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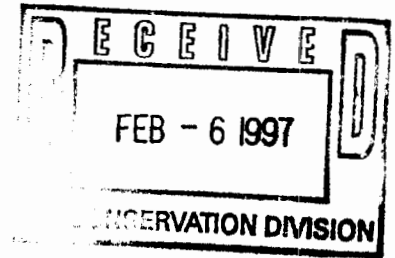
**WELL
PLUG &
ABANDONMENT**



Department of Energy

Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

FEB - 4 1997



CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Roy Johnson
Senior Petroleum Geologist
Supervisor District IV
New Mexico Oil Conservation Division
2040 S. Pacheco Street
Santa Fe, NM 87507

Dear Mr. Johnson:

Subject: Sundry Notices for Plugging and Abandonment of Fenton Hill Geothermal Wells

As required under New Mexico Oil Conservation Division Rule G-203B, Form G-103, Sundry Notice and Report, must be filed within 30 days of completion of geothermal well Plugging and Abandonment (P&A) operations. To fulfill your Division's requirement, enclosed are three (3) copies of Form G-103 for the six (6) geothermal wells plugged and abandoned at the Fenton Hill Geothermal Facility during the last quarter of 1996.

Included with each Sundry Notice are casing schematics for each well prior to abandonment. A full set of field reports is also enclosed. The deep wells, GT-2, EE-2, and EE-3, each have separate field reports which are attached to their respective Sundry Notices. The field reports for PC-1, PC-2, and GT-1 are included in the enclosed compendium of shallow well P&A operations. The other wells described in the compendium were less than 1,000 feet and, it is our understanding, do not require G-103 filing.

New Mexico Oil Conservation Rules G-205, G-206, and G-207 require that Forms G-105, G-106, and G-107 must be filed for plugged and abandoned geothermal wells. It is our understanding that you have issued a verbal waiver of these requirements and have instead requested that logs of wells be provided to characterize porosity, resistivity, and temperature in the well vicinities both to satisfy the intent of these requirements and to provide background information for a future injection permit application for EE-2, the remaining deep Fenton Hill well, for water disposal. Presently, only the temperature logs are available. Enclosed is a plot of three data sets from static temperature logs in EE-2 which should serve to characterize the regional temperature gradient. The additional

Roy Johnson

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logging data you requested, porosity and resistivity, will be forwarded to your office as soon as reproductions can be made.

Questions regarding the enclosed Sundry Notices and attachments should be addressed to Jim Thomson of Los Alamos National Laboratory's GeoEngineering Group (EES-4) at (505) 667-1924.

Sincerely,



Mathew P. Johansen, P.E.
Acting Assistant Area Manager
Office of Environment and Projects

LAAMEP:3MJ-005

Enclosures (3)

cc w/enclosures:

Mr. Steve Salzman

Petroleum Engineer

U. S. Bureau of Land Management

P. O. Box 27115

Mail Stop NM932

Santa Fe, NM 87505-0115

B. Koch, LAAMEP, LAAO

J. Albright, EES-4, LANL, MS-D443

J. Thomson, EES-4, LANL, MS-D443

B. Beers, ESH-18, LANL, MS-K497

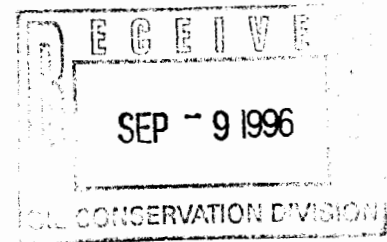
cc w/o enclosures:

S. Rae, ESH-18, LANL, MS-K497

N. Williams, ESH-18, LANL, MS-K497



Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544
SEP - 6 1996



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Dear Mr. Johnson:

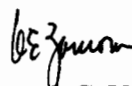
Subject: Plugging and Abandonment (P&A) Procedures for Wells Associated with Fenton Hill
Hot Dry Rock Geothermal Project: May 30, 1996

Following are some additions and modifications which the Los Alamos National Laboratory (LANL) wishes to append to the above-referenced document. These come as a result of your recommendations and comments and those of Mr. Steve Salzman, U. S. Bureau of Land Management.

1. Mud used for filler plugs on all wells will include an appropriate corrosion inhibitor.
2. Cement used in all wells will contain 40% silica flour.
3. The 7-5/8" casing in GT-2 will be cut at the lowest free point and removed.
4. Attempt to pull 8-5/8" casing in well PC-1.
5. Cut 7" casing at the lowest free point in well PC-2 and remove.
6. All casing cuts will be made below the shoe of the next outer casing. In some cases, the procedures specify making casing cuts slightly above the shoe.

Questions regarding these additions and modifications to the existing P&A Procedures should be addressed to Jim Albright of LANL's Earth and Environmental Sciences Group at (505) 667-4318.

Sincerely,


for Joseph C. Vozella
Assistant Area Manager
Office of Environment and
Projects

LAAMEP:9KZ-023

cc:
See page 2

Roy Johnson

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cc:

K. Zamora, AAMEP, LAAO

S. Rae, (ESH-18/WQ&H-96-0401), ESH-18, LANL,
MS-K497

B. Beers, ESH-18, LANL, MS-K497

N. Williams, ESH-18, LANL, MS-K497

J. Albright, EES-4, LANL, MS-D443

K. McAda, EPD, AL



Department of Energy
Albuquerque Operations Office
Los Alamos Area Office
Los Alamos, New Mexico 87544

*Evaluated 7-19-96
call Jim Albright - out
today.*

JUL 12 1996

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

Mr. Roy Johnson
Senior Petroleum Geologist
District IV Supervisor
New Mexico Oil Conservation Division
2040 Pacheco Street
Santa Fe, NM 87507

Dear Mr. Johnson:

Subject: Plugging and Abandonment (P&A) Procedures

Enclosed please find the P&A procedures for wells associated with the Los Alamos National Laboratory's (LANL) Fenton Hill Hot Dry Rock Geothermal Project. The U. S. Department of Energy has directed LANL to plug and abandon sixteen wells in Sandoval County as part of the planned decommissioning of the Fenton Hill facility. These P&A procedures are being submitted to your agency for review, comment, and approval.

Questions regarding the enclosed P&A procedures should be addressed to Jim Albright of LANL's GeoEngineering Group at 667-4318. Please submit written comments and approvals to me at your earliest convenience.

Sincerely,

Joseph C. Vozella
Assistant Area Manager
Office of Environment and Projects

LAAMEP:7JV-210

Enclosure

cc w/enclosure:
K. Zamora, AAMEP, LAAO
S. Rae, ESH-18, LANL, MS-K497
N. Williams, ESH-18, LANL, MS-K497
J. Albright, EES-4, LANL, MS-D443

Comments
#1 / Mud to contain corrosion inhibitors
#2 / Pull as esp as possible w/ CO₂ & H₂S in wellbores
#3 / cements to contain silica flour.

PLUGGING AND ABANDONMENT PROCEDURES
FOR WELLS ASSOCIATED WITH THE
FENTON HILL HOT DRY ROCK GEOTHERMAL PROJECT

May 30, 1996

Los Alamos National Laboratory
GeoEngineering Group - EES-4
Earth and Environmental Sciences Division
and
Water Quality and Hydrology Group - ESH-18
Environment, Safety, and Health Division

REGULATORY APPROVALS:

N.M. Oil Conservation Division - Roy Johnson

U.S. Bureau of Land Management - Steve Salzman

U.S. Forest Service - Dennis Trujillo

N.M. State Engineer's Office - Calvin Chavez

Overview:

Los Alamos National Laboratory (LANL) has been directed by the U.S. Department of Energy to plug and abandon (P&A) the wells associated with the Fenton Hill Hot Dry Rock (HDR) Geothermal Project. The wells are located in Sandoval County, New Mexico approximately 35 miles west of Los Alamos and range in depth from 450' to 12,235'. LANL intends to maintain two of the wells associated with the project, EE-2A and TH-3, for geoscientific studies and instrumentation development. These two wells will be abandoned at a later date.

Following is a list of the wells scheduled for abandonment during 1996. This document contains detailed P&A procedures of each of these wells arranged in the order in which they appear below. Casing schematics are provided for the deeper wells. Sundry Notices are attached for wells with depths in excess of 1,000'.

Name	Depth	Casing	Previous Service
GT-2	8,909'	See schematic	Phase I production
EE-1	10,053'	See schematic	Phase I injection
EE-3A	12,107'	See schematic	Phase II injection
GT-1	2,575'	See schematic	Heat/seismic measurement
PC-1	2,178'	See schematic	Heat/seismic measurement
PC-2	1,825'	See schematic	Heat/seismic measurement
TH-A	590'	4-1/2"/7" cemented @ 97'	Heat measurement
TH-B	650'	4-1/2"/7" cemented @ 97'	Heat measurement
TH-C	750'	4-1/2"/7" cemented @ 97'	Heat measurement
TH-D	500'	4-1/2"/7" cemented @ 97'	Heat measurement
TH-1	450'	1-1/2" steel pipe	Heat measurement
TH-2	450'	1-1/2" steel pipe	Heat measurement
TH-4	450'	1-1/2" steel pipe	Heat measurement
TH-5	450'	1-1/2" steel pipe	Heat measurement
WW-2	450'	16" casing (slotted)	Fresh water prod.
WW-3	460'	16" casing (slotted)	Fresh water prod.

Water Disposal in the Phase I reservoir

Approximately 700,000 gallons of produced geothermal fluid will be injected into the Phase I Hot Dry Rock reservoir through the EE-1 wellbore. GT-2 and EE-1 are the only two wells connected to the Phase I reservoir which is located approximately 8,000-9,600' below the surface and isolated from the aquifers by app. 5,500' of impermeable granite. GT-2 will be plugged and abandoned prior to injection operations. The 8-5/8" casing in EE-1 will be perforated at approximately 7,600' and cement squeezed outside the casing up to 6,500' to assure that the Phase I reservoir is isolated from the 8-5/8" x 10-3/4" casing annulus prior to injection. A mechanical integrity test of the 8-5/8" casing will then be performed. If there is evidence of a leak in the 8-5/8" casing, fluid injection will be performed through drill pipe and a packer set just above the 7-5/8" casing shoe at 9,599'. Complete P&A of EE-1 will be performed immediately after the injection operations are complete.

Well Locations

The physical locations of the deep wells (those over 1,000' in depth) can be found on the attached Sundry Notices. The remaining well locations are provided in Attachment 7.

Schedule

The P&A operations will be performed using three different rigs: a drilling rig rated to 500,000 lb hook load for the the deep wells (GT-2, EE-1, and EE-3A), a workover rig rated to 150,000 for the all other wells with casing sizes over 1-1/2", and a LANL owned pulling unit for well TH-1,2,4, and 5. Two rigs may be active simultaneously. Operations may start as soon as mid-July and it's expected that all P&A work will be completed before October 1, 1996.

Attachments

- 1.A. Sundry Notice for EE-1
- 1.B. P&A procedures for EE-1
- 1.C. Casing schematic for EE-1
- 2.A. Sundry notice for EE-3
- 2.B. P&A procedures for EE-3
- 2.C. Casing schematic for EE-3
- 3.A. Sundry Notice for GT-1
- 3.B. P&A procedures for GT-1
- 3.C. Casing schematic for GT-1
- 4.A. Sundry Notice for GT-2
- 4.B. P&A procedures for GT-2
- 4.C. Casing schematic for GT-2
- 5.A. Sundry Notice for PC-1
- 5.B. P&A procedures for PC-1
- 5.C. Casing schematic for PC-1
- 6.A. Sundry Notice for PC-2
- 6.B. P&A procedures for PC-2
- 6.C. Casing schematic for PC-2
7. Casing Descriptions, P&A Procedures, and Physical Locations for Shallow Wells Associated with the Fenton Hill Project

ATTACHMENT 7
CASING DESCRIPTIONS, P&A PROCEDURES, AND PHYSICAL LOCATIONS
FOR SHALLOW WELLS ASSOCIATED WITH THE FENTON HILL PROJECT

Plugging objective

The primary objective of the procedures described below is to eliminate the possibility of contamination of the aquifers from surface. The Bandelier Tuff provides an impermeable barrier between the surface and the fresh water aquifer. A cement plug consisting of at least 50 linear feet will be placed in the Bandelier Tuff to protect the fresh water aquifer from surface contamination. The procedures described below assume that the casing can be removed from the wells. In the event that a casing string can't be pulled, the freepoint of the string will be determined and the string will be cut as deep as possible before cement is placed.

Well descriptions and procedures

Name	Depth	Casing	P&A Procedure
TH-A	590'	4-1/2"/7" cemented @ 97'	Procedure A (below)
TH-B	650'	4-1/2"/7" cemented @ 97'	Procedure B
TH-C	750'	4-1/2"/7" cemented @ 97'	Procedure C
TH-D	500'	4-1/2"/7" cemented @ 97'	Procedure D
TH-1	450'	1-1/2" steel pipe	Procedure 1
TH-2	450'	1-1/2" steel pipe	Procedure 1
TH-4	450'	1-1/2" steel pipe	Procedure 1
TH-5	450'	1-1/2" steel pipe	Procedure 1
WW-2	450'	16" casing (slotted)	Procedure W
WW-3	460'	16" casing (slotted)	Procedure W

Procedure A: Pull 4-1/2" casing, set 200 linear foot cement plug at bottom and tag, fill w/9.5 ppg mud, set 50 linear foot plug at surface

Procedure B: Pull 4-1/2" casing, set 320 linear foot cement plug at bottom and tag, fill w/9.5 ppg mud, set 50 linear foot plug at surface

Procedure C: Pull 4-1/2" casing, set 560 linear foot cement plug at bottom and tag, fill w/9.5 ppg mud, set 50 linear foot plug at surface

Procedure D: Pull 4-1/2" casing, set 310 linear foot cement plug at bottom and tag, fill w/9.5 ppg mud, set 50 linear foot plug at surface

Procedure 1: Pull 1-1/2" pipe, cement to surface

Procedure W: Sand back to 350', set 100 linear foot cement plug, fill w/9.5 ppg mud, set 50 linear foot plug at surface

Note: 10% will be added to all calculated cement volumes

ATTACHMENT 7 (CONT'D)

Well Locations

Physical well locations are described below in Universal Transverse Mercator (UTM) coordinates. All wells are located in Sandoval County, NM in the NW quadrant of the Jemez Springs 15' Quadrangle.

<u>Well Name</u>	<u>UTM East Coordinate</u>	<u>UTM North Coordinate</u>
TH-A	3-49-793	13 39-71-429
TH-B	3-49-941	13 39-76-669
TH-C	3-53-433	13 39-81-646
TH-D	3-45-506	13 39-72-926
TH-1	3-48-913	13 39-71-699
TH-2	3-49-042	13 39-71-824
TH-4	3-48-846	13 39-71-955
TH-5	3-48-866	13 39-71-464
WW-2	3-48-846	13 39-71-749
WW-3	3-48-954	13 39-71-771
REF*	3-49-322	13 39-72-275

* REF is a reference location to the NE corner of Section 13 Township 19N Range 2E.