked through a section cut in the 9-5/8" between 9285' to 9372'. The section was then underreamed to 16" from 9293' to 9330'. Present bottom of 9-5/8" casing at 9285'. 9-5/8" casing is cemented from 9285' up to 5200' using stage collar at 7281'. Top of cement in 9-5/8" casing X 12-1/4" hole is at approximately 5200' based on CBL.
3. 13-3/8" casing set to total depth of 2552' and cemented from 2552' up to 2275' and from 1421' back to surface using an external casing packer set at 1421' in 20" casing.
4. 20" casing set to total depth of 1580' and cemented from total depth back to surface.
5. 30" conductor pipe set and cemented to a total depth of 87'.
6. 5-1/2" liner from 9191' to 11,436' and cemented from 11,436' up to 10,950'. Combination 4-1/2" (3.75" Minimum I.D.) and 5" tubing tied-back to top of liner at 9191' using polish bore receptacle back to surface.
7. EE-3A was drilled with a 8-1/2" bit to total depth of 13,182 on 6-17-85. Hole was plugged back with barite, packer and sand to 12,107'.

Los Alamos National Lab
Fenton Hill HDR
EE-3A Well Abandonment
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<u>Time</u>	<u>Sequence of Operations</u>
18 hours	1. Rig up on well and nipple up appropriate blow preventer stack. Test stack and complete rig up operations.
12 hours	2. Rig up and pull 4-1/2" tubing and pull same out of hole and lay down same from tie-back sleeve at 9191'.
6 hours	3. Pick up 8-1/2" bit and 9-5/8" casing scrapper. Run in hole with same and check 9-5/8" casing to 9100'.
8 hours	4. Pull out of hole with 8-1/2" bit and pick up 9-5/8" casing cement retainer. Run in hole with retainer and set same at 9100'. Disengage from retainer and pull above retainer and prepare to set cement plug.
10 hours	5. Mix and pump cement to fill 200 linear feet of 9-5/8" casing from 9100' up to 8900'. Pull out of cement and wait on cement form 8 hours. While waiting on cement mix and fill hole with 30 to 40 vis. gel mud. Tag top of cement to verify proper location of cement.
26 hours	6. Pull out of hole and pick up 9-5/8" casing cutter and cut 9-5/8" casing at approximately 4200'. Pull out of hole and attempt to pull 9-5/8" casing. Pull and lay down 9-5/8" casing.
12 hours	7. Run in hole with 12-1/4" bit and 13-3/8" casing scrapper. Clean out 13-3/8" casing to 2552' and 12-1/4" open hole to top of 9-5/8" stub at 4200'. Trip out of hole with bit and run in hole open ended to top of 9-5/8" stub and set 100 linear open hole cement plug from top of 9-5/8" stub up to 4100' +/-.
12 hours	8. Wait on cement to set and tag top to verify cement plug is in proper location. Fill hole with good 30 to 40 vis. gel mud.
5 hours	9. Trip to pick up 13-3/8" casing cement retainer and run in hole with same. Set retainer at 2452'. Disengage from retainer and pull above

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Fenton Hill HDR
EE-3A Well Abandonment
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same and prepare to set cement plug.

- 3 hours 10. Mix and pump cement to fill 100 linear feet of 13-3/8" casing from 2452' up to 2352'. Mix and fill hole with 30 to 40 vis gel mud.
- 2 hours 11. Set another cement plug from 1471' up to 1371' and another from 50' to surface.
- 18 hours 12. Nipple down blow out preventer stack and cut all casing string at ground level. Weld top plate on all casings with well name welded on top.
- 18 hours 13. Rig down and release rig.

150 hours (6.25 days) Total Time on Location

Los Alamos National Laboratory
Fenton Hill Hot Dry Rock Test Site

Preliminary Well Abandonment Procedure
Well: GT-2

ThermaSource, Inc.

4-2-96 Revision 2

Pertinent Well Data

1. Total depth of the well is 8909'.
2. 7-5/8" 33.7 ppf, S-95 and N-80 casing set to a total depth of 8572'. 7-5/8" cemented from 8572' up to 6924'.
3. 7-5/8" is appeared to be parted at 1021' and casing stubs are separated approximately 12 feet.
4. 10-3/4" 45.5 ppf casing set to total depth of 2535'. 10-3/4" casing is cemented from 2535' up to 2000' and from approximately 1100' up to 250'.
5. 13-3/8" 54.4 ppf, K-55, ST&C casing set to total depth of 1600' and cemented from total depth to surface.
6. 20" conductor set and cemented from 60' to surface.
7. Top of Precambrian Granite basement is 2404' up inside and behind the 10-3/4" casing.
8. Apparent flow around 7-5/8" shoe cement from below casing at 8572' up to above cement top in annulus indicated by noise log run on 11-15-78.

Time Sequence of Operations

- | | |
|----------|---|
| 18 hours | 1. Rig up on well and nipple up appropriate blow out preventer stack. Test stack and complete rig up operations. |
| 18 hours | 2. Pick up 6-5/8" bit and run in hole and attempt to work through parted area in 7-5/8" at 1021'. If successful then proceed to bottom of the 7-5/8" casing at 8572' checking for obstructions or bridges. If unsuccessful the pull out of hole and pull top portion of 7-5/8" from 1021' and lay down recovered section. Proceed ahead with abandonment. |

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- 8 hours 3. Pull out of hole with bit and pick 7-5/8" casing cement retainer. Run in hole with same and set at approximately 8472'. Disengage from retainer and pull up above it. Circulate through drill pipe and stab back into retainer. Attempt to inject fluid below retainer.
- 22 hours 4. Mix and pump cement below retainer if possible to inject below retainer. Pump enough cement to fill 450' of 7-5/8" casing and open hole to 8909'. Pull out of retainer and mix and pump enough cement to fill 200 linear feet of 7-5/8" casing from 8472' up to 8272'. Pull up out of cement and wait 8 hours. While waiting on cement mix and fill hole with 30 to 40 vis. gel mud. Tag top of cement to verify proper cement plug location. Pull up and set 100 linear feet cement plug every 2000' from 8272' upward to 2500' before proceeding on to next step. Wait on cement and tag top of top plug to verify proper location.
- 12 hours 5. Pull out of hole with drill pipe. Attempt to retrieve top portion of 7-5/8" if not already removed.
- 10 hours 6. Run in hole with 7-5/8" internal casing cutter and cut 7-5/8" casing below shoe of 10-3/4" casing.
- 12 hours 7. Trip out of hole and lay down casing cutter and pick up 7-5/8" casing spear and run in hole. Engage 7-5/8" casing stub at 1021' and pull 7-5/8" from cut point and lay down same.
- 6 hours 8. Pick up 9-7/8" bit and casing scrapper and run in hole to 2500', approximate top of cement plug, checking for bridges and obstructions. Pull out of hole and lay down bit.
- 4 hours 9. Pick up 10-3/4" casing cement retainer and run in hole with same. Set retainer at approximately 2450' just above top of cement. Disengage from retainer and pull above.
- 3 hours 10. Mix and pump cement to fill 200 linear feet of 10-3/4" casing from 2435' up to 2235'. Pull up

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Fenton Hill HDR
GT-2 Well Abandonment
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to 1650'.

- 3 hours 11. Mix and pump cement to fill 100 linear feet of 10-3/4" casing from 1650' up to 1550'. Pull up out of cement to 50'.
- 2 hours 12. Mix and pump cement to fill 50 linear feet of 10-3/4" casing from 50' to surface. Pull out of hole.
- 18 hours 13. Remove blow out preventer stack and cut off all casing strings at ground level. Weld on metal plate on all casings with well name welded in top of plate.
- 18 hours 14. Rig down and remove rig.

154 hours (6.42 days) Total Time on Location

Turner Engineering Associates
8764 S. Russell Park Road
Salt Lake City, UT
84121

ROUGH

DRAFT

2/15/96

Mr. Roy Johnson
Supervisor District IV
New Mexico State Oil Conservation Division
2040 S. Pacheco St.
Santa Fe, New Mexico 87507

Dear Mr. Johnson,

As required by the "State of New Mexico Energy and Minerals Department Oil Conservation Division -- Geothermal Rules and Regulations" Rule G-503, the Department of Energy, Los Alamos National Laboratory requests your approval to commence temporary injection operations in well EE-1 at the Fenton Hill Hot Dry Rock test site in Sandoval County, New Mexico. This well is on US Forest Service land that has been reserved for the purpose of conducting hot dry rock reservoir system experiments by way of special agreement between the US Department of the Interior (Forest Service) and the Department of Energy.

Major test operations are being suspended at this site and as a part of this process the Laboratory wishes to dispose of the fluids remaining in the one million gallon test pond located on the site. Approximately 700,000 gallons of water from the Phase II hot dry rock reservoir are proposed to be injected into the Phase I hot dry rock reservoir in the interval 9020'/9600' via injection well EE-1. Attached are a recent pond water analysis and a completion drawing for the proposed injection well.

In order to assure that the injection fluids are confined to the intended zone of injection the Laboratory proposes to conduct the following operations prior to beginning injection activities:

- Repair the chimney existing in well GT-2 (completion drawing attached) that allows flow up the uncemented 7-5/8" X 10-3/4" annulus from the intended zone of injection. It is proposed to accomplish this by setting a cement retainer at 8472' and displacing adequate cement to fill the open hole completion interval (8572'/8909') and the 7-5/8" casing below the retainer. Please see the attached procedure for details. This plug is also intended to partially satisfy the abandonment requirements for this well.
- Monitor the well-head and 7-5/8" X 10-3/4" annulus pressures at GT-1 during injection in well EE-1 to insure that no fluids migrate behind the casing in well GT-1.
- Monitor the pressure in the 8-5/8" X 10-3/4" annulus of well EE-1 during injection to insure the integrity of the 8-5/8" injection string and confinement of fluids to the intended zone.

-2-

Additional documents required by Rule G-503 for approval of injection are enclosed as follows: Plat of Wells Within One Mile of Injection Well EE-1; Plat of all Wells on the Fenton Hill Site; Fenton Hill Site Deep Wells Planar View; Fenton Hill Site EE-2A and EE-3A Looking North; Fenton Hill Site EE-2A and EE-3A Looking West; Attachment to Plat describing the surface location, total depth, open-hole sections and the status of all wells in the area; and two copies of New Mexico Oil Conservation Division Form G-112.

Your consideration of this request for approval is greatly appreciated and should you have any questions or need of additional information please don't hesitate to contact me at 801-942-4566 or 801-575-5229 for clarification.

Sincerely,

Thomas A. Turner

STATE OF NEW MEXICO
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION
P. O. BOX 2088
SANTA FE, NEW MEXICO 87501

Form G-112
Adopted 10-1-74
Revised 10-1-78

APPLICATION TO PLACE WELL ON INJECTION-GEOTHERMAL RESOURCES AREA

Operator Los Alamos National Lab/Univ.		Address PO Box 1663, MS D443	
of CA under contract for DOE		Los Alamos, NM 87545	
Lease Name Dept. of Agriculture/US Forest Service-Special Use Per	Well No. EE-1	Field Phase I Reservoir Hot Dry Rock Test Facility	County Sandoval
Location Unit Letter G : Well is Located 1462 Feet From The E Line And 1503 Feet From The N Line, Section 13 Township 19N Range 2E NMPM.			

CASING AND TUBING DATA

NAME OF STRING	SIZE	SETTING DEPTH	SACKS CEMENT	TOP OF CEMENT	TOP DETERMINED BY
Conductor Pipe 30"	30"	10' BCL	10 yards	surface	sight
Surface Casing Intermediate	20"	580'	830 cu ft	surface	"
	13-3/8"	2432'	225 sx	2100'	calculated
Long String	10-3/4"	6420'	300 cu ft	4640'	CBL
Tubing (1000' 7-5/8")	8-5/8"	9599'	Name, Model and Depth of Tubing Packer 1000' of 7-5/8" on bottom. cmt is 7700'/9020' per CBL		

Name of Proposed Injection Formation Phase I Reservoir		Top of Formation 8000'	Bottom of Formation 9600'
Is Injection Through Tubing, Casing, or Annulus? 8-5/8" & 9-5/8" csg.	Perforations or Open Hole? OH	Proposed Interval(s) of Injection 9020'/9600'	
Is This a New Well Drilled For Injection? no	If Answer is No, For What Purpose was Well Originally Drilled? injection	Has Well Ever Been Perforated in Any Zone Other Than the Proposed Injection Zone? no	

List All Such Perforated Intervals and Sacks of Cement used to Seal Off or Squeeze Each

Depth of Bottom of Deepest Fresh Water Zone in This Area 450'	Is This Injection for Purpose of Pressure Maintenance or Water Disposal? (See Rules 501 and 502) water disposal		
Anticipated Daily Injection Volume 100,000 gal.	Minimum 27,000	Maximum 180,000	Open or Closed Type System closed
Is Injection to be by Gravity or Pressure? pressure		Approx. Pressure (psi) 1000 psig	
Answer Yes or No Whether the Following Waters are Mineralized to such a Degree as to be Unfit for Domestic, Stock, Irrigation, or Other General Use— yes		Natural Water in Injection Zone none	Are Water Analyses Attached? yes

Name and Address of Surface Owner (or Lessee, if State or Federal Land) **Los Alamos National Laboratory/University of California under contract for DOE**

List Names and Addresses of all Operators Within One-Half (1/2) Mile of This Injection Well

None

Have Cop-
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Are the
this Ar

Yes <input type="checkbox"/> No <input type="checkbox"/> No other operators within one mile			
Plat of Area Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Electrical Log Yes <input type="checkbox"/> No <input checked="" type="checkbox"/>	Diagrammatic Sketch of Well Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	

I certify that the information above is true and complete to the best of my knowledge and belief.

(Title)

(Date)

applied
by the
the app-
RULE 503.

and waivers from all operators within one-half mile of the proposed injection well not accompany this
to Oil Conservation Division will hold the application for a period of 20 days from the date of receipt
Fe office. If at the end of the 20-day waiting period no protest has been received by the Santa Fe office,
cessed. If a protest is received, the application will be set for hearing. If the applicant so requests, SEE

KB Depths

25 ft
270 ft
580 ft
600 ft

790 ft

1783 ft

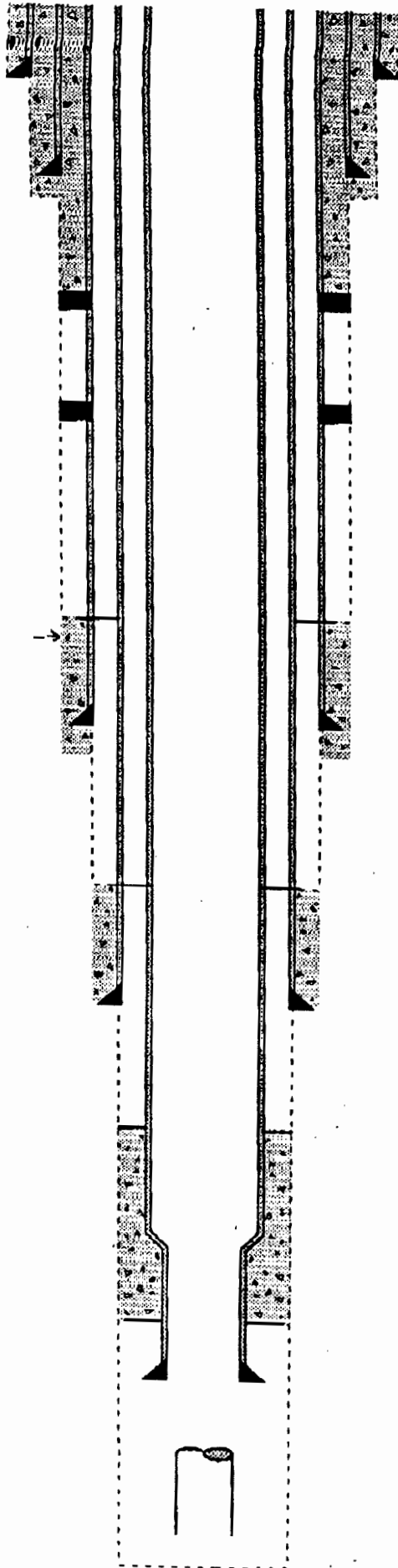
1905 ft

2100 ft
2401 ft
2431 ft
2600 ft

3350 ft
4640 ft

6420 ft

7700 ft
7936 ft
8600 ft
9020 ft
9599 ft
9747 ft
10,053 ft



KB 8711 ft - GL 8696 ft
48" hole drilled to 10' GL
30" culvert SA 10' GL with 10 yards concrete
10 3/4" casing parted at 270' - cemented four times
with a total of 500 sacks
20" 94# H-40 BT&C casing SA 580' with 830 ft³ cement
26 1/2" hole drilled to 600'

**Wellbore Diagram
for EE-1
9-22-81**

13 3/8" stage collar

13 3/8" stage collar cemented without returns
Cement lost to LC zone

Lost circulation zone in 17 1/2" hole

Calculated top of cement on first stage
recementing of 13 3/8" casing
Top of Precambrian

13 3/8" 54.5# k-55 ST&C casing SA 2432" with
225 sacks of cement on recementing
17 1/2" hole drilled to 2600'

Lost circulation zone in 12 1/4" hole

Top of cement per CBL on cementing of
10 3/4" casing

10 3/4" 45.5# K-55 BT&C casing SA 6420 with
300 ft³ cement

Top of cement per CBL at 7700' on cementing
of 8 5/8" x 7 5/8" casing
Lost circulation zone in 9 7/8" hole

Bottom of 8 5/8" 32# k-55 LT&C casing
Top of 7 5/8" 26.4# N-80 Hydril casing

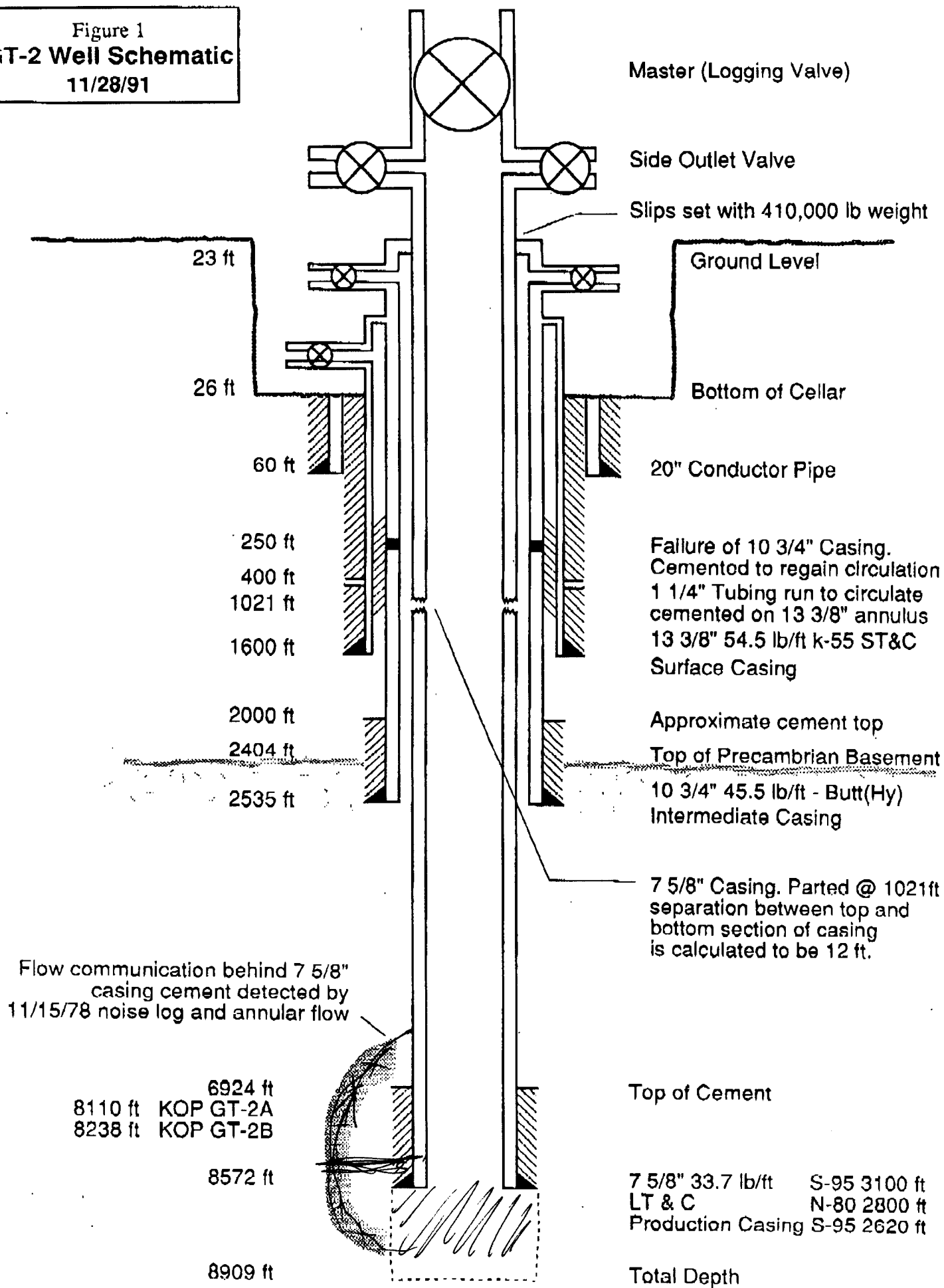
Bottom of cement per CBL at 9020'

7 5/8" 26.4# N-80 Hydril casing SA 9599'
with 240 ft³ and recemented with 180 ft³

Top of fish (5 1/2" casing and inflatable packers)

TD of 9 5/8" hole (cleaned out with 6 3/4" bit)

Figure 1
GT-2 Well Schematic
11/28/91



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FENTON HILL

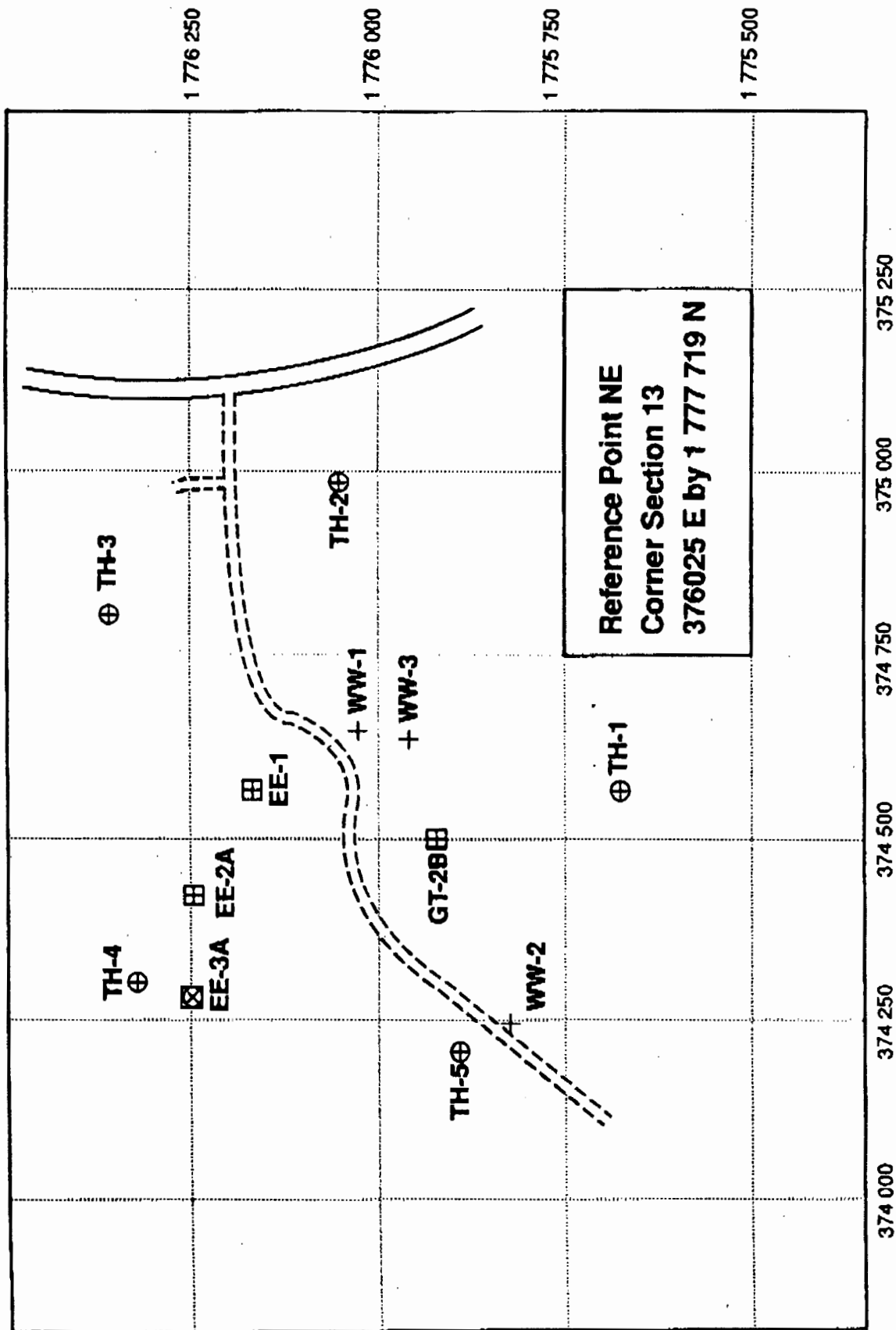
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February 15, 1996

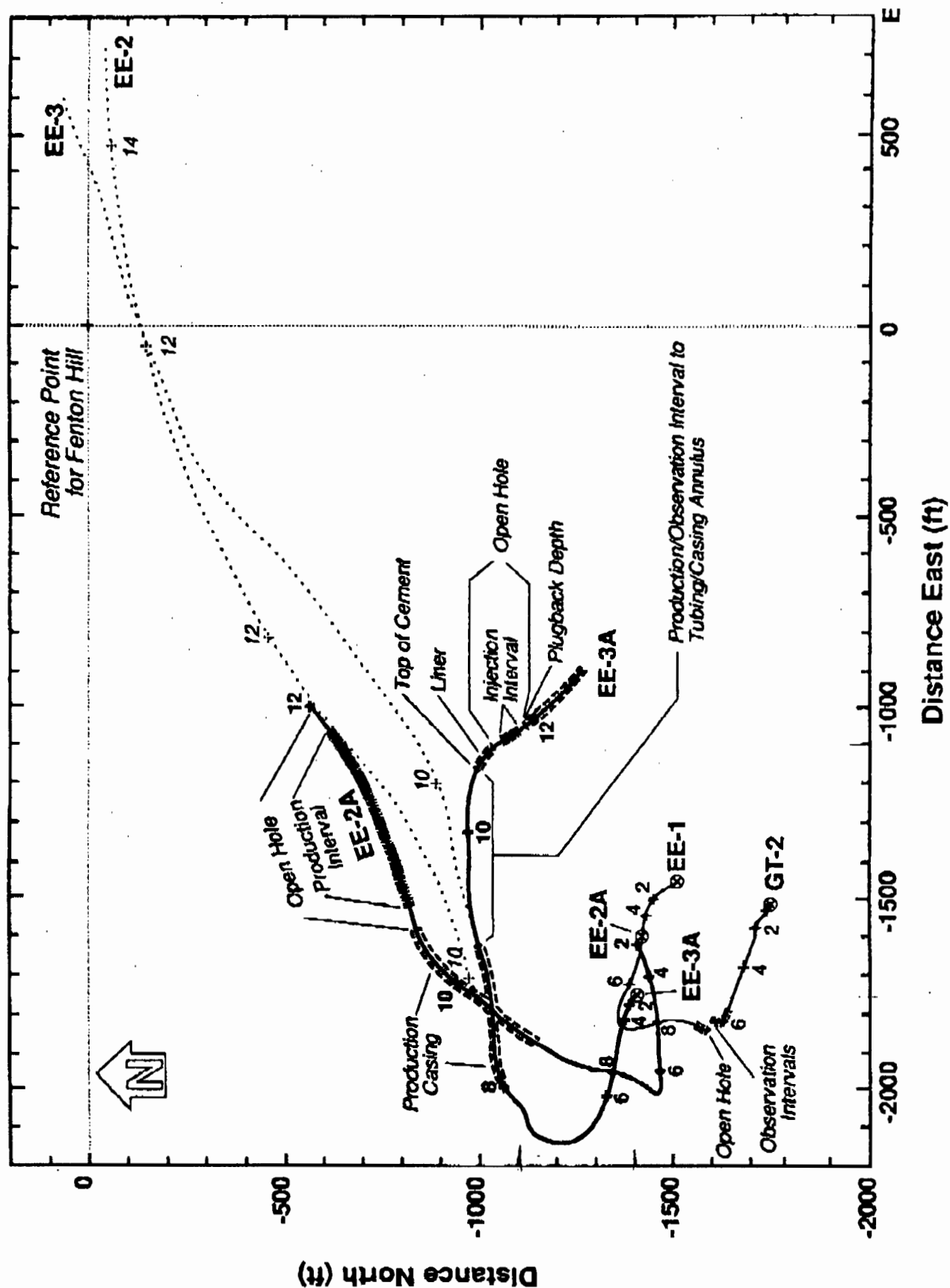
PROCEDURE TO PLUG LOWER GT-2 WELLBORE
WITH COILED TUBING

1. RUN GAUGE RING ON COILED TUBING TO 7-5/8" CASING SHOE AT 8572 FT.
2. RUN HYDRAULICALLY SET CEMENT RETAINER ON COILED TUBING TO 8500 FT. AND SET
3. PUMP SUFFICIENT GEOTHERMAL GRADE CLASS G CEMENT WITH 40% SILICA FLOUR, FRICTION REDUCER, RETARDED TO 400 DEG.F FOR 3-4 HOURS TO FILL CASING AND OPEN HOLE TO 8909 FT PLUS ADDITIONAL 20%.
4. RELEASE FROM RETAINER AND PUMP 200 LINEAR FT PLUG ABOVE RETAINER (8300-8500 FT).

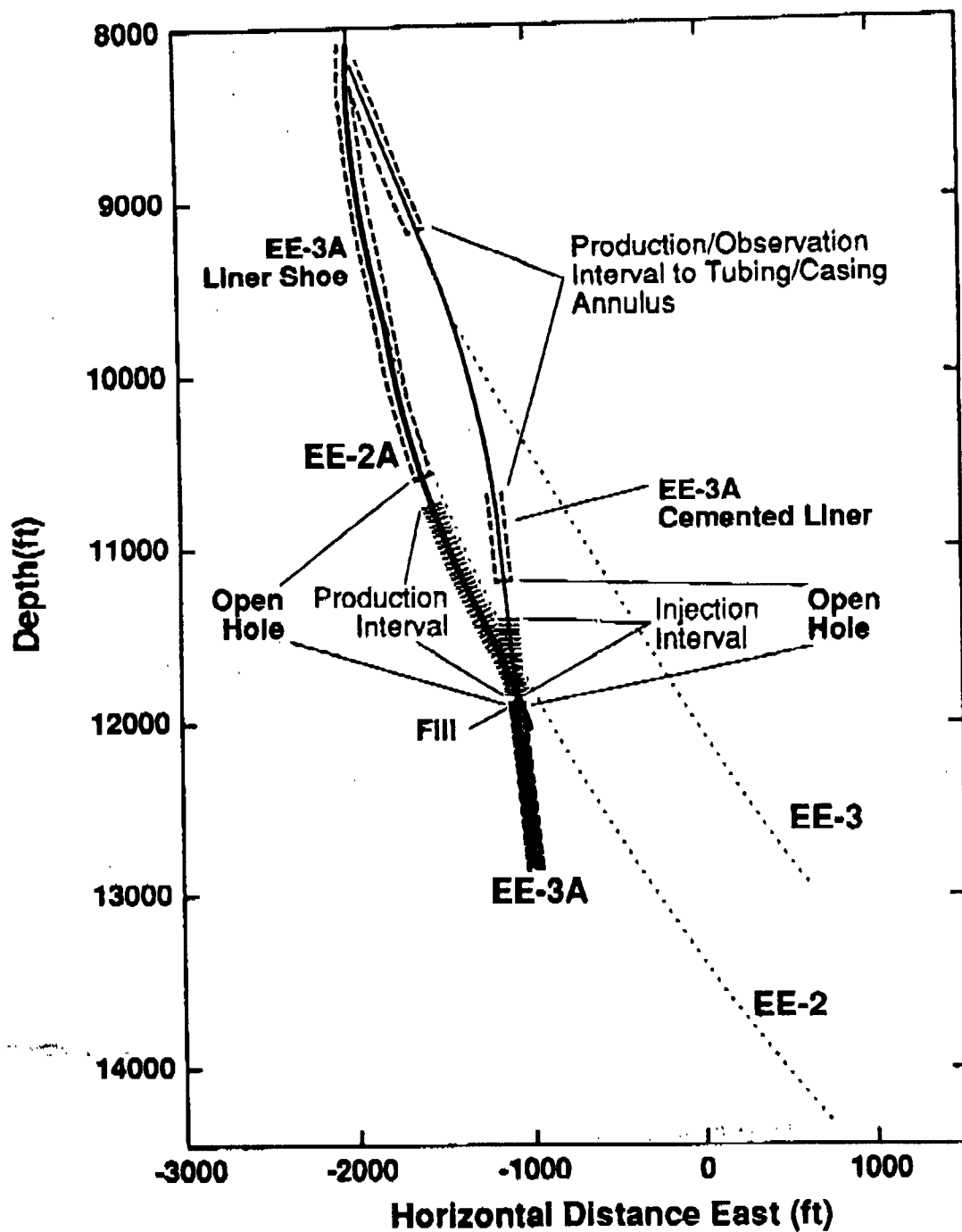
Surface Locations for Plat of all Wells on the Fenton Hill Site



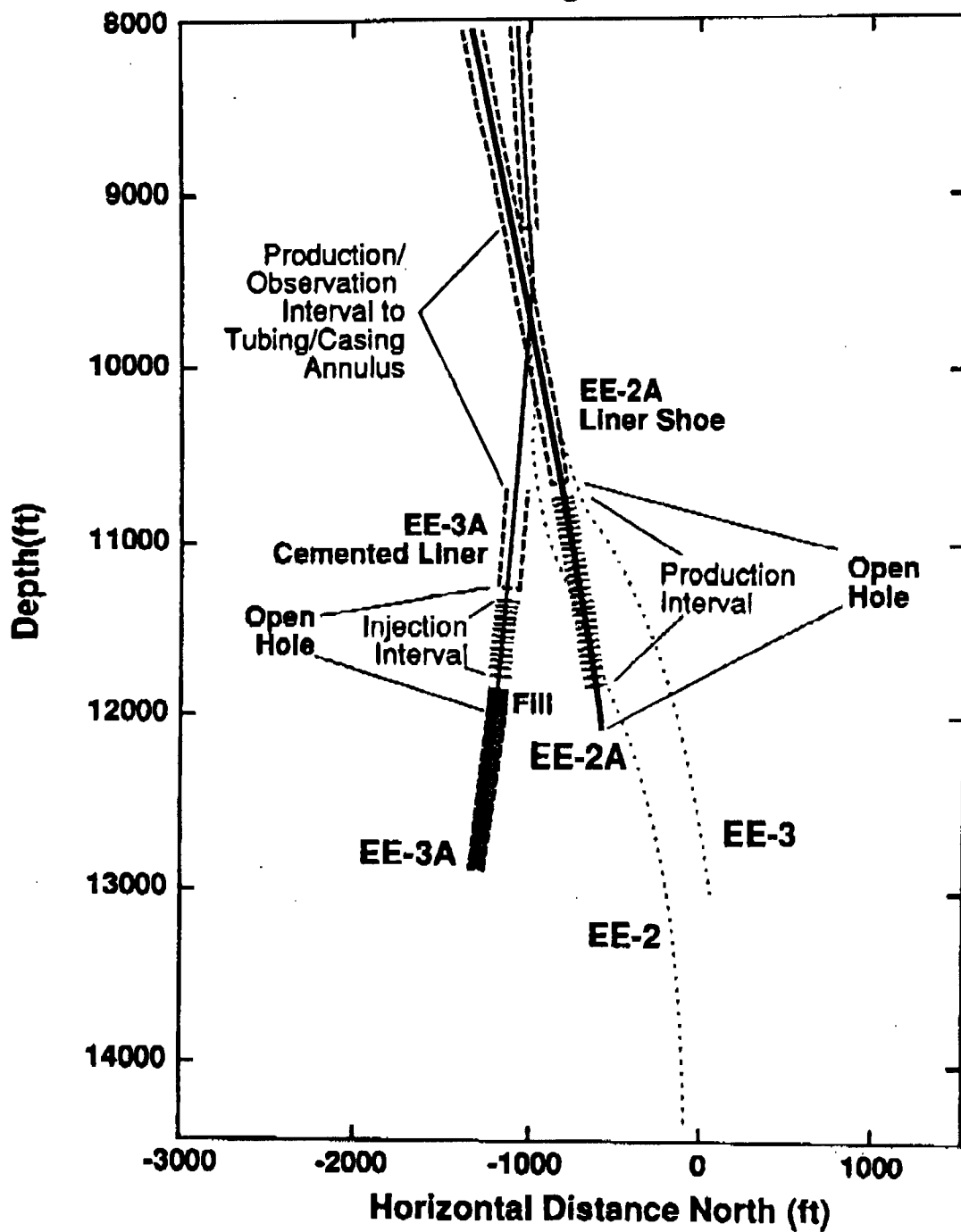
Fenton Hill Site Deep Wells Planar View



Fenton Hill Site EE-2(A) and EE-3(A) Looking North



Fenton Hill Site EE-2(A) and EE-3(A) Looking West



ATTACHMENT TO PLAT

WELL	SURFACE LOCATION	TOTAL DEPTH (ft)	OPEN HOLE/ PERFORATIONS (ft-ft)	STATUS
EE-1	1462 FEL, 1503 FNL, SEC 13 T19N, R2E, Sandoval Co., NM	10053	9599-10053	Instrument test & observation well
EE-2	1603 FEL, 1428 FNL, SEC 13 T19N, R2E, Sandoval Co., NM	15289	none	Plugged back to 9722 ft & redrilled AS
EE-2A	same as EE-2	12360	10775-12360	HDR production well
EE-3	1755 FEL, 1417 FNL, SEC 13 T19N, R2E, Sandoval Co., NM	13933	none	Plugged back to 9372 ft & redrilled AS
EE-3A	same as EE-3	13,182	9285-10950 11,436-12,107	HDR injection well
GT-2	1524 FEL, 1747 FNL, SEC 13 T19N, R2E, Sandoval Co., NM	9607	none	Plugged back to 8200 ft & redrilled
GT-2A	same as GT-2	9184	none	Plugged back to 8238 ft & redrilled
GT-2B	same as GT-2	8909	8572-8909 2535-7000	HDR observation well
PC-1	2013 FWL*, 2149 FSL*, SEC 18 T19N, R3E, Sandoval Co., NM	2178	2150-2178	Geophone station
PC-2	868 FWL*, 2195 FSL*, SEC 13 T19N, R2E, Sandoval Co., NM	1825	None	Geophone station
WW1	(1379 FEL, 1642 FNL,)** SEC 13	450	389-449	Active water
FH-1	T19N, R2E, Sandoval Co., NM 5-5/8" slotted liner @ 449		7" @ 390	well RG-24834
WW2	(1779 FEL, 1851 FNL,) SEC 13	450	372-431	Inactive water
FH-2	T19N, R2E, Sandoval Co., NM		16" @ 450	well
WW3	(1770 FEL, 1922 FNL,) SEC 13	460		Nonproducing
FH-3	T19N, R2E, Sandoval Co., NM		16"	water well

TEST ^E NE/4, ^W NE/4, ^W SE/4 SEC 18	590	478-590	Geothermal heat
HOLE T19N, R3E, Sandoval Co. NM		4-1/2" casing	flow measurement
A			hole
TEST (1471 FEL, 2004 FNL, SEC 13)	450		Nonproducing
HOLE T19N, R2E, Sandoval Co., NM	436	rabbit	observation well
1			
TEST (1129 FEL, 1627 FNL, SEC 13)	450		Nonproducing
HOLE T19N, R2E, Sandoval Co., NM	402		observation well
2			
TEST (1226 FEL, 1315 FNL, SEC 13)	450		Nonproducing
HOLE T19N, R2E, Sandoval Co., NM	372		observation well
3			
TEST (1726 FEL, 1356 FNL, SEC 13)	450		Nonproducing
HOLE T19N, R2E, Sandoval Co., NM	378		observation well
4			
TEST (1818 FEL, 1851 FNL, SEC 13)	450		Nonproducing
HOLE T19N, R2E, Sandoval Co., NM	418		observation well
5			

* MEASUREMENTS BASED ON 5280 FT BY 5280 FT SECTION. SURVEY DATA BASED ON REFERENCE TO NE CORNER OF SECTION 13, T19N, R2E.

** MEASUREMENTS IN PARENTHESIS ARE MAP MEASUREMENTS FROM AN ENG-4 MAP BASED ON MEASUREMENTS MADE ON 2/4/1980.

LOS ALAMOS NATIONAL LABORATORY ANALYTICAL RESULTS REPORT

Project: Fenton Hill Geothermal Facility

Sample
Location: 1 MG Service PondSample
Collection Date: August 28, 1995

Sample Type: Water, unfiltered

Analyst: Dale Counce, EES-1

HDR 1995

SAMPLE #	DESCRIPTION	DATE MM/DD/YY	Time	Al Std.D.		As Std.D.		B Std.D.		Ba Std.D.	
				ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm +/-
HDR95-76	1 MSP near EESA Discharge	08/28/95	09:00	0.15	0.01	5.08	0.02	52.5	0.1	0.19	0.01
HDR95-77	1 MSP East End	08/28/95	09:00	0.19	0.01	5.08	0.09	51.8	0.1	0.20	0.01

SAMPLE #	Sr		Ca Std.D.		Cl	CO2 Cond. (L)		F	Fe Std.D.		MnO3	K Std.D.		Li Std.D.		Mg
	ppm	ppm +/-	ppm +/-	ppm	ppm	umho/cm	ppm	ppm +/-	ppm	ppm +/-	ppm	ppm +/-	ppm +/-	ppm +/-	ppm	ppm
HDR95-76	9.57	75.2	0.3	1723	62.2	7090	9.34	0.39	0.01	623	112	2	20.0	0.1	3.67	
HDR95-77	9.70	74.1	0.9	1705	63.0	7090	9.92	4.12	0.03	617	111	1	21.2	0.1	2.63	

SAMPLE #	Std.D.		Mn Std.D.		Na Std.D.		NO3	pH (L)	PO4	Si Std.D.		SiO2	SO4	Sr Std.D.		Zn
	ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm +/-	ppm				ppm +/-	calculated	ppm	ppm +/-	ppm +/-	ppm	ppm
HDR95-76	0.02	0.34	0.01	1390	13	(0.1	7.91	(0.2	91.3	0.7	195	384	1.74	0.01	(0.01	
HDR95-77	0.05	0.41	0.01	1350	10	(0.1	7.93	(0.2	140	1	317	382	1.79	0.01	(0.01	

SAMPLE #	TDS	Cation	Anion	Balance
	ppm	Sum	Sum	
HDR95-76	4660	70.521	71.472	-0.0134
HDR95-77	4725	66.373	70.831	-0.0333

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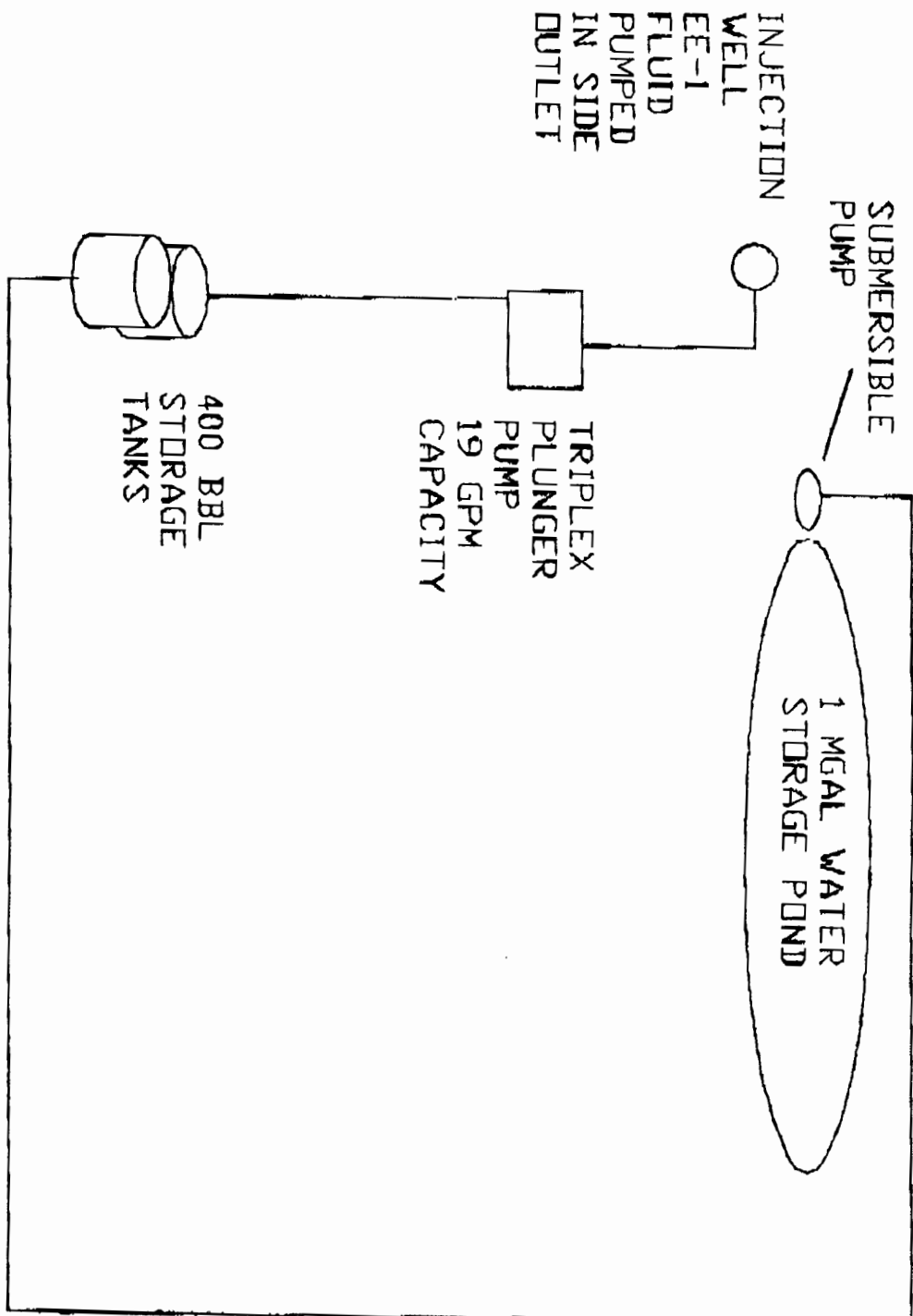
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02/15/96

CONFIGURATION OF SURFACE PIPING FOR FLUID INJECTION IN EE-1 LANL FENTON HILL GEOTHERMAL SITE



2/14/

**Turner Engineering Associates
215 S. State Suite 10
Salt Lake City, Utah 84111**

December 27, 1995

Tom Parker
Lee Wilson and Associates
PO Box 931
Santa Fe, New Mexico 87504

Dear Tom,

The following memorializes our conversation concerning the RE/SPEC, Inc. proposal to drill a small diameter stratigraphic and injection test hole for the Bureau of Reclamation in New Mexico.

The primary objective of this effort is to obtain lithologic and pressure draw-down and build-up information in order to assess the ability of the porous zones encountered during drilling to accept large volumes of water at high rates from the Trujillo formation. The integrity of this information is of paramount importance. The entire effort can be lost if depth objectives or pressure data are compromised.

Elements of the approach proposed by the RE/SPEC seriously jeopardize the ability of the effort to accomplish the project objectives.

The design approach for exploration wells is totally different from the perspective used for the design of development wells in areas of known geology. The primary consideration in exploration well design is to reach the stated geologic objectives with the ability to assess the value of potential zones of interest. Cost is a secondary consideration in exploration well design and redundancy must be provided to allow for unforeseen hole problems while attempting to reach the objective formations. Most importantly of all the objective data *cannot be compromised*. Schemes for data acquisition that *might work* if everything goes perfectly are simply unacceptable.

In order to mitigate the risk of failure to acquire adequate data for injectivity assessment and to maximize the probability of reaching target depths the following changes in design approach are necessary. Suggested program modifications are necessarily "broad brush" since the reviewed proposal states only what is to be done, omitting the details of how it is done. A detailed review will be possible when a complete drilling program has been prepared including such important details as drilling fluid system composition and cementing material admixture proposals to handle the anticipated hole conditions. The suggested approach changes are listed in order of importance.

- Set a 10-3/4" or 9-5/8" fresh water shut off string and use larger coring tools initially to allow for the isolation of each potential injection zone with core rod cemented in place. This allows either a contingency shut off string of large diameter pipe high in the hole to control potential problems such as lost circulation, swelling or sloughing clays and shales while also providing a contingency string of core rods deeper in the hole. This is necessary to guarantee the ability to reach the depth objective with a workable hole size where economical standard tool sizes can be utilized when required. Alternatively, zonal isolation can be accomplished by opening hole at the completion of coring and logging operations, running and cementing 5-1/2" or larger casing and selectively perforating and testing each individual zone of interest from the bottom up. Zones would then be isolated by the use of bridge plugs in casing prior to testing the next upper zone of interest. Providing larger diameter surface pipe will allow the flexibility of employing either approach as hole conditions allow.
- The cementing off of each potential injection zone as it is encountered with individual strings or all behind one string of pipe at the completion of coring allows the positive segregation of zones during injection testing. This eliminates the risky use of packers and bridge plugs in open hole below producing zones and precludes the very real possibility of compromising chemical and pressure data due to leaks by the packers in open hole. Finding good packer seats in salt, lime, clay and sand strata may be quite difficult. The very costly risk having to recover stuck packers in open hole due to sloughing from washouts or producing zones above the packer seat is also eliminated. You should also provide for the recovery of stuck tools by reducing hole size below casing so that overshots (larger than the stuck tool O.D. but smaller than the I.D. of the last casing string) can be run for recovery operations. The procedure of running full bore tools below permeable zones in maximum size open hole is a guaranteed formula for disaster. An equally serious drawback to this procedure is the almost certainty of leaks past the packers compromising pressure transient data rendering the permeability and reservoir volumetric analysis worthless. Given the small diameter pipe and shallow depths it is doubtful that wellbore storage effects will be significant and the use of packers can be eliminated entirely. Either of the above strategies will result in significantly less risk and substantially less overall cost than the proposed procedure and have the further advantage of virtually eliminating risk of failure to achieve project goals.
- Use bidding procedures to select sub-contractors, especially for the drilling. There are many capable continuous wire-line core drilling contractors in the industry. Take advantage of competition to reduce costs.
- Make frequent directional measurements to control dog-leg severity. Excessive dog-leg severity can limit the depth to which you can drill and compromise project objectives. If the location of the bottom of the hole or the actual vertical depth below the surface is of interest multi shot slick line surveys should be run during drilling rather than single shot surveys. Gyroscopic surveys can also be run at the completion of drilling to determine hole trajectory.
- Make use of drilling data recorders to log drilling information such as RPM, weight on bit, mud flow rates and pit levels at all times rather than spot checks by personnel.

- There is absolutely no need for the presence of a geologist, a drilling superintendent and a drilling engineer to be on site during normal drilling and coring operations. All necessary reporting functions can be easily accomplished by a competent geologist experienced in field operations. A morning phone call to the superintendent or drilling engineer is all that is required to prepare complete reports and adequately supervise the job. Engineering assistance will be required on site only during unusual operations such as testing, logging and cementing operations. The suggestion that two engineers might be required is amazing. Money can prudently be saved by eliminating unnecessary personnel costs, not by jeopardizing project goals with unnecessarily risky drilling and data acquisition procedures.
- Obtain individual formation fluid samples either with DST tools set in casing or by swabbing with cups. Analyze fluids for silica. Run temperature logs and multi finger calipers to assist in determining formation fluid compatibility and in-situ rock stress. NMOCD regulations limit injection pressures to 0.2 psi/ft. Injection testing at pressures up to 0.7 lithostatic will probably not be useful in New Mexico since continuous injection at these pressures is unlikely.

As we discussed, many other details need to be discussed once a detailed drilling procedure has been agreed upon and prepared. I am enjoying working with you on this project and hope that I can be of further assistance as the need arises.

Sincerely,



Thomas A. Turner

Turner Engineering Associates
251 South State St. #10
Salt Lake City, Ut
84111

801-575-5229 (fax and voice)

FAX COVER SHEET
Sheet 1 of 4

TO: Roy Johnson
Name

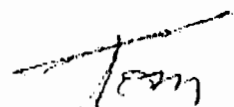
NMOCD
Company

505-827-8177
fax no.

FROM: Tom

MESSAGE: Here is some light reading for you - thanks for your help. I hope that your holidays were great and I hope to see you soon.

Tom

A handwritten signature, likely "Tom", written in ink. It is positioned below the printed name "Tom".