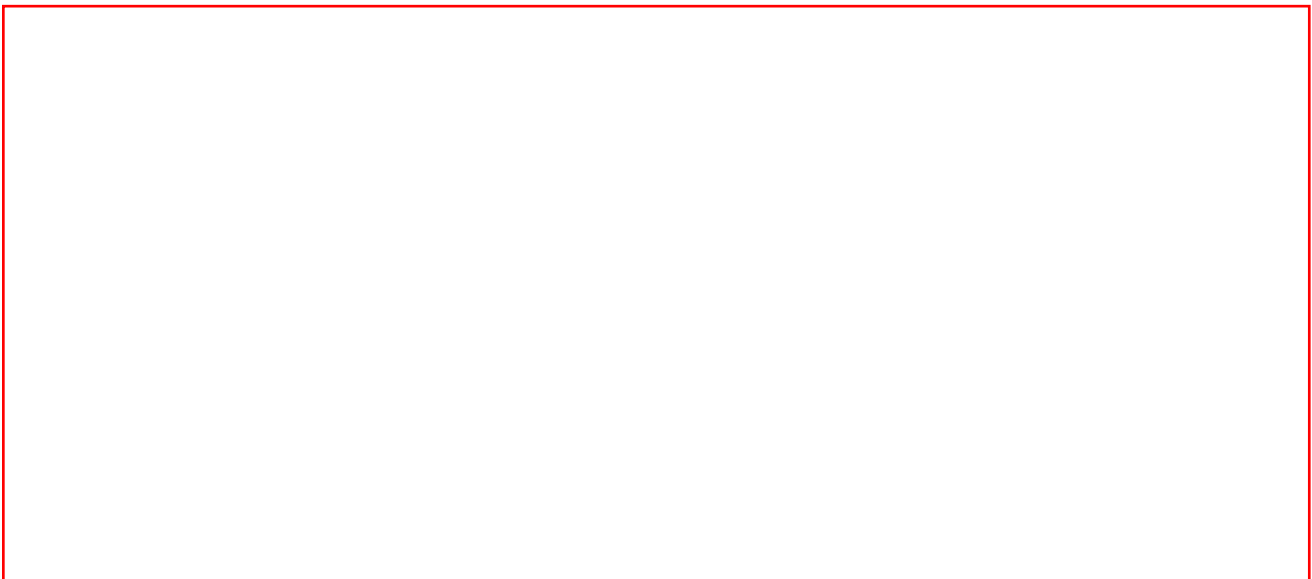


**GTLT - \_\_\_\_\_ 1 \_\_\_\_\_**

# **MEETINGS**



**Los Lobos Renewable Power, LLC GTHT-001 & Water Quality Sample Plan Meeting**

**Communication Meeting**

Date & Time: 8/7/2013 (1:00 - 5:00 p.m.)

Location: OCD Santa Fe Wendell Chino Building

The wireless access code for EMNRD-Public is "securityfirst". This is the one the public would use.

NAME:	AGENCY/COMPANY	PHONE	E-MAIL
Carl Chavez	OCD	505-476-3490	<a href="mailto:CarlJ.Chavez@state.nm.us">CarlJ.Chavez@state.nm.us</a>
CHUCK SMILEY	LOS LOBOS	843.725.9167	<a href="mailto:chuck.smiley@cyrgenergy.com">chuck.smiley@cyrgenergy.com</a>
Michelle Hurrie	Atty for Los Lobos	505 8421800	<a href="mailto:michelle@wccorn2.com">michelle@wccorn2.com</a>
David Janney	AMEC - for Los Lobos	505.821.1801	<a href="mailto:david.janney@amec.com">david.janney@amec.com</a>
Mike Gipson	LOS LOBOS	435-820-9840	<a href="mailto:mike.gipson@cyrgenergy.com">mike.gipson@cyrgenergy.com</a>
David Brooks	OCD	505-476-340	<a href="mailto:david.brooks@state.nm.us">david.brooks@state.nm.us</a>
Glenn van Gortem	OCD	476-3488	

State of New Mexico  
Energy, Minerals and Natural Resources Department

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**Susana Martinez**  
Governor

**David Martin**  
Cabinet Secretary Designate

**Brett F. Woods, Ph.D.**  
Deputy Cabinet Secretary

**Jami Bailey**  
Division Director  
Oil Conservation Division



**JULY 25, 2013**

Mr. Nick Goodman  
Los Lobos Renewable Power, L.L.C.  
136 South Main Street, Suite 600  
Salt Lake City, Utah 84101

**Re: Lightning Dock Geothermal Power Project (Order No. R-13675-B) Water Quality Sampling Plan for Well Flow and Injection Well Test in Hidalgo County, New Mexico**

Dear Mr. Goodman:

The New Mexico Oil Conservation Division (OCD) is in receipt of Los Lobos Renewable Power, L.L.C.'s (Operator) proposed Water Quality Sampling Plan (WQSP) submitted pursuant to Order No. R-13675-B (Order) issued by the Oil Conservation Commission (OCC) on May 9, 2013. After review of the WQSP, OCD has the following comments, recommendations and/or requirements that Los Lobos must address to satisfy the requirements of the Order.

The following regulations apply to this geothermal project: Geothermal Resources Conservation Act (Chapter 71, Article 5 NMSA 1978); Geothermal Power (Title 19, Chapter 14 NMAC); and Water Quality Control Commission (20.6.2NMAC and 20.6.4 NMAC).

It appears that this is the exploratory well test (test) that the Operator may utilize to determine whether geothermal power production is feasible in the project location. Therefore, the Operator must make some key demonstrations during the upcoming test that OCD will need to consider when reviewing the "Final G-104 Forms" These demonstrations include:

- 1) Demonstration that an equilibrium condition (water table stabilization throughout steady-state pumping rate) has been achieved under flow rates simulating operational conditions and which stresses the aquifer system to demonstrate that the geothermal reservoir has the capacity to produce fluids without depletion of the aquifer system in order to extract heat during operations;
- 2) Demonstration that the thermal reservoir heat source temperature remains constant or sustainable and at a temperature that will produce geothermal power during operations;
- 3) Demonstration that correlative rights of geothermal leaseholders near the project are not adversely affected by the project;

July 25, 2013

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- 4) Demonstration that water quality (project wells and nearby water supply wells) remains constant before, during and after the test; and
- 5) Demonstration that all of the above are supported by Final G-104 Submittals with associated forms and well test information for OCD approval/disapproval of the test based on the Order.

OCD reminds the operator that Los Lobos has not submitted the required MIT information (both CBL and CIT) from the injection wells for OCD's review and approval prior to injection.

Los Lobos must address the following OCD WQSP comments, recommendations and/or requirements in order to satisfy the Order:

Comments:

- 1) The operator refers to the WQSP specified in the Order as the "Geothermal Fluid Quality Monitoring Plan". Please revise to use the terminology of the Order.
- 2) It is important to note that the WQSP required in the Order is not just for the two referenced injection wells, but is also applies to the OCD Discharge Permit (GTHT-001) .
- 3) In general, the proposed WQSP sampling and/or monitoring locations, frequencies, parameters (especially field parameters, i.e., pH, static water level, temperature, oxidation-reduction, etc.) are not frequent enough, and/or are lacking. The objective of the Los Lobos WQSP is to obtain water quality data, temperature, and static water level fluctuations before, during, near cessation, and after the test. Los Lobos proposed WQSP is inadequate and must be revised.

Recommendations/Requirements:

- 1) Change the title of the submittal to "Water Quality Sample Plan" to be consistent with the Order.
- 2) The Operator shall fully comply with the Order and Discharge Permit GTHT-001 provisions; including: waste handling, analytes, run-off, discharges into surface drains, etc. during testing.
- 3) The Operator shall include a map(s) to scale illustrating the sample and/or monitoring locations (i.e., production, injection, and water supply wells).
- 4) The operator shall furnish isoconcentration maps of water quality, static water level (piezometric/potentiometric), and temperature isoconcentration maps before, during, near completion of test, and after test to assess the capacity of the thermal reservoir to produce thermal heat for the project.
- 5) The Operator shall revise its WQSP to specify that maps shall be submitted with the required G-Forms in the WQSP to adequately depict sampling and/or monitoring information during the test.



- 6) The Operator shall revise its WQSP to specify that it will provide supporting documentation for any isoconcentration maps generated from the test (i.e., production well flow rates, water quality maps, static water level piezometric/ potentiometric surface maps, temperature maps, etc.).
- 7) The Operator shall revise its WQSP to propose more frequent sampling/monitoring with rationale that will satisfy the Order.
- 8) The Sampling and monitoring frequency for the test (test is scheduled for maximum of 30-days) is not adequate. The Operator shall revise its WQSP to specify that it will test at least daily for field parameters such as static water level and temperature measurements. The Operator shall revise its WQSP to propose more frequent monitoring and shall provide its rationale for the proposed sampling frequency. All water quality samples collected at the end of the test need to be collected just prior to cessation of the test.
- 9) OCD requires ASTM E-947-83 whenever possible, unless temperatures, field conditions, etc. requires implementation of the other ASTM. The OCD approves low-flow to conserve loss of fluids in the reservoir or aquifer system.
- 10) Low-flow sampling well stabilization in field parameters of not greater than +/- 10% is required before water quality sampling except when anomalous readings of +/- 25% occur, in which case, a sample is to be collected with re-sampling conducted within 24-hours using same sample methodology at the same location.
- 11) Static Water Level with Temperature monitoring: The operator shall include as many monitor well locations as needed to adequately collect this essential data. The Operator shall Provide detailed procedure and its rationale for SWL (i.e., monitoring at least 24-hrs in advance of start of test through 24-hrs after cessation of test) and Temperature monitoring with reference to attachment(s) with locations, etc.
- 12) The Operator shall set the pumps as near to the base of open and/or lined borehole as feasible for this approved low-flow water quality sample method. OCD notes that there has been a lack of water quality information at depth and the planned testing should help to address this water quality information during the test. However, monitoring throughout the test should indicate when higher total dissolved solids and salinity fluids are upwelling into the project area from pumping.
- 13) The Operator shall provide all applicable attachments associated with the Order from GTHT-001, i.e., Tables 1 – 3, list of fresh water supply wells, etc.) with monitoring/sampling locations, frequencies, and parameters being monitored.
- 14) The Operator shall ensure in advance of the test that all well owners are notified of the schedule for the test activities with a copy of the OCD approved WQSP and have provided permission (provide documentation with the final G-104 submittals) for the operator to sample and/or monitor in accordance with the WQSP.
- 15) The Operator shall document and notify OCD of any well owners that deny access to their well. Well owners may choose to hire an environmental consultant to monitor their well in accordance with the WQSP.

July 25, 2013  
Page 4

If you have any questions, please do not hesitate to contact me by phone at (505) 476-3490, mail at the address below, or email at [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us).

Sincerely,



Carl J. Chávez  
Environmental Engineer

Attachments: Operator's WQSP Submittal

CJC/cjc

cc: Mr. David Janney, AMEC  
Mr. Scott Dawson, OCD Santa Fe  
Mr. Daniel Sanchez, OCD Santa Fe  
Mr. Glenn von Gonten, OCD Santa Fe  
OCD Artesia Office

## Chavez, Carl J, EMNRD

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**From:** Janney, David <david.janney@amec.com>  
**Sent:** Tuesday, July 09, 2013 6:21 PM  
**To:** Chavez, Carl J, EMNRD  
**Cc:** VonGonten, Glenn, EMNRD; Dawson, Scott, EMNRD; Shapard, Craig, EMNRD  
**Subject:** RE: Field Operations Test Fluid Monitoring Plan  
**Attachments:** Field OperationsTest Fluid Monitoring Plan 7-9-13.pdf

Greetings Mr. Chavez:

Please find attached the above referenced document for Los Lobos' Lightning Dock Geothermal project in Hidalgo County, New Mexico.

This document contains revisions that meet the requirements of the May 9, 2013 order from the OCC with attached conditions of approval for the injections wells. We have included language that keeps the plan general to include "any injection well" rather than refer to specific injection wells.

Please feel free to contact me with questions.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

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July 9, 2013

Project No. 1151700102

Mr. Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, New Mexico 87505

**RE: Revised geothermal fluid quality monitoring plan for the proposed field operations testing of geothermal well LDG 45-7 located in the Lightning Dock Geothermal Field, Hidalgo County, New Mexico**

Dear Mr. Chavez:

On behalf of Los Lobos Renewable Power, LLC (Los Lobos), AMEC Environment and Infrastructure, Inc. is pleased to submit this revised geothermal fluid quality monitoring plan for well flow testing at the above referenced site in Hidalgo County, New Mexico. This plan was revised to incorporate the recent conditions of approval in the approved G-112 forms for injection wells LDG 53-7, LDG 55-7 and LDG 63-7 dated 5/9/3013.

Los Lobos proposes to monitor the quality of the geothermal fluid during the flow test according to the following plan.

- Los Lobos will collect field fluid quality parameters (temperature, pH, oxidation/reduction potential, and specific conductance) from its production well LDG 45-7 on a daily basis. The meter used to record these field parameters will be calibrated against known standards on a weekly basis and checked against the standards daily. The calibration of the water quality meter will be recorded into a field book and a written record of the daily field geothermal fluid quality parameters will be recorded on field data sheets for inclusion into the permanent record.
- Los Lobos will collect geothermal fluid samples for laboratory analysis from LDG 45-7 at the initiation of the flow test; after 15 days of flow testing; and just prior to the conclusion of the flow test. If daily field parameter testing indicates a substantial change (+/- 25 percent), Los Lobos will collect an additional sample for laboratory analysis.
- Los Lobos will collect geothermal fluid samples for laboratory analysis from any injection well before injecting into any injection well and after the cessation of the injection into any injection well. At least 48 hours of time will lapse between cessation of injection and collection on the final sample.
- Low flow methods may be used to collect these samples from the water column and the samples will be collected according to ASTM Method E-947-83 or E-1675-95a at the surface. Samples will be transported under chain-of-custody to a certified analytical laboratory. The appropriate US Environmental Protection Agency or Standard Methods analytical methods with appropriate detection limits will be used to analyze the samples and standard laboratory quality assurance/quality control data will be submitted to OCD with the analytical results. Laboratory samples will be analyzed for the inorganic and organic constituents listed in NMAC 20.6.2.3103, pH, and total dissolved solids. Samples will be submitted to the laboratory on a standard 10-day analytical turn-around-time.

Mr. Carl Chavez  
July 9, 2013  
Fluid Quality Monitoring Plan

Thank you for your assistance in these matters. Please contact me at 505.821.1801 if you have any questions.

Regards,



David Janney, PG  
Agent for Los Lobos Renewable Power, LLC

**Cc:** Randy Dade - NMOCD Artesia  
Nick Goodman - Cirq Energy/Los Lobos Renewable Power/Lightning Dock  
Geothermal  
Chuck Smiley - Cirq Energy/Los Lobos Renewable Power/Lightning Dock  
Geothermal  
Michelle Henrie - Attorney for Los Lobos Renewable Power, LLC

**Table 1**  
**Ground Water Monitoring Program**

ID*	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-1 <sup>1</sup>	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 42-18 and associated pits (OCD)
MW-3 <sup>1</sup>	Annual	GW	VOCs (8260B) SVOCs (8270C)	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 51-07 and associated pits (OCD)
MW-2 <sup>1</sup>	Annual	GW	PAHs ( 8310)	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 53-12 and associated pits (OCD)
MW-4 <sup>1</sup>	Annual	GW	TPH (418.1)	Shallow MW located ~1500' (Northwest) of DW 45-07 directly downgradient from facility (OCD)
MW-5 <sup>1</sup>	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods) Mercury (7470A/7471A)	Shallow MW (water table) located ~1000' upgradient (South) of the nursery greenhouses 3 & 4 to monitor background (OCD)
MW-6 <sup>1</sup>	Annual	GW	General Chemistry (Methods specified at 40 CFR 136.3)	Shallow MW (water table) located ~100' downgradient (North) of DW 53-07 and associated pits (OCD)
MW-7 <sup>1</sup>	Annual	GW	Uranium (6010B/6020), Radioactivity (E903/E904) Radon (by EPA Method or method approved by OCD)	Shallow MW (water table) located ~100' downgradient (North) of DW 13-07 and associated pits (OCD)

Mr. Steve Brown  
 Los Lobos Renewable Power, L.L.C.  
 July 1, 2009  
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ID*	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-8 <sup>1</sup>	Annual	GW		Shallow MW (water table) located ~100' downgradient (North) of DW 33-07 and associated pits (OCD)
NW-1 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-2 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-3 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.

**Table 2**  
**Geothermal Injection Wells and**  
**Production/Development Wells Monitoring Program**

ID <sup>1</sup>	Frequency	Media	Analytical Suite/Method	Approximate Well Location
DW 13-07 <sup>1,3</sup>	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents  VOCs (8260B)  SVOCs (8270C)  PAHs ( 8310)  TPH (418.1)  Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods) Mercury (7470A/7471A)  General Chemistry (Methods specified at 40 CFR 136.3)  Uranium (6010B/6020), Radioactivity (E903/E904)  Radon (by EPA Method or method approved by OCD)	As Proposed in Application
DW 33-07 <sup>1,3</sup>	Annual	GW		
DW 45-07 <sup>1,3</sup>	Annual	GW		
DW 47-07 <sup>1,3</sup>	Annual	GW		
DW 53-07 <sup>1,3</sup>	Annual	GW		
IW 42-18 <sup>1,3</sup>	Annual	GW		
IW 51-07 <sup>1,3</sup>	Annual	GW		
IW 53-12 <sup>1,3</sup>	Annual	GW		



**Table 3**  
**Water Supply Wells Monitoring Program**

ID*	Frequency	Media	Analytical Suite/Method	Approximate Location
TG 52-07	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	Similar to monitoring & sampling plan from Los Lobos.
AmeriCulture No. 1 Federal	Annual	GW	VOCs (8260B)	
AmeriCulture State Well No. 2	Annual	GW	SVOCs (8270C)	
McCants No. 1 State	Annual	GW	PAHs ( 8310)	
Burgett No. 1 State	Annual	GW	TPH (418.1)	
Burgett Greenhouse No. 2	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)  Mercury (7470A/7471A)  General Chemistry (Methods specified at 40 CFR 136.3)  Uranium (6010B/6020),  Radioactivity (E903/E904)  Radon (by EPA Method or method approved by OCD)	

**STATE OF NEW MEXICO  
ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT  
OIL CONSERVATION COMMISSION**

**IN THE MATTER OF THE HEARING CALLED  
BY THE OIL CONSERVATION COMMISSION FOR  
THE PURPOSE OF CONSIDERING:**

**APPLICATION OF LOS LOBOS RENEWABLE  
POWER, LLC FOR APPROVAL TO INJECT  
INTO A GEOTHERMAL AQUIFER THROUGH  
TWO PROPOSED GEOTHERMAL INJECTION  
WELLS AT THE SITE OF THE PROPOSED  
LIGHTNING DOCK GEOTHERMAL POWER  
PROJECT, HIDALGO COUNTY, NEW MEXICO.**

Case No. 14948  
Order No. R-13675-B

**ORDER OF THE COMMISSION**

This case came before the Oil Conservation Commission (Commission) for consideration on March 19, 20, and 26, 2013, and the Commission having considered the evidence in support and opposition to these applications, on the 16th day of April, 2013,

**FINDS THAT:**

1. Los Lobos is developing a utility-scale binary (two closed loops) geothermal power facility.
2. On or about December 13, 2012, Los Lobos submitted applications to the Oil Conservation Division (OCD) to place two geothermal wells (wells LDG 55-7 and LDG 53-7) on injection for well testing and potential future re-injection of geothermal fluids. The form of these applications was a Form G-112 packet, pursuant to 19.14 NMAC, specifically 19.14.93.8 NMAC.
3. Well LDG 55-7, a well that has been in existence since 1985, is located in Unit J, 2390 feet from the South line and 2412 feet from the East line, Section 7, Township 25 South, Range 19 West, Hidalgo County, New Mexico.
4. Well LDG 53-7, completed in November 2011, is located in Unit G, 1525 feet from the North line and 2228 feet from the East line, Section 7, Township 25 South, Range 19 West, Hidalgo County, New Mexico.
5. Each Los Lobos G-112 application contains (a) a plat showing the location of the proposed injection/disposal well and the location of all other wells within a radius

of one mile from said well, and indicating the perforated or open-hole interval of all other wells within a radius of one mile from said well, together with the ownership of all geothermal leases within the one-mile radius; (b) the log of the proposed injection well, if available; and (c) a diagrammatic sketch of the proposed injection well showing casing strings, including diameters and setting depths, quantities used and tops of cement, perforated or open-hole interval, tubing strings, including diameters and setting depths, and the type and location of packers, if any.

6. Each Los Lobos G-112 application (without the above attachments) was sent to all other geothermal lease owners within a one-half mile radius of the proposed injection well.

7. AmeriCulture, Inc. wrote a letter to OCD dated December 26, 2012 regarding the pending G-112 applications. The letter protested the use of either Well LDG 55-7 or Well LDG 53-7 as injection wells. The protest asserted that AmeriCulture, Inc.'s State Well No. 1 is in direct hydraulic connection with the production interval in Well LDG 55-7. The protest regarding Well LDG 53-7 asserted a possibility of migration of disposed geothermal power plant "fluids" to one or more of AmeriCulture, Inc.'s production wells.

8. OCD's Director, pursuant to 19.14.93.9 NMAC, scheduled a Hearing Examiner hearing on January 24, 2013. The hearing was initially postponed to allow Los Lobos' hydrologist to be present at the hearing, and was then continued to February 21, 2013, to allow AmeriCulture, Inc.'s new counsel time to prepare. Los Lobos then applied for the matter to be heard directly by the Commission. The matter was set for the Commission hearing on March 19, 2013. Notice of the hearing was issued on February 20, 2013. Notice was posted on OCD's website and published in the Hidalgo Herald.

9. OCD proposed draft Conditions of Approval that were filed with the Commission.

10. Los Lobos presented evidence that its proposal is in the interest of conservation and will prevent waste. Los Lobos proposes to reinject all water produced for geothermal power plant operations into the same geothermal reservoir from which it was produced. Los Lobos presented testimony that if its field testing reveals that there is, in fact, a structural "boundary" between the proposed production wells and injection wells, it would be financially imprudent to build the geothermal power facility project using the proposed configuration of production wells and injection wells. Los Lobos also presented a report from John Shomaker & Associates, Inc. that during pump and injection testing in 2012, water levels had reached, or nearly reached, equilibrium by the end of the test.

11. Los Lobos presented evidence that its proposal protects correlative rights. Under the principle of correlative rights, and New Mexico's geothermal statutes and rules, all lease holder and mineral owners have a right to develop the resource in proportion to their corresponding acreage. Los Lobos leases more than 2500 acres of

geothermal mineral acreage. AmeriCulture, Inc. has a state geothermal lease for 10 acres and shares 15 acres of geothermal mineral with Los Lobos pursuant to a Joint Facility Operating Agreement.

12. Los Lobos presented evidence that Well LDG 53-7 and Well LDG 55-7 are cased, cemented, and equipped in such a manner that there will be no danger to any natural resource (including geothermal resources, useable underground water supplies, and surface resources).

13. Los Lobos presented evidence that even if AmeriCulture, Inc.'s State Well No. 1 is in direct hydraulic connection with the production interval in Well LDG 55-7, injection into Well LDG 55-7 is unlikely to create any significant drawdown or effects at AmeriCulture, Inc.'s State Well No. 1.

14. Los Lobos presented evidence of consistent concentrations of analytes from the geothermal fluid flow intervals in Wells LDG 45-7, LDG 53-7, and LDG 55-7, and demonstrated that analyte concentrations are not substantially different from those in the shallow alluvial wells within the geothermal fluid up-flow areas, such as AmeriCulture, Inc.'s wells.

15. Los Lobos presented evidence that the geothermal fluid production zone in Well LDG 53-7 and Well LDG 55-7 is the same, and that the geothermal fluid flow intervals occur in the same geological formations and are not directly connected to the alluvial aquifer at 400 feet below ground surface in AmeriCulture, Inc.'s State Well No. 1.

The Commission concludes that:

16. Due notice of the hearing on this application has been given, and the Commission has jurisdiction of the parties to this case and the subject matter thereof.

17. Los Lobo's proposal complies with 19.14.93.8 NMAC.

18. Los Lobos' proposal is in the interest of conservation and will prevent waste.

19. Los Lobos' proposal will protect correlative rights.

20. Well LDG 53-7 and Well LDG 55-7 are cased, cemented, and equipped in such a manner that there will be no danger to any natural resource including geothermal resources, useable underground water supplies, or surface resources.

**IT IS THEREFORE ORDERED THAT:**

1. The application of Los Lobos to place Wells LDG 53-7 and LDG 55-7 on injection is hereby granted subject to the Conditions of Approval attached as Exhibit A.

2. The OCD shall review the approved application in five years to ensure continued compliance with the Geothermal Resources Conservation Act, NMSA 1978, Section 71-5-1 *et seq.* and 19.14.93.8 NMAC.

3. The Commission retains jurisdiction over this case for the entry of such further orders as the Commission deems necessary.

DONE at Santa Fe, New Mexico on the 9th of May, 2013.

STATE OF NEW MEXICO  
OIL CONSERVATION COMMISSION



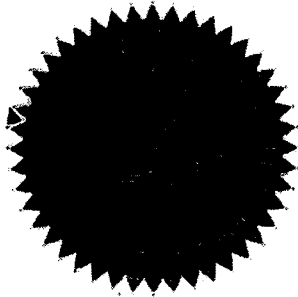
TERRY WARNELL, Member



ROBERT BALCH, Member



JAMI BAILEY, Chair



SEAL

**Exhibit A**

**Conditions of Approval**

1) **G-104 Form:** The operator shall submit a final G-104 Form with all other associated G-Form information (i.e., G-105, G-106, and G-107) with required logs and well test information (19.14.55.8 NMAC) for this G-112 submittal (19.14.63 NMAC and 19.14.93 NMAC) to the Oil Conservation Division (OCD) for approval prior to injection into Well 53-07 or Well 55-07.

2) **Water Quality Sampling Plan:** The operator shall provide a water quality sampling plan (plan) to OCD for approval prior to injecting any produced geothermal fluid into Well 53-07 or Well 55-07. The operator shall comply with OCD's approved ASTM sample procedure(s) with environmental water quality sampling and analytical laboratory testing that complies with EPA Quality Assurance/Quality Control (QA/QC) and Data Quality Objectives (DQOs).

The operator shall sample for the constituents specified in Tables 1 through 3 of its Discharge Permit (GTHT-01) using the specified methods. The operator shall collect environmental water quality samples from Production Well 45-07 before, during and just before the end of well testing. Injection Well 53-07 and Injection Well 55-07 shall be sampled before and immediately at the end of well testing. During Production Well 45-07 well testing, the operator shall collect a sample and notify the OCD within 24-hours of discovery whenever daily production well field testing water quality parameters (i.e., temperature, oxidation/reduction, pH, and Specific Conductivity) vary by +/- 25%. The operator shall request permission from each water supply well owner (see Table 3 of GTHT-01 to allow the operator to conduct water quality testing, including the analytes and methods specified in Tables 1 through 3, water quality analyte suites, and monitor well static water-levels during testing to help assess the capacity of the reservoir to sustain production of geothermal fluids for the extraction of heat and any heat loss observed during well testing.

3) **Water Quality Sample Method:** When sampling for Water Quality Control Commission (WQCC) DP parameters, the operator shall sample any source of injected fluids, Injection Well 53-07, Injection Well 55-07, and Water Supply Wells utilizing ASTM E-947-83 (Standard Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis) whenever possible.

4) **Water Quality Monitoring Parameters:** The operator shall monitor for the analyte suites listed in Tables 1 through 3 as specified in Condition of Approval 2 (COA 2) above. The operator shall assess the potential for the effluent from any source of injected fluids into Injection Well 53-07 and Injection Well 55-07 to adversely affect ground water quality at any place of withdrawal for the present or reasonably foreseeable future in water supply wells located within one-half mile from Injection Well 53-07 or from Injection Well 55-07. OCD may require the operator to implement corrective

action(s) if water quality exceeds the greater of the WQCC ground water standards specified at 20.6.2.3103 NMAC or background at any place of withdrawal of ground water for the present or reasonably foreseeable future use. The operator shall conduct operations in such manner so as to protect fresh water and in a manner consistent with the requirements specified in GTHT-01.

5) **Water Quality Background:** The operator shall obtain ground water quality data from any source of injected fluids and Injection Well 53-07 and Injection Well 55-07 as specified in COAs 2 through 4 to help determine background geothermal reservoir water quality conditions.

6) **Correlative Rights:** The operator shall monitor the geothermal reservoir for sustainable production well capacity for the long-term extraction of heat to efficiently produce power, prevent waste, and protect correlative rights of nearby geothermal lease owners sharing the reservoir. The operator shall implement commercially reasonable efficient geothermal engineering power generation design, operations, and environmental best management practices to address applicable regulations and to prevent pollution. Any deviation from a closed loop binary system, such as use of a wet cooling tower, shall require the operator to request a hearing before the Oil Conservation Commission.

7) **Geothermal Waste:** The operator shall minimize geothermal waste of heat from geothermal reservoir fluids treated and/or stored at surface, and prevent the reinjection of high turbidity cooled geothermal reservoir fluids treated and/or stored at surface back into the reservoir. "Geothermal Waste" includes the inefficient, excessive, or improper management of reservoir thermal fluid production, use, or dissipation of geothermal fluid heat (e.g., transporting or storage methods that cause or tend to cause unnecessary surface heat loss of the geothermal resource, and/or reinjection of cold reservoir fluids back into the geothermal reservoir resulting in inefficient and/or decreased geothermal reservoir temperature(s)). In addition, the operator shall not locate, space, construct, equip, operate, produce, or vent any well in a manner that results or tends to result in unnecessary heat and/or evaporative losses or in reducing the ultimate economic recovery of geothermal resources.

8) **Water Evaporation:** The operator shall accurately monitor and estimate evaporation losses (See COA 12) to the water resource(s) including, all geothermal production fluid evaporative losses from surface management operations to ensure that its water rights are adequate to replace the net loss of the ground water resources due to its surface fluid management operations. Surface fluid management operations shall include annual production well testing, well work over, repair, maintenance, and/or anytime geothermal reservoir fluids are exposed to ambient air conditions.

The operator shall monitor the in-flow/out-flow rate(s) and fluid level in ponds/pits to maintain adequate free board, prevent overflow, and to detect leaks and spills. The operator shall record evaporation fluid loss volumes and shall total cumulative losses from ponds/pits at least daily during well testing. The operator shall report pond/pit volumes daily to OCD whenever a pond or pit is used.

The operator shall report to OCD when evaporative losses from surface management of produced geothermal fluids exceed the operator's available water rights during well testing and/or during geothermal operations.

If the Office of the State Engineer issues an opinion finding that existing ground water rights may be impaired, OCD, upon receipt of that opinion, shall require the operator to submit a "Water Replacement Plan" (see COA 12) to resolve the situation. The operator shall conduct annual production well testing as specified in GTHT-1. The operator shall provide information on the size and extent of the geothermal reservoir as specified in GTHT-1.

9) **Mechanical Integrity Testing Initial Reporting:** The operator shall submit an initial G-103 Sundry Notice for an injection well Mechanical Integrity Test (MIT) before initial injection into Injection Well 53-07 or Injection Well 55-07 to be approved by the OCD, and give OCD at least five business days' prior notice of when the MIT is scheduled so that the OCD has the opportunity to witness the test.

The operator shall ensure that the UIC Class V Geothermal Injection Well 53-07 and Well 55-07, MITs performed subsequent to well work over, unless it occurs after the 4<sup>th</sup> year, since the last EPA MIT, shall not disrupt the 5-year MIT schedule. In general, the well shall be tested every 5 years regardless of well work over MITs conducted between the required EPA MIT 5-year MIT schedule. The operator may proceed at its own risk when attempting to perform an MIT with external equipment on the well head, i.e., BOPE, which could be the cause of a well MIT failure.

10) **Mechanical Integrity Testing Subsequent Reporting:** The operator shall submit a subsequent G-103 Sundry Notice to report MIT results for OCD approval in accordance with COA 9 above and prior to injection into Well 53-07 or Well 55-07 (19.14.54.8.C(2) NMAC).

If OCD does not witness the MIT, the Operator shall submit the original MIT chart with required information, test type, witness signatures, and chart recorder calibration information with MIT chart for approval prior to injecting into a well. This submittal shall start the OCD Underground Injection Control (UIC) Program 5-Year MIT injection well monitoring schedule. The operator shall file a G-103 Sundry Notice in a timely manner whenever an injection well is no longer needed as an injection well. OCD may modify GTHT-01 when this occurs. The operator shall file a new G-112 Form with the OCD for approval if the same well is needed for use as an injection well at a later date. OCD may again modify GTHT-01 if this occurs.

For injection wells under completion, the operator may submit a Cement Bond Log (CBL) and Casing Integrity Test (CIT) performed during and/or after Well 53-07 completion or Well 55-07 completion to the OCD attached to a "Subsequent" G-103 Form to satisfy the MIT requirement prior to injection into Injection Well 53-07 or injection into Injection Well 55-07.



11) **OCD Discharge Permit (GTHT-001):** The operator shall ensure that any OCD approved G-104 and G-112 Permits shall also comply with the terms and conditions of GTHT-01. The operator shall request a minor "Modification" to the permit for any changes to its permit to include any new and/or removed existing UIC Class V Geothermal injection/disposal well(s) prior to commercial power production operations and/or as needed at least 30 days in advance of plans for OCD approval.

12) **Water Replacement Plan (WRP):** The operator shall furnish OCD information sufficient to demonstrate that its proposed plan(s) and/or any modified plan(s) of operation will not result in a "diversion" of ground water beyond water rights owned or leased by the operator, and that water temperature at the location from which the water will be produced is greater than 250 degree Fahrenheit bottomhole temperature. Bottomhole temperature shall mean the highest temperature measured in the well or bore hole, and is normally attained directly adjacent to the producing zone, and commonly at or near the bottom of the borehole.

This information shall include the information specified by The Office of the State Engineer (OSE) and shall be submitted to the OCD in order that OSE may render an opinion pursuant to NMSA 1978 Section 71-5-2.1 as to whether a "Water Replacement Plan(s) - WRP" is necessary based on available water rights and planned extraction and injection operations.

In the event that OSE (a) opines that a WRP is necessary, (b) declines to opine, or (c) the temperature of produced water is less than 250 degrees Fahrenheit, in which case, all Production Well 45-07 operations (and/or all applicable project production well locations) shall be subject to OSE Jurisdiction. The operator shall also continue to comply with all applicable OCD Jurisdictions.

13) **Applicable Regulations:** The operator shall comply with the terms and conditions of GTHT-01, the Geothermal Resources Conservation Act (Chapter 71, Article 5 NMSA 1978, and OCD's Geothermal Regulations (Title 19, Chapter 14 NMAC). The operator shall comply with the applicable sections of Water Quality Control Commission Regulations (20.6.2.5000 - 5006 NMAC) while any Underground Injection Control (UIC) Class V Geothermal Injection and/or Disposal Wells are being used as injection wells. The operator shall ensure that all of its geothermal field activities comply with the applicable provisions of 20.6.2 NMAC and 20.6.4 NMAC.

14) **Termination of Injection Authority:** The operator shall comply with the above Conditions of Approval or OCD may after notice and hearing (or without notice and hearing in event of an emergency, subject to the provisions of NMSA 1978 Section 71-5-17) terminate the operator's injection permit.

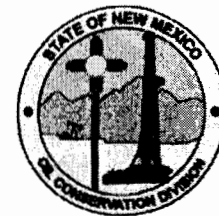
**Disclaimer:** *Please be advised that approval does not relieve Los Lobos Renewable Power, L.L.C. from responsibility if its operations pose a threat to ground water, subsurface trespass, water supply/diversion, surface water, human health, or the environment. In addition, approval does not relieve Los Lobos*

*Renewable Power, L.L.C. of responsibility for compliance with any other federal, state, or local laws and/or rules or regulations.*

**Bill Richardson**  
Governor

Joanna Prukop  
Cabinet Secretary

Mark Fesmire  
Division Director  
Oil Conservation Division



July 1, 2009

Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
5152 North Edgewood Drive, Suite 375  
Provo, Utah 84604

**RE: LOS LOBOS RENEWABLE POWER, L.L.C. - LIGHTNING DOCK  
GEOTHERMAL NO. 1 (HI-01) DISCHARGE PERMIT (GTHT-001)  
NE/4 SW/4 OF SECTION 7, TOWNSHIP 25 SOUTH, RANGE 19 WEST,  
NMPM, HIDALGO COUNTY, NEW MEXICO  
CLASS V INJECTION WELLS AND GEOTHERMAL PRODUCTION OR  
DEVELOPMENT WELLS, TOWNSHIP 25 SOUTH, RANGES 19 AND 20 WEST,  
NMPM, HIDALGO COUNTY, NEW MEXICO**

Dear Mr. Brown:

Pursuant to the Water Quality Control Commission (WQCC) Regulations 20.6.2.3104 through 20.6.2.3114 NMAC (*Permitting and Ground Water Standards*) and 20.6.2.5000 through 20.6.2.5299 NMAC (*Underground Injection Control*), the Oil Conservation Division (OCD) hereby approves the discharge permit for of three (3) Class V geothermal injection wells and authorizes the operation of five (5) production or development wells for the Los Lobos Renewable Power, L.L.C. (**owner/operator**) for the above referenced site, contingent upon the conditions specified in the enclosed **Attachment 1 to the Discharge Permit**. The owner/operator of the geothermal power plant is located in the NE/4 SW/4 of Section 7, Township 25 South, Range 19 West, NMPM, Hidalgo County, New Mexico. The Class V geothermal injection wells and the production or development wells are located in Township 25 South, Ranges 19 and 20 West, NMPM, Hidalgo County, New Mexico.

#### **Class V Injection Wells**

Well 42-18 is located in the NE/4, NW/4 of Section 18 (1307 FNL and 2123 FWL)  
Well 51-07 is located in the NW/4, NE/4 of Section 07 (169.2 FNL and 2406.9 FEL)  
Well 53-12 is located in the SW/4, NE/4 of Section 12 (1574.8 FNL and 3350 FWL)



Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
July 1, 2009  
Page 2

### **Geothermal Production or Development Wells**

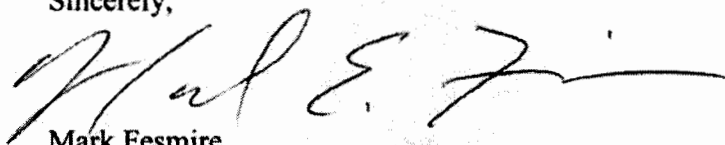
Well 13-07 is located in the SW/4, NW/4 of Section 7 (3781 FSL and 530 FWL)  
Well 33-07 is located in the SE/4, NW/4 of Section 7 (3721 FSL and 1789 FWL)  
Well 45-07 is located in the NE/4, SW/4 of Section 7 (2360 FSL and 2278 FWL)  
Well 47-07 is located in the SE/4 SW/4 of Section 7 (1219 FSL and 2266 FWL)  
Well 53-07 is located in the SW/4 NE/4 of Section 7 (3775 FSL and 3052 FWL)

Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the Oil Conservation Division (OCD) Santa Fe Office within 30 days of receipt of this letter.**

Please be advised that approval of this permit does not relieve the owner/operator of responsibility should operations result in pollution of surface water, ground water or the environment. Nor does approval of the permit relieve the owner/operator of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions, please contact Carl Chavez of my staff at (505-476-3490) or E-mail [carlj.chavez@state.nm.us](mailto:carlj.chavez@state.nm.us). On behalf of the staff of OCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,



Mark Fesmire  
Oil Conservation Division Director

MF/cc  
Attachments - 1  
xc: OCD District Office

**ATTACHMENT 1  
LIGHTNING DOCK GEOTHERMAL NO. 1 (HI-01) (GTHT-001)  
DISCHARGE PERMIT APPROVAL CONDITIONS**

- 1. Payment of Discharge Plan Fees:** All discharge permits are subject to WQCC Regulations. Every billable facility that submits a discharge permit application will be assessed a filing fee of \$100.00 plus a renewal flat fee (*see* WQCC Regulation 20.6.2.3114 NMAC). The Oil Conservation Division (OCD) has received the required \$100.00 filing fee and the \$1700.00 Class V Geothermal Well permit fee.
- 2. Permit Expiration and Renewal:** Pursuant to WQCC Regulation Paragraph 4 of Subsection H of 20.6.2.3109 NMAC, this permit is valid for a period of five years. **This permit will expire on August 4, 2014** and an application for renewal should be submitted no later than 120 days before that expiration date. Pursuant to WQCC Regulation Subsection F of 20.6.2.3106 NMAC, if a discharger submits a discharge permit renewal application at least 120 days before the discharge permit expires and is in compliance with the approved permit, then the existing discharge permit will not expire until the application for renewal has been approved or disapproved. *Expired permits are a violation of the Water Quality Act {Chapter 74, Article 6 NMSA 1978} and civil penalties may be assessed accordingly.*
- 3. Permit Terms and Conditions:** Pursuant to WQCC Regulation 20.6.2.3104 NMAC, when a permit has been issued, the owner/operator must ensure that all discharges shall be consistent with the terms and conditions of the permit. In addition, all facilities shall abide by the applicable rules and regulations administered by OCD pursuant to the Geothermal Resources Conservation Act (71-5-1 through 71-5-24 NMSA) and the Geothermal Power regulations (19.14.1 through 19.14.132 NMAC).
- 4. Owner/Operator Commitments:** The owner/operator shall abide by all commitments submitted in its May 12, 2008 discharge permit application, including attachments and subsequent amendments and these conditions. Permit applications that reference previously approved plans on file with OCD shall be incorporated in this permit and the owner/operator shall abide by all previous commitments of such plans and these conditions for approval.
- 5. Modifications:** WQCC Regulations Subsection C of 20.6.2.3107 NMAC, 20.6.2.3109 NMAC and Subsection I of 20.6.2.5101 NMAC address possible future modifications of a permit. The owner/operator (discharger) shall notify OCD of any facility expansion, production increase or process modification that would result in any significant modification in the discharge of water contaminants. The Division Director may require a permit modification if any water quality standard specified at WQCC Regulation 20.6.2.3103 NMAC is being or will be exceeded or if a toxic pollutant as defined in WQCC Regulation 20.6.2.7 NMAC is present in ground water at any place of withdrawal for present or reasonably foreseeable future use or that the Water Quality Standards for Interstate and Intrastate streams as specified in WQCC Regulation 20.6.4 NMAC (*Water Quality Standards for Interstate and Intrastate Streams*) are being or may be violated in surface water in New Mexico.

**6. Waste Disposal and Storage:** The owner/operator shall dispose of all wastes at an OCD-approved facility. Only geothermal RCRA-exempt wastes (*i.e.*, geothermal production fluids, hydrogen sulfide abatement wastes from geothermal energy production, *etc.*) may be disposed of by injection in a Class II salt water disposal well. RCRA non-hazardous, non-exempt geothermal wastes may be disposed of at an OCD-approved facility upon proper waste determination pursuant to 40 CFR part 261. Any waste stream that is not listed in the discharge permit application must be approved by OCD on a case-by-case basis.

**A. Disposal Of Certain Non-Domestic Waste At Solid Waste Facilities:** Pursuant to 19.15.35.8 NMAC disposal of certain non-domestic waste without notification to OCD is allowed at NMED permitted solid waste facilities if the waste stream has been identified in the discharge permit and existing process knowledge of the waste stream does not change.

**B. Waste Storage:** The owner/operator shall store all waste in an impermeable bermed area, except waste generated during emergency response operations for up to 72 hours. All waste storage areas shall be identified in the discharge permit application. Any waste storage area not identified in the permit shall be approved on a case-by-case basis only. The owner/operator shall not store geothermal waste on-site for more than 180 days unless approved by OCD.

**7. Drum Storage:** The owner/operator must store drums, including empty drums, or drums containing materials other than fresh water on an impermeable pad with curbing. The owner/operator must store empty drums on their sides with the bungs in place and lined up on a horizontal plane. The owner/operator must store chemicals in other containers, such as tote tanks, sacks or buckets on an impermeable pad with curbing.

**8. Process, Maintenance and Yard Areas:** The owner/operator shall either pave and curb or have some type of spill collection device incorporated into the design at all process, maintenance and yard areas which show evidence that water contaminants from releases, leaks and spills have reached the ground surface.

**9. Above-Ground Tanks:** The owner/operator shall ensure that all aboveground tanks have impermeable secondary containment (*e.g.*, liners and berms), which will contain a volume of at least one-third greater than the total volume of the largest tank or all interconnected tanks. The owner/operator shall retrofit all existing tanks before discharge permit renewal. Tanks that contain fresh water or fluids that are gases at atmospheric temperature and pressure are exempt from this condition.

**10. Labeling:** The owner/operator shall clearly label all tanks, drums and containers to identify their contents and other emergency notification information. The owner/operator may use a tank code numbering system, which is incorporated into their emergency response plans.

**11. Below-Grade Tanks/Sumps and Pits/Ponds.**

**A.** All below-grade tanks and sumps must be approved by OCD prior to installation and must incorporate secondary containment with leak detection into the design. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal. Owner/operator must test all existing below-grade tanks and sumps without secondary containment and leak detection annually, or as specified herein. For all systems that have secondary containment with leak detection, owner/operator shall perform a monthly inspection of the leak detection system to determine if the primary containment is leaking. Small sumps or depressions in secondary containment systems used to facilitate fluid removal are exempt from these requirements if fluids are removed within 72 hours.

**B.** All pits and ponds, including modifications and retrofits, shall be designed by a registered professional engineer and approved by OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.

**C.** The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted or otherwise rendered non-hazardous to wildlife, including migratory birds. Where netting is not feasible, routine witnessing and/or discovery of dead wildlife and migratory birds shall be reported by the owner/operator to the appropriate wildlife agency with notification also provided to OCD in order to assess and enact measures to prevent the above from reoccurring.

**D.** The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure and/or visual inspection of cleaned tanks and/or sumps or other OCD-approved methods. The owner/operator shall notify OCD at least 72 hours prior to all testing.

**12. Underground Process/Wastewater Lines:**

**A.** The owner/operator shall test all underground process/wastewater pipelines at least once every five (5) years to demonstrate their mechanical integrity, except lines containing fresh water or fluids that are gases at atmospheric temperature and pressure. The owner/operator shall submit a comprehensive listing of process/wastewater pipelines to OCD within three months of the date of the permit issuance. The owner/operator shall test pressure rated pipe by pressuring up to



one and one-half times the normal operating pressure, if possible or for atmospheric drain systems, to 3 pounds per square inch greater than normal operating pressure and pressure held for a minimum of 30 minutes with no more than a 1% loss/gain in pressure. The owner/operator may use other methods for testing if approved by OCD.

**B.** The owner/operator shall maintain underground process and wastewater pipeline schematic diagrams or plans showing all drains, vents, risers, valves, underground piping, pipe type, rating, size and approximate location. All new underground piping must be approved by OCD prior to installation. The owner/operator shall report any leaks or loss of integrity to OCD within 15 days of discovery. The owner/operator shall maintain the results of all tests at the facility covered by this discharge permit and they shall be available for OCD inspection. The owner/operator shall notify OCD at least 72 hours prior to all testing.

**13. Class V Wells:** With the exception of Class V geothermal energy injection wells associated with the recovery of geothermal energy for heating, aquaculture, and production of electrical power, the owner/operator shall close all Class V wells (*e.g.* septic systems, leach fields, dry wells, *etc.*) that inject non-hazardous industrial wastes or a mixture of industrial wastes and domestic sanitary effluent wastes, unless it can be demonstrated that ground water will not be impacted in the reasonably foreseeable future. Leach fields and other wastewater disposal systems at OCD-regulated facilities that inject sanitary effluent and non-hazardous fluid into or above an underground source of drinking water are considered Class V injection wells under the EPA UIC program. Class V wells that inject domestic sanitary effluent waste only must be permitted by the New Mexico Environment Department (NMED).

**14. Housekeeping:** The owner/operator shall inspect all systems designed for spill collection/prevention and leak detection at least monthly to ensure proper operation and to prevent over topping or system failure. All spill collection and/or secondary containment devices shall be emptied of fluids within 72 hours of discovery. The owner/operator shall maintain all records at the facility and available for OCD inspection.

**15. Spill Reporting:** The owner/operator shall report all unauthorized discharges, spills, leaks and releases and shall conduct corrective actions pursuant to WQCC Regulation 20.6.2.1203 NMAC and 19.15.29 NMAC. The owner/operator shall notify both OCD District Office and the Santa Fe Office within 24 hours and file a written report within 15 days. The owner/operator shall notify OCD of any fire, break, leak, spill or blowout occurring at any geothermal drilling, producing, transporting, treating, and disposal or utilization facility in the State of New Mexico by the person operating or controlling the facility pursuant to 19.14.36.8 NMAC.

**16. OCD Inspections:** OCD may impose additional requirements on the facility and modify the permit conditions based on OCD inspections.

**17. Storm Water:** The owner/operator shall implement and maintain run-on and runoff plans and controls. The owner/operator shall not discharge any water contaminant that exceeds the WQCC standards specified in WQCC Regulations 20.6.2.3103 NMAC or 20.6.4 NMAC including



to monitor for contamination in any different fresh water aquifer system(s).

- ii. The owner/operator shall submit a Background and Compliance Report reflecting the first 6 months of sampling conducted to the OCD within 30 days of completion of the first 6 months of sampling that includes the results of the initial sampling conducted in accordance with Permit Conditions 20 and 21 to determine background water quality conditions at the facility and compliance with WQCC 20.6.2.3103 NMAC and Subparagraph WW of 20.6.2.7 NMAC. The report shall specify all monitoring locations, including nested wells, hydrogeology, piezometric and/or potentiometric ground water flow direction, hydraulic gradient and water quality data from all monitoring locations and down-gradient locations from potential point sources at the facility (*i.e.*, cooling tower blow-down combined with spent production water at all Class V Well injection locations). The report shall note all exceedences of the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected.
- iii. The owner/operator shall implement the ground water monitoring program specified in the applicable Tables in Appendix 1. The owner/operator shall monitor static water levels from monitoring locations at least quarterly to assess ground water flow direction and hydraulic gradient at the facility. If draw-down of the water table below the screen level in any monitor well occurs at and/or nearby production or development well locations, the owner/operator shall deepen wells within 30 days to provide for monitoring and the OCD and Office of the State Engineer (OSE) District Supervisor shall be notified within 24 hours of having knowledge of the above. In addition, the Owner/Operator shall provide a written statement of whether the water resource in the Animas Valley is or is not adequate to sustain steady-state production of the geothermal resource within 60 days of the original notification above. The OCD and OSE may require the owner/operator to perform corrective action(s) to private water user wells that are adversely affected by geothermal operations. The OCD and/or OSE may require the owner/operator to implement corrective action(s) to private water wells depending on the situation.
- iv. The owner/operator shall gauge and sample nested monitor well head elevations (accuracy to 0.01 ft.), recorded to establish the natural vertical hydrogeologic gradient(s) within the aquifer(s) or between reservoir(s) and to monitor for any potentially upwelling contamination to nearby down-gradient pumping domestic and commercial water supply wells.

any oil sheen, in any storm water run-off. The owner/operator shall notify OCD within 24 hours of discovery of any releases and shall take immediate corrective action(s) to stop the discharge.

**18. Unauthorized Discharges:** The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3103 NMAC (*Standards for Ground Water of 10,000 mg/L TDS Concentration or Less*) or 20.6.4 NMAC (*Water Quality Standards for Interstate and Intrastate Streams*) unless specifically listed in the permit application and approved herein.

**An unauthorized discharge is a violation of this permit.**

**19. Vadose Zone and Water Pollution:** The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000 through 20.6.2.4116 NMAC (*Prevention and Abatement of Water Pollution*). OCD may require the owner/operator to modify its permit for investigation, remediation, abatement and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement or to submit subsequent reports will constitute a violation of the permit.

**20. Additional Site Specific Conditions - Water Quality Monitoring Program:** The owner/operator shall implement the following water quality monitoring programs.

- A. Aquatic Toxicity Testing:** Prior to the startup of geothermal operations, the owner/operator shall conduct an aquatic toxicity test (ATT) on the Tilapia fish species present at the AmeriCulture aquaculture facility located down-gradient from the owner/operators proposed Class V injection well locations with all NALCO cooling-tower chemical constituents. The chemicals used in the ATT shall consist of the high range application of all mixed Nalco chemicals proposed during the hearing on December 1, 2008, to determine the LD<sub>50</sub> under a worse-case scenario. OCD will use the results of the ATT as a tool to help assess the threat to Aquaculture and wildlife near the facility.
- B. Ground Water and Surface Water Sampling and Monitoring Requirements:**
  - i. The owner/operator shall submit a ground water monitoring program work plan that includes a well installation and monitoring plan and a sampling and analysis plan for the monitor wells to the OCD Santa Fe Office for approval at least 3 months before system startup. The owner/operator shall conduct all water quality monitoring using low-flow purging and sampling methods where monitor well screens do not exceed 15 feet with 5 feet of screen placed above the water table (potential for water table draw-down addressed at subpart 20(B)(iii)). If multiple isolated fresh water aquifers are found to exist, the owner/operator shall include a provision in the work plan for the installation of additional monitor wells

- v. The owner/operator shall comply with the Federal Underground Injection Control requirements for Class V Wells (40 CFR 144 subpart G) and WQCC 20.6.2 NMAC injection well construction standards to protect the Underground Source of Drinking Water (USDW). The owner/operator shall immediately shut down the system and contact the OCD for further instructions if the concentration of any water contaminants in the injection fluids exceed the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, as established for the injection formation at the injection well location pursuant to Clause (i) of Paragraph 21.D, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.
- vi. The owner/operator shall construct all monitor wells with at least 15 feet of screen with 10 feet of screen positioned below the water table (~ 60 – 70 feet bgs). The screen slot size must facilitate the collection of low turbidity samples. Low-flow ground water sampling may be used with stabilization monitoring for temperature, oxygen reduction potential (ORP) and dissolved oxygen (DO) prior to and during sample collection, if wells are constructed for low-flow sampling techniques. Otherwise, the owner/operator shall purge the wells of three well volumes prior to sampling.
- vii. The owner/operator shall triangulate seasonal piezometric surface flow across the facility, including surveying all well locations (TOC and ground elevations, Mean Sea Level) to the nearest 0.01 feet. The owner/operator shall measure static water levels at least quarterly for 2 years to determine ground water flow direction. The owner/operator shall submit plots of ground water flow direction with estimates of hydraulic gradients from quarterly monitoring.
- viii. The owner/operator shall notify the Santa Fe OCD office immediately after having knowledge that the concentration of a monitor well sample exceeds the greater of the water quality standards specified in WQCC 20.6.2.3103 NMAC or background established at that well's location pursuant to the monitoring program described in this paragraph or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected. In the event of an exceedence, the owner/operator may be required to shut down the operation for such time as may be necessary to allow the owner/operator and OCD to investigate the cause of the exceedence. If the cause is associated with geothermal operations, the OCD may invoke the permit modification provision for treatment provided herein, and may require additional conditions.

**C. Water Supply Wells Monitoring Program:**

- i. The owner/operator shall sample all water supply wells in accordance with Table 3 of Appendix 1 prior to owner/operator startup to establish background water quality conditions and thereafter at least annually to demonstrate that the water quality of the water supply wells does not exceed the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is present.
- ii. The owner/operator shall determine the depth to water, ground elevation, and well elevation to an accuracy of 0.01 foot.
- iii. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of the ground water sample exceeds the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.

**D. Holding Ponds, Drainage Ditches, Pits and Ponds Monitoring Program:** The owner/operator shall sample the holding ponds, drainage ditches, pits and ponds in accordance with Table 4 of Appendix 1. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of a water sample taken at an unlined ditch or location listed above exceeds the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background. *Note: Table 4 analytes consist of metals and general chemistry only. They do not monitor for "toxic pollutants" as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC.*

**E. Spent Produced Water and Cooling-Tower Blow-Down Water Monitoring Program:**

- i. The owner/operator shall submit a flow diagram to the OCD Santa Fe Office that depicts where the comingled spent produced water and cooling-tower blow-down water will be sampled in-line before injection, as well as specification of injection well sample port locations used for the in-line sampling at least 30 days before system startup.
- ii. The owner/operator shall sample and analyze the comingled spent produced water and cooling-tower blow-down water daily for 10 business days at system startup, weekly for two months; and thereafter the sampling frequency shall be based on correlation that the owner/operator established with the 3D Tresar Control Monitoring System in accordance with Table 5 of Appendix 1 to this discharge permit. Injection wells shall be sampled

monthly for 6 months in accordance with the analytical suite in Table 2 of Appendix 1.

- iii. The owner/operator shall inject comingled spent produced water and cooling-tower blow-down water only if it meets either the standards for ground water specified at Subparagraph WW of 20.6.2.7 NMAC and 20.6.2.3103 NMAC or the background concentration as established from the first sampling event. In-line sample ports or devices shall be installed at each injection well to enable owner/operator to perform the in-line sampling required herein, to ensure that the specified requirements for spent produced water and cooling-tower blow-down water are met.
- iv. The owner/operator shall not discharge untreated chemicals to storm water and/or "Waters of the State." Any discharge to a rip-rap area(s) is an illegal discharge. The owner/operator shall inform the OCD Santa Fe office within 72 hours of discovery of a discharge to a rip-rap basin. Discharges shall be routed to lined pits or evaporation pond areas whenever possible.
- v. The owner/operator may only discharge into "Waters of the State" in accordance with a National Pollutant Discharge Elimination System (NPDES) Permit issued by EPA Region 6. The OCD must approve the discharge concurrently with EPA. The applicant must comply with all of the Federal NPDES monitoring, treatment, and reporting requirements specified in its NPDES permit.

**F. Annual Water Quality Monitoring Program Report:** The owner/operator shall submit an Annual Water Quality Monitoring Program Report by January 31 of each year. The report shall include the following information:

- i. Cover sheet marked as "Annual Water Quality Monitoring Program Report, name of owner/operator, Discharge Permit Number, API number(s) of well(s), date of report and the name of the person submitting report.
- ii. Comprehensive summary of all water quality monitoring data.
- iii. Summary charts and tables depicting the constituents that have ever exceeded the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected.
- iv. Description and reason for any remedial or work on well(s), ponds, ditches, etc.
- v. Copies of the chemical analyses in accordance with Permit Condition 20.

- vi. A copy of any leaks and spills reports submitted in accordance with Permit Condition 15 above.
- vii. A "Miscellaneous" section to include any other issues that should be brought to OCD's attention.
- viii. Discharge Permit Signatory Requirements pursuant to WQCC Regulation Subsection G of 20.6.2.5101 NMAC.

**21. Class V Geothermal Injection Wells and Geothermal Production or Development Wells:**

**A. Well Identification:**

**i. Class V Geothermal Injection Wells:**

Well No. 42-18 (API No. 30-023-20018)  
Well No. 51-07 (API No. 30-023-20020)  
Well No. 53-12 (API No. 30-023-20019)

**ii. Geothermal Production or Development Wells:**

Well No. 13-07 (API No. 30-023-20013)  
Well No. 33-07 (API No. 30-023-20014)  
Well No. 45-07 (API No. 30-023-20015)  
Well No. 47-07 (API No. 30-023-20016)  
Well No. 53-07 (API No. 30-023-20017)

**B. Well Casing and Cementing Requirements:**

- i. The owner/operator shall ensure that all casing and cementing meets or exceeds the requirements of 19.14.27.8 NMAC (*Casing and Cementing Requirements*). Conductor pipe shall be run to a minimum depth of 100 feet.
- ii. Surface casing shall be to a depth of at least 100 feet greater than the deepest fresh water well within one-half mile from the well location.
- iii. Intermediate strings shall be cemented solid to surface.
- iv. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if run. If production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet. The lap shall be cemented solid and it shall be pressure tested to ensure integrity.

- v. The owner/operator shall submit a logging program to OCD for review with the owner/operator depth setting recommendations for its casing program based on the logging program. The owner/operator prior to setting intermediate or production casing in each of the production and injection wells shall run open-hole logs, pursuant to the logging program, approved by the OCD. Logs must be submitted to the OCD for review with the applicant's recommendations for casing setting depths, and in case of injection wells, for precise definition of the injection interval. The type of tubing installed shall be conducive to the characteristics of the injected fluids determined after initial testing of the injected fluids. The owner/operator shall ensure that the tubing is installed with a packer set within 100 feet of the uppermost injection perforations. The casing-tubing annulus shall be filled with an inert fluid, and a gauge or approved leak-detection device shall be connected to the annulus to detect for leakage in the casing, tubing or packer.

**C. Formation Fracturing Fluids:** The owner/operator shall ensure that all fluids used in the fracturing of formations shall not harm human health, wildlife or the environment. The owner/operator shall ensure that all fluids used to fracture shall be swabbed back, collected and properly disposed.

**D. Class V Geothermal Injection Wells and Geothermal Production/ Development Wells Monitoring Program:**

- i. The owner/operator shall sample the groundwater at all injection and production/development wells prior to owner/operator startup in accordance with Table 2 of Appendix 1 to establish background water quality conditions.
- ii. The owner/operator shall sample cooling tower effluent (and not the groundwater) at all injection wells monthly for the first six months with dynamic water level (DWL) recordings in accordance with Table 2 of Appendix 1 to demonstrate that the injection fluid meets the standards specified in WQCC 20.6.2.3103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected.
- iii. If after the first six months the owner/operator demonstrates that the in-line injection well samples meet the standards specified in WQCC 20.6.2.3103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected, then the owner/operator shall then sample ground water annually in accordance with the other annual monitoring events.



- iv. The owner/operator shall determine the depth to water, ground elevation, and well elevation to an accuracy of 0.01 foot. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of the ground water sample exceeds the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.
- E. Well Workover Operations:** The owner/operator shall obtain OCD's approval prior to performing remedial work, pressure test or any non-routine work. The owner/operator shall request approval on form G-103 "Sundry Notice" pursuant to 19.14.52 NMAC, with copies provided to both the OCD Artesia District II Office and the Santa Fe Office.
- F. Production/Injection Method:** The production/injection method that the owner/operator shall follow is as follows: High temperature (>250 °F) geothermal water shall be brought to surface from the Horquilla Formation or geothermal reservoir at approximately 3,400 feet below ground level by five (5) production or development wells at approximately 3,000 gpm per well. Hot water shall be routed in parallel and in series through approximately 50 binary cycle (self-contained heat exchanger, evaporator and condenser) power generation units. Condensed produced or effluent water (approximately 225 °F) shall be routed directly to three (3) Class V geothermal wells and into the same depth within the Horquilla Formation or geothermal reservoir.
- G. Well Pressure Limits:** The owner/operator shall ensure that the operating surface injection and/or test pressure for each injection well measured at the wellhead shall be at a flow rate and pressure (psi) that will not exceed 0.2 psi per foot of depth from the surface to the top of injection interval, unless the owner/operator secures OCD approval for an increase based on demonstration that the increase will not involve a hazard of formation fracture and/or adversely affect public health, the environment and the correlative rights of any geothermal operators in the high temperature geothermal reservoir. The Owner/Operator shall report the intended maximum injection pressure to the Division for approval after testing the injection formation and prior to the commencement of injection in accordance with Form G-112. Re-injected fluids shall be confined to the aquifer where production is occurring and shall not adversely impact another aquifer(s). The owner/operator shall have working pressure limiting devices or controls to prevent overpressure. The owner/operator shall report any pressure that causes damage to the system to OCD within 24 hours of discovery.
- H. Mechanical Integrity Testing:** At least once every five years and after any well work over, the geothermal reservoir will be isolated from the casing or tubing annuals and the casing pressure tested at a minimum of 600 psig for 30 minutes.



A passing test shall be within +/- 10% of the starting test pressure. All pressure tests must be performed in accordance with the testing schedule shown below and witnessed by OCD staff unless otherwise approved.

Testing Schedule:

2009: Prior to system start-up, a 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing), and

2013: A 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing)

- I. **Capacity/Reservoir Configuration and Subsidence Survey:** The owner/operator shall provide information on the size and extent of the geothermal reservoir and geologic/engineering data demonstrating that continued geothermal extraction will not cause surface subsidence, collapse or damage to property or become a threat to public health and the environment. This information shall be supplied to OCD in each annual report. OCD may require the owner/operator to perform additional well surveys, tests, etc. A subsidence monitoring section is required in the annual report and shall include well top-of-casing and ground elevation surveying (Accuracy: 0.01 ft.) before start-up and on an annual basis in order to demonstrate that there are no subsidence issues. If the owner/operator cannot demonstrate the stability of the system to the satisfaction of OCD, then OCD may require the owner/operator to shut-down, close the site and properly plug and abandoned the wells. *The owner/operator shall report any subsidence to the OCD Santa Fe office within 24 hours of discovery.*
- J. **Production/Injection Volumes:** After placing a geothermal well on production, the owner/operator shall file in duplicate a monthly production report form G-108, with the OCD Santa Fe office by the 20th day of each month and also with the annual reports. The owner/operator shall also document the production from each well and each lease during the preceding calendar month.
- K. **Analysis of Injection and Geothermal Reservoir Fluids:** After placing any well on injection in a geothermal resources field or area, the owner/operator shall file in duplicate a monthly injection report, form G-110, with the OCD Santa Fe office by the 20th day of each month and also with the annual report. The owner/operator shall specify the zone or formation into which injection is being made, the volume injected, the average temperature of the injected fluid and the average injection pressure at the wellhead.
- L. **Area of Review (AOR):** The owner/operator shall report within 24 hours of discovery of any new wells, conduits or any other device that penetrates or may

penetrate the injection zone within one-quarter mile from a Class V Geothermal Injection Well. *Note: AOR applies specifically to Class V Injection Wells.*

- M. Annual Geothermal Temperature and Pressure Tests:** The owner/operator shall test its production or development wells at least annually and submit the results to the OCD Santa Fe office on form G-111 within 30 days of the completion of the test. The owner/operator shall record the flowing temperatures and flowing pressure tests at the wellhead for a minimum of 72 hours of continuous flow at normal producing rates. The owner/operator shall then shut in the well for 24 hours and record the shut-in pressures at the wellhead. The owner/operator shall submit the results of these tests in duplicate to the OCD Santa Fe office.
- N. Loss of Mechanical Integrity:** The owner/operator shall report to the OCD Santa Fe Office within 24 hours of its discovery of any failure of the casing, tubing or packer or movement of fluids outside of the injection zone. The owner/operator shall cease operations until proper repairs are made and the owner/operator receives OCD approval to re-start injection operations.
- O. Bonding or Financial Assurance:**
- i. **Class V Geothermal Injection Wells:** The owner/operator shall maintain at a minimum a cash bond (*i.e.*, Assignment of Cash Collateral Deposit or Multi-Well Cash Financial Assurance Bond Geothermal Injection) in the amount of \$50,000.00 to restore the site and/or plug and abandon wells, pursuant to OCD rules and regulations.
  - ii. **Geothermal Production or Development Wells:** The owner/operator shall maintain at a minimum a cash bond (*i.e.*, \$10,000.00 Multi-Well (4 wells) and/or \$5,000.00 (1 well) Geothermal Plugging Bonds). If warranted, OCD may require additional financial assurance for closure of the power plant or facility (see Permit Condition 34 below).
- P. Annual Geothermal Well Report:** The owner/operator shall submit an Annual Geothermal Well Report by January 31 of each year. The report shall include the following information:
- i. Cover sheet marked as "Annual Geothermal Well Report, name of owner/operator, Discharge Permit Number, API number(s) of well(s), date of report and the name of the person submitting report.
  - ii. Comprehensive summary of all geothermal well operations, including description and reason for any remedial or work on the well(s). The

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bonding or financial assurance is in place and approved by the OCD. OCD reserves the right to require a modification of the permit during transfer.

**23. Closure:** The owner/operator shall notify OCD when operations of the facility are to be discontinued for a period in excess of six months. Prior to closure of the facility, the owner/operator shall submit for OCD approval, a closure plan including a completed C-103 form for plugging and abandonment of the well(s). Closure and waste disposal shall be in accordance with the statutes, rules and regulations in effect at the time of closure. OCD may require additional financial assurance if surface water and/or ground water is impacted pursuant to WQCC Regulation Paragraph (11) of Subsection A of 20.6.2.3107 NMAC.

**24. Certification:** Los Lobos Renewable Power, L.L.C. (Owner/Operator), by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. **Owner/Operator** further acknowledges that OCD may, for good cause shown, as necessary to protect fresh water, public health, safety and the environment, change the conditions and requirements of this permit administratively.

**Conditions accepted by:** *"I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."*

\_\_\_\_\_  
Company Name - print name above

\_\_\_\_\_  
Company Representative - print name

\_\_\_\_\_  
Company Representative - signature

Title \_\_\_\_\_

owner/operator shall include copies of the form G-103s that it submitted to the OCD Santa Fe office.

- iii. Production and injection volumes in accordance with Permit Condition 21.J, including a running total to be carried over each year. The owner/operator shall report the total mass produced, dry steam produced, flow rates, temperatures and pressures, average injection pressures, temperatures, *etc.*
- iv. A copy of the chemical analyses in accordance with Permit Condition 21.K.
- v. A copy of any mechanical integrity test chart, including the type of test, (*i.e.*, EPA 5-Year casing test), date, time, *etc.*, in accordance with Permit Conditions 21.H.
- vi. A copy of the annual subsidence survey data results in accordance with Permit Condition 21.I.
- vii. Brief explanation describing deviations from normal production methods.
- viii. A copy of any leaks and spills reports submitted in accordance with Permit Condition 15 above.
- ix. A copy of analytical data results from annual groundwater monitoring including the QA/QC Laboratory Summary.
- x. An updated Area of Review (AOR) summary (WQCC Regulation 20.6.2 NMAC) when any new wells are drilled within 1/4 mile of any UIC Class V Geothermal Injection Well.
- xi. A "Miscellaneous" section to include any other issues that should be brought to the OCD's attention.
- xii. Discharge Permit Signatory Requirements pursuant to WQCC Regulation Subsection G of 20.6.2.5101 NMAC.

**22. Transfer of Discharge Permit:** Pursuant to WQCC Regulation Subsection H of 20.6.2.5101 NMAC, the owner/operator and new owner/operator shall provide written notice of any transfer of the permit. Both parties shall sign the notice 30 days prior to any transfer of ownership, control or possession of a facility with an approved discharge permit. In addition, the purchaser shall include a written commitment to comply with the terms and conditions of the previously approved discharge permit. OCD will not transfer ~~brine~~ well operations until proper

*geothermal*

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**APPENDIX 1**  
**WATER QUALITY MONITORING PROGRAM**

**Table 1**  
**Ground Water Monitoring Program**

ID	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-1 <sup>1</sup>	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 42-18 and associated pits (OCD)
MW-3 <sup>1</sup>	Annual	GW	VOCs (8260B) SVOCs (8270C)	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 51-07 and associated pits (OCD)
MW-2 <sup>1</sup>	Annual	GW	PAHs ( 8310)	Shallow MW (water table) located ~100' downgradient (North) of Class V IW 53-12 and associated pits (OCD)
MW-4 <sup>1</sup>	Annual	GW	TPH (418.1)	Shallow MW located ~1500' (Northwest) of DW 45-07 directly downgradient from facility (OCD)
MW-5 <sup>1</sup>	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods) Mercury (7470A/7471A)	Shallow MW (water table) located ~1000' upgradient (South) of the nursery greenhouses 3 & 4 to monitor background (OCD)
MW-6 <sup>1</sup>	Annual	GW	General Chemistry (Methods specified at 40 CFR 136.3)	Shallow MW (water table) located ~100' downgradient (North) of DW 53-07 and associated pits (OCD)
MW-7 <sup>1</sup>	Annual	GW	Uranium (6010B/6020), Radioactivity (E903/E904) Radon (by EPA Method or method approved by OCD)	Shallow MW (water table) located ~100' downgradient (North) of DW 13-07 and associated pits (OCD)

**Table 2**  
**Geothermal Injection Wells and**  
**Production/Development Wells Monitoring Program**

ID	Frequency	Media	Analytical Suite/Method	Approximate Well Location
DW 13-07 <sup>1,3</sup>	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	As Proposed in Application
DW 33-07 <sup>1,3</sup>	Annual	GW		
DW 45-07 <sup>1,3</sup>	Annual	GW	VOCs (8260B)	
DW 47-07 <sup>1,3</sup>	Annual	GW	SVOCs (8270C)	
DW 53-07 <sup>1,3</sup>	Annual	GW	PAHs ( 8310)	
IW 42-18 <sup>1,3</sup>	Annual	GW	TPH (418.1)	
IW 51-07 <sup>1,3</sup>	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)	
IW 53-12 <sup>1,3</sup>	Annual	GW	Mercury (7470A/7471A)	
			General Chemistry (Methods specified at 40 CFR 136.3)	
			Uranium (6010B/6020), Radioactivity (E903/E904)	
			Radon (by EPA Method or method approved by OCD)	

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ID*	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-8 <sup>1</sup>	Annual	GW		Shallow MW (water table) located ~100' downgradient (North) of DW 33-07 and associated pits (OCD)
NW-1 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-2 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-3 <sup>1</sup>	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.



**Table 3**  
**Water Supply Wells Monitoring Program**

ID*	Frequency	Media	Analytical Suite/Method	Approximate Location
TG 52-07	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	Similar to monitoring & sampling plan from Los Lobos.
AmeriCulture No. 1 Federal	Annual	GW	VOCs (8260B)	
AmeriCulture State Well No. 2	Annual	GW	SVOCs (8270C)	
McCants No. 1 State	Annual	GW	PAHs ( 8310)	
Burgett No. 1 State	Annual	GW	TPH (418.1)	
Burgett Greenhouse No. 2	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)  Mercury (7470A/7471A)  General Chemistry (Methods specified at 40 CFR 136.3)  Uranium (6010B/6020),  Radioactivity (E903/E904)  Radon (by EPA Method or method approved by OCD)	

**Table 4**  
**Holding Ponds, Drainage Ditches, Pits and Ponds Monitoring Program**

ID <sup>a</sup>	Frequency	Media	Analytical Suite/Method	Approximate Location
GH Holding Pond No. 1	Quarterly <sup>a</sup>	SW	Metals- dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)	Similar to monitoring & sampling plan from Los Lobos.
GW Holding Pond No. 2	Quarterly <sup>a</sup>	SW		
Drainage Ditch No. 1 (East)	Quarterly <sup>a</sup>	SW	General Chemistry (Methods specified at 40 CFR 136.3)	
Retention Pond No. 1	Quarterly <sup>a</sup>	SW		
Bermed Canal No. 1	Quarterly <sup>a</sup>	SW		
Pit Associated with Well 13-07	Within 30 days of use	SW		
Pit Associated with DW 33-07	Within 30 days of use	SW		
Pit Associated with DW 45-07	Within 30 days of use	SW		
Pit Associated with DW 47-07	Within 30 days of use	SW		
Pit Associated with DW 53-07	Within 30 days of use	SW		
Pit Associated with IW 42-18	Within 30 days of use	SW		
Pit Associated with IW 51-07	Within 30 days of use	SW		

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ID*	Frequency	Media	Analytical Suite/Method	Approximate Location
Pit Associated with IW 53-12	Within 30 days of use	SW		

**Table 5**  
**Cooling Tower Effluent Monitoring Program**

ID*	Frequency	Media	Analytical Suite/Method	Approximate Location
Cooling Tower Effluent	Daily <sup>5</sup>	Effluent	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)  BOD <sub>5</sub> (405.1/5210B) COD (410.2)  General Chemistry (Methods specified at 40 CFR 136.3)	Similar to monitoring & sampling plan from Los Lobos.

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BOD<sub>5</sub>: Biochemical Oxygen Demand  
COD: Chemical Oxygen Demand  
DW: Development/Production Well  
DWL: Dynamic Water Level  
GH: Greenhouse  
GW: Ground Water  
IW: Injection Well  
MSL: Mean Sea-Level  
MW: Monitor Well  
NW: Nested Well  
SW: Surface Water  
SWL: Static Water Level

\* Quarterly Static Water Level (SWL): MSL to nearest 0.01 feet prior to sampling event

1. Wells must be installed in advance of system startup and sampled.
2. Semi-Annual groundwater monitoring event must be completed no more than 30 days prior to the start of the irrigation season but no later than April 30 of each year. Monitoring must be conducted no later than 30 days after the conclusion of the irrigation season but no later than November 15 of each year.
3. One time sampling event with static water level (SWL) mean sea-level (0.01 ft. accuracy) measurements in advance of system start-up. Thereafter, monthly sampling for the first six months with dynamic water level (DWL) recording is required. After six months of monthly monitoring, the sampling shall be conducted at least annually.
4. Sample quarterly while in use. If organics are evident, sampling with analytical methods similar to MWs shall be implemented during the sampling event.
5. Daily for 10 business days at system startup; thereafter weekly for two months; thereafter based on establishing correlation with the 3D Tresar Control Monitoring System.

Note: All wells with phase-separated hydrocarbons (PSHs) must be checked at a minimum of once per month and recorded on a spreadsheet. The data must be presented in table form listing all of the impacted wells, date inspected, product thickness measured to 0.01 of a foot, and amount of product/water recovered. If PSHs are observed in a monitoring well, then appropriate steps must be taken to recover the PSHs using the best available technology.

LIGHTNING DOCK GEOTHERMAL PROJECT (HIDALGO COUNTY)			
OCD GTHT-001 Wells LDG 45-7 and LDG 55-7 G-104 & G-112 Conditions of Approval Meeting			
		Date & Time: 9/26/2012 (3:00 - 5:00 p.m.)	
Location: OCD Conference Room (3rd Floor) Wendell Chino Building, Santa Fe, New Mexico			
NAME:	AGENCY/COMPANY	PHONE	E-MAIL
<i>Carl J. Chavez</i>	OCD	505-476-3490	<i>Carl.j.Chavez@state.nm.us</i>
<i>David Journey</i>	AMEC	505.821.1801	<i>david.journey@amec.com</i>
<i>GLENN VAN GOSTEN</i>	OCD	476-3488	<i>GLENN.VAN GOSTEN@STATE-NM.US</i>
<i>Michelle Henrie</i>	Atty for LDG	505-842-1800	<i>michelle@mhenrie.com</i>
<i>Chuck Smiley</i>	Cyrg Energy	843.725.9167	<i>chuck.smiley@cyrgenergy.com</i>
<i>David Brooks</i>	OCD	505-476-3450	<i>david.brooks@state.nm.us</i>
<i>Daniel Sanchez</i> <sup>(see entry for)</sup>	"	505-476-3493	

W

## Chavez, Carl J, EMNRD

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**Subject:** Los Lobos Mtg.  
**Location:** OCD 3rd Floor Conference Room

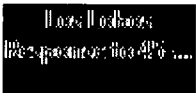
**Start:** Wed 9/26/2012 3:00 PM  
**End:** Wed 9/26/2012 5:00 PM

**Recurrence:** (none)

**Meeting Status:** Meeting organizer

**Organizer:** Chavez, Carl J, EMNRD

**Required Attendees:** Janney, David (david.janney@amec.com); Michelle Henrie (michelle@mhenrie.com); Brooks, David K., EMNRD; Dade, Randy, EMNRD; Chuck Smiley; Shapard, Craig, EMNRD; Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD



Telephone Conference Call-in Phone Number:

### Conference Details

Scheduled Conference Date: Wednesday, September 26, 2012  
Scheduled Start Time: 03:00 PM Mountain Daylight Time  
Scheduled End Time: 04:55 PM Mountain Daylight Time  
Scheduled # of Participants: 3  
Type of Conference: Web-Scheduled Standard  
Dial-in Number: 1-213-342-3000 (Los Angeles, CA)  
Participant Access Code: 4509670

Organizer Access Code: \*693464 (you must include the leading star key)

Note: Meeting time changed to 3 p.m. (G.M.T.) to allow David Brooks to be in attendance. Please let me know if there is a conflict and the date and time may be rescheduled. Thank you.

Please forward any agenda items, electronic training material, etc. in advance of the meeting. A telephone conference number will be provided in advance of the meeting for callers.

\*\*\*\*\*

9/18:

Thank you.

I don't think we will be able to provide geothermal 101 at this meeting.

We have seeking the best person to do this. We were hoping to get Rich Esterbrook with BLM to do this but this does not look promising. We are investigating someone from BLM in Utah and there may be a geothermal expert with the California Division of Mines and Geology that can do this. I will keep you posted.

The remainder of the agenda below looks fine practical.

Regards,  
David W. Janney, PG

\*\*\*\*\*

**Draft Agenda:**

Objective: To allow Los Lobos to train the OCD on geothermal field operations related to COA issues and basis for the meeting request. OCD is allowing the meeting for communication purposes and in consideration of its COAs for the Lightning Dock Geothermal Project.

- 1) Introductions
- 2) Los Lobos: Well 45-7 and 55-7 Conditions of Approval (COA) Issues
- 3) Miscel.
- 4) Path Forward

**Meeting Request:**

*Los Lobos proposes to meet with OCD in one week on Wednesday October 26 in your office at 0930.*

*If this is acceptable I will send out a meeting notice.*

*We hope Artesian can call in on this.*

Regards,

*David W. Janney, PG  
Senior Geologist*



*AMEC Environment and Infrastructure*  
*8519 Jefferson, NE*  
*Albuquerque, NM 87113*  
*505.821.1801 off*  
*505.821.7371 fax*  
*505.449.8457 cell*

## Chavez, Carl J, EMNRD

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**From:** Janney, David <david.janney@amec.com>  
**Sent:** Friday, September 21, 2012 12:15 PM  
**To:** Chavez, Carl J, EMNRD; Shapard, Craig, EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Bailey, Jami, EMNRD  
**Cc:** 'Chuck Smiley'; 'Michelle Henrie'; 'John Perry'  
**Subject:** Response to Conditions of Approval on the G-104 and G-112 for LDG 45-7 and G-104 for LDG 55-7  
**Attachments:** Los Lobos Response to 45-7-55-7 Injection-Flow Testing COAs\_9-21-12\_FINAL.pdf

Greetings:

Please find attached Los Lobos Renewable Power's response to the above conditions of approval, dated 9/6/2012, received from OCD. We look forward to meeting with you on September 26 to discuss them.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

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September 21, 2012

Mr. Carl Chavez, CHMM  
New Mexico Oil Conservation Division  
1220 South Saint Francis Drive  
Santa Fe, NM 87505  
505-476-3490  
[CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

**RE: Response to Conditions of Approval for Wells LDG 45-7 and LDG 55-7 Forms  
G-104 and G-112 for Los Lobos Renewable Power, LLC, Hidalgo County, New Mexico**

**Dear Mr. Chavez:**

On behalf of Los Lobos Renewable Power, LLC (Los Lobos), AMEC Environment & Infrastructure, Inc. has prepared the following responses to the Conditions of Approval (COAs) dated September 6, 2012, for the flow testing of LDG 55-7 and injection of the flow test geothermal fluids into LDG 45-7 located on the Lightning Dock Geothermal Project in Hidalgo County, New Mexico.

**LDG 45-7 G-104 COAs**

**COA #1:** The operator shall provide a water quality monitoring plan for well testing to OCD for review and approval at least 30 days prior to any water injection into the well. The operator shall comply with OCD's approved ASTM sample procedure(s) with environmental water quality sampling and analytical laboratory that complies with EPA QA/QC and DQOs for any OCD required environmental sampling and analyses. OCD may require the operator to implement corrective action(s) if water quality exceeds the greater of the WQCC ground water standards or background, at any place of withdrawal of water for present or reasonably foreseeable future use.

Environmental water quality data is needed from the well before and during well testing to help evaluate water quality conditions during full-scale geothermal power operations, since large volumes of injected water must meet the greater of background and/or WQCC water quality standards before injection into a fresh water aquifer system(s). Well testing provides an opportunity for the operator and OCD to evaluate water quality conditions based on the above.

**Los Lobos Response:**

1. Los Lobos submitted baseline analytical data for LDG 45-7 and a monitoring/sampling plan for LDG 55-7 on August 9, 2012. It is impractical to sample LDG 45-7 during injection because doing so would require airlifting when we are trying to inject. Hopefully injection will create a vacuum and the two are mutually opposed to one another. Instead, the operator submitted a plan to sample the injectate from LDG 55-7, the source of the injectate. While it is feasible to collect a sample from the well after injection has stopped, assuming the well will flow freely; this sample will be of the injection water and will not be the same as the baseline sample already submitted. A better sampling plan is to sample the injectate at its source, LDG 55-7, as the operator proposed in its sampling plan dated August 9, 2012.
2. Please define EPA QA/QC and DQOs. All samples will be collected according to ASTM methods in laboratory-provided containers, be properly filtered and preserved, and transported to a State-certified laboratory under chain-of-custody. Samples will be analyzed by EPA analytical methods and results will be reported with standard laboratory quality assurance/quality control packages.
3. Please define "background concentrations" in the geothermal fluid.
4. Please define the term "or reasonably foreseeable future use". Both the agency and the operator need specificity so that each can know whether permit conditions have been met or not.
5. Please define the term "at any place of withdrawal of water"; a radius of influence must be defined. Both the agency and the operator need specificity so that each can know whether permit conditions have been met or not.

**COA #2:** The operator shall comply with the production/development well terms and conditions of the Geothermal Regulations (Chapter 71, Article 5 NMSA 1978 and Title 19, Chapter 14 NMAC). Since production wells may also become injection wells, all Underground Injection Control (UIC) Class V Geothermal Injection Wells must comply with the applicable sections of Water Quality Control Commission Regulations (20.6.2.5000 - 5006 NMAC). All geothermal field activities must comply with 20.6.2 NMAC and 20.6.4 NMAC).

Los Lobos Response

1. The operator understands this permit condition to be applicable to the LDG 45-7 well specifically when it is being used as an injector, whether temporarily during testing or permanently if needed for optimal well field operations. Similarly, the operator would expect this permit condition might be included when any other wells are being placed on injection. The operator does not interpret this permit condition to apply to production wells never proposed for placement on injection.

*Please be advised that OCD's approval does not relieve Los Lobos Renewable Power, LLC. from responsibility if their operations pose a threat to ground water, subsurface trespass, water supply/diversion, surface water, human health or the environment. In such event, OCD may order the operator to plug and abandon its well pursuant to the geothermal regulations. In addition, OCD approval does not relieve Los Lobos Renewable Power, L.L.C. of responsibility for compliance with any other federal, state, or local laws and/or regulations.*

Los Lobos Response

1. It is extremely difficult for Los Lobos to convince its lenders and investors to continue with a project when the regulating agency takes the position that it can shut down a well, effectively crippling the investment, plant operations, and contractual power delivery requirements, for reasons that are subjective. As Los Lobos reads the Geothermal Resources Conservation Act, allegations of violation of the Act trigger a hearing process. Further, Los Lobos finds no statutory authority supporting OCD's position that its regulatory authority is as broad as stated above, e.g., including water supply/diversion. Los Lobos encourages the OCD to consider the Legislative intent and purposes in enacting the Geothermal Resources Conservation Act, stated at 71-5-2 NMSA 1978: "It is hereby found and determined that the people of the state of New Mexico have a direct and primary interest in the development of geothermal resources, and that this state should exercise its power and jurisdiction through its oil conservation commission and the Division to require that wells drilled in search of, development of, or incident to the production of geothermal resources be drilled, tested, operated, maintained and abandoned in such a manner as to safeguard life, health, property, natural resources and the public welfare, and to encourage maximum economic recovery."

**LDG 45-7 G-112 COAs**

**COA #1:** The operator shall submit a G-104 Form with all other associated G-Forms and required information for this G-112 submittal (19.14.63 NMAC and 19.14.93 NMAC) to OCD for approval within 30 days of well completion and/or before injection may be allowed into the well.

Los Lobos Response

1. The operator has submitted these forms, is this condition suggesting that additional forms are required?

**COA #2:** The operator shall assess the well's potential to adversely affect, i.e., aquifer drawdown, environmental water quality at any place of withdrawal of water for present or reasonably foreseeable future use (including a water quality sample from waters supply wells before injection as allowed/approved by the well owner), geothermal correlative rights, etc., in wells within 1-mile from the injection well.

Los Lobos Response

1. Please define "Assess the well's potential to affect aquifer drawdown." This permit is to allow injection, which returns geothermal fluid to the aquifer, thus preventing drawdown, not causing drawdown.

2. It is impractical and unnecessary to sample all the fresh water wells within a one-mile radius of LDG 45-7 because not all these wells are equipped in a way that allows sampling, e.g., with a pump. We have already proposed to monitor a limited number of wells that are equipped with pumps, screened to the greatest depths, and located at various distances away from LDG 45-7. In addition to LDG 55-7, the source of the injectate, we propose to sample Rosette State Well No. 1 or Rosette State Well No. 3, Burgett Greenhouse Well No. 2, and McCants State Well No. 1, contingent upon well owner approval. Sampling these wells will provide a cross-section of water quality for a radius of approximately 3,400 feet from LDG 45-7. Water table monitoring will also take place during testing, as it has in the past, via transducers set in the wells, as indicated our letter to BLM dated August 17, 2012, of which you received a copy.
3. It is impractical to sample wells that do not have dedicated pumps. In order to properly collect a representative sample according to ASTM D 4448-01, the operator must purge wells of three casing volumes before a representative sample can be properly collected.

**COA #3:** The operator shall conserve the fresh water resource(s) by implementing proven geothermal engineering power generation design, operations, and best management practices.

Los Lobos Response

1. The operator has proposed to generate electricity using a binary technology, which strips the heat from the geothermal fluid without that fluid ever leaving its pipe. All fluid is then returned to the geothermal reservoir to reheat and be reused again. Los Lobos believes that binary power production is a better approach to conserving geothermal resources than generation of electricity via steam or "flash" technology.
2. Los Lobos would like OCD to cite the statutory authority on which this permit condition is based.

**COA #4:** The operator shall monitor the in-flow/out-flow rate(s) and fluid level in the centralized pond to maintain adequate free board or prevent overflow; and shall compare injection volume vs. pond containment volume to assess leaky liner vs. evaporative loss conditions on a daily basis.

Los Lobos Response

1. Los Lobos agrees this condition is consistent with the sampling plan submitted on August 9, 2012.

**COA #5:** The operator shall sample utilizing ASTM E-947-83 (Standard Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis) whenever possible. All OCD environmental analytical laboratory analyses during well testing shall include: General Chemistry and Metals. The operator shall notify OCD within 24-hours of daily field water quality parameter monitoring that exhibits a field test differential of +/- 25%. OCD may require the operator to implement corrective action(s) if water quality exceeds the greater of the WQCC ground water standards or background at any place of withdrawal of water for present or reasonably foreseeable future use for injection into the well.

Los Lobos Response

1. The operator has already submitted baseline geothermal fluid analytical data for LDG 45-7. Los Lobos cannot sample a well into which it is injecting for reasons stated above in connection with LDG 45-7 G-104 COA #1. All sampling for laboratory analysis will be done according to the sampling plan we submitted on August 9, 2012, and it will be performed according to one of the ASTM methods indicated above.
2. As stated in the sampling plan dated August 9, 2012, samples of LDG 55-7 fluid will be collected for laboratory analysis at the initiation of the flow test, after 24 hours of flow testing and after 5 days of flow testing. If changes in daily field fluid quality parameters indicate a change of +/- 25% from the previous field parameters reading, an additional laboratory sample will be collected and OCD will be notified within 24 hours.
3. The metals list will include arsenic, barium, copper, iron, lithium, magnesium, manganese, strontium. Additional analytes will include boron, calcium, lithium, nitrate, potassium, sodium, sulfate, chloride, pH, TDS, and specific conductance.

4. Please define the "background concentrations" for constituents of concern in the geothermal fluid. Both the agency and the operator need specificity so that each can know whether permit conditions have been met or not.
5. Please define the term "or reasonably foreseeable future use". Both the agency and the operator need specificity so that each can know whether permit conditions have been met or not.

**COA #6:** The operator shall submit an initial G-103 Sundry Notice for a Casing Test (test) or EPA Mechanical Integrity Test (Min with proposed MIT method for OCD approval at least 15 days in advance of any injection well completion, existing well MIT requirement, and after any existing well workover date(s).

Los Lobos Response

1. LDG 45-7 was drilled to total depth on February 3, 2011, and the workover was completed in March 2012. Los Lobos will provide the digital data for the CIT performed in early 2011 and proposes to run a cement bond log (CBL) prior to injection. Los Lobos does not believe that additional MIT will provide any materially new or different information that would justify the costs of the additional MIT.

**COA #7:** The operator shall submit a final G-103 Sundry Notice for the EPA MIT results within 10 days of injection well completion (19.14.54.8(C) (2) NMAC). The operator shall include a detailed description of the test method employed and the results obtained by such test, and any other pertinent information required by 19.14.27.8B (5) NMAC in the final G-103 submittal. The results of the casing test, including actual pressure held on the pipe and the pressure drop observed, shall also be reported on the form G-103 (19.14.54.8 NMAC). The first well MIT date shall mark the start date of OCD's mandatory 5-year EPA MIT schedule. Casing strings in wells drilled with cable tools may be tested as outlined in 19.14.27.8(B) (5) (a) NMAC.

Los Lobos Response

1. The operator understands this permit condition to be applicable if and only if LDG 45-7 is permanently used in as an injector when the electric power plant is in operation.

**COA #8:** MITs performed subsequent to well workover, unless it occurs after the 4th year, since the last EPA MIT, shall not disrupt the 5-year MIT schedule. In general, the well must be tested every 5-years regardless of well workover MITs conducted between the required EPA MIT 5-year M IT schedule. The operator may proceed at its own risk when attempting to perform an MIT with external equipment, i.e., BOPE that could be the cause of the well MIT failure.

Los Lobos Response

1. The operator understands this permit condition to be applicable if and only if LDG 45-7 is permanently used in as an injector when the electric power plant is in operation.

**COA #9:** The operator shall ensure that the MIT performed during well completion and/or during drilling shall have an adequate cement plug thickness positioned not greater than 20 feet above the casing shoe before conducting the MIT. The operator shall also receive BLM approval on MIT procedures for injection wells drilled on Federal Mineral Estates and/or Surface Rights.

Los Lobos Response

1. LDG 45-7 has a 100' overlap of liner in the bottom of the 13.375" production casing. It is impractical to try to place a cement plug inside the liner as it may not seal correctly and using a cement plug would require additional clean out of the well. The operator proposes to place a packer approximately 10 feet above the top of the liner. The operator is happy to receive BLM approval on this prior to submitting the G-103 to OCD.

**COA #10:** The operator shall provide a water quality monitoring plan for well testing to OCD for approval at least 30 days prior to any water injection into the well. The operator shall comply with OCD's approved ASTM sample procedure(s) with environmental water quality sampling and analytical laboratory that complies with to EPA QA/QC and DQOs for any OCD required environmental sampling and analyses. OCD may require the operator to implement corrective action(s) if water quality exceeds the greater of the WQCC ground water standards or background at any place of withdrawal of water for present or reasonably foreseeable future use.

Los Lobos Response

1. Please see responses to LDG 45-7 G-104 COA #1.

**COA #11:** The operator shall obtain environmental water quality data from the well and during well testing to help evaluate water quality conditions before and during full-scale geothermal power operations due to the large volumes of injected fluids into protectable ground water aquifer and/or reservoir system(s) « 10,000 mg/L TDS). Well testing provides an opportunity for the operator and OCD to evaluate water quality conditions in the well before and after injection based on the above.

Los Lobos Response

1. Operator has already submitted baseline analytical data for the geothermal fluid in LDG 45-7. It should be feasible to collect a sample from the well after injection has stopped, assuming the well will flow freely, but this sample will be of the injection water, not of formation water.

**COA #12:** The operator shall comply with the terms and conditions of its discharge permit and OCD's Geothermal Regulations (Chapter 71, Article 5 NMSA 1978 and Title 19, Chapter 14 NMAC). All Underground Injection Control (UIC) Class V Geothermal Injection Wells must comply with the applicable sections of Water Quality Control Commission Regulations (20.6.2.5000 - 5006 NMAC). All geothermal field activities must comply with 20.6.2 NMAC and 20.6.4 NMAC).

*Please be advised that OCD's approval does not relieve Los Lobos Renewable Power, LLC. from responsibility if their operations pose a threat to ground water, subsurface trespass, water supply/diversion, surface water, human health or the environment. In such event, OCD may order the operator to plug and abandon its well pursuant to the geothermal regulations. In addition, OCD approval does not relieve Los Lobos Renewable Power, L.L.C. of responsibility for compliance with any other federal, state, or local laws and/or regulations.*

Los Lobos Response

1. Please see responses to LDG 45-7 G-104 COA #2.

**LDG 55-07 G-104 COAs**

**COA #1:** The operator shall provide a water quality monitoring plan for well testing to OCD for review and approval at least 30 days prior to any water injection into the well. The operator shall comply with OCD's approved ASTM sample procedure(s) with environmental water quality sampling and analytical laboratory that complies with EPA QA/QC and DQOs for any OCD required environmental sampling and analyses. OCD may require the operator to implement corrective action(s) if water quality exceeds the greater of the WQCC ground water standards or background, at any place of withdrawal of water for present or reasonably foreseeable future use.

Environmental water quality data is needed from the well before and during well testing to help evaluate water quality conditions during full-scale geothermal power operations, since large volumes of injected water must meet the greater of background and/or WQCC water quality standards before injection into a fresh water aquifer system(s). Well testing provides an opportunity for the operator and OCD to evaluate water quality conditions based on the above.

Los Lobos Response:

1. The operator has submitted baseline analytical data for the geothermal fluid and a monitoring plan for LDG 55-7. Please indicate the deficiencies in this monitoring plan.
2. Please see responses to LDG 45-7 G-104 COA #1 and LDG 45-7 G-112 COA #5.

**COA #2:** The operator shall comply with the production/development well terms and conditions of the Geothermal Regulations (Chapter 71, Article 5 NMSA 1978 and Title 19, Chapter 14 NMAC). Since production wells may also become injection wells, all Underground Injection Control (UIC) Class V Geothermal Injection Wells must comply with the applicable sections of Water Quality Control Commission Regulations (20.6.2.5000 - 5006 NMAC). All geothermal field activities must comply with 20.6.2 NMAC and 20.6.4 NMAC).

*Please be advised that OCD's approval does not relieve Los Lobos Renewable Power, LLC. from responsibility if their operations pose a threat to ground water, subsurface trespass, water supply/diversion, surface water, human health or the environment. If/ such event, OCD may order the operator to plug and abandon its well pursuant to the geothermal regulations. In addition, OCD approval does not relieve Los Lobos Renewable Power, L.L.C. of responsibility for compliance with any other federal, state, or local laws and/or regulations.*

Los Lobos Response

1. Please see responses to LDG 45-7 G-104 COA #1 and LDG 45-7 G-112 COA #5.

Thank you very much for your assistance in the development of this important energy project. Should you have questions regarding these responses, please do not hesitate to contact me by email at [David.Janney@amec.com](mailto:David.Janney@amec.com) or by phone at (505) 821-1801.

Respectfully submitted,



**David W. Janney, PG**  
**Agent for Los Lobos Renewable Power, LLC**

**Cc:** Jami Bailey - NMOCD  
Glenn Von Gonten – NMOCD  
David Brooks – NMOCD  
Randy Dade - NMOCD  
TC Shapard – NMOCD  
Nick Goodman – Los Lobos Renewable Power, LLC  
Chuck Smiley – Los Lobos Renewable Power, LLC  
Michelle Henrie – Attorney for Los Lobos Renewable Power, LLC



## Chavez, Carl J, EMNRD

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**From:** Janney, David <david.janney@amec.com>  
**Sent:** Friday, July 13, 2012 11:06 AM  
**To:** Chavez, Carl J, EMNRD; VonGonten, Glenn, EMNRD  
**Cc:** Michelle Henrie; Michael Hayter  
**Subject:** FW: Groundwater Quality at Lightning Dock Geothermal and in Animas Valley  
**Attachments:** WQ in Greenhouse Area.pdf; WQ in the Valley.pdf

Good morning Gentlemen:

Please find attached two documents that provide groundwater quality data for the area centered near the Burgett green house facility and for the Animas Valley in general. The water quality data for the samples included in the green house area were collected and analyzed by a number of individuals since 1949 and compiled by Los Lobos/Cyrq Energy some time ago. I believe this document was sent to you in June 2010.

The field groundwater quality data for the Animas Valley was collected by a Los Lobos consultant earlier this year.

We believe these documents illustrate the overall groundwater quality with respect to total dissolved solids and fluoride in and around the geothermal resource. Please feel free to contact me with any questions you may have.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

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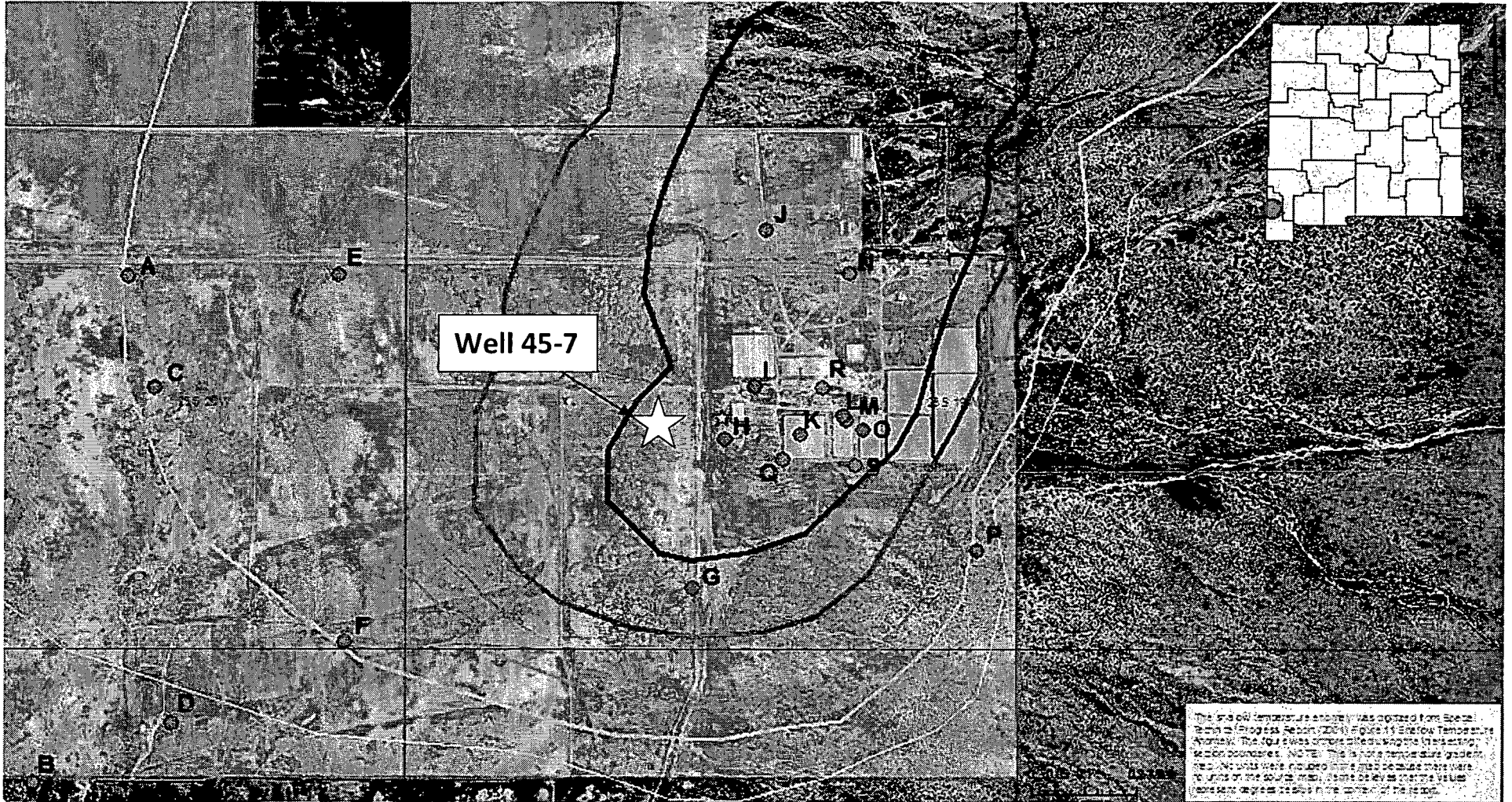
Lightning Dock TDS and F values

\*Average Values from the multiple data sets will appear on the following maps \*\*Do not have exact coordinates

MAP REFERENCE	DATUM REFERENCE	SOURCE REFERENCE	SAMPLE	DATE	WATER SOURCE	W LONGITUDE 27	N LATITUDE 27	TEMP °C	TEMP °F	TDS mg/l	F mg/l
A	165	Norman	N-39	-	Well	-108.85263	32.14987	-	-	-	-
B	167	Norman	N-41	-	Well	-108.85520	32.13586	-	-	-	-
C	4	Logsdon	P-4	1981	Well	-108.85188	32.14678	-	-	1608	7.25
D	37	Logsdon	AN-5	1981	Well	-108.85141	32.13749	-	-	1184	3.48
E	131	OCD	OCD-2	01/28/86	Beall water well	-108.84682	32.14992	17.5	63.5	443	2.00
E	138	Cunniff	C-3	11/07/85	Beall water well, OCD-2	-108.84682	32.14992	-	-	-	-
F	5	Logsdon	P-5	1981	Well	-108.84665	32.13973	-	-	1660	3.55
*G	183	Summers	Sum-5	04/04/60	Folk well	-108.83698	32.14122	-	-	620	-
*G	62	AMAX	AMAX-7	01/27/75	Folk well	-108.83698	32.14122	65.0	149.0	457	7.80
H	135	OCD	OCD-6	01/28/86	Burgett grnhouse discharge	-108.83612	32.14534	47.0	116.6	1115	11.70
I	133	OCD	OCD-4	01/28/86	Burgett geowell	-108.83528	32.14681	48.0	118.4	1195	12.50
J	136	Cunniff	C-1	11/07/85	Beall grnhouse well	-108.83501	32.15117	-	-	1092	-
*K	93	NMSU	NMSU-20	08/07/80	Burgett well	-108.83405	32.14549	71.0	159.8	1628	-
*K	2	Logsdon	P-2	1981	Burgett hot well	-108.83405	32.14549	-	-	1116	12.60
*K	89	NMSU	NMSU-16	03/27/81	Burgett well	-108.83405	32.14549	84.0	183.2	1167	-
*K	94	NMSU	NMSU-21	01/06/81	Burgett well	-108.83405	32.14549	65.0	149.0	1452	-
*L	179	Summers	Sum-1E	04/27/54	Well	-108.83288	32.14599	-	-	1160	9.90
*L	90	NMSU	NMSU-17	01/06/81	Burgett well	-108.83288	32.14599	-	-	1034	-
*L	178	Summers	Sum-1B	04/28/49	Well	-108.83288	32.14599	-	-	1130	11.00
M	166	Norman	N-40	-	Well	-108.83282	32.14589	-	-	-	-
*N	63	AMAX	AMAX-8	01/26/75	McCants well	-108.83272	32.14997	85.0	185.0	1132	13.00
*N	3	Logsdon	P-3	1981	McCants well	-108.83272	32.14997	-	-	8	12.00
*N	88	NMSU	NMSU-15	08/06/80	McCants well	-108.83272	32.14997	88.9	192.0	982	-
*N	137	Cunniff	C-2	11/07/85	McCants grnhouse well	-108.83272	32.14997	-	-	1114	-
*O	91	NMSU	NMSU-18	08/07/80	Burgett well	-108.83233	32.14563	89.4	192.9	16281	-
*O	92	NMSU	NMSU-19	01/06/81	Burgett well	-108.83233	32.14563	94.0	201.2	15604	-
*O	181	Summers	Sum-2B	04/30/66	Well	-108.83233	32.14563	-	-	1070	12.00
*P	95	NMSU	NMSU-22	08/07/80	Well	-108.82916	32.14227	24.5	76.1	352	-
*P	96	NMSU	NMSU-23	01/06/81	Well	-108.82916	32.14227	24.0	75.2	418	-
**Q	-	Raser	153440	05/13/08	Burget discharge	-	-	-	-	1110	9.95
**R	-	Raser	Geo well 1	6/9/2008	Burgett well	-	-	-	-	1320	13.2
**S	-	Raser	Geo well D	6/9/2008	Burgett well	-	-	-	-	1140	11.6

**Lightning Dock TDS and F values**

\*Average Values from the multiple data sets will appear on the following maps \*\*Do not have exact coordinates



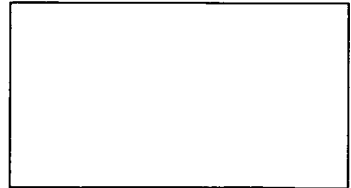
The groundwater temperature anomaly was derived from Seocal Basin Oil Progress Report (2011) Figure 11 Shallow Temperature Anomaly. The TDS was derived following the 10% contour section boundaries. NOTE: This is a temperature gradient map. No units were included in the map because there were no units on the source map. It is only to show the values represent progress relative to the contour of the map.

- ☆ 55-7
- Wells
- 100 c
- 120 c
- 80 c
- 150 c
- 90 c

**Lightning Dock, NM  
Reference Map**

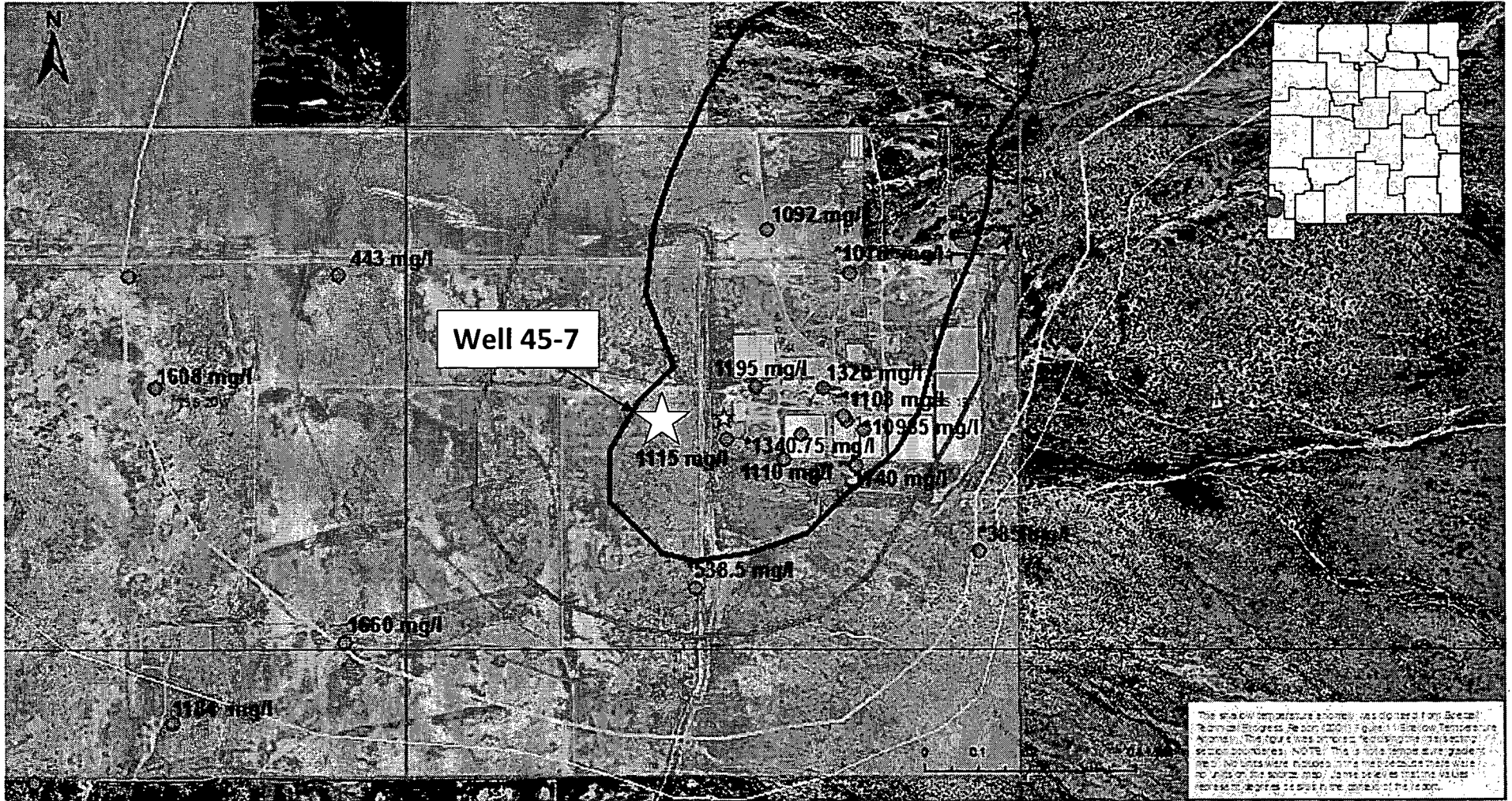
Map by James Robinson  
Date: 08/23/10

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**Lightning Dock TDS and F values**

\*Average Values from the multiple data sets will appear on the following maps \*\*Do not have exact coordinates



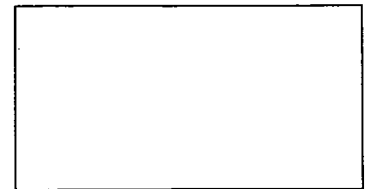
**Lightning Dock, NM  
TDS Concentrations**

Map by: Jaime Robinson

Date: 06/03/00

Note: Values are averages of multiple data sets

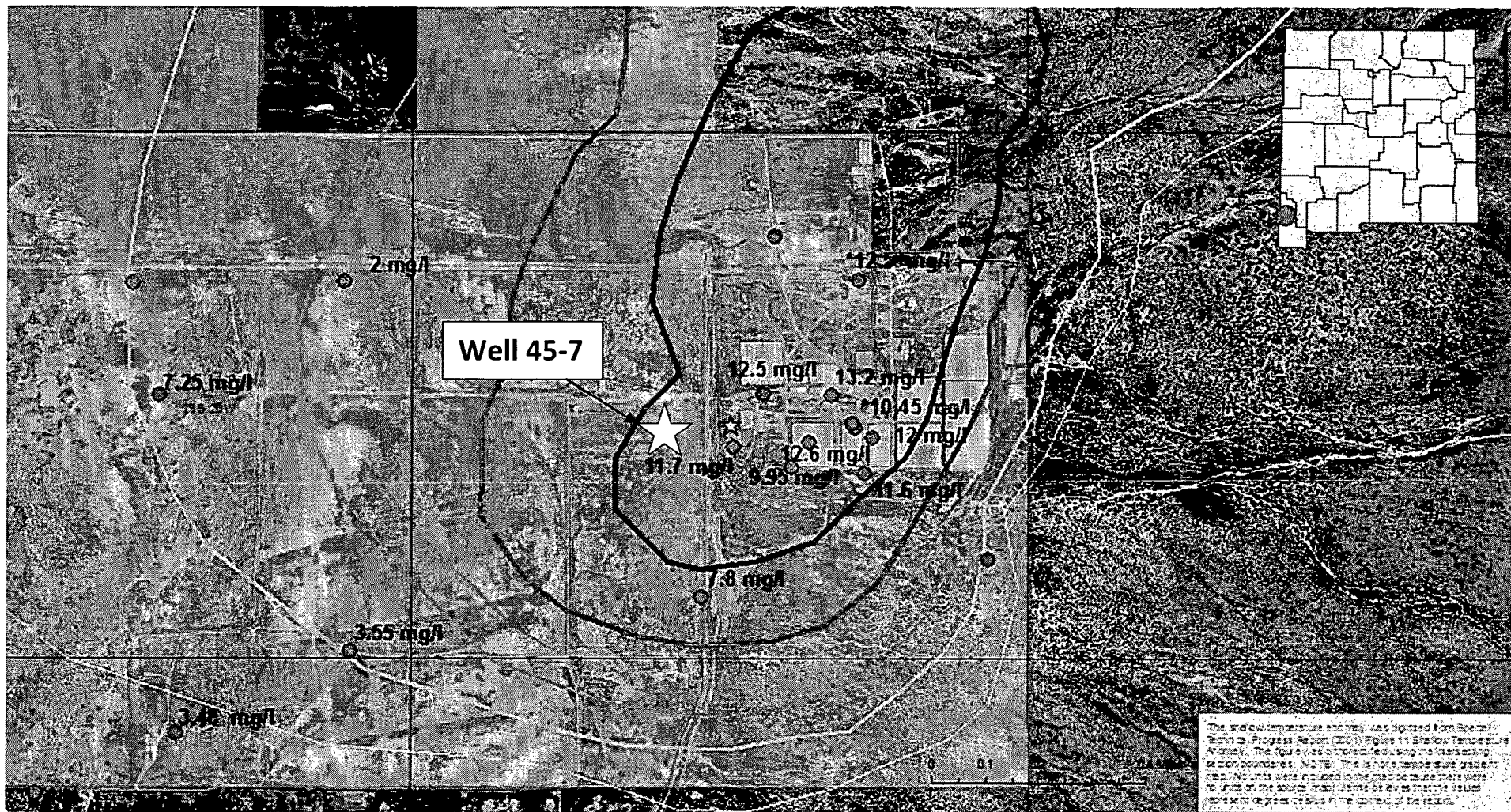
Path: N:\GIS\Work\eng\A03\Projects\ENM\GIS\Working\A03\Projects\James H\Map\Lightning\_Dock\_TDSConcentrations061700





### Lightning Dock TDS and F values

\*Average Values from the multiple data sets will appear on the following maps \*\*Do not have exact coordinates



- ☆ 55-7
- Wells
- 100 c
- 120 c
- 80 c
- 150 c
- 90 c

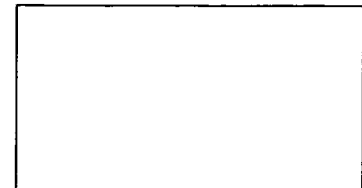
### Lightning Dock, NM Fluoride Concentrations

Map by: Jaime Robinson  
Date: 06/23/10

Note: Values are averages of multiple data sets

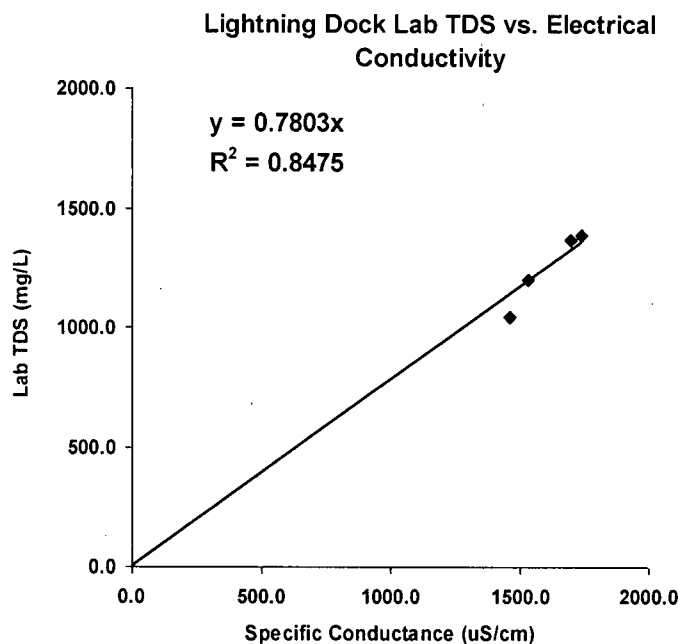
Path: N:\GIS\Working\Ac03\Project\ENM\GIS\Working\Ac03\Project\James\Map\Lightning\_Dock\_FluorideConcentration10

The snowflow temperature anomaly was digitized from the 2001-2002 Progress Report (2003) Figure 11 Snowflow Temperature Anomaly. The figure was digitized using the latest available section boundaries. NOTE: This is not a temperature gradient map. No units were included in the original data. There were no units on the original data. Units of degrees Celsius were added to the legend to represent degrees Celsius in the context of the report.



The electrical conductivity of a water sample (specific conductance) is related to the amount and type of compounds that are dissolved in water and the temperature of the sample. Because of this relationship, and the ease of use of electrical conductivity meters in water quality sampling and field studies, specific conductance is often measured on water samples. Charged dissolved ions in water make the water electrically conductive. Specific Conductance (SC) is commonly expressed in units of Siemens (S) per centimeter.

The Total Dissolved Solids (TDS) of a water sample is another parameter that is related to the amount and type of compounds that are dissolved in water but not the temperature of the sample. TDS can be measured directly by evaporation or calculated from a complete water quality analysis. Because SC is related to the electrical charge of the dissolved substances, and not just their amount and weight as in TDS, SC cannot be perfectly and directly convertible to TDS by a universal formula. However, when data is available, relationships between SC and TDS can be developed for waters that are chemically similar. An example of such a relationship is depicted in the figure below, using data from Lightning Dock and AmeriCulture thermal wells.



The correlation between lab SC and calculated TDS is significant with an  $R^2$  value of 0.85. The formula  $TDS = SC \times 0.7803$  is derived. This value is used to calculate the range of TDS in shallow non-thermal wells near Cotton City, NM (Table 1 and Figure 1 and 2) from observed SC. Shallow aquifer TDS varies from 265 to 2,403 mg/L with an average of 744 mg/L.

**Table 1. Wells sampled for field parameters near Cotton City, Hidalgo County, New Mexico.**

Sample ID <sup>1</sup>	Sample Date	Sample Time	Field pH	Field Specific Conductance (uS/cm)	Field Temperature (°C)	Calculated TDS (mg/L)	OSE Well Number <sup>2</sup>	UTM Easting (meters) <sup>3</sup>	UTM Northing (meters) <sup>4</sup>
A0141	29-Feb-12	1200	7.10	480	22.0	375	A0141	12701727	3562522
A0145	29-Feb-12	1248	7.36	1510	22.0	1178	A0145	12703265	3561269
A0055	29-Feb-12	1343	7.45	340	18.5	265	A0055	12700745	3562570
MT01	29-Feb-12	1439	7.80	370	20.5	289		12701139	3562401
GK01	29-Feb-12	1550	6.56	520	19.7	406		12702990	3568589
A0018	29-Feb-12	1601	7.09	1670	21.2	1303	A0018	12702974	3570885
A0012	1-Mar-12	1016	6.73	3080	20.1	2403	A0012	12702522	3556942
A0276	1-Mar-12	1120	6.99	880	15.5	687	A0276	12701958	3553368
VVC	1-Mar-12	1200	6.35	360	19.0	281	A0253	12699959	3559275
A0083	1-Mar-12	1313	6.48	1150	20.5	897	A0083	12702078	3558948
DB1	1-Mar-12	1400	7.39	610	19.5	476		12701671	3558907
DB2	1-Mar-12	1414	6.48	820	20.0	640		12701687	3558872
DB3	1-Mar-12	1426	6.91	610	19.5	476		12701680	3558866

<sup>1</sup> Sample ID used for analytical work and Figure 1

<sup>2</sup> Some OSE well numbers unresolved by the date of this report

<sup>3</sup> Readings by handheld GPS, NAD 83

Median  
TDS 744

CONFIDENTIAL



Figure 1. Map showing wells sampled for Specific Conductance near Cotton City, Hidalgo County, New Mexico on February 29 and March 1, 2012. Wells depicted in red are geothermal. Not all wells are depicted in the center of the figure for clarity. See Figure 2 for detail of the Figure 1 center.





Figure 2. Detail of center section of Figure 1.

## Chavez, Carl J, EMNRD

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**From:** Janney, David <david.janney@amec.com>  
**Sent:** Thursday, July 12, 2012 11:17 AM  
**To:** VonGonten, Glenn, EMNRD; Chavez, Carl J, EMNRD  
**Cc:** Michelle Henrie; Michael Hayter  
**Subject:** Temperature Distribution  
**Attachments:** DOEID-13989[1].pdf

Greetings:

Please find attached a DOE report that includes a temperature contour figure (page 14 of the pdf [page 6, Figure 2 in the document]) that presents the temperature distribution in the shallow subsurface.

We believe that this will provide the temperature gradient information that you requested in our meeting on July 11.

We believe that the well indicated as the McCants State well in this figure has been P&Ad.

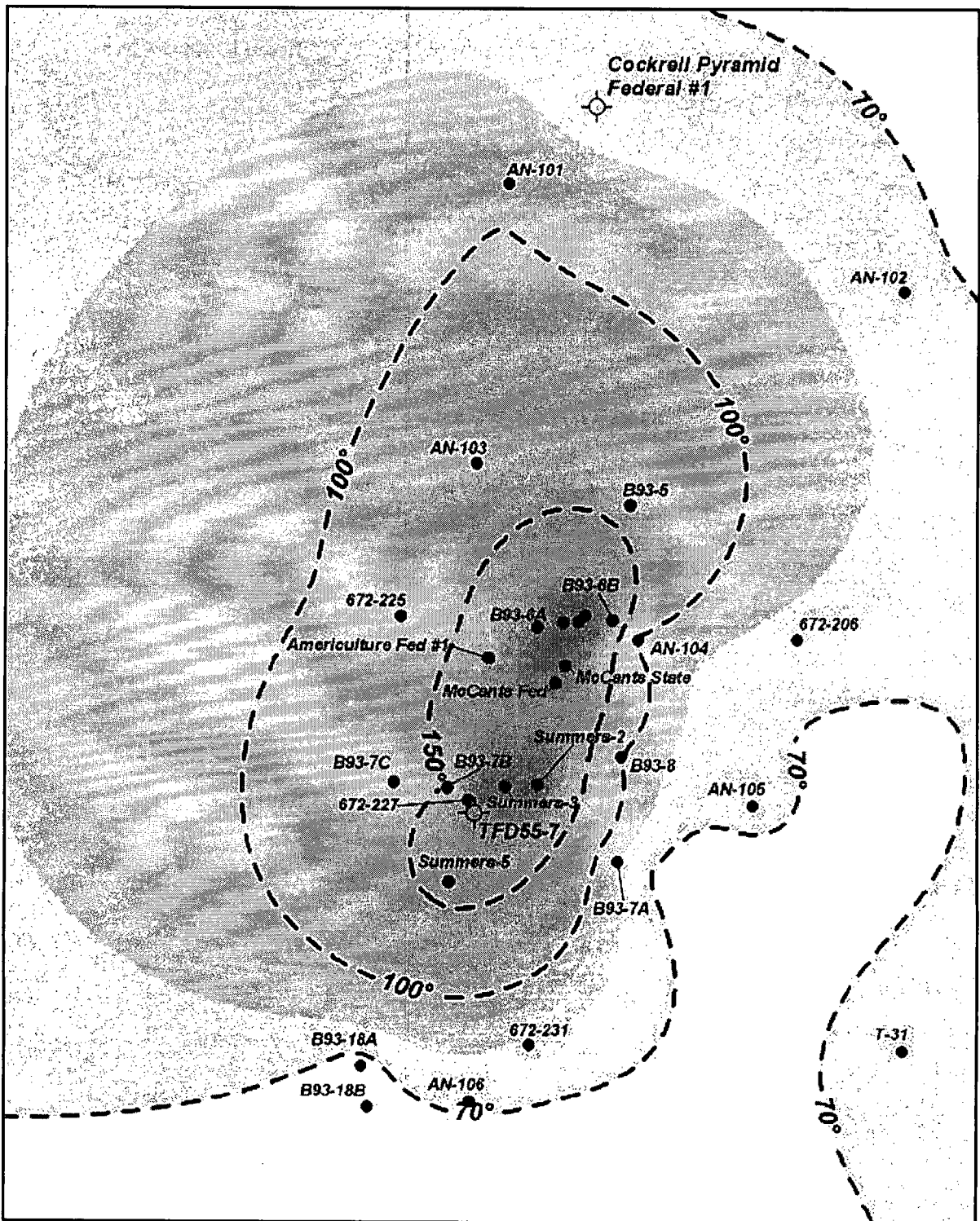
Please feel free to contact me with any questions you may have on this issue.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

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**Figure 2.** Distribution of temperatures in shallow subsurface, Animas Valley, New Mexico. (Data source, Bowers, 2001c)

**Chavez, Carl J, EMNRD**

---

**From:** Chavez, Carl J, EMNRD  
**Sent:** Wednesday, July 11, 2012 4:32 PM  
**To:** CarlJ.Chavez@state.nm.us  
**Subject:** Lightning Dock Geothermal Meeting 7/10/2012 Well 63-7 Casing Depth Change Request (NOTE TO FILE)

On 7/10, the OCD met with Los Lobos Renewable Power, LLC in Santa Fe to discuss their updated cross-sections from the 7/2 meeting in Santa Fe.

The meeting discussion included the following:

- 1) The operator hand delivered new cross sections to OCD on 7/10. A meeting occurred between Michelle Henrie, David Janney, Glenn von Gonten, and Carl Chavez to discuss the new submittal.
- 2) The operator indicated that the geothermal zone of interest based on temperature logs resides from about 1,500 – 1,800 ft. below ground level (bgl). Most water supply wells within ½ mile of the well are less than 550 TD, but the AmeriCulture State Well No. 2 was deepened to 2,100 ft. If OCD requires injection at 2,200 ft. bgl, into a lower temperature and permeability zone, this would not enhance the extraction and injection into the same formation/injection zone for the geothermal flow regime.
- 3) OCD is reviewing shallow and deeper water quality data.
- 4) OCD requested more shallow water quality data to evaluate the request and possible approval and/or approval with conditions of the 1,500 casing depth. For example, water quality monitoring of fresh water wells during well testing may be required to assess changes in the shallow water quality under dynamic flow conditions.
- 5) One issue appears to be whether a “Modification” under WQCC Regulations will be required for the change or handled under the geothermal regulations. Fresh water supply owners were not aware of the casing depth change at the time the well was public noticed under the Geothermal Regulations. In addition, a nearby water supply well owner, Mr. McCants has inquired as to why he was not public noticed on the well.

\*\*\*\*\* END \*\*\*\*\*

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Department  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Drive, Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
E-mail: [CarlJ.Chavez@State.NM.US](mailto:CarlJ.Chavez@State.NM.US)

Website: <http://www.emnrd.state.nm.us/ocd/>

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<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>

**Chavez, Carl J, EMNRD**

---

**From:** Chavez, Carl J, EMNRD  
**Sent:** Tuesday, July 10, 2012 9:52 AM  
**To:** CarlJ.Chavez@state.nm.us  
**Subject:** Lightning Dock Geothermal Meeting 7/2/2012 Well 63-7 Note to File

On 7/10 after returning from a week of leave, I was debriefed on the above subject meeting by Glenn von Gonten.

Glenn stated the following:

- 1) The operator indicated that the temperature logs indicate that the high-temperature geothermal zone of interest is between about 1,500 – 1,800 ft. below ground and forms the basis for their well casing program to the BLM/OCD. This depth appears to interfere with terms and conditions of the OCD GTHT-1 Discharge Permit Condition determined in the OCD G-112 approval with conditions casing depth of 2,200 ft. to protect freshwater supply wells within ½ mile from Well 63-7:

*Section 21 . Class V Geothermal Injection Wells and Geothermal Production or Development Wells:*

*B. Well Casing and Cementing Requirements:*

*I. The owner/operator shall ensure that all casing and cementing meets or exceeds the requirements of 19.14.27.8 NMAC (Casing and Cementing Requirements). Conductor pipe shall be run to a minimum depth of 100 feet.*

- 2) OCD requested a cross-section of the area with water quality data from all wells to assess the feasibility of a shallower discharge into protectable water in the project area. Upon review of the preliminary submittal on 7/9 by the operator to address the OCD's request, Glenn responded that it was inadequate and that a more comprehensive submittal (inclusive of well lithology too) was required for OCD review and approval to change the casing program. The OCD is currently awaiting receipt of another acceptable submittal to evaluate the request for the 1,500 casing depth.
- 3) Carl discussed with Glenn the concern about thermal temperatures issues associated with injection of spent thermal fluids or produced water into the high volume injection well and the fact that geothermal temperature needs to be a consideration in addition to water quality. There are concerns about exceedances to WQCC water quality standards of Fluoride, pH, and some of the other standards, but OCD will assess after receipt of the submittal request.
- 4) There is the issue of how the OCD could modify the permit condition based on the current preliminary exploration phase of the project based on item no. 1 above.

\*\*\*\*\* END \*\*\*\*\*

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Department  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Drive, Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
E-mail: [CarlJ.Chavez@State.NM.US](mailto:CarlJ.Chavez@State.NM.US)  
Website: <http://www.emnrd.state.nm.us/ocd/>

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## Chavez, Carl J, EMNRD

---

**Subject:** 6/29 Meeting Continuation (Protectable vs. Fresh Water)  
**Location:** OCD Conference Room (3rd. Floor) Wendell Chino Building 1220 South St. Francis Drive, Santa Fe, NM 87505

**Start:** Mon 7/2/2012 10:30 AM  
**End:** Mon 7/2/2012 11:30 AM

**Recurrence:** (none)

**Meeting Status:** Meeting organizer

**Organizer:** Chavez, Carl J, EMNRD  
**Required Attendees:** Michelle Henrie (michelle@mhenrie.com); Cotter, Jeff (jeff.cotter@amec.com); VonGonten, Glenn, EMNRD; Sanchez, Daniel J., EMNRD; Chavez, Carl J, EMNRD; Bailey, Jami, EMNRD; Brooks, David K., EMNRD

Ladies and Gentlemen:

Meeting to held in Santa Fe at the above subject address.

\*\*\*\*\*

Agenda Items:

- 1) Fresh Water vs. Protectable Water
- 2) Los Lobos Renewable Power LLC would like the OCD to withdraw the permit condition (see text in italics below) requiring casing to 2,200 feet in the above subject well. The requirement was referenced in the OCD G-101 and G112 Approval with Conditions (see attachments).

*21 . Class V Geothermal Injection Wells and Geothermal Production or Development Wells:*

*B. Well Casing and Cementing Requirements:*

- I. The owner/operator shall ensure that all casing and cementing meets or exceeds the requirements of 19.14.27.8 NMAC (Casing and Cementing Requirements). Conductor pipe shall be run to a minimum depth of 100 feet.*
- II. Surface casing shall be to a depth of at least 100 feet greater than the deepest fresh water well within one-half mile from the well location.*
- III. Intermediate strings shall be cemented solid to surface.*
- IV. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if run. If production casing is lapped into an intermediate string. the casing overlap shall be at least 50 feet. The lap shall be cemented solid and it shall be pressure tested to ensure integrity.*
- v. The owner/operator shall submit a logging program to OCD for review with the owner/operator depth setting recommendations for its casing program based on the logging program. The owner/operator prior to setting intermediate or production casing in each of the production and injection wells shall run open-hole logs, pursuant to the logging program, approved by the OCD. Logs must be submitted to the OCD for review with the applicant's recommendations for casing setting depths, and in case of injection wells, for precise definition of*

*the injection interval. The type of tubing installed shall be conducive to the characteristics of the injected fluids determined after initial testing of the injected fluids. The owner/operator shall ensure that the tubing is installed with a packer set within 100 feet of the uppermost injection perforations. The casing-tubing annulus shall be filled with an inert fluid, and a gauge or approved leak detection device shall be connected to the annulus to detect for leakage in the casing, tubing or packer.*

- 3) Miscellaneous
- 4) Path Forward
- 5) End

\*\*\*\*\*

Late Wednesday afternoon Michelle Henrie, attorney for Los Lobos Renewable Power, sent an e-mail demanding that OCD withdraw the permit condition requiring casing to 2,200 feet in the injection well they are drilling.

Legally, the Discharge Plan, approved several years ago, after extensive hearings, requires that all injection wells be cased to a depth at least 100 feet below the deepest "fresh water" well within one half mill. Americulture's fish tank well is within one half mile. (-- David Brooks)

## Chavez, Carl J, EMNRD

---

**From:** Chavez, Carl J, EMNRD  
**Sent:** Wednesday, May 09, 2012 7:48 AM  
**To:** Dade, Randy, EMNRD; Shapard, Craig, EMNRD  
**Cc:** Smith, Michael A (michaelsmith@blm.gov); Jackson, Charles L., OSE; Phillips, Haddy L., OSE; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD  
**Subject:** Lightning Dock Geothermal Meeting 5/8/2012 in Santa Fe  
**Attachments:** DRAFT LDG PROJECT OPTIONS 5-8-2012.doc

Randy and TC:

Re: Communication from Yesterday's OCD Meeting with Cyrq (meeting to be posted today on OCD Online "Meetings" (click [here](#)).

Good morning. Please find attached the draft options provided to Cyrq at yesterday's meeting. The meeting focused on the new injection well locations and problem that deviation of the injection well locations pose to the OCD under WQCC Regulations and for any injection into the injection wells once they are drilled. The OCD "Big Picture" is that a Modification to the OCD Permit may need to be issued with public notice under WQCC Regulations with C-108 information to assess the injection at the new injection well locations.

Cyrq is focused on drilling injection well 63-7I in Section 7 (click [here](#) for updated map for project at bottom of webpage). As you are aware, the BLM is working to approve the GDP with conditions, some that were shared with the OCD. David Janney (Cyrq's Designated Agent) will be forwarding an updated G-101 to the OCD soon that will reflect BLM approved GDP contents. It is unclear at this time of the well type as the meeting was to discuss options on how Cyrq could drill the relocated injection well, but the OCD Attorney issue is any injection including during well testing requires a WQCC Public Notice (20.6.2.3108 NMAC) depending on how the company wishes to proceed based on the draft OCD options and how Cyrq will proceed. Please begin reviewing the Well 63-7 well location and construction details for (injection and production well) to ensure that it meets the OCD standard geothermal siting approval at this time. One approval condition for your signature Randy may be: "An OCD well bond approval letter shall be issued by the OCD in advance of well drilling."

Finally, at the conclusion of the meeting, the OCD requested that Cyrq provide: 1) Legal assessment in writing based on the meeting and discussions surrounding the draft options and Cyrq's wishes to proceed administratively with injection well relocations that deviate from the approved OCD Permit; 2) List of changes or modifications to Permit (Cyrq mentioned changes to the permit besides injection well relocations); and 3) Cyrq timelines for completion of field drilling, well testing, and engineering power generation design based on testing for the plant. Cyrq has reached agreement with PNM to supply power to their grid by 1/2014.

Based on the above, and OCD review of Cyrq's submittal and response, the OCD can expect Cyrq to complete the field drilling activities (2 production wells and 2 or 3 of the remaining injection wells. The OCD sticking point is the term "Injection well" and any injection well relocations outside of the current OCD Permit appear to require WQCC Public Notice. However, Cyrq may be able to drill the well under Geothermal Regulations until such time as it wishes to inject and/or request authorization to inject or produce from the well.

I told David Janney that I would give you a "Heads Up" to begin looking at Well 63-7, since this is the well they are focused on drilling right now with no plans to submit G-101s for the other injection wells at this time. Cyrq will simply submit Riders to the existing OCD Mutli-Well WQCC Bond referencing each well at the time they need a G-101 approval.

Please contact me if you have questions. Thank you.



## Chavez, Carl J, EMNRD

---

**Subject:** LDG/Los Lobos Renewable Power on the status of the injection well permitting process  
**Location:** Office of the Secretary Conference Room 3rd Floor Wendell Chino Building (1220 South St. Francis Drive, Santa Fe, NM 87505)

**Start:** Tue 5/8/2012 3:00 PM  
**End:** Tue 5/8/2012 4:00 PM

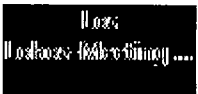
**Recurrence:** (none)

**Meeting Status:** Meeting organizer

**Organizer:** Chavez, Carl J, EMNRD  
**Required Attendees:** Janney, David; Brooks, David K., EMNRD; Bemis, John, EMNRD; Bailey, Jami, EMNRD; Brancard, Bill, EMNRD  
**Optional Attendees:** VonGonten, Glenn, EMNRD; Nick Goodman; Michael Hayter; Michelle Henrie

John Bemis requested an internal pre-meeting in his office to discuss the OCD's draft options to Cyrq. Then OCD should meet w/ Cyrq at 3 p.m. or thereafter to discuss OCD draft options under development by David Brooks for communication with the operator. David Brooks will setup the conference room and time with the operator and all attendees at the meeting with John Bemis to communicate on any issues before OCD issues final options to the operator on Wednesday.

David Brooks is setting up the meeting stemming from the 4/5 meeting with the operator with issues on Monday with the location, etc. The agenda will focus on the OCD's draft options to the operator. Thanks.



---

**From:** Janney, David [<mailto:david.janney@amec.com>]  
**Sent:** Friday, May 04, 2012 3:28 PM  
**To:** Chavez, Carl J, EMNRD; Brooks, David K., EMNRD  
**Cc:** VonGonten, Glenn, EMNRD  
**Subject:** RE: LDG/Los Lobos Renewable Power on the status of the injection well permitting process

Very well, we understand.

Thank you sir.

Enjoy your weekend.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

---

**From:** Chavez, Carl J, EMNRD [<mailto:CarlJ.Chavez@state.nm.us>]  
**Sent:** Friday, May 04, 2012 3:21 PM  
**To:** Janney, David; Brooks, David K., EMNRD  
**Cc:** VonGonten, Glenn, EMNRD  
**Subject:** RE: LDG/Los Lobos Renewable Power on the status of the injection well permitting process

David:

David Brooks is out of the office today and will return on Monday. Since you are attempting to request a meeting before the OCD finalizes its response to the operator's C-108 concerns, I must defer to the OCD Attorney Mr. Brooks on whether the meeting should occur before OCD issues a response to the operator.

I will be in the office on Tuesday and available at 13:30, but will only meet if Mr. Brooks is present and agrees that the meeting should occur before the OCD has issued its response to an issue(s) stemming from the 4/5 meeting in Santa Fe.

Thank you.

---

**From:** Janney, David [<mailto:david.janney@amec.com>]  
**Sent:** Friday, May 04, 2012 2:18 PM  
**To:** Chavez, Carl J, EMNRD; Brooks, David K., EMNRD  
**Cc:** VonGonten, Glenn, EMNRD  
**Subject:** FW: LDG/Los Lobos Renewable Power on the status of the injection well permitting process

Good afternoon Mr. Chavez:

Los Lobos Renewable Power formally requests a meeting with OCD to discuss the permitting process of the proposed relocated injection wells before OCD makes any formal written decisions on the matter.

We understand that this is a new process and believe we can communicate our mutual concerns and formulate ways to address them while seated around a conference table. This is a complicated situation and we believe that we need to be able to provide input before OCD arrives at a formal decision.

We request a meeting with you at 1000 or 1300 on Tuesday May 8<sup>th</sup> in your office.

Sincerely,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off

505.821.7371 fax  
505.449.8457 cell

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LOS LOBOS RENEWABLE POWER, L.L.C.  
LIGHTNING DOCK GEOTHERMAL POWER PROJECT (HIDALGO COUNTY)  
DRAFT OPTIONS (5/8/2012)

OCD Staff has considered Los Lobo's recent C-108 and WQCC regulatory concerns associated with the two new proposed injection wells and from the April 5, 2012 meeting in Santa Fe. Based on the existing situation, the OCD outlines 3 options that Los Lobos may consider in order to proceed with the project. The options are:

- 1) Proceed to drill the injection wells as they are already approved under the OCD Discharge Permit (GTHT-001) and at completion, perform the EPA Casing MIT on injection wells. No public notice or hearing would be required if this option is selected. The bonding would also remain unchanged.
- 2) Proceed solely under the OCD Geothermal Resources Conservation Act and associated Administrative Code provisions during the exploration phase while applying for production/development wells utilizing the G-101, 102, etc. geothermal forms, leaving the issue of permitting wells for injection until Los Lobos is ready to commence any injection, unless it is currently a permitted injection well. This option includes:
  - a) Prior to commencement of injection into any well (including well testing) at a location different from the locations specified in the existing permit, a WQCC permit modification is required unless the permit is under an application for renewal and approved for renewal with new injection well locations.
  - b) Existing G-101s for moved injection well and/or other permit approved well locations not drilled could be allowed to expire.
  - c) To obtain a permit modification to inject into any well other than an injection well drilled in accordance with the existing permit, you will have to comply at that time with the public notice requirements of both the Geothermal Rules (19.14.93.8.B NMAC) and the Water Quality Control Commission Rules (20.6.2.3.3108.B NMAC).
  - d) If the application for a permit modification and/or renewal is protested, a new hearing will probably be necessary.
  - e) Bonding of wells could also fall under the geothermal regulations unless and until a decision is made to use a well for injection/disposal, which would require financial assurance under WQCC regulations.
  - f) Los Lobos must also comply with all permit requirements of both Geothermal and WQCC regulations for injection wells in the event any production well is converted into an injection/disposal well.
  - g) The risks for Los Lobos associated with proceeding under this option: 1) Well testing of any new wells and/or production wells converted to injection wells still requires a WQCC modification to the existing permit and production wells may not meet injection well regulatory requirements, if not constructed accordingly; 2) A well application and/or modification to the permit may be denied depending on

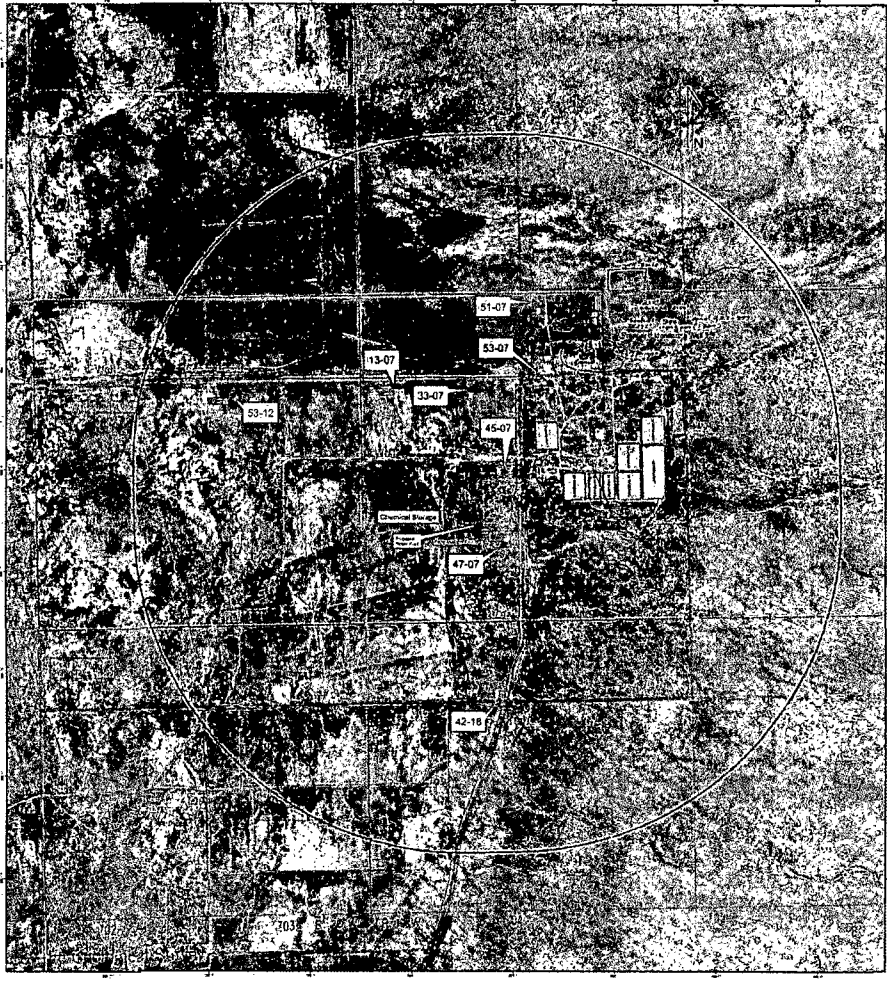
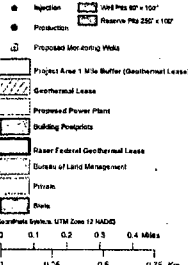
the circumstances at the time a modification to the permit is requested for injection and/or for well testing.

- 3) Proceed under both WQCC and Geothermal regulations and associated bonding requirements to obtain permitting for proposed injection wells at new locations. Any new injection well location different from the locations specified in the current discharge permit will require permitting in compliance with both regulations. New injection wells will be handled under one WQCC modification and/or at the time of permit renewal issuance.

**Lightning Dock  
 Area of Review  
 Animas Valley, NM**

Map Scale: 1 inch = 1 mile  
 Map Date: 12/01/2008  
 Map Title: Lightning Dock Area of Review  
 Map Author: [illegible]  
 Map Reviewer: [illegible]

- Legend**
- 0 - Vacant
  - 1 - Laboratory Work - Federal
  - 2 - Laboratory Work - Private
  - 3 - Agriculture - All Other
  - 4 - Wild No. - 1000-2000
  - 5 - Wild No. - 2000-3000
  - 6 - Wild No. - 3000-4000
  - 7 - Wild No. - 4000-5000
  - 8 - Wild No. - 5000-6000
  - 9 - Wild No. - 6000-7000
  - 10 - Wild No. - 7000-8000
  - 11 - Wild No. - 8000-9000
  - 12 - Wild No. - 9000-10000
  - 13 - Wild No. - 10000-11000
  - 14 - Wild No. - 11000-12000
  - 15 - Wild No. - 12000-13000
  - 16 - Wild No. - 13000-14000
  - 17 - Wild No. - 14000-15000
  - 18 - Wild No. - 15000-16000
  - 19 - Wild No. - 16000-17000
  - 20 - Wild No. - 17000-18000
  - 21 - Wild No. - 18000-19000
  - 22 - Wild No. - 19000-20000
  - 23 - Wild No. - 20000-21000
  - 24 - Wild No. - 21000-22000
  - 25 - Wild No. - 22000-23000
  - 26 - Wild No. - 23000-24000
  - 27 - Wild No. - 24000-25000
  - 28 - Wild No. - 25000-26000
  - 29 - Wild No. - 26000-27000
  - 30 - Wild No. - 27000-28000
  - 31 - Wild No. - 28000-29000
  - 32 - Wild No. - 29000-30000
  - 33 - Wild No. - 30000-31000
  - 34 - Wild No. - 31000-32000
  - 35 - Wild No. - 32000-33000
  - 36 - Wild No. - 33000-34000
  - 37 - Wild No. - 34000-35000
  - 38 - Wild No. - 35000-36000
  - 39 - Wild No. - 36000-37000
  - 40 - Wild No. - 37000-38000
  - 41 - Wild No. - 38000-39000
  - 42 - Wild No. - 39000-40000
  - 43 - Wild No. - 40000-41000
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  - 53 - Wild No. - 50000-51000
  - 54 - Wild No. - 51000-52000
  - 55 - Wild No. - 52000-53000
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  - 85 - Wild No. - 82000-83000
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  - 90 - Wild No. - 87000-88000
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  - 92 - Wild No. - 89000-90000
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  - 94 - Wild No. - 91000-92000
  - 95 - Wild No. - 92000-93000
  - 96 - Wild No. - 93000-94000
  - 97 - Wild No. - 94000-95000
  - 98 - Wild No. - 95000-96000
  - 99 - Wild No. - 96000-97000
  - 100 - Wild No. - 97000-98000
  - 101 - Wild No. - 98000-99000
  - 102 - Wild No. - 99000-100000



GTHT - 1

**Public Meeting  
 Map**

**12/01/2008**



### **Minnesota: UMD Finds Geothermal Potential**

Geologists at the University of Minnesota Duluth's Natural Resources Research Institute have analyzed data in a government-funded study of the state's geothermal potential. The team found the state has three times the energy potential than earlier estimated, saying the state's granite geology makes for a stable working environment. The study takes enhanced geothermal system advancements into consideration. Commenting on next steps, Steve Hauck, program manager for the UMD institute told press researchers or an energy company should "take a much closer look to pinpoint good areas for geothermal." Hauck added that the estimated \$140 million price tag for a 50-MW geothermal plant is competitive with other energy sources, including natural gas.

### **New Mexico: PNM Cites Power from Lightning Dock in 2014 Plans**

The Public Service Co. of New Mexico's newly submitted renewable energy procurement plan for 2013 and 2014 calls for a 20-year PPA for use of geothermal power. The energy would come from the 10-MW Lightning Dock plant by Cyrq Energy in southwest New Mexico, planned for construction and scheduled to begin start-up operations in January 2014. PNM is also asking for a "pay-as-you-go" rate rider that would adjust the cost to customers by spreading it out rather than charging a lump sum. PNM also plans to add solar power and solar PV and to purchase renewable energy credits from wind farms.

### **Washington: Geothermal Candidate Mount Baker one of Most-Studied in the Region**

An article on *Tgdaily.com* sheds further lights on a site at Mount Baker that may open for geothermal leasing. The volcano was last active in the mid-1970s, spurring the temporary closure of its recreation areas around the Baker Lake reservoir. The peak remains one of the most-studied in the Cascades. Additionally, according to the article a geothermal company today would be required to avoid nesting sites of northern spotted owls and marbled murrelets by at least 65 yards (2010 FS record of decision). The U.S. Forest Service is seeking public comment until May 20 on whether to lease the lands (see **Notices** in this newsletter).



## ***Notice Requirements For New Discharge Permits and Modifications***

### **20.6.2.3108 PUBLIC NOTICE AND PARTICIPATION:**

**A.** Within 15 days of receipt of an application for a discharge permit, modification or renewal, the department shall review the application for administrative completeness. To be deemed administratively complete, an application shall provide all of the information required by Paragraphs (1) through (5) of Subsection F of 20.6.2.3108 NMAC and shall indicate, for department approval, the proposed locations and newspaper for providing notice required by Paragraphs (1) and (4) of Subsection B or Paragraph (2) of Subsection C of 20.6.2.3108 NMAC. The department shall notify the applicant in writing when the application is deemed administratively complete. If the department determines that the application is not administratively complete, the department shall notify the applicant of the deficiencies in writing within 15 days of receipt of the application and state what additional information is necessary.

**B.** Within 30 days of the department deeming an application for discharge permit or discharge permit modification administratively complete, the applicant shall provide notice, in accordance with the requirements of Subsection F of 20.6.2.3108 NMAC, to the general public in the locale of the proposed discharge in a form provided by the department by each of the methods listed below:

(1) for each 640 contiguous acres or less of a discharge site, prominently posting a synopsis of the public notice at least 2 feet by 3 feet in size, in English and in Spanish, at a place conspicuous to the public, approved by the department, at or near the proposed facility for 30 days; one additional notice, in a form approved by and may be provided by the department, shall be posted at a place located off the discharge site, at a place conspicuous to the public and approved by the department; the department may require a second posting location for more than 640 contiguous acres or when the discharge site is not located on contiguous properties;

(2) providing written notice of the discharge by mail, to owners of record of all properties within a 1/3 mile distance from the boundary of the property where the discharge site is located; if there are no properties other than properties owned by the discharger within a 1/3 mile distance from the boundary of property where the discharge site is located, the applicant shall provide notice to owners of record of the next nearest adjacent properties not owned by the discharger;

(3) providing notice by certified mail, return receipt requested, to the owner of the discharge site if the applicant is not the owner; and

(4) publishing a synopsis of the notice in English and in Spanish, in a display ad at least three inches by four inches not in the classified or legal advertisements section, in a newspaper of general circulation in the location of the proposed discharge.

**C.** Within 30 days of the department deeming an application for discharge permit renewal administratively complete, the applicant shall provide notice, in accordance with the requirements of Subsection F of 20.6.2.3108 NMAC, to the general public in the locale of the proposed discharge in a form provided by the department by each of the methods listed below:

(1) providing notice by certified mail to the owner of the discharge site if the applicant is not the owner; and

(2) publishing a synopsis of the notice, in English and in Spanish, in a display ad at least two inches by three inches, not in the classified or legal advertisements section, in a newspaper of general circulation in the location of the discharge.

**D.** Within 15 days of completion of the public notice requirements in Subsections B or C of 20.6.2.3108 NMAC, the applicant shall submit to the department proof of notice, including an affidavit of mailing(s) and the list of property owner(s), proof of publication, and an affidavit of posting, as appropriate.

**E.** Within 30 days of determining an application for a discharge permit, modification or renewal is administratively complete, the department shall post a notice on its website and shall mail notice to any affected local, state, federal, tribal or pueblo governmental agency, political subdivisions, ditch associations and land grants, as identified by the department. The department shall also mail or e-mail notice to those persons on a general and facility-specific list maintained by the department who have requested notice of discharge permit applications. The notice shall include the information listed in Subsection F of 20.6.2.3108 NMAC.

**F.** The notice provided under Subsection B, C and E of 20.6.2.3108 NMAC shall include:

(1) the name and address of the proposed discharger;

(2) the location of the discharge, including a street address, if available, and sufficient information to locate the facility with respect to surrounding landmarks;

(3) a brief description of the activities that produce the discharge described in the application;

(4) a brief description of the expected quality and volume of the discharge;  
(5) the depth to and total dissolved solids concentration of the ground water most likely to be affected by the discharge;  
(6) the address and phone number within the department by which interested persons may obtain information, submit comments, and request to be placed on a facility-specific mailing list for future notices; and  
(7) a statement that the department will accept comments and statements of interest regarding the application and will create a facility-specific mailing list for persons who wish to receive future notices.

**G.** All persons who submit comments or statements of interest to the department or previously participated in a public hearing and who provide a mail or e-mail address shall be placed on a facility-specific mailing list and the department shall send those persons the public notice issued pursuant to Subsection H of 20.6.2.3108 NMAC, and notice of any public meeting or hearing scheduled on the application. All persons who contact the department to inquire about a specific facility shall be informed of the opportunity to be placed on the facility-specific mailing list.

**H.** Within 60 days after the department makes its administrative completeness determination and all required technical information is available, the department shall make available a proposed approval or disapproval of the application for a discharge permit, modification or renewal, including conditions for approval proposed by the department or the reasons for disapproval. The department shall mail by certified mail a copy of the proposed approval or disapproval to the applicant, and shall provide notice of the proposed approval or disapproval of the application for a discharge permit, modification or renewal by:

(1) posting on the department's website;  
(2) publishing notice in a newspaper of general circulation in this state and a newspaper of general circulation in the location of the facility;  
(3) mailing or e-mailing to those persons on a facility-specific mailing list;  
(4) mailing to any affected local, state, or federal governmental agency, ditch associations and land grants, as identified by the department; and  
(5) mailing to the governor, chairperson, or president of each Indian tribe, pueblo or nation within the state of New Mexico, as identified by the department.

**I.** The public notice issued under Subsection H shall include the information in Subsection F of 20.6.2.3108 NMAC and the following information:

(1) a brief description of the procedures to be followed by the secretary in making a final determination;  
(2) a statement of the comment period and description of the procedures for a person to request a hearing on the application; and  
(3) the address and telephone number at which interested persons may obtain a copy of the proposed approval or disapproval of an application for a discharge permit, modification or renewal.

**J.** In the event that the proposed approval or disapproval of an application for a discharge permit, modification or renewal is available for review within 30 days of deeming the application administratively complete, the department may combine the public notice procedures of Subsections E and H of 20.6.2.3108 NMAC.

**K.** Following the public notice of the proposed approval or disapproval of an application for a discharge permit, modification or renewal, and prior to a final decision by the secretary, there shall be a period of at least 30 days during which written comments may be submitted to the department and/or a public hearing may be requested in writing. The 30-day comment period shall begin on the date of publication of notice in the newspaper. All comments will be considered by the department. Requests for a hearing shall be in writing and shall set forth the reasons why a hearing should be held. A public hearing shall be held if the secretary determines there is substantial public interest. The department shall notify the applicant and any person requesting a hearing of the decision whether to hold a hearing and the reasons therefore in writing.

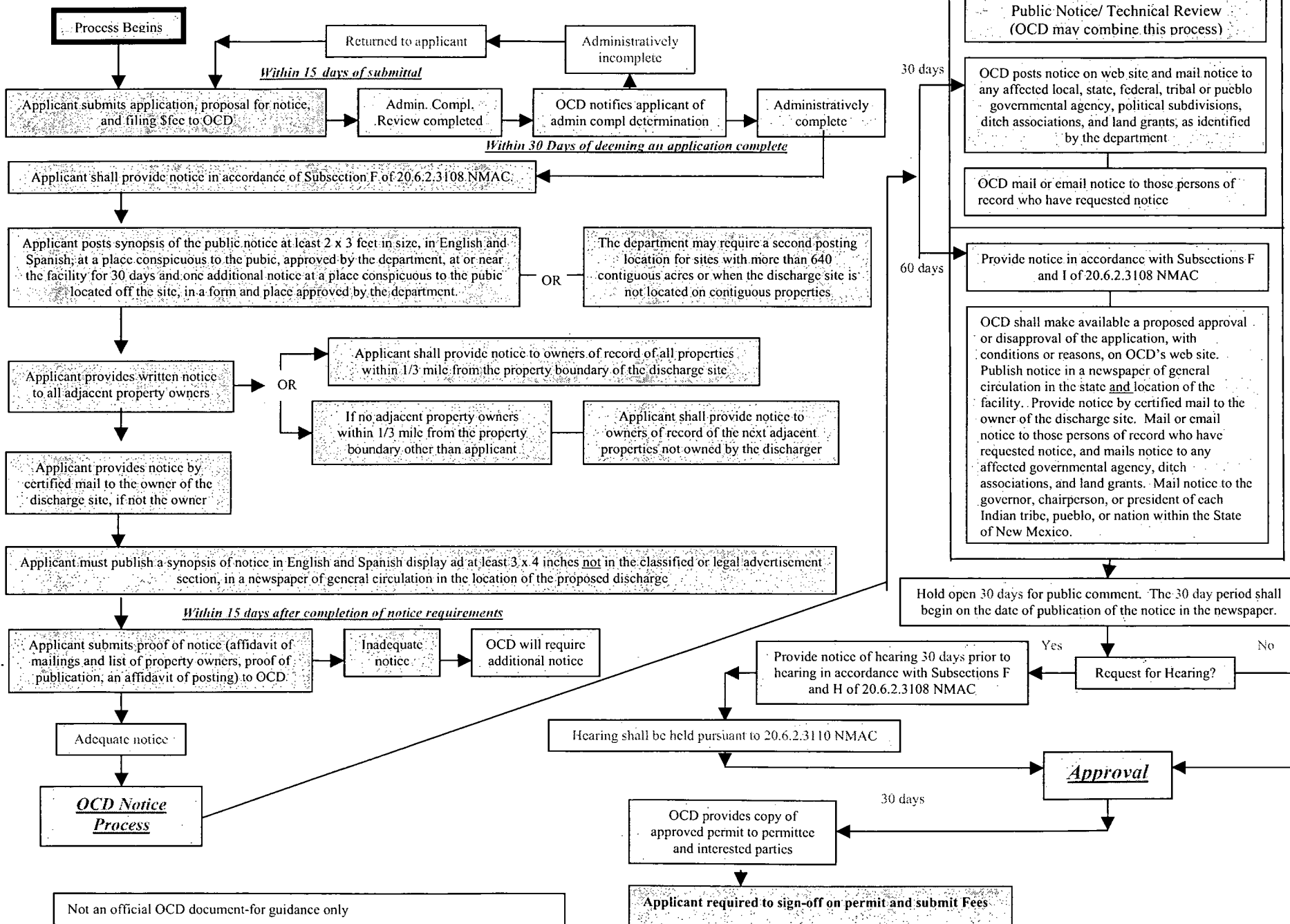
**L.** If a hearing is held, pursuant to Subsection K of 20.6.2.3108 NMAC, notice of the hearing shall be given by the department at least 30 days prior to the hearing in accordance with Subsection H of 20.6.2.3108 NMAC. The notice shall include the information identified in Subsection F of 20.6.2.3108 NMAC in addition to the time and place of the hearing and a brief description of the hearing procedures. The hearing shall be held pursuant to 20.6.2.3110 NMAC.

20.6.2 NMAC 17

[2-18-77, 12-24-87, 12-1-95, 11-15-96; 20.6.2.3108 NMAC - Rn, 20 NMAC 6.2.III.3108, 1-15-01; A, 12-1-01; A, 9-15-02; A, 7-16-06]

**WQCC PUBLIC NOTICE AND PERMITTING FLOWCHART:**  
**20.6.2.3108 – Applications for new discharge permits or discharge modifications**

**Applicant flow path**      **OCD flow path**



Not an official OCD document-for guidance only

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Wednesday, April 25, 2012 12:25 PM  
**To:** Sanchez, Daniel J., EMNRD  
**Cc:** Ezeanyim, Richard, EMNRD; VonGonten, Glenn, EMNRD; Griswold, Jim, EMNRD; Gonzales, Elidio L, EMNRD; Dade, Randy, EMNRD; Shapard, Craig, EMNRD; Perrin, Charlie, EMNRD; Martin, Ed, EMNRD  
**Subject:** Accepted ASTM Geothermal Single & Double Phase Thermal Fluids Chemical Analysis Procedures

Daniel:

The **ASTM E 947 – 83 (Standard Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis)** and **ASTM E 1675 – 95a (Standard Practice for Sampling Two-Phase Geothermal Fluid for Purposes of Chemical Analysis)** Procedures have been saved in the OCD Training Folder (click [here](#) and see "Sampling- ASTM Methods") for your review and/or general knowledge. The above ASTM Methods were provided to the OCD by Los Lobos Renewable Power, LLC. for the Geothermal Project in Hidalgo County.

The above high-temperature thermal fluid sample procedures allow for a single phase (either liquid or steam) and double phase (liquid and steam) to be collected appropriately and at final acceptable temperatures to meet EPA QA/QC and DQO environmental laboratory analytical sampling and laboratory requirements.

I find them to be acceptable for the OCD UIC Geothermal Program under the WQCC Regulations.

Please contact me if you have any questions. Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/oed/>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at: <http://www.emnrd.state.nm.us/oed/environmental.htm#environmental>)

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Friday, April 20, 2012 8:44 AM  
**To:** 'Janney, David'  
**Cc:** Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Shapard, Craig, EMNRD  
**Subject:** Los Lobos Renewable Power, LLC Lightning Dock Geothermal Project GTHT-001 (OCD Meeting Minutes 4/5/2012 Meeting in Santa Fe)  
**Attachments:** Los Lobos-Meeting Minutes Final 4-5-12 Mtg in Santa Fe.pdf

David:

Please find attached the above subject meeting minutes. The minutes will be posted under the "Meetings" thumbnail on OCD Online.

Please contact me if you have questions.

Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/ocd/>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at: <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>

**Lightning Dock Geothermal Project (Hidalgo County)**  
**OCD Wendell Chino Conference Room, Santa Fe (4/5/2012)**  
**Meeting Minutes (Completed by Carl J. Chavez: 4/20/2011)**

**Attendees:** OCD: Carl J. Chavez & Glenn von Gonten  
Los Lobos Renewable Power, LLC (Cyrq Energy Inc.): David Janney (Designated Agent)

**Objective:** To foster good communication on APD, sundry notices, and any other concerns/issues that the parties identify during and after the meetings that need to be communicated and/or raised to each other's attention. *Note that communication meetings generally do not include direct compliance and enforcement discussions for apparent reasons.*

**AGENDA**

1. Amending the location of an injection well already approved by OCD via Discharge Permit. Operator rescission of most recent G-101s and G-102s for new wells: 68-6, 88-6, and 45A-7 along with multi-well bond.
  - *OCD handed over the original well bond at the meeting and stopped its review of the G-Forms received at both the Santa Fe and Artesia DO.*
  
2. Operator describes changes to current injection wells (42-18, 51-7, and 53-12) and the federal "Modified Kettleman Nomenclature Numbering System". The operator requested that Injection Wells 51-7 and 53-12 be omitted from the OCD DP because they are being moved to different kettleman sections; thus, the operator will submit new G-101s and G-102 Forms. In addition, Injection Well 42-18 will remain in the same kettleman section, but will be moved requiring a G-101, G-102 and G-103. All wells are located on federal land. The operator handed out the federal kettleman information above and an updated map reflecting existing and future well locations that it is planning inclusive of the above.
  - *OCD agreed that the Kettleman System is appropriate for well nomenclature. OCD indicated that it could issue a "Modification" to the DP to remove references to the injection well names, etc. for 51-7 and 53-12 based on OCD approvals. All new injection wells require submittal of a completed C-108 application with an "Area of Review" of at least 1/2 mile. In addition, OCD requires that the operator submit a WQCC Bond Rider to its existing WQCC multi-well bond replacing the aforementioned injection wells with the new 54-12 and 63-7 injection wells. In addition, the OCD will add Production Well 55-7 to the Modification, since it was bonded, reworked, and recompleted to be included in the DP. The OCD prefers to issue the "Modification" letter after the wells have been approved by the OCD, if approved.*
  
3. Water quality or chemistry of deep geothermal fluids. The operator indicated that it cannot set a sample pump near the formation at depth due to the extreme thermal temperature. The operator indicated that it currently sets the pump in the well and/or open well-bore down about 1,400 ft. into the well and evacuates the well-bore and/or well casing fluid for sample procurement and analytical laboratory testing.

- *OCD notices that the operator is basically sampling stagnant and comingled formation fluids in the well based on the method and that accurate formation specific water quality information may not be obtainable based on this method. OCD is concerned about deeper drilling and well completions based on the above and the potential for contamination of the fresh water resource to occur. The operator currently lacks knowledge of where the depth of basal fresh water exists in the project area.*
- *Based on the above, the OCD requests to know how the operator will address the OCD concern(s) in order for it to approve deeper drilling requests. A cross-section(s) identifying the top and bottom of fresh or protectable water with an acceptable casing program may help to address this issue.*
- *The operator handed out ASTM documents: "E 947-83 and E 1675 – 95a" related to single and two phase chemical analysis. The OCD is currently reviewing the documents.*

4. Other agency (i.e., BLM, OCD, etc.) issues, discussions, etc.

- A. Operator discussed the need for better communication between the BLM and OCD on the GDP/SN application process on federal land and/or federal mineral estate.

*OCD is currently communicating with the BLM on a co-agency review process on federal land and/or federal mineral estate. Once the BLM and OCD agree on this, the OCD will share the procedure that may assist the operator in streamlining the permit process with the agencies.*

*Based on OCD communication with the third permitting agency involved with geothermal projects, the Office of State Engineer (OSE), OCD has received a message indicating that OSE will await well permit and sundry notice approvals from the BLM and OCD before completing its permit approval process, if necessary in accordance with statutory requirements. The OSE urges the operator to be consistent with applications, permit info, sundry notices, etc. that it sends to the BLM and OCD to promote efficiency in the process. Note that there is no guarantee that approvals from the BLM and OCD may be acceptable to the OSE; therefore, the operator will need to communicate separately with the OSE on all permits to drill and sundry notices submitted to the BLM and OCD to ensure that OSE may approve the approvals of the BLM and OCD. The above is also accurate for geothermal wells on state land and state mineral estate, except the BLM would not be involved in the permit and/or sundry notice process on state land and/or state mineral estate.*

5. Miscellaneous

- A. Notice of Intent (NOI) required by the OCD to inject/dischARGE associated with exploration phase testing outside of the OCD discharge permit provisions.

- *The OCD Attorney David Brooks indicated that the OCD must review Notice of Intent (NOI) to inject/dischARGE during the exploration phase from the operator from now on. The NOI will require submittal of a G-103 Sundry Notice for the well being discharged into and satisfy the WQCC 20.6.2.1201 *et seq.* NMAC regulations for such an NOI. The OCD may likely approve discharges without requiring a permit where the extraction and injection are within the same aquifer system, etc., but these tests should occur within the*

*target zone 3,400 ft. below ground and/or below water supply wells within the area and as specified in the OCD Discharge Permit.*

- *Discharges in non-conformance with the above paragraph may require the operator to demonstrate that it meets WQCC Regulations: 20.6.2.7(WW) NMAC and 20.6.2.3103 NMAC.*

**B. G-101 Well Form**

- *The field option denoted as "Wildcat" shall be left undesignated by the operator, since there has not been enough exploration to complete the designation and the term is not defined in the geothermal regulations and appears to be a relic of oil and gas regulations. The other options: "Field" and "Pool" suggest that the geothermal reservoirs have been defined, which does not appear to be the case today.*

**C. Well Bonding**

- *The operator requested a letter from the OCD stating for the financial institution what it requires for bonding.*
- *The OCD responded that it does not interface or send instruction letters to the financial institution responsible for operator well bonding, and if there are any questions, the financial institution may contact the OCD Attorney to resolve them before final submittal to the OCD. The OCD usually receives Bond Riders with any changes or additions to the terms, amounts, etc. on existing single and multi-well bonds.*

**D. Updated map**

- *The operator handed out a map and the OCD verbally communicated on the day after the meeting with the operator that there are symbols on the map that reflect locations that the operator indicated during the meeting would be omitted. A preliminary review of the map drew OCD concerns about correlative rights and well spacing, etc. The operator indicated that a new map would be developed that should reflect only existing and/or actual well locations to physically verify what exists or is about to exist on the project.*

**E. Handwritten notes on OCD G-forms**

- *According to the OCD Attorney, hand written notes of G-102 forms indicating the GPS coordinates for the well is acceptable to the OCD. The concern is the accuracy, but will be reconciled in the siting and approval process by the OCD.*

**6. OCD potential issues identified from the meeting**

- *OCD is concerned about current well drilling, water quality sampling, and construction methods and potential for contamination of fresh water aquifer systems in the project area. The key concern is the protection of the fresh water aquifer(s) in the Animas Valley where the base of fresh water has not been identified and where the current drilling, water quality sampling methods, and well completion (open-hole) practices may not be protective of the fresh water resource(s) in the project area. For example, if the operator breaches a brine*



*formation at depth and does not recognize it, a well may be completed that is contaminating protectable water and current water quality sampling methods may not detect it in order to undertake plug back procedures to remedy the situation.*

- *A BLM/OCD joint APD review process to streamline the review process may not be approved by the BLM. Draft agenda language was sent to BLM in Las Cruces for feedback. If approved, the operator must submit APDs that adequately address federal and state regulations in each submittal to ensure compliance with both federal and state geothermal regulations and to streamline the process.*
- *OCD now requires during the exploration phase of the project a "Notice of Intent" (NOI) via G-103 form submittal to inject/discharge under WQCC 20.6.1201 NMAC for any injection into the geothermal reservoir where the OCD discharge permit does not apply, i.e., during the geothermal exploration phase of the project. For example, pump testing may be straight forward in this process; however, non-standard testing with chemical additions, etc. may require more rigorous review and may require a permit and/or be prohibited by the OCD.*

Attachments (see OCD Online GTHT-1 "Meetings" thumbnail)

## Chavez, Carl J, EMNRD

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**From:** Janney, David [david.janney@amec.com]  
**Sent:** Tuesday, April 03, 2012 11:07 AM  
**To:** Chavez, Carl J, EMNRD  
**Subject:** Kettleman well numbering system  
**Attachments:** BLM\_Form\_3260-2.pdf

Greetings Carl:

In our conversation last week you indicated you would like to see some information regarding the Kettleman well numbering system. Please find attached the BLM GPD that includes the Kettleman well numbering system.

Regards,

David W. Janney, PG  
Senior Geologist  
AMEC Environment and Infrastructure  
8519 Jefferson, NE  
Albuquerque, NM 87113  
505.821.1801 off  
505.821.7371 fax  
505.449.8457 cell

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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF LAND MANAGEMENT  
**GEOHERMAL DRILLING PERMIT**

FORM APPROVED  
OMB No. 1004-0132  
Expires: January 31, 2004

The Bureau of Land Management (BLM) requires this form or other BLM approved forms to be prepared and filed in triplicate with requisite attachments with the authorized officer. The authorized officer must approve this permit prior to any lease operation.

1a. Type of Work: <input type="checkbox"/> Drill New Well <input type="checkbox"/> Redrill <input type="checkbox"/> Deepen <input type="checkbox"/> Plug Back <input type="checkbox"/> Directionally Drill <input type="checkbox"/> Other		7. Lease Serial No.	
1b. Well Type: <input type="checkbox"/> Production <input type="checkbox"/> Injection <input type="checkbox"/> Heat Exchange <input type="checkbox"/> Observation <input type="checkbox"/> Water Supply <input type="checkbox"/> Other		8. Surface Manager: <input type="checkbox"/> BLM <input type="checkbox"/> FS <input type="checkbox"/> Other	
1c. Well Status:		9. Unit Agreement Name	
2. Name of Lessee/Operator		10. Well No.	11. Permit No.
3. Address of Lessee/Operator		12. Field or Area	
4. Location of Well At surface At proposed prod. zone		13. Sec., T., R., B. & M.	
5. Distance from Proposed Location to Nearest Property or Lease Line		14. County	
6. Distance from Proposed Location to Nearest Well, or Previously Applied for Well Location on this Lease.		15. State	
18. Drilling Media and Characteristics: <input type="checkbox"/> Air <input type="checkbox"/> Water <input type="checkbox"/> Mud <input type="checkbox"/> Foam <input type="checkbox"/> Other		19. Proposed Depth Measured: True Vertical:	20. Elevations: <input type="checkbox"/> Estimated <input type="checkbox"/> Final Reference Datum: <input type="checkbox"/> GR <input type="checkbox"/> MAT <input type="checkbox"/> DF <input type="checkbox"/> KB <input type="checkbox"/> RT <input type="checkbox"/> Casinghead Flange <input type="checkbox"/> Other
21. Existing and/or Proposed Casing and Cementing Program (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)			

18. Drilling Media and Characteristics: <input type="checkbox"/> Air <input type="checkbox"/> Water <input type="checkbox"/> Mud <input type="checkbox"/> Foam <input type="checkbox"/> Other		19. Proposed Depth Measured: True Vertical:	20. Elevations: <input type="checkbox"/> Estimated <input type="checkbox"/> Final Reference Datum: <input type="checkbox"/> GR <input type="checkbox"/> MAT <input type="checkbox"/> DF <input type="checkbox"/> KB <input type="checkbox"/> RT <input type="checkbox"/> Casinghead Flange <input type="checkbox"/> Other
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21. Existing and/or Proposed Casing and Cementing Program (List existing program first, followed by proposed program, and separate by a sufficient space to clearly distinguish the two programs)

SIZE OF HOLE	SIZE OF CASING	WEIGHT PER FOOT	COUPLING (Collars & Threads)	GRADE	SETTING DEPTH		QUANTITY OF CEMENT
					Top	Bottom	

22. Proposed Work Summary

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23.

Signed \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

(This space for Federal use)

Approved by \_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_

Conditions of Approval, If Any:

Title 18 U.S.C. Section 1001, makes it a crime for any person knowingly and willfully to make to any department or agency of the United States any false, fictitious or fraudulent statements or representations as to any matter within its jurisdiction.

(See instructions on page 2)

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## Standard Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis<sup>1</sup>

This standard is issued under the fixed designation E 947; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

<sup>ε1</sup> Note—Keywords were added editorially in April 1996.

### 1. Scope

1.1 This specification covers the basic requirements for equipment to be used for the collection of uncontaminated and representative samples from single-phase geothermal liquid or steam. Geopressured liquids are included. Fig. 1

### 2. Application

2.1 This specification covers only that equipment which is commonly used for the sampling of single-phase geothermal liquid or steam. It does not cover specialized equipment required for, and unique to, a specific test or method of analysis. The specification covers items such as valves, fittings, tubing, cooling coils and condensers, pumps, degassers, sample containers, sample probes, and packaging materials, but excludes equipment used in specific testing and analysis.

2.2 This procedure applies to single-phase steam or liquid streams prior to separation and to separated single-phase steam or liquid streams.

2.3 For most geothermal and geopressured fluids tested by the procedures outlined in this specification, both liquid and gas samples may be collected.

### 3. Sample Probes

3.1 Sample probes shall be used to extract liquid or steam from the main part of the geothermal flow rather than using a wall-accessing valve and pipe arrangement.

3.1.1 The probe permits the sampling of various positions within the flow to determine whether stratified or annular two-phase flow is present which would bias a single-point sample.

3.2 Sample probes shall be designed to extract representative samples from flowing systems. Special attention during construction of the probe shall be given to the stresses that the probe will later be subjected to during insertion into, and operation in, a pressurized flowing system.

3.3 The sampling probe (Fig. 2) passes through the sliding seal and access valve in order that liquid or steam can be sampled from the mainstream of the flow line. Thereafter, the

sample contacts only surfaces that the operator can verify are noncontaminating and nonabsorbing.

3.3.1 Moving the probe tip across the diameter of the pipe may allow the operator to determine the existence of stratification or multiphase sampling problems.

3.3.2 Flow regulation is accomplished downstream of the cooling coils in order to avoid residual flashing into steam at the point of pressure reduction. Flashing may cause scale deposition which would preclude the accurate determination of certain constituents.

### 4. Sampling Lines

4.1 *Safety*—Sampling lines shall be as short as practical and of sufficient strength to prevent structural failure.

4.2 *Construction*—All sample lines shall be constructed to eliminate traps in which condensate, entrained particulates, or scale precipitates might settle since they may be partially emptied with changes in flow conditions and may result in sample contamination. Allow for thermal expansion.

### 5. Valves, Fittings, and Gages

5.1 Valves which control access to the sampling point shall have straight throats (frequently designated as ball, plug, and gate valves). For flexibility of sampling, a minimum of 1/2-in. diameter throat is recommended. This permits a probe to be inserted directly into the flow.

5.2 It is recommended that at least one full-port shut-off valve be placed on the downstream end of the sample probe so that the sampling line may be isolated when desired.

5.3 Throttling devices such as valves, capillary tubes, or orifices, if used, shall be placed at the sample outlet of the cooler or condenser. This practice will ensure cooling at the highest pressure and will minimize the possibility of fluid flashing or scale forming in the cooling coil. A head column such as that recommended for normal water and steam sampling (Specification D 1192, for Equipment for Sampling Water and Steam<sup>2</sup>) shall not be used because it provides a mechanism for gas separation and escape prior to sample collection.

5.4 Equipment adequate to determine the pressure and

<sup>1</sup> This specification is under the jurisdiction of ASTM Committee E-44 on Solar, Geothermal, and Other Alternative Energy Sources and is the direct responsibility of Subcommittee E44.15 on Field Development.

Current edition approved May 27, 1983. Published August 1983.

<sup>2</sup> Annual Book of ASTM Standards, Vol 11.01.

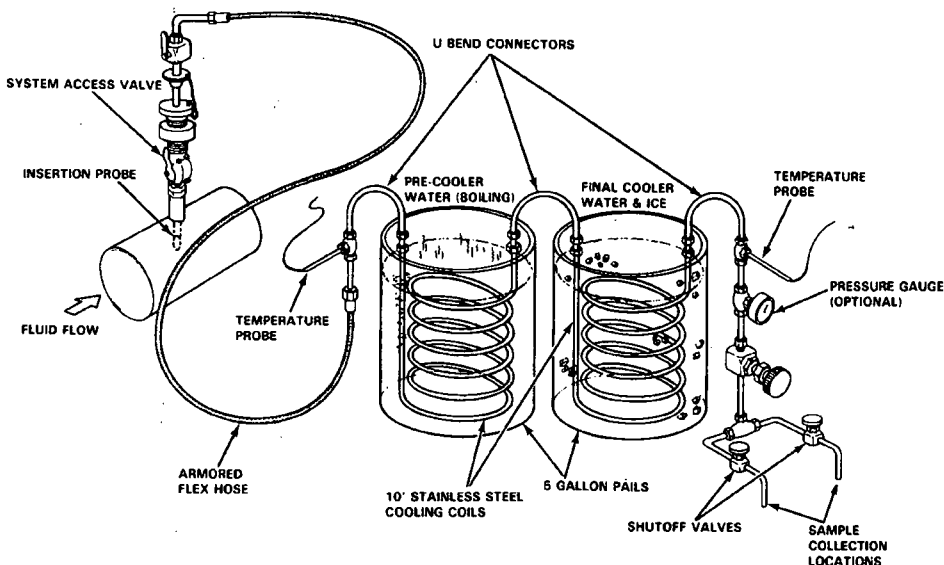


FIG. 1 Example Assembly (Particularly Suited for Liquid Flows)

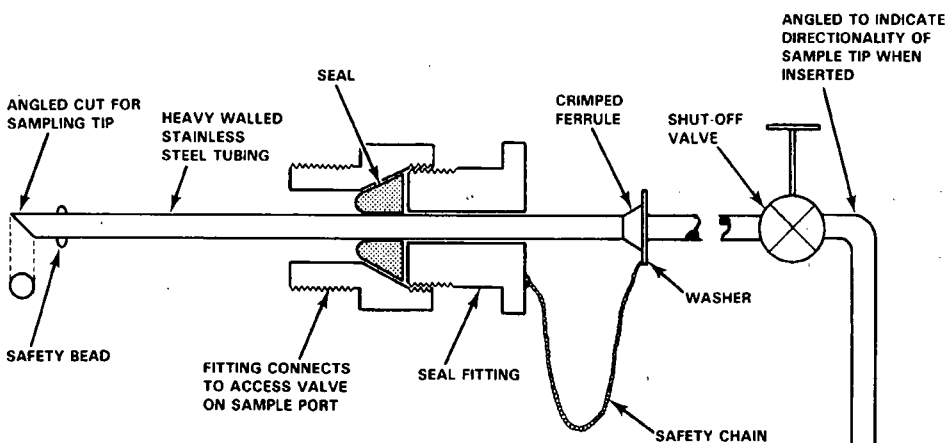


FIG. 2 Sample Probe

temperature of the mainstream liquid or steam flow shall be utilized.

## 6. Sample Cooler

6.1 The tube through which the sample flows shall be continuous through the cooling location so there will be no possibility of sample contamination or dilution from the cooling water. The internal diameter of the tube is suggested to be no larger than that of the sample probe so that storage within the coil is low and the time lag of sample through the cooling phase will be a minimum.

6.2 When the temperature of the sample is above the boiling point of water, it may be advantageous, in order to conserve ice, to use a pre-cooler containing water to lower the temperature of the sample before it enters the cooler. The temperature of the sample can then be controlled by the flow rate and the temperature of the final cooling bath (frequently an ice water bath).

## 7. Materials and Lubricants

### 7.1 Lubricants:

7.1.1 No lubricant shall be used in the collection containers, or their valves and seals, where it could contact the sample and bias the components of interest. This is particularly important if minor constituents are to be measured.

7.1.2 Other valves and moving parts in the sampling equipment that contact the sample should be lubricated to the minimum extent consistent with service life.

### 7.2 Materials:

7.2.1 In all cases, the sampling equipment shall be made of materials resistant to corrosion by the sample and that will not bias the results. Stainless steel, glass, and polymers are examples of materials that are generally satisfactory.

7.2.2 Copper-based alloys should be avoided.

## 8. Liquid Sample Containers

8.1 Liquid sample containers and compatible closures shall

not bias the sample components of interest. Sample containment shall conform to EPA guidelines.<sup>3</sup> These guidelines recommend the collection of liquid samples in either plastic or glass containers. Boron and silica samples should be collected in plastic containers.

8.2 The closures of the filled sample containers shall be fixed in place to prevent accidental opening in transit. Alternatively, the sample containers may be secured inside a shipping container designed to prevent disturbance of the inner container.

### 9. Gas Sample Containers

9.1 Devices used to collect and transport the gas component of the samples (as shown in Fig. 3) shall be resistant to chemical reactions and to gaseous diffusion or adsorption. They should be filled to equal or exceed atmospheric pressure to prevent air from leaking into the sample container.

### 10. Filters

10.1 Filters, when used, shall be housed in a pressure-tight

container assuring that the full flow passes through the filter.

### 11. Cleaning

11.1 The sampling apparatus shall be kept clean.

11.2 When finished sampling, or when the sampling apparatus will be idle, the interior of the apparatus shall be rinsed with distilled water to minimize corrosion and contamination.

11.3 It may be necessary to disassemble and clean new equipment prior to initial use.

### 12. Example of Sampling Train

12.1 Examples of a sampling train are shown in Fig. 3 and Fig. 1. Consideration should be given to the force generated by any specific combination of probe diameter and system pressure and to the limitations and safety of sliding seals. A combination of probe tip bead and safety chain are recommended to restrict forcible ejection of the probe from the line being sampled. In unsafe cases, a fixed connection is preferred.

### 13. Keywords

13.1 chemical analysis; geopressed liquid; geothermal liquid; geothermal steam; single-phase geothermal liquid; single-phase geothermal steam

<sup>3</sup> Federal Register, Vol 44, No. 244, pp. 75050-75052.

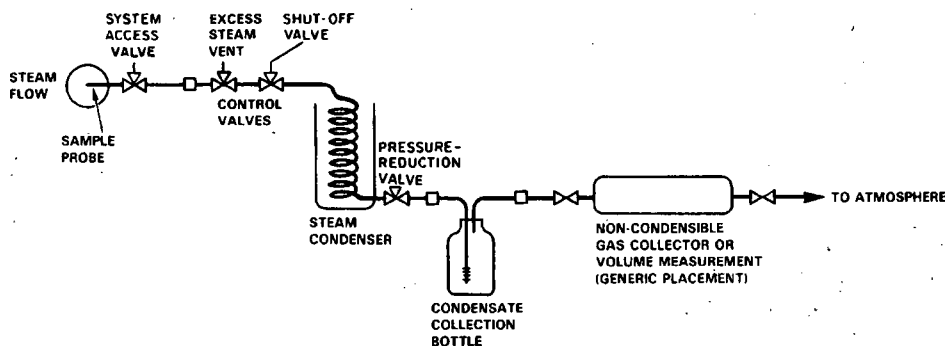


FIG. 3 Example Assembly (Particularly Suited for Steam Flows)

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## Standard Practice for Sampling Two-Phase Geothermal Fluid for Purposes of Chemical Analysis<sup>1</sup>

This standard is issued under the fixed designation E 1675; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reappraisal. A superscript epsilon ( $\epsilon$ ) indicates an editorial change since the last revision or reappraisal.

### 1. Scope

1.1 The purpose of this practice is to obtain representative samples of liquid and steam as they exist in a pipeline transporting two-phase geothermal fluids.

1.1.1 The liquid and steam samples are collected and properly preserved for subsequent chemical analysis in the field or an off-site analytical laboratory.

1.1.2 The chemical composition data generated from the analysis of liquid and steam samples may be used for many applications important to geothermal energy exploration, development, and the long-term managed exploitation of geothermal resources. These applications include, but are not limited to, resource evaluations such as determining reservoir temperature and the origin of reservoir fluids, compatibility of produced fluids with production, power generation and reinjection hardware exposed to the fluids (corrosivity and scale deposition potential), long-term reservoir monitoring during field exploitation, and environmental impact evaluations including emissions testing.

1.1.2.1 To fully utilize the chemical composition data in the applications stated in 1.1.2, specific physical data related to the two-phase discharge, wellbore, and geothermal reservoir may be required. Mathematical reconstruction of the fluid chemistry (liquid and steam) to reservoir conditions is a primary requirement in many applications. At a minimum, this requires precise knowledge of the total fluid enthalpy and pressure or temperature at the sample point. Fluid reconstruction and computations to conditions different from the sample collection point are beyond the scope of this practice.

1.2 This practice is limited to the collection of samples from two-phase flow streams at pressures greater than 10 psig and having a volumetric vapor fraction of at least 20%. This practice is not applicable to single-phase flow streams such as pumped liquid discharges at pressures above the flash point or superheated steam flows. Refer to Specification E 947 for sampling single-phase geothermal fluids.

1.3 The sampling of geothermal fluid two-phase flow streams (liquid and steam) requires specialized sampling

equipment and proper orientation of sample ports with respect to the two-phase flow line. This practice is applicable to wells not equipped with individual production separators.

1.4 In many cases, these techniques are the only possible way to obtain representative steam and liquid samples from individual producing geothermal wells. The sampling problems that exist include the following:

1.4.1 Unstable production flow rates that have a large degree of surging,

1.4.2 Unknown percentage of total flow that is flashed to steam or is continuously flashing through the production system,

1.4.3 Mineral deposition during and after flashing of the produced fluid in wellbores, production piping, and sampling trains,

1.4.4 Stratification of flow inside the pipeline and unusual flow regimes at the sampling ports, and

1.4.5 Insufficient flash fraction to obtain a steam sample.

1.5 This practice covers the sample locations, specialized sampling equipment, and procedures needed to obtain representative liquid and steam samples for chemical analysis.

1.6 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.* For specific hazard statements, see Section 7.

### 2. Referenced Documents

#### 2.1 ASTM Standards:

E 947 Specification for Sampling Single-Phase Geothermal Liquid or Steam for Purposes of Chemical Analysis<sup>2</sup>

#### 2.2 Other Document:

ASME Code Section VIII, Division 1(1986), Pressure Vessel Design, Fabrication and Certification<sup>3</sup>

### 3. Summary of Practice

3.1 Samples are collected from a pipeline carrying two-phase geothermal fluids by using a sampling separator that separates liquid and steam phases through centrifugal force. A

<sup>1</sup> This practice is under the jurisdiction of ASTM Committee E-44 on Solar, Geothermal, and Other Alternative Energy Sources and is the direct responsibility of Subcommittee E44.15 on Geothermal Field Development.

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<sup>2</sup> Annual Book of ASTM Standards, Vol 12.02.

<sup>3</sup> Available from American Society of Mechanical Engineers 345 E. 47th St. New York, NY 10017.

fraction of the separated steam is condensed and a fraction of the separated liquid is cooled. Portions of the condensed steam and cooled liquid are collected in appropriate sample containers for subsequent chemical analysis.

**4. Significance and Use**

4.1 The objective of this practice is to obtain representative samples of the steam and liquid phases as they exist in the pipeline at the sample point, without allowing steam condensation or additional liquid flashing in the separator. A significant feature of the practice is the use of a cyclone-type separator for high-efficiency phase separation which is operated at flow rates high enough to prevent significant heat loss while maintaining an internal pressure essentially the same as the pipeline pressure.

4.2 Another significant feature of the practice is to locate the sampling separator at a point on the pipeline where the two-phase flow is at least partially stratified to aid in the separation process. It is neither necessary nor possible to pass representative proportions of each phase through the sampling separator to obtain representative samples. The separator is usually attached to an appropriately oriented port to collect each specific phase—normally on top of the line for steam and at the bottom for liquid. In some cases, piping configurations can generate unusual flow regimes where the reverse is required. If the ratio of one phase to another is not extreme, representative samples of each phase can often be obtained from a horizontal port on the side of the pipeline.

4.3 This practice is used whenever liquid or steam samples, or both, must be collected from a two-phase discharge for chemical analysis. This typically includes initial well-testing

operations when a well is discharged to the atmosphere or routine well production when a well discharges to a fluid gathering system and power plant. The combined two-phase flow of several wells producing through a common gathering system may also be sampled in accordance with this practice.

4.4 This practice is not typically employed when individual wells produce to dedicated production separators. In these cases, the separated steam and liquid at the outlet of the production separator is sampled in accordance with single-phase sampling methods (Specification E 947).

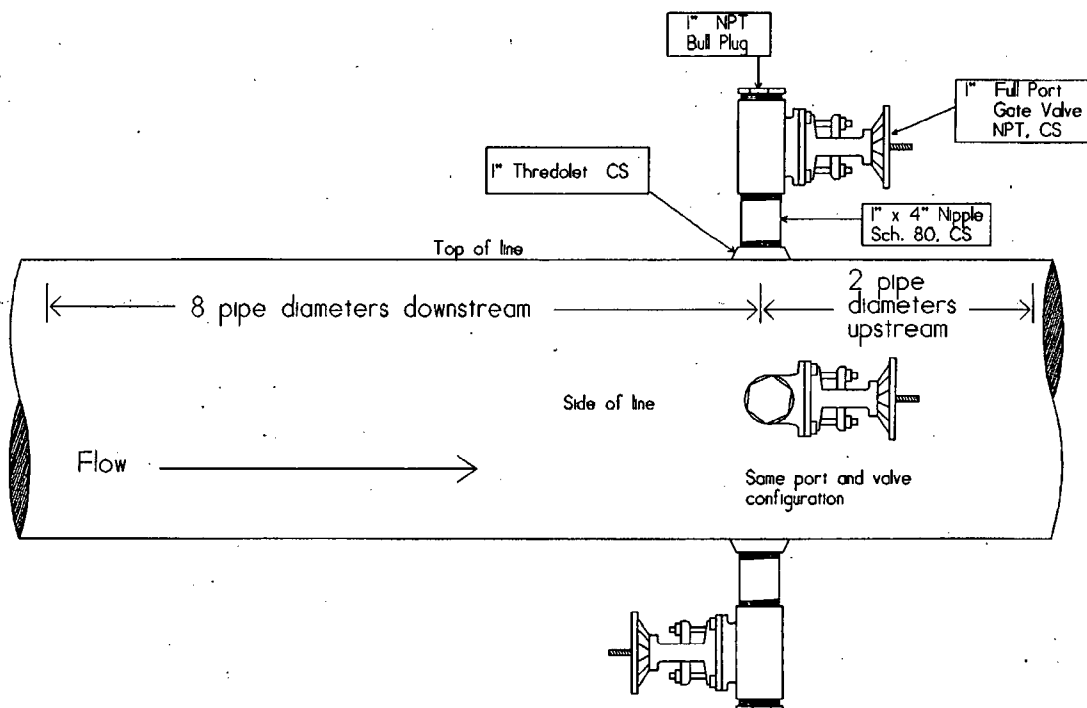
**5. Sample Location**

5.1 Sample locations vary and are dependent upon the gross quantities of each phase at the sample point. If sample ports are properly oriented on the two-phase pipeline, a certain degree of phase stratification will have occurred prior to sampling, facilitating further separation of the target phase through the sampling separator.

5.2 Ports are ideally located on the top and bottom of the pipeline at least eight diameters downstream and two diameters upstream of major flow disturbances such as pipe bends, reductions, valving, etc. (see Fig. 1).

5.2.1 In cases where the fluid contains substantial quantities of solid debris that may plug the sample port, the liquid port can be located at a 45° angle from the bottom, provided that a sufficient liquid phase is present.

5.2.2 If the flow regime is known, the number of ports may possibly be reduced to a single port located either on the side, top, or bottom of the two-phase pipeline. Sufficient quantities of each phase must be available at the single port to allow collection of representative steam and liquid samples.



NOTE 1—Minimum pipe diameters required upstream and downstream of major flow disturbances (piping bends, reductions).

**FIG. 1 Two-Phase Flowline Sampling Separator Ports**

5.2.3 The sample ports must be at least 1-in. diameter and configured with a full-open port ball or gate valve. This requirement is necessary to ensure that only a minimal pressure drop occurs through the port valve and associated piping. Scale and debris often reduce the effective inner diameter of the port, therefore smaller ports are not recommended. The port size restriction also provides a safety margin given the weight of the separator and force needed to install and remove fittings from the port.

5.3 Sample ports should never be located on side-stream piping from the main flow line unless only the side-stream fluids are to be characterized. The proportions of each phase are not likely to remain the same in a flow stream split off from the main flow line. Any pressure reduction in the side stream piping will change the steam and liquid compositions to an unknown degree.

## 6. Equipment

6.1 *Sampling Separator*—A cyclone-type separator rated to the pipeline pressure at the sample point, including a pressure gage, temperature probe, and sight glass (optional). The separator should be designed to attach directly to the sample port to minimize heat loss and pressure drop.

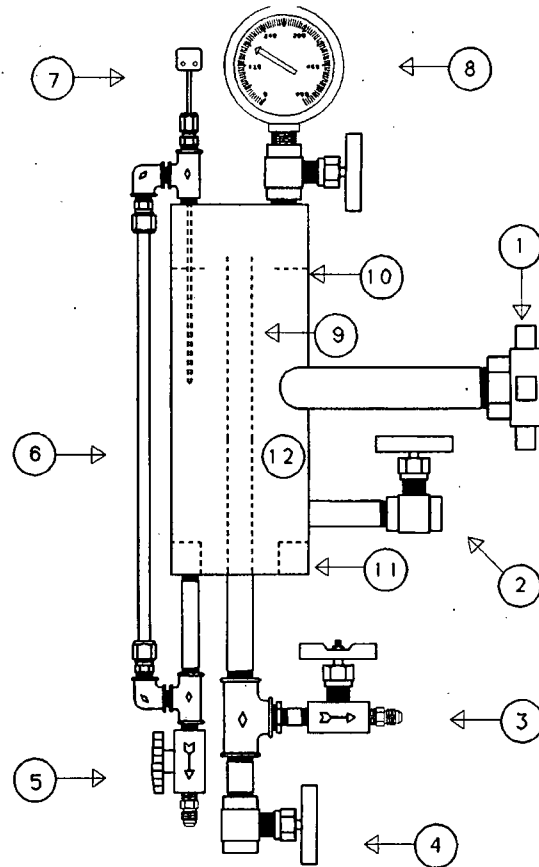
6.1.1 A typical sampling separator is shown in Fig. 2. This is a cyclone-type separator with a 1-in. pipe inlet attached at a tangent to the separator body. The separator is rated to 500 psig at 500°F. A pressure gage and thermocouple are located at the top of the separator, and steam and liquid sample valves are located at the bottom. Steam is drawn from the top of the separator through an axial pipe extending up from the bottom of the vessel. Liquid is drawn directly off the bottom. Internal baffles prevent liquid films from rising up the inner walls of the vessel with the steam flow to the sample valves. Vortex breakers are placed in the bottom of the vessel to prevent steam entrainment in the liquid flow to the sample valves.

6.1.1.1 The vent valve on the side of the sampling separator (No. 2 in Fig. 2) can be used to maintain an excess flow of steam and liquid through the separator, beyond the amount needed for sample collection. If sufficient quantities of each phase are present, the side vent valve will maintain a liquid level about 2 in. above the liquid sample valve (No. 5 in Fig. 2). This allows collection of both steam and liquid samples from the separator without the need to adjust the liquid level.

6.1.1.2 An optional sight-glass (PFA-fluorocarbon) for liquid level is located along one side of the separator to aid in proper separator operation and confirm the position of the liquid level. The sight glass is only rated to 250 psig and must be removed for higher pressure operation.

6.2 *Sample Hoses*—Sample hoses are PFA-lined stainless steel braided hoses rated to 500 psig and 450°F. JIC type fittings or quick-disconnect fittings attach hoses to the separator and condenser. Hoses are dedicated to either steam or liquid service to prevent cross-contamination. The inner diameter of the hose should not exceed 0.375 in. Stainless steel tubing may also be used (0.25 to 0.375-in. outside diameter), although it is less convenient. Convuluted, flexible stainless steel hose is specifically excluded due to potential entrapment and contamination problems caused by the internal convolutions.

6.3 *Condenser*—A sample condenser configuration with

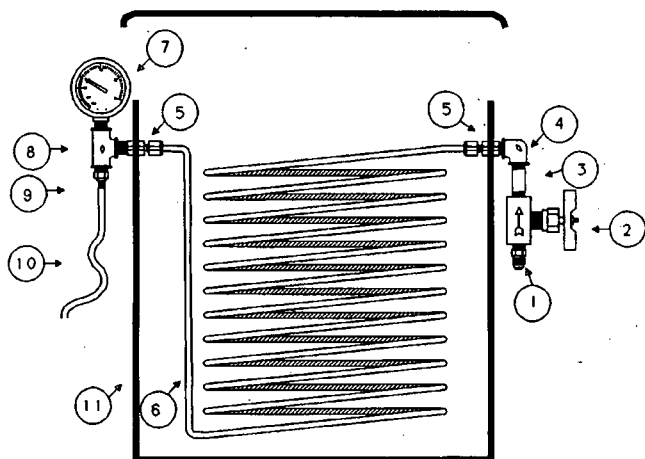


- 1) 1 in. Two-Phase Inlet (Hammer Union)
  - 2) ½ in. Vent Valve (Regulating Valve or Ball Valve)
  - 3) ¼ in. Steam Sample Valve (Regulating Valve)
  - 4) ½ in. Steam Bleed Valve (Regulating Valve)
  - 5) ¼ in. or ⅜ in. Liquid Sample Valve (Ball Valve)
  - 6) ⅜ in. Teflon Sight Glass (250 psi limit; ⅜ in. wall, Teflon PFA)
  - 7) ¼ in. × 12 in. Type K Thermocouple
  - 8) Pressure Gage with Surge Protector Valve
  - 9) ½ in. × Steam Outlet Pipe
  - 10) Baffle Ring
  - 11) Vortex Breaker Plates
  - 12) Separator Body, 4 in. I.D. × 12 in.
- Material specification: All metal components 304 or 316 stainless steel

FIG. 2 Sampling Separator

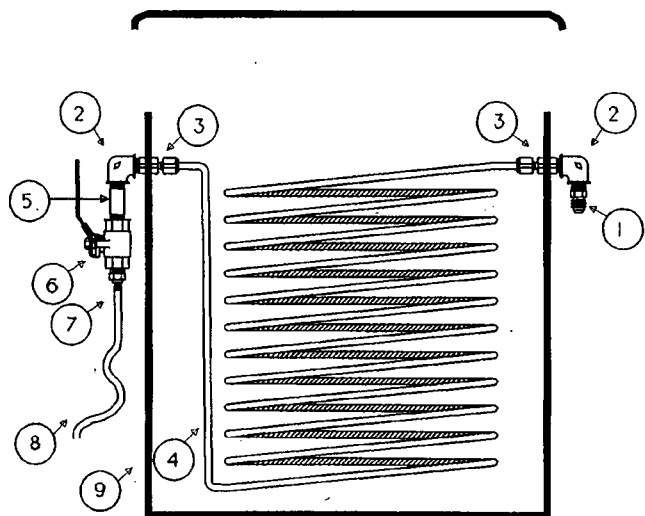
two sets of stainless steel tubing coils is recommended. One set of coils is dedicated for condensing steam and the other is dedicated for cooling liquid. The steam condenser coil has a pressure/vacuum gage located at the sample outlet and a regulating valve at the inlet. The steam flow can be precisely regulated at the inlet as opposed to regulating the flow of condensate and gas at the outlet that can result in large pressure surges and the hold-up of gas or condensate phases in the coils. The liquid cooling coil has a regulating valve at the outlet and an optional pressure gage. Regulating the outlet flow prevents flashing of liquid at the inlet to the condenser where chemical deposition could occur. Dedicated condensers with single sets of tubing coils for sampling either steam or liquid also can be used (see Fig. 3 and Fig. 4).

6.3.1 The condenser coil tubing must not exceed 0.25-in. outside diameter to prevent the segregation of gas and condensate phases during sampling of steam. Larger tubing sizes also



- 1) JIC Fitting (1/4 in. NPT × S.A.E. 37°)
  - 2) Regulating Valve (1/4 in. NPT)
  - 3) Pipe Nipple (1/4 in. NPT)
  - 4) Pipe Elbow (1/4 in. NPT)
  - 5) Bulkhead Fitting (1/4 in. NPT × 1/4 in. Swagelok)
  - 6) 20 ft. × 1/4 in. O.D. Stainless Steel Tubing (0.035 in. wall)
  - 7) 30 in. Hg × 30 psi Vacuum/Pressure Gage
  - 8) Gage Tee (1/4 in. NPT)
  - 9) Hose Adapter (1/4 in. NPT × 1/4 in. Hosebarb)
  - 10) Plastic<sup>5</sup> Tubing (3/8 in. O.D., 3/16 in. I.D.)
  - 11) 8- to 20-Gallon Drum with Lid
- Material specification: All metal components 304 or 316 stainless steel

FIG. 3 Steam Sample Condenser



- 1) JIC Fitting (1/4 in. NPT × S.A.E. 37°)
  - 2) Pipe Elbow (1/4 in. NPT)
  - 3) Bulkhead Fitting (1/4 in. NPT × 1/4 in. or 3/8 in. Swagelok)
  - 4) 20 ft. × 1/4 in. or 3/8 in. O.D. Stainless Steel Tubing (0.035 in. wall)
  - 5) Pipe Nipple (3 in. × 1/4 in. NPT)
  - 6) Sample Valve (Ball Valve, 1/4 in. NPT)
  - 7) Hose Adapter (1/4 in. NPT × 1/4 in. Hosebarb)
  - 8) Plastic<sup>5</sup> Tubing (3/8 in. O.D., 3/16 in. I.D.)
  - 9) 8- to 20-Gallon Drum with Lid
- Material specification: All metal components 304 or 316 stainless steel

FIG. 4 Liquid Sample Cooler

increase the risk of contamination and chemical deposition during liquid sampling due to low fluid velocities and longer residence times within the tubing. In cases where the liquid

contains substantial quantities of particulate matter, 0.375-in. outside diameter tubing coils may be used to minimize cooling coil plugging problems.

6.3.2 In cases where the noncondensable gas concentration in steam exceeds approximately 5% by weight, the outlet of the steam condenser coil should be at an elevation below the inlet with a continuous down-slope in the tubing from inlet to outlet. This allows the small volume of condensate to freely drain out of the condenser and prevents hold-up within the coils.

6.4 Condenser cooling can be achieved by an ice/water bath surrounding the coils or by a continuous overflow of cooling water running into the vessel holding the coils (configuration shown in Fig. 3 and Fig. 4). Alternate configurations may include a water-tight jacket around the coils through which a constant source of cooling water flows. A source of coolant may be a glycol/water mixture circulated through the condenser jacket and an external fan-cooled heat exchanger.

6.5 *Pressure Gage*—For the measurement of separator pressure. Bourdon-tube type gages or pressure transducers may be used. A pressure-snubbing device is recommended to minimize the pressure spikes and surges common in two-phase flow lines. The full-scale pressure range of the gage should not exceed two times the measurement reading. The gage should be calibrated at monthly intervals when in routine use and every six months for intermittent use. The measurement accuracy of the gage should be at least  $\pm 1\%$  of full-scale. All gages require permanent identification numbers so that field data and calibration data can be traced to each specific instrument.

6.6 *Temperature Meter and Thermocouple Probes*—For the measurement of separator temperature. Temperature meters are the digital readout style with plug-in thermocouple probes. Type K thermocouples are preferred due to the corrosion resistance of the exposed electrical connectors. The meter accuracy should be at least  $\pm 1^\circ\text{F}$ . Meters and thermocouple probes should be calibrated at the same intervals as the pressure gages to ensure consistency between the measurements of pressure and temperature. All meters and probes require permanent identification numbers so that field data and calibration data can be traced to each specific instrument.

6.7 *Fittings*—Sample ports often need to be replumbed, and fittings may need to be replaced. A selection of pipe fittings including reducer bushings, pipe nipples, couplings and elbows, plus those needed for sample equipment maintenance, are required on site.

6.8 *Plastic<sup>4</sup>*—Sample Tubing Located at the exit of the condenser for gas and liquid sample collection (3/16-in. inside diameter by 3/8-in. outside diameter). Heavy wall plastic<sup>4</sup> tubing is required for use under vacuum during gas sample collection and pressure during in-line filtration of liquid samples.

6.9 *Filter Holder*—High-pressure stainless steel (47 mm diameter) with 0.45 micron or smaller membrane filters for use at the condenser inlet. Polycarbonate membranes are required

<sup>4</sup> Tygon, a registered trademark product of Norton Co., has been used for this purpose.

at high temperatures (up to 300°F). The same filter holder can be used at the outlet side or a low-pressure plastic filter holder may be substituted.

6.10 *Tool Kit*—Includes at a minimum several pipe wrenches (sizes 24-, 18-, and 14-in.), crescent wrenches (sizes 8- and 12-in.), and a hammer.

## 7. Hazards

7.1 Hydrogen sulfide gas is present in most geothermal steam. Typically the steam itself and the surrounding air are sufficient to dilute H<sub>2</sub>S below hazardous levels. For wells that produce high concentrations of H<sub>2</sub>S (>500 ppm<sub>w</sub> in steam), a personal H<sub>2</sub>S air monitor is required to verify that safe ambient air levels of H<sub>2</sub>S are not exceeded. This is very important during sampling of shut-in wells or wells on bleed flows which tend to build high gas concentrations.

7.2 Hydrogen sulfide gas is concentrated during sampling as the steam is condensed to a liquid. Care must be taken when sampling high-gas wells to make sure that the gas is allowed to dissipate. If this sampling is done in an enclosed building or confined area, a properly sized fan or hood must be used. A personal H<sub>2</sub>S air monitor is also required.

7.3 Geothermal steam or water temperatures can exceed 450°F. Dry superheated steam is generally less of a hazard than saturated steam and boiling water. Leather gloves must be worn when working on hot piping, sample hoses, fittings and valves.

7.4 Use extreme caution when attempting to vent geothermal fluids through sample ports to the atmosphere. Ports may be plugged with scale or rocks which can be released explosively and unexpectedly after the sample valve has been opened. Warn any assistants or workers nearby to stand clear.

7.5 Sample port valves and associated plumbing can be severely corroded or eroded. Extra care must be taken when operating old valves. If the valves are frozen or operate abnormally, they must not be used. Sample port fittings may be too weak to support the weight of the sampling separator. Schedule 80 sample port piping is the minimum grade needed to attach the separator.

7.5.1 Do not force valves or fittings with large pipe wrenches. Ruptures and uncontrolled steam releases may result. When tightening fittings with a pipe wrench, verify that the pipe wrench has a “bite” before exerting force and make sure footing is secure.

7.6 The noise from geothermal steam bleeds may be above the safe working levels. Ear plugs should be worn during operation of the separator.

7.7 Goggles or a face shield must be worn during sampling. An eye hazard exists from debris entrained in venting geothermal fluid and from corrosive chemicals used in sample bottles.

7.8 Gas bottles usually contain sodium hydroxide that is hazardous to the skin and eyes. A face shield and eye goggles must be worn when sampling. Gas bottles also may contain cadmium chloride which is poisonous and carcinogenic. Latex gloves should also be worn when handling gas sample bottles.

## 8. Procedure

### 8.1 *Installation and Set-Up of the Sampling Separator:*

8.1.1 Install a Schedule 80, 1-in. pipe nipple, with one part

of the connecting hammer union attached to the sample port. Use an elbow fitting and second nipple if the port is vertical. Nipples should be only 4 to 6 in. long. At least a 1-in. size port is needed to support the weight of the separator and to allow sufficient flow without a pressure drop through the separator.

8.1.2 Orient the nipple so that it is pointing away from personnel and equipment, downwind if possible. Verify that the path is clear, then open the sample valve to blow out any debris. A qualitative check on the amount of liquid and steam discharged may be made to verify your choice of sample port location. Close the valve.

8.1.3 Connect the separator to the 1-in. pipe. Use the hammer to secure the union tightly. Insulate the attached inlet piping and fittings.

8.1.4 Close all valves on the separator except the isolation valve to the pressure gage.

8.1.5 Open the sample port valve completely and record the pressure reading. This pressure represents the static line pressure.

8.1.6 Slowly open the ½-in. vent valve (No. 2 in Fig. 2). Open the valve until the pressure on the gage starts to drop, then shut the valve slightly so that the pressure is maintained at the original static line pressure. Maximize the vent without significantly dropping the pressure (<2 % of reading), so that the relative heat loss between the pipeline and the separator is minimized.

### 8.2 *Operation of the Sampling Separator to Sample Steam:*

8.2.1 Open the steam bleed valve (No. 4 in Fig. 2) one-half to one turn. Adjust the ½-in. vent valve as needed to maintain static line pressure. Check the sight glass (if available) to verify that the liquid level is lower than the separator inlet. Let the separator level, pressure and temperature stabilize for 5 min. A transparent or bluish steam vent indicates that dry steam is exiting the steam bleed valve. Excess moisture is usually visible as white spray or streaks in the steam plume.

8.2.2 Open the steam sample valve (No. 3 in Fig. 2). Allow the steam to blow out any impurities, close the valve and connect the dedicated steam sample hose to this valve. Connect the other end of the hose to the steam condenser coil.

8.2.3 Open the steam sample valve 100 % and throttle the sample flow using the regulating valve on the condenser. Adjust the ½-in. vent valve as needed to maintain static line pressure. Allow the condensate to flush for 5 min through the condenser before sampling. Collect all samples as needed using the referenced methods. Record the separator pressure and temperature before and after collecting samples and monitor during sampling.

8.2.4 Prior to and during steam sampling, the separator liquid level should remain below the separator inlet pipe. If this level rises, reduce the steam bleed and steam sample flow rates and open the ½-in. vent valve as much as possible without allowing a significant pressure drop. If the level still rises, another sample port location may be required.

8.2.5 If the optional sight glass is not installed, excessive liquid level can be observed when white spray or streaks are present in the steam plume from the steam bleed valve. A surging flow (alternating hissing sound) from the ½-in. vent valve usually indicates that both liquid and steam are venting

and the liquid level is at the 1/2-in. vent valve. A transparent or bluish steam vent indicates dry steam is exiting the steam bleed valve and the liquid level is not too high.

### 8.3 Operation of the Sampling Separator to Sample Liquid:

8.3.1 Open the steam bleed valve (No. 4 on Fig. 2) 100%. Adjust the 1/2-in. vent valve as needed to maintain static line pressure. The separator liquid level should rise and may flood the separator, venting liquid and steam from the steam bleed valve. This ensures that pure liquid will be obtained from the liquid sample valve. Let the separator level, pressure and temperature stabilize for 5 min.

8.3.2 If liquid is scarce at the chosen sample port, both the steam bleed and steam sample valves may be opened (while maintaining line pressure) and the 1/2-in. vent valve shut completely in order to flood the separator. Let the separator level, pressure and temperature stabilize for 5 min.

8.3.3 Open the liquid sample valve (No. 5 on Fig. 2). Allow the water to blow out any impurities that may have settled there. Close the valve and connect one end of the dedicated liquid sample hose to the valve. Connect the other end to the liquid cooling coil.

8.3.4 Open the liquid sample valve 100% and throttle the sample flow using the liquid sample cooler valve. Adjust the 1/2-in. vent valve or the steam bleed/sample valves, or both, as needed to maintain static line pressure. Allow the condenser to flush for 5 min before collecting samples. Collect all samples as needed using the referenced methods. Record the separator pressure and temperature before and after sampling and monitor during sampling.

8.3.5 Prior to and during liquid sampling, the separator liquid level should remain at or above the 1/2-in. vent valve as observed on the sight glass. If a sight glass is not installed, the separator should remain flooded as evidenced by liquid present in the steam bleed. If the level falls, operate the separator as described in 8.3.2. The liquid sample rate may also have to be reduced. If the level still falls, another sample port location may be required.

### 8.4 Collection of Noncondensable Gas Samples:

8.4.1 *Stem-Type Gas Bottle*—The term "stem-type" refers to the type of inlet system used on the gas bottle to collect the sample. A typical stem-type gas bottle is shown in Fig. 5. Stems are usually 5 in. long, having a small hole in the side 3 in. down from the top inlet. The end of the stem tube inside the bottle is sealed shut. The stem is secured to the bottle by a threaded packing nut with silicon and O-rings.<sup>5</sup> Tightening the packing nut compresses the O-ring which holds the stem in place with the side hole above the O-rings, maintaining the bottle vacuum. The stem is ridged near the inlet to allow a firm grip with fingers and to prevent it from being sucked completely into the bottle. The sealed end of the stem is enlarged slightly to impede blowout through the O-rings under pressure. Obtain a sample as follows:

8.4.1.1 Place the discharge end of the plastic<sup>4</sup> tubing from the condenser gage tee over the end of the stem 1/4 to 1/2-in., using care not to push the stem in or twist and break it. Make

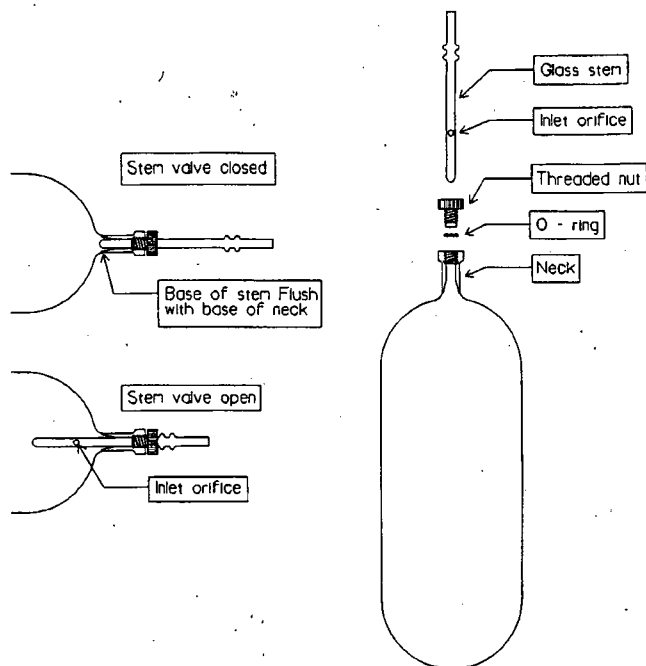


FIG. 5 Stem Type Gas Bottle

sure the condenser valve is throttled sufficiently, so as not to over-pressure the tubing. The pressure gage on the outlet of the condenser should not read greater than 15 psig to start. If it does, turn down the sample flow rate. Remember the stem purge pressure at this point; this is the reference pressure when filling the bottle.

8.4.1.2 Condensate and noncondensable gas will purge the stem and escape to the atmosphere past the packing nut. As long as the small hole in the stem is above the O-rings, condensate and gas will purge to the atmosphere. When the stem is inserted below the O-rings, the sample is allowed into the container. Gently rotate the stem within the O-rings to loosen and slide the stem into the bottle. Loosen the packing nut one-eighth turn only if the stem does not slide easily.

8.4.1.3 After stem insertion, the bottle is turned stem down so that gases and liquids mix. The gage on the condenser should show an increase in vacuum or a drop in pressure, and the sample rate should increase slightly. Due to the small side-hole restriction in the stem, the condenser gage does not read the actual bottle pressure, but rather a relative pressure given the sample flow rate.

(1) During sampling, the bottle inlet pressure may rise sharply if particulate matter enters the stem and plugs the side-hole. Withdraw the stem before the pressure exceeds 15 psig and try to dislodge the particle, then resume sampling.

(2) It is desirable to maintain the bottle inlet pressure above atmospheric when sampling by adjusting the sample flow rate. This eliminates the potential for in-leakage of air through the sampling train.

8.4.1.4 As sampling progresses, condensate and gases fill the container and the vacuum will slowly decrease back to zero or the pressure will increase back to the initial stem purge pressure. Gently shake the bottle to facilitate absorption of CO<sub>2</sub>. When the initial stem purge pressure is reached, sampling

<sup>5</sup> Viton O-rings, available from Ace Glass, Inc., 1430 Northwest Blvd., Vineland, NJ 08360, have been found suitable for this purpose.

is completed, and the stem should be withdrawn. Slide the stem back up until the side-hole is above the O-rings and condensate/gas is purging again to the atmosphere. The bottom end of the stem should be at the shoulder of the bottle neck, about 1/2-in. below the O-rings. Tighten the nut firmly.

8.4.1.5 If the vacuum does not return to zero or the pressure does not increase to the original stem purge pressure, fill the container to approximately three-fourth full with total liquid, but no more than three-fourth full. Those wells producing larger quantities of gas relative to steam will pressurize the bottles much faster and with less liquid volume.

(I) Although it may be possible to fill the bottle more than three-fourth full with liquid, do not fill bottles beyond this point, regardless of the vacuum remaining in the bottle.

8.4.2 *Single Stopcock Valve Gas Bottle*—Single stopcock valve gas bottles have a sampling nipple to attach the plastic<sup>4</sup> tubing directly to a valve mounted on the bottle. No initial purge is possible—the nipple has a minimal dead volume. A typical stopcock valve gas bottle is shown in Fig. 6.

8.4.2.1 Place the discharge end of the plastic<sup>4</sup> tubing from the condenser gage tee over the end of the nipple 1/4 to 1/2 in. Make sure the regulating valve on the condenser is throttled sufficiently to not over-pressure the tubing. The pressure gage on the outlet of the condenser will continue to increase until the stopcock valve is opened. If the sample rate is too high or if the valve is not opened quickly enough, the plastic<sup>4</sup> tubing will pop off the condenser or the bottle nipple. This usually occurs at approximately 30 psig.

8.4.2.2 Upon opening the stopcock valve, condensate and

non-condensable gas will rapidly enter the bottle. The vacuum gage will show an increase in vacuum, usually much more than the stem-type bottle due to the larger opening of the stopcock valves. The stopcock valve can be throttled to reduce the sample rate and decrease the inlet vacuum.

8.4.2.3 It is desirable to maintain the bottle inlet pressure above atmospheric when sampling by adjusting the sample flow rate. This eliminates the potential for in-leakage of air through the sampling train.

8.4.2.4 Invert the container valve down to allow the gas and liquid to mix. Gently shaking the bottle will help dissolve CO<sub>2</sub> in the liquid and allow more sample to enter the bottle before the pressure increases.

(I) If the sample flow rate is too low, the absorbing solution in the bottle may back-flow into the plastic<sup>4</sup> tubing when the bottle is inverted. Increase flow or keep the bottle upright.

8.4.2.5 As sampling progresses, condensate and gases fill the container. The vacuum will slowly decrease back to zero and then the bottle will reach a slight positive pressure. Sampling is completed at this point, and the stopcock valve should be closed. If the vacuum does not return to zero or positive pressure, fill the container approximately three-fourths full with total liquid, but no more than three-fourths full. Slide the plastic<sup>8</sup> tubing off the nipple immediately after the bottle valve is closed. Those wells producing larger quantities of gas relative to steam will pressurize the bottles much faster and with less liquid volume.

8.5 *Collection of Steam Condensate and Geothermal Liquid Samples:*

8.5.1 *Steam Condensate* (see Table 1)—Steam condensate is collected in polyethylene, polypropylene, TFE-fluorocarbon, or glass bottles. Sample bottles not containing preservatives are rinsed at least twice with sample and the end of the plastic<sup>4</sup> tubing is rinsed with condensate from the bottle. The cap is rinsed twice with condensate before tightening onto the bottle.

8.5.1.1 If acid or other preservatives are present in the bottles, care must be taken not to spill or overfill the bottles. The condensate temperature should not exceed 80°F during

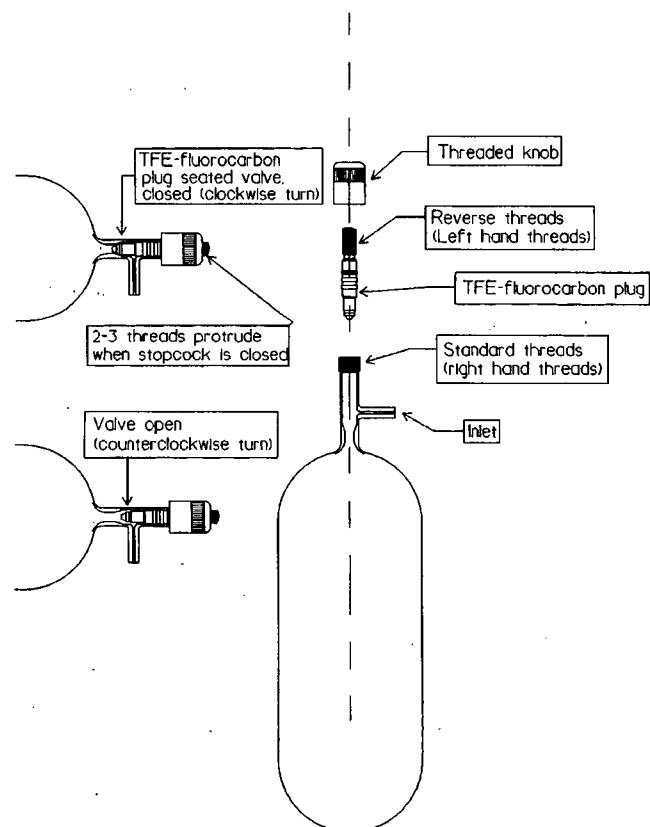


FIG. 6 Stopcock Valve Gas Bottle

TABLE 1 Steam Sample Collection

Sample Type	Parameter
Gas bottle, evacuated glass containing NaOH/CdCl <sub>2</sub>	Ar, O <sub>2</sub> , N <sub>2</sub> , CH <sub>4</sub> , H <sub>2</sub> , He, CO <sub>2</sub> , H <sub>2</sub> S, NH <sub>3</sub> , saturated hydrocarbons, radon-222, freon and SF <sub>6</sub> tracers
Gas bottle, evacuated glass containing deionized water/CdCl <sub>2</sub>	Unsaturated hydrocarbons, aromatic hydrocarbons, CO
Impinger, gas scrubbing bottle containing NaOH/CdCl <sub>2</sub> ; 0.1 N H <sub>2</sub> SO <sub>4</sub>	H <sub>2</sub> S, NH <sub>3</sub>
Raw, unacidified (RU) condensate in polyethylene bottle, 250–500 mL	Cl <sup>-</sup> , F <sup>-</sup> , B, SiO <sub>2</sub> , Na, As, Se
Raw, acidified HNO <sub>3</sub> (RA) or filtered acidified HNO <sub>3</sub> (FA) in polyethylene or TFE-fluorocarbon bottle, 250 mL + 5 mL HNO <sub>3</sub>	Fe, Mn, other heavy metals
Raw, HNO <sub>3</sub> /K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> preserved in glass bottle, 125 to 250 mL + 25 to 50 mL preservative solution	Hg
Raw, unacidified (RU) condensate in glass vial containing copper wire, 25 to 50 mL	Stable isotopes

collection, minimizing loss of dissolved gases, and water vapor.

8.5.2 *Geothermal Liquid* (see Table 2)—Liquid sample bottles are filled in the same manner as steam condensate sample bottles.

8.5.3 Liquid samples are normally filtered for silica and metals analysis. The filter holder is assembled with a 0.45  $\mu\text{m}$  or smaller membrane filter. Attach the filter holder directly to the discharge end of the plastic<sup>8</sup> tubing from the liquid cooling coils. Reduce the sample flow rate as needed to prevent the tubing from popping off under pressure. Verify that the filter has not ruptured during sampling by inspecting the membrane after the samples have been collected.

8.5.3.1 In cases where the suspended matter to be removed may dissolve upon cooling through the coils (calcite) or where precipitates may form upon cooling, the high-pressure stainless steel filter holder can be installed directly at the inlet to the coils using stainless steel JIC fittings. Only polycarbonate membrane filters should be used on the high temperature side. Verify that the filter has not ruptured during sampling by inspecting the membrane after the samples have been collected.

8.5.4 Dilution and preservation of liquid samples with  $\text{HNO}_3$ , deionized water or dilute  $\text{NaOH}$  may be required for silica analysis. Dilution with  $\text{HNO}_3$  or deionized water may also be required for the analysis of metals and other species in highly saline brines. The dilutions are best performed gravimetrically by adding an approximate amount of geothermal liquid directly from the condenser to a pre-weighed sample bottle containing a known amount of preservative. The exact sample volume and dilution factor can be precisely determined later in the laboratory before analysis.

**TABLE 2 Geothermal Liquid Sample Collection**

Sample Type	Parameter
Raw, unacidified (RU) brine in polyethylene bottle, 500 to 1000 mL	$\text{Cl}^-$ , $\text{F}^-$ , $\text{B}$ , $\text{SO}_4^{2-}$ , TDS, TSS, pH, alkalinity, As, Se
Raw, acidified $\text{HNO}_3$ (RA) or filtered acidified $\text{HNO}_3$ (FA) in polyethylene bottle, 250 mL, 5 mL $\text{HNO}_3$	Na, K, Ca, Mg, Sr, Li, $\text{SiO}_2$ (by ICP), Fe, Mn, other heavy metals
Filtered, acidified, $\sim 1/10$ dilution of sample with 2% $\text{HNO}_3$ , in polyethylene bottle, 100 to 250 mL	$\text{SiO}_2$ (by ICP), other high-level metals
Raw, $\text{NaOH}/\text{CdCl}_2$ preserved in polyethylene bottle, 500 to 1000 mL, 25 mL preservative solution	$\text{H}_2\text{S}$ , $\text{SO}_4^{2-}$
Raw, $\text{HNO}_3/\text{K}_2\text{Cr}_2\text{O}_7$ preserved in glass bottle, 125 to 250 mL, 25 to 50 mL preservative solution	Hg
Raw, unacidified (RU) condensate in glass vial, 125 mL	$\text{NH}_3$ , total inorganic carbon
Raw, unacidified (RU) condensate in glass vial containing copper wire, 25 to 50 mL	Stable isotopes
Filtered, 0.1 N $\text{NaOH}$ preserved ( $\sim 1/10$ dilution of sample with $\text{NaOH}$ ) in polyethylene bottle, 100 to 250 mL	$\text{SiO}_2$

## 9. Quality Control

9.1 *Separator Operation*—Carefully compare static line pressure to the separator pressure to ensure that there is no significant difference. Reduce vent and bleed flows temporarily to check for an increase in separator pressure.

9.1.1 Ensure that the maximum allowable flow is being passed through the separator without a pressure drop and that connected inlet piping and fittings are insulated.

9.1.2 Compare separator pressure and temperature readings to steam tables to verify proper instrument operation.

9.1.3 Be certain that there is no liquid carry-over into steam samples and no steam entrainment into liquid samples by the techniques described in 8.2 and 8.3.

9.2 *Gas Bottle Sampling*—Whenever possible, gas bottle samples are collected with back-pressure at the bottle inlet as described in the procedure; but no more than 10 psig. By collecting samples in this manner, air contamination from condenser fitting leaks can be minimized. Stem bottles usually are best suited for sampling with back-pressure, but stopcock bottles can also be used in this manner by throttling the stopcock valve. The steam condenser should be leak-checked regularly by drawing a 20-in. Hg vacuum on the condenser, shutting off the vacuum source, and verifying the system will maintain this vacuum for 10 min.

9.3 *Condensate Samples*—Properly cleaned and prepared sample bottles are obtained from qualified laboratories and are rinsed with condensate in the field when appropriate. Only condenser trains and sample hoses dedicated strictly for steam sampling are used. Steam samples are not collected with geothermal liquid sampling equipment.

9.3.1 Sample train equipment must be sufficiently flushed between wells and upon initial sampling to prevent cross-contamination. Typically, a 5-min condensate flush at full flow is required before any samples are obtained.

9.4 *Geothermal Liquid Samples*—Properly cleaned and prepared sample bottles are obtained from qualified laboratories and are rinsed with liquid in the field when appropriate.

9.4.1 Sample train equipment must be sufficiently flushed between wells and upon initial sampling to prevent cross-contamination. Typically, a 5-min liquid flush at full flow is required before any samples are obtained.

9.4.2 Check filter membranes after collecting filtered samples to ensure that the filter is intact.

9.4.3 Check for excessive gas bubbles in the liquid sample stream which may indicate steam entrainment.

## 10. Keywords

10.1 chemical analysis; fluid chemistry; geothermal resources; two-phase geothermal fluids

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## Chavez, Carl J, EMNRD

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**Subject:** Cyrq Energy, Inc. Lightning Dock Geothermal Communication Meeting (GTHT-001)  
**Location:** Office

**Start:** Fri 10/28/2011 8:30 AM  
**End:** Fri 10/28/2011 11:00 AM

**Recurrence:** (none)

**Meeting Status:** Meeting organizer

**Organizer:** Chavez, Carl J, EMNRD  
**Required Attendees:** 'Ben Barker'; VonGonten, Glenn, EMNRD; 'Carl Chavez'; Dade, Randy, EMNRD; Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD; 'Mike\_Smith@blm.gov'; Brooks, David K., EMNRD; Bailey, Jami, EMNRD  
**Optional Attendees:** 'Michael Hayter'



Meeting Handouts  
10-28-2011 ....



Meeting Sign-in  
Sheet.pdf

### Cyrq Energy, Inc. Meeting Agenda:

Post meeting OCD agenda notes for OCD Online "Meetings" file are provided in red text below.

1. Update on corporate structure.

\* Pending OCD Attorney review of recent Cyrq Energy, Inc. e-mail response to OCD October 12, 2011 letter requesting clarification of whether the "Transfer of Ownership" provision of discharge permit applies to new Cyrq company designation, and other issues. – OCD

- *Operator will send response letter (with flow chart hierarchy) to OCD's October 12, 2011 letter addressing the requested items and OCD Attorney David Brooks will weigh in on the path forward with name change from Raser to Cerq or transfer of ownership, which will require significant online (new OGRID) and hardcopy revisions to wells not drilled under the former name, etc. Operator does not believe that it is a transfer of ownership, operator, etc.*

2. Update on drilling and testing plans, and their relationship to power plant schedule.

\* Concerns about large open hole completions and potential for upward discharge and comingling with shallow saturated zones and G-101 APD conditions of approval. – OCD

- *Operator used bulletin board to display well casing shoe depths to ensure they comply with the OCD permit (min. 100 ft. below deepest well (~ 2100 ft) within ½ mile AOR). Drilled well casing*

*shoe depths are below; however, existing Well 55-07 that became part of the geothermal project later (well rework of an existing well) is at a depth of ~ 1050 ft. OCD would likely not allow this well to be used for injection due to concerns with higher TDS fluids being injected within the area of influent o water well users in the project area. This well may be allowed for use as a production/development well.*

*\* OCD approvals during drilling phase? -- OCD*

- Operator has not requested any approvals with Well 53-07 because it is being drilled similar to the last well with OCD approvals, (i.e., WOC approval, casing shoe depth, etc.). However, there will be an approval request sent to OCD soon.*

*\* OCD February 2011 Santa Fe Meeting Minutes. -- OCD*

- This is referenced for extraneous issues that have already been addressed leading up to this meeting and for reference to any new issues where resolution of perceived new issues (i.e., temporary discharge requests under 20.6.2 NMAC, water quality chemicals of concern and discharge to the farm field, etc.) had already been addressed.*

3. *Regulatory issues associated with relocation of permitted wells, particularly injection wells.*

*\* New APD (G-101 and G-102) with OCD approval of change(s) to drill/well location. – OCD*

- A new G-103 with new G-102 will be required under an administrative process to be sent to the OCD DO with copy to Santa Fe. This would also apply to any plans to change wells from production to injection.*
- A new G-103 with new G-102 will be required under an administrative process to be sent to the OCD DO with copy to Santa Fe. This would also apply to any plans to change wells from production to injection.*

*\* Letter of Violation (MITs) for 2 Wells. – OCD*

- Respond to OCD Letter of Violation (LOV) and address items at issue. Operator indicated that well 45-07 had not been completed yet. Restricted travel has prevent the OCD from field inspections to date and communication issues could be the reason. OCD addressed issues*

*with the type of MITs it may accept and considered one idea that the operator had, but felt if approved, it could only be used after well work-overs and not for the official EPA 5-Yr. casing MIT. Operator maintained that they would have to drill out cement plug everytime an EPA MIT was required, but OCD was not sure about this. Would need to consider alternate MIT proposals in G-103 Sundry Notices.*

- OCD is handling production/development wells as Class V wells under WQCC regulations because these regulations are in place for any other well that is not a UIC Class I-IV Well. This also assist OCD in the MIT procedure for the well. The EPA 5-Yr. MIT is required every 5-years. Geothermal regulations prescribe annual well testing (flow, temp, pressure) requirements that will also need to be met when the wells are authorized by OCD for use.*

4. Use of formation water in drilling and completion.

*\* Acceptable conditions. – OCD*

- OCD requires that a G-103 Sundry Notice for well receiving drilling/completion fluid be sent for drilling/completion of other project wells to the District Office with documentation of where the fluid is coming from, volume, etc. This will also assist in keeping the centralized evaporation pond nearby Well 55-07 evacuated for other project uses and/or disposal through evaporation too. Operator needs to be careful not to inject fluids in the pond into existing wells for any other purpose than what is specified and approved by the OCD in the G-103. Showed operator example of letter where OCD approved fluids for beneficial use. If operator has water rights, easier to justify beneficial reuse than if it does not have water rights and the type of testing that may be required if they do not have water rights.*

5. Testing program considerations such as disposal and/or treatment of produced fluids.

*\* Discharge Permit. – OCD*

- Operator proposed new injection well with several production well testing that would require a G-103 Sundry Notice for approval where there would be now discharge to surface, but a Tracer chemical (i.e., Methyl Sulfonate?- used in bleaches to make closure lighter or to fluoresce), which MSDS information would be provided and monitored to determine the capacity of the aquifer system(s) for the OSE in lieu of a standard pump test that would require discharge to land surface. In the proposed process, pipelines from production wells to the injection well with tracer addition to the injection well would determine aquifer characteristics*

*similar to a pump test and pressure transducers would be placed in surrounding water wells to evaluate pressure drops under operational conditions to alleviate concerns about water table draw-down (OSE issues). OCD's issue is capacity and the ability of the reservoir to sustain stress from production (capacity must be there from fluid to reach surface and for heat to be extracted over the operational life of the system) while verify that there is indeed a known geothermal resource area to justify approval of authorization to inject or produce from each well.*

## **6. Miscellaneous**

- Toward the end of the meeting some discussion was devoted to remaining fluids in the centralized holding evaporation pond nearby Well 55-07 that may need to be discharged possibly into the farm field, but certainly not into waters of the state (i.e., arroyo, etc.) without an NPDES Permit from the EPA and modification request to discharge to the OCD under the OCD discharge permit. Reminded operator about the G-103 rejection based on water quality issues and reminded them to double-check the metals against WQCC 20.6.2.3103 NMAC too for water treatment considerations before OCD could approve a land discharge with conditions (i.e., monitoring).*
- OCD once again encouraged the operator to issue a Notice of Intent with the EPA Region 6 and Modification request with the OCD to discharge into "Waters of the State" under an NPDES Permit due to the magnitude of the volumes of produced water extracted during the exploration (drilling and well testing) and production (annual well tests, etc.) phase of operations.*
- Operator did not seem to want to apply for an NPDES permit for the geothermal project and OCD is concerned based on produced fluid volumes and containment that they will clearly not have the capacity to handle the magnitude of volumes required for exploration and operations aspects of the project. Operator indicated that treatment of the produced fluid before discharge was not an issue.*

## **7. Possible Issues**

- Operator is again dealing with the issue of discharging to surface and/or waters of the state (due to the proximity of the arroyo that transects the central location of the project area), which the OCD has rejected because the operator did not propose treatment with monitoring before*

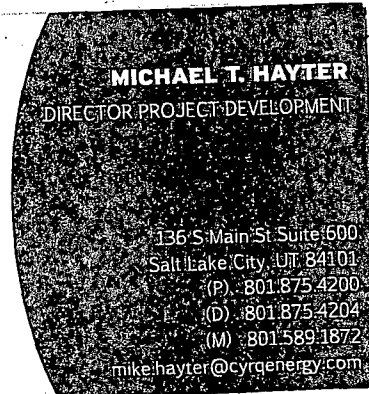
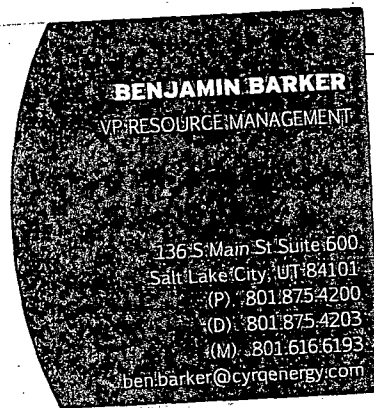
*discharge to land surface. Waters of the state would become an issue when water discharged to land drains into the arroyo from overflow, etc.*

- Tracer chemical (methyl sulfonate?) issue with proposed well test for OSE may become an issue, but we would review the G-103 for this to make a determination and approve/disapprove.*
- Could proposed injection/production well test for OSE with Tracer be approved under a G-103? OCD thinks it could as long as no discharges occur to the land surface and/or waters of the state. OCD attempted to determine whether this would be part of well completion, but the testing would occur after well completion. Also, the operator may think that an MIT is required after this, since it is considered well entry with lines connected, etc. downhole fluid movement, but OCD does not think that a workover MIT would be required in this instance where fluid is moving in the well, versus tubing being removed, etc.*

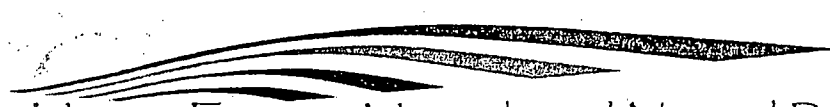
# Cyrg Energy Mtg OCD Santa Fe

10/28/2011

Name	Co.	Phone	Email
Carl Chavez	OCD	505-476-3490	Carl.j.chavez@state.nm.us
Mike Hayter	Cyrg	801-589-1872	Mike.hayter@cyrgenergy.com
Ben Barker	Cyrg	801-616-6193	ben.barker@cyrgenergy.com
GLENN vonGOTTE	OCD	505-476-3488	GLENN.vonGOTTE@STATE.NM.US







New Mexico Energy, Minerals and Natural Resources Department

**Susana Martinez**  
Governor

**John H. Bemis**  
Cabinet Secretary-Designate

**Brett F. Woods, Ph.D.**  
Deputy Cabinet Secretary

**Jami Bailey**  
Division Director  
Oil Conservation Division



**OCTOBER 12, 2011**

Cyrq Energy, Inc.  
c/o Mr. Ben Barker  
136 South Main Street, Suite 600  
Salt Lake City, Utah 84101

**Re: Lightning Dock Geothermal Project Information Request (GTHT-001): Raser Technologies, Township 22 South, Range 19 West, NMPM, Hidalgo County, New Mexico**

Dear Mr. Barker:

The New Mexico Oil Conservation Division (OCD) became aware of geothermal field activity at the above OCD permitted facility during a telephone call on September 28, 2011 while discussing another geothermal project with the Bureau of Land Management (BLM) - Las Cruces District Office. The OCD was informed by BLM that the company formerly known as Raser Technologies had re-emerged out of Chapter 11 Bankruptcy as "Cyrq Energy, Inc." (Cyrq); however, the OCD has not been contacted by Cyrq about its post bankruptcy plans and/or to discuss any issues with the discharge permit, i.e., bonding, G-101 (Application for Permit to Drill (APD), new operator OCD OGRID requirements, etc.

The OCD hereby lists reminders, possible requirements, and/or requests the following information from Cyrq Energy, Inc.:

- 1) Verification that Cyrq is registered with the Public Regulation Commission (PRC) as a registered company.
- 2) Must obtain a new OGRID from the OCD and change its operating status on OCD's system, unless the new name represents merely a name change and not a new entity.
- 3) Provide the status of field drilling activity, since it apparently became a new company.
- 4) Submit new applications, i.e., G-101s, 102s, etc. reflecting the "Cyrq Energy, Inc." revisions to forms.
- 5) OCD will not approve the discharge of produced water onto the farm field and/or "Waters of the State" (see attached February 24, 2011 Santa Fe Meeting Minutes) at the facility.

The information is requested within 30 days of the date of this letter. The OCD and BLM are communicating and working together on this project. Please contact me at (505) 476-3490 or [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us) if you have questions. Thank you.



Mr. Ben Barker  
Cyrq Energy, Inc.  
October 12, 2011

Sincerely,



Carl J. Chávez  
Environmental Engineer

CJC/cjc

Attachment: February 24, 2011 Santa Fe Meeting Minutes

Xc: Bureau of Land Management- Las Cruces District Office  
OCD Underground Injection Control Director  
OCD Artesia District Office

## Chavez, Carl J, EMNRD

---

**From:** Ben Barker [Ben.Barker@cyrqenergy.com]  
**Sent:** Monday, October 24, 2011 5:56 PM  
**To:** Chavez, Carl J, EMNRD  
**Cc:** Mike\_Smith@blm.gov; Dade, Randy, EMNRD; Michael Hayter  
**Subject:** Cyrq ownership letter

Hello Carl,

I returned to my office in Salt Lake City today and found your letter of October 12. A copy should have been forwarded to me in the field and I apologize for our not acknowledging your letter sooner.

I will send a letter responding to your specific queries this week but in the meantime I want to reassure you that none of our interests or operations in New Mexico have changed owners and none of the operator names have changed. All of the permits, bonds and plans filed with or received from NMEMNRD, NMOSE or DOI/BLM are in the names of our two PRC-registered New Mexico operating entities: Los Lobos Renewable Power, LLC (LLRP) and Lightning Dock Geothermal HI-01, LLC (LDG). LDG continues to be owned by LLRP and LLRP continues to be owned by Raser Power Systems. The corporate parent of Raser Power Systems has undergone a change in name only to Cyrq Energy, Inc.

The practical change since we last spoke is our greatly strengthened corporate balance sheet and more resources to support our development plan. We are completing negotiations with our financial partners over the types of testing that will be needed as we move forward and we wish to discuss those with you. Mike Hayter and I will be in Santa Fe later this week. If you have a time on Friday morning or Thursday afternoon we would be happy to meet with you and answer questions. If that is not convenient for you, would a day next week be better?

Thanks,  
Ben Barker

VP Resource Management  
Lightning Dock Geothermal HI-01, LLC  
Kearns Building, Suite 600  
136 South Main Street  
Salt Lake City, UT 84101-1684  
801-875-4203 office  
801-616-6193 mobile1  
707-508-9963 mobile2  
801-374-3314 fax

# New Mexico Energy, Minerals and Natural Resources Department

**Susana Martinez**  
Governor

**John H. Bemis**  
Cabinet Secretary-Designate

**Brett F. Woods, Ph.D.**  
Deputy Cabinet Secretary

**Jami Bailey**  
Division Director  
Oil Conservation Division



OCTOBER 21, 2011

Mr. Ben Barker  
Cyrq Energy, Inc.  
136 S. Main Street, Suite 600  
Salt Lake City, Utah 84101

Via U.S. Certified Mail No.: 7001 1940 0004 7923 1213

Re: **LETTER OF VIOLATION Geothermal Discharge Permit (GTHT-001) Mechanical Integrity Tests (MITs) Hidalgo County, New Mexico [Production Wells: 45-07 and 55-07]**

Dear Mr. Barker:

The New Mexico Oil Conservation Division (OCD) is writing to inform Cyrq Energy, Inc. (Cyrq) that it is in violation of OCD Geothermal Regulation: Title 19, Chapter 14 *et seq.* NMAC (see attachments). All geothermal production/development wells fall under this regulation while geothermal injection and/or disposal wells fall under Water Quality Control Commission (WQCC) Regulations: § 20.6.2.5000 – 5299 NMAC, which are implemented for the OCD Underground Injection Control (UIC) Program for UIC Class V Geothermal and/or any other type wells besides UIC Class I - IV.

Cyrq failed to conduct annual MITs before September 30, 2011, the end of the Federal Environmental Protection Agency (EPA) Fiscal Year 2011 (Oct. 1, 2010 – Sept. 30, 2011). The OCD had sent out an e-mail reminder to Cyrq (formerly known as Los Lobos, Raser Technologies, etc.) on April 15, 2011 (see attachments).

The MIT requires advanced notification to the OCD in order to witness the MIT; the original MIT pressure chart with signatures and test information that reflects a "pass/fail" on the chart; and a copy of the calibration sheet (minimum every 6 months) from the used chart recorder that OCD scans into its well file as confirmation that the MIT requirement has been met.

Please contact Mr. Carl Chavez of my staff at (505) 476-3490 or [Carl.Chavez@state.nm.us](mailto:Carl.Chavez@state.nm.us) to schedule MITs for your production wells that need to be completed before December 31, 2011. Failure to meet this date may result in escalated enforcement actions. Thank you in advance for your cooperation in this matter.

Sincerely,

A handwritten signature in black ink, appearing to read "Jami Bailey".

Mr. Ben Barker  
Cyrq Energy, Inc.  
October 21, 2011

Daniel Sanchez  
UIC Director

Attachments

DS/ejc

Xc: GTHH-001 Well File "MTTs"  
Mike Smith, BLM  
OCD District Office

Chavez, Carl J, EMNRD

---

**From:** Chavez, Carl J, EMNRD  
**Sent:** Friday, April 15, 2011 8:18 AM  
**To:** 'Ben Barker'; 'Michael Hayter'  
**Cc:** Sanchez, Daniel J., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD;  
'Mike\_Smith@blm.gov'  
**Subject:** Lightning Dock Geothermal Project (GTHT-001) UIC Program Mechanical Integrity Testing (MITs) of Wells  
**Attachments:** EPA 5-Yr MIT.DOC

Gentlemen:

Good morning. I'm writing to notify you that the OCD requires your well casing mechanical integrity test (MIT) information to be submitted to the OCD before the end of the Federal UIC Program Reporting Period (i.e., FY Q4 July – Sept.) or before September 30, 2011.

Please find attached the OCD requirements for reporting a successful EPA 5-Yr. MIT on the well casing. Please contact me if you have questions. Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

Website: <http://www.emnrd.state.nm.us/ocd/index.htm>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at:

<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>

## Brine Well EPA 5-Yr. MIT Draft Guidance (30 minute hydrostatic casing closed to formation)

This guidance is intended to provide technical guidance to well operators or technical means to achieve compliance with the EPA Underground Injection Control Regulations and Oil Conservation Division- Oil and Gas Regulations. Other test procedures may exist to achieve compliance with these regulations that the OCD may approve.

- 1) A work over rig must remove all tubing from the hole.
- 2) A packer or plug must be set within 20 feet of the casing shoe depth and piping must be filled, and pressured up from 300 to 500 psi (note: higher pressure is preferred). The casing/tubing annulus must be loaded with inert fluid at least 24 hours prior to testing for temperature equilibrium to be attained.
- 3) Have manpower and equipment available for pressure test. Wellhead shall be prepared for test and all valves and gauges should be in good working order.
- 4) Pumps, tanks, external lines etc. must be isolated from the wellhead during test.
- 5) A continuous recording pressure device with a 1 or 4-hour clock shall be installed on the casing annulus. The pressure range shall not be greater than 500 psig. The chart recorder spring weight shall not exceed 1000 pounds. The operator must provide proof that the pressure-recording device has been calibrated within the past 6 months of the test date.
- 6) A minimum of one pressure gauge shall be installed on the casing/tubing annulus.
- 7) OCD must be notified at least 72 hours prior to test for an opportunity to witness the beginning of test (putting chart on) and ending of test (removing chart). At the end of test operator may be required to bleed-off well pressure to demonstrate recorder and gauge response into an adequately sized flow-back containment vessel for this purpose. Flow-back fluids from this vessel must be discharged back into the well at the completion of the test.
- 8) The Operator shall supply the following information on the pressure chart:
  - A. Company Name, Well Name, API #, Legal Location.
  - B. Test Procedure: (1) EPA 5-Yr. Casing; (2) Casing + Formation; (3) Both; and (4) Other
  - C. Testing Media: Water, Inert Gas, Oil, etc.
  - D. Date, time started and ending.
  - E. Name (printed) and signature of company representative and OCD inspector

witnessing test

- 9) **TEST ACCEPTANCE:** The OCD will use the following criteria in determining if a well has passed the Mechanical Integrity Test:
- A. **Passes** if Zero Bleed-Off during the test.
  - B. **Passes** if Final Test Pressure is within  $\pm 10\%$  of Starting Pressure, if approved by the OCD inspector.
  - C. **Fails** if any Final Test Pressure is greater than  $\pm 10\%$  of Starting Pressure. Operators must investigate for leaks and demonstrate that mechanical integrity of the well(s) by ensuring there are no leaks in the casing, or packer, and injected/produced fluids are confined within the piping and injection zones. Wells shall not resume operations until approved by OCD.

*Note: OCD recognizes that different operations, well designs, formation characteristics and field conditions may cause variations in the above procedures. If operator wishes to make or anticipate changes please notify the OCD for approval. All operators are responsible to notify OCD of any procedure that may cause harm to the well system or formation. Please be advised that OCD approval does not relieve any operator of liability should operations result in pollution of surface water, groundwater, or the environment. OCD recommends that a licensed professional engineer or licensed professional geologist or designee supervise all test procedures and associated field activity.*

This rule was filed as Rule G-211.

**TITLE 19      NATURAL RESOURCES AND WILDLIFE**  
**CHAPTER 14    GEOTHERMAL POWER**  
**PART 62       ANNUAL GEOTHERMAL TEMPERATURE AND PRESSURE TESTS (FORM G-111)**

**19.14.62.1      ISSUING AGENCY:** Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.  
[Recompiled 12/31/01]

**19.14.62.2      SCOPE:** [RESERVED]  
[Recompiled 12/31/01]

**19.14.62.3      STATUTORY AUTHORITY:** [RESERVED]  
[Recompiled 12/31/01]

**19.14.62.4      DURATION:** [RESERVED]  
[Recompiled 12/31/01]

**19.14.62.5      EFFECTIVE DATE:** [November 15, 1983]  
[Recompiled 12/31/01]

**19.14.62.6      OBJECTIVE:** [RESERVED]  
[Recompiled 12/31/01]

**19.14.62.7      DEFINITIONS:** [RESERVED]  
[Recompiled 12/31/01]

**19.14.62.8      ANNUAL GEOTHERMAL TEMPERATURE AND PRESSURE TESTS (FORM G-111):**  
Annual temperature and pressure tests shall be submitted by the owner or operator of each geothermal resource producing well in accordance with the annual testing schedule published by the division. Flowing temperatures and flowing pressure tests at the wellhead shall be recorded after at least 72 hours of continuous flow at normal producing rates. The well shall then be shut in for 24 hours and shut-in pressure at the wellhead recorded. Results of these tests shall be submitted in duplicate to the Santa Fe office of the division.  
[Recompiled 12/31/01]

**HISTORY OF 19.14.62 NMAC:**

Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:

Rule G-211, Annual Geothermal Temperature and Pressure Tests (Form G-111), 11/1/83.

History of Repeated Material: [RESERVED]





- iv. The owner/operator shall determine the depth to water, ground elevation, and well elevation to an accuracy of 0.01 foot. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of the ground water sample exceeds the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.
- E. **Well Workover Operations:** The owner/operator shall obtain OCD's approval prior to performing remedial work, pressure test or any non-routine work. The owner/operator shall request approval on form G-103 "Sundry Notice" pursuant to 19.14.52 NMAC, with copies provided to both the OCD Artesia District II Office and the Santa Fe Office.
- F. **Production/Injection Method:** The production/injection method that the owner/operator shall follow is as follows: High temperature (>250 °F) geothermal water shall be brought to surface from the Horquilla Formation or geothermal reservoir at approximately 3,400 feet below ground level by five (5) production or development wells at approximately 3,000 gpm per well. Hot water shall be routed in parallel and in series through approximately 50 binary cycle (self-contained heat exchanger, evaporator and condenser) power generation units. Condensed produced or effluent water (approximately 225 °F) shall be routed directly to three (3) Class V geothermal wells and into the same depth within the Horquilla Formation or geothermal reservoir.
- G. **Well Pressure Limits:** The owner/operator shall ensure that the operating surface injection and/or test pressure for each injection well measured at the wellhead shall be at a flow rate and pressure (psi) that will not exceed 0.2 psi per foot of depth from the surface to the top of injection interval, unless the owner/operator secures OCD approval for an increase based on demonstration that the increase will not involve a hazard of formation fracture and/or adversely affect public health, the environment and the correlative rights of any geothermal operators in the high temperature geothermal reservoir. The Owner/Operator shall report the intended maximum injection pressure to the Division for approval after testing the injection formation and prior to the commencement of injection in accordance with Form G-112. Re-injected fluids shall be confined to the aquifer where production is occurring and shall not adversely impact another aquifer(s). The owner/operator shall have working pressure limiting devices or controls to prevent overpressure. The owner/operator shall report any pressure that causes damage to the system to OCD within 24 hours of discovery.
- H. **Mechanical Integrity Testing:** At least once every five years and after any well work over, the geothermal reservoir will be isolated from the casing or tubing annulars and the casing pressure tested at a minimum of 600 psig for 30 minutes.

A passing test shall be within +/- 10% of the starting test pressure. All pressure tests must be performed in accordance with the testing schedule shown below and witnessed by OCD staff unless otherwise approved.

Testing Schedule:

2009: Prior to system start-up, a 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing), and

2013: A 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing)

- I. **Capacity/Reservoir Configuration and Subsidence Survey:** The owner/operator shall provide information on the size and extent of the geothermal reservoir and geologic/engineering data demonstrating that continued geothermal extraction will not cause surface subsidence, collapse or damage to property or become a threat to public health and the environment. This information shall be supplied to OCD in each annual report. OCD may require the owner/operator to perform additional well surveys, tests, etc. A subsidence monitoring section is required in the annual report and shall include well top-of-casing and ground elevation surveying (Accuracy: 0.01 ft.) before start-up and on an annual basis in order to demonstrate that there are no subsidence issues. If the owner/operator cannot demonstrate the stability of the system to the satisfaction of OCD, then OCD may require the owner/operator to shut-down, close the site and properly plug and abandoned the wells. The owner/operator shall report any subsidence to the OCD Santa Fe office within 24 hours of discovery.
- J. **Production/Injection Volumes:** After placing a geothermal well on production, the owner/operator shall file in duplicate a monthly production report form G-108, with the OCD Santa Fe office by the 20th day of each month and also with the annual reports. The owner/operator shall also document the production from each well and each lease during the preceding calendar month.
- K. **Analysis of Injection and Geothermal Reservoir Fluids:** After placing any well on injection in a geothermal resources field or area, the owner/operator shall file in duplicate a monthly injection report, form G-110, with the OCD Santa Fe office by the 20th day of each month and also with the annual report. The owner/operator shall specify the zone or formation into which injection is being made, the volume injected, the average temperature of the injected fluid and the average injection pressure at the wellhead.
- L. **Area of Review (AOR):** The owner/operator shall report within 24 hours of discovery of any new wells, conduits or any other device that penetrates or may

District I  
1625 N. French Dr., Hobbs, NM 88240  
District II  
1301 W. Grand Avenue, Artesia, NM 88210  
District III  
7000 Rio Brazos Road, Aztec, NM 87410  
District IV  
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico  
Energy Minerals and Natural Resources

Form C-  
May 27, 2007

Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, NM 87505

Submit to appropriate District Office  
 AMENDED REPORT

**APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE**

<sup>1</sup> Operator Name and Address Los Lobos Renewable Power, LLC 5125 North Edgewood Drive Suite 375 Pruvo, Utah 84604		<sup>2</sup> OGRID Number
		<sup>3</sup> API Number 30 -
<sup>4</sup> Property Code	<sup>5</sup> Property Name Lightning Dock No 1, HI-01 LLC	<sup>6</sup> Well No. 53-07
<sup>7</sup> Proposed Pool 1		<sup>8</sup> Proposed Pool 2

<sup>7</sup> Surface Location

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
	07	25S	19W		3775.3	South	3052.1	West	Hidalgo

<sup>8</sup> Proposed Bottom Hole Location If Different From Surface

UL or lot no.	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
Same									

Additional Well Information

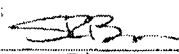
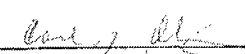
<sup>11</sup> Work Type Code N	<sup>12</sup> Well Type Code (P) Production Well	<sup>13</sup> Cable/Rotary R	<sup>14</sup> Lease Type Code P - Land BLM - Geothermal	<sup>15</sup> Ground Level Elevation 4100
<sup>16</sup> Multiple See Plan of Operation	<sup>17</sup> Proposed Depth 3,400 feet	<sup>18</sup> Formation	<sup>19</sup> Contractor Layne Christensen Company	<sup>20</sup> Spud Date May 2008
Depth to Groundwater 40 feet	Distance from nearest fresh water well .4 miles	Distance from nearest surface water None		
Pit: Liner: Synthetic <input checked="" type="checkbox"/> .45 mils thick Clay <input type="checkbox"/>		Pit Volume: .45,000 bbls		Drilling Method:
Closed-Loop System <input checked="" type="checkbox"/>				Fresh Water <input type="checkbox"/> Brine <input checked="" type="checkbox"/> Diesel/Oil-based <input type="checkbox"/> Gas/Air <input type="checkbox"/>

<sup>21</sup> Proposed Casing and Cement Program

Hole Size	Casing Size	Casing weight/foot	Setting Depth	Sacks of Cement	Estimated TOC
26"	20"	3/8" Wall	63'	150 Sacks	
17.7"	13.375"	54.5 lb/ft	1,500'	750 Sacks	
12.25"	9.625"	36.0 lb/ft	3,400'	980 Sacks	
	7" Liner (If)	23.0 lb/ft			

<sup>22</sup> Describe the proposed program. If this application is to DEEPEN or PLUG BACK, give the data on the present productive zone and proposed new productive zone. Describe the blowout prevention program, if any. Use additional sheets if necessary.

SEE PLAN OF OPERATION

<sup>23</sup> I hereby certify that the information given above is true and complete to the best of my knowledge and belief. I further certify that the drilling pit will be constructed according to NMOCD guidelines <input type="checkbox"/> , a general permit <input type="checkbox"/> , or an (attached) alternative OCD-approved plan <input type="checkbox"/> .	<b>OIL CONSERVATION DIVISION</b>	
Signature: 	Approved by: 	
Printed name: Steven Brown	Title: Environmental Engineer	
Title: Manager	Approval Date: 6/11/2010	Expiration Date: 6/11/2012
E-mail Address: Steve.Brown@nmtach.com		
Date: 6/11/09	Phone: 801.765.1200	Conditions of Approval Attached <input checked="" type="checkbox"/>

**G-101 Lightning Dock Geothermal HI-01 LLC Project  
Production/Development Well 53-07 (GTHT-001)**

**OCD G-101 Conditions of Approval**

(06/11/2010)

- 1) Geothermal exempt work over wastes must be disposed at an OCD approved waste disposal facility in accordance with 19.15.35.8(D) NMAC or OCD permitted treatment or disposal facility (19.15.36 et seq. NMAC).
- 2) All water quality sampling and laboratory methods must be in accordance with the terms and conditions of the discharge permit (GTHT-001). The operator must document the back annulus quality of the ground water to OCD's satisfaction.
- 3) Additional tanks (or large frac tank) will be necessary to circulate the hole for clean sampling representative of the formation to satisfy Condition 2 above. If the operator is unable to document that the ground water produced during the test is adequately "fresh," then it must immediately stop the test and contact OCD-EB.
- 4) All applicable G-Forms documenting well construction, lithology, tests, etc. and request for approval to produce or develop the well and the geothermal resource(s) shall be submitted to OCD-EB for approval.
- 5) The "Smith Corp" Geothermal Data Log from Well TFD-55-7 within the project area indicates that there is stratigraphic or formation variation with depth, i.e., alluvium to ~ 150 ft; ash/tuff to ~1950 ft; siltstone to ~2300 ft; limestone ~ 2950 ft; intrusive dike ~ 3200 ft; limestone ~ 3400 ft; intrusive dike w/ chert ~ 3600 ft; and so on. The project work is within ~ 3500 ft. of surface and the operator believes there is natural hydrogeologic connection between water bearing formations due to fault systems and associated natural rock fracturing in the area. The operator shall implement well completion measures that protect fresh water in accordance with the discharge permit.
- 6) All field work and well completions must comply with the terms and conditions of the discharge permit and associated Geothermal Regulations (Chapter 71, Article 5 NMSA 1978 and Title 19, Chapter 14 NMAC).

*Please be advised that OCD approval does not relieve **Los Lobos Renewable Power, L.L.C.** of responsibility should their operations pose a threat to ground water, surface water, human health or the environment. In addition, OCD approval does not relieve **Los Lobos Renewable Power, L.L.C.** of responsibility for compliance with any other federal, state, or local laws and/or regulations.*

## Chavez, Carl J, EMNRD

---

**From:** Chavez, Carl J, EMNRD  
**Sent:** Thursday, October 06, 2011 12:59 PM  
**To:** VonGonten, Glenn, EMNRD  
**Cc:** Brooks, David K., EMNRD; Dade, Randy, EMNRD; Sanchez, Daniel J., EMNRD  
**Subject:** FW: CYRQ Energy (Formerly Raser Technologies) Well Air Lift Message and Lightning Dock Geothermal Discharge Permit (GTHT-001)  
**Attachments:** Letter from CYRQ to BLM 2011-09-30.pdf

FYI.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

Website: <http://www.emnrd.state.nm.us/ocd/>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at: <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

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**From:** Smith, Michael A [<mailto:michaelsmith@blm.gov>]  
**Sent:** Thursday, October 06, 2011 9:20 AM  
**To:** Chavez, Carl J, EMNRD  
**Subject:** RE: CYRQ Energy (Formerly Raser Technologies) Well Air Lift Message and Lightning Dock Geothermal Discharge Permit (GTHT-001)

Thanks Carl. I've attached a scan of the letter that Ben Barker sent to BLM regarding well 45-07. They don't specify when the airlift test will occur, they just ask to be relieved of filing a Well Completion Report (WCR) until it's done. Of course, BLM cannot exempt them from filing a WCR because it's required by Federal Regulation. We have mailed a letter to Cyrq Energy declining their request and a copy is being cc'd to you and Randy Dade.

His statement about BLM approval of this airlift test is essentially correct, Cyrq Energy does have an approved Federal Sundry Notice to complete an airlift on 45-07 (issued Feb. 28, 2011).

To clarify; Cyrq Energy was planning to spud Federal well 53-07 (not 47-07) on 09/28/2011 but this did not happen as mentioned in my e-mail from last Tuesday. They are planning to spud 53-07 today, but I have not received confirmation this has happened (they are required to e-mail daily drilling reports to the Feds). I will get out to Lightning Dock again next week and I'll keep you informed of developments.

Regards,

Michael Smith  
Geologist - BLM  
Las Cruces District Office  
1800 Marquess Street  
Las Cruces, NM 88005  
575-525-4421  
[mikesmit@blm.gov](mailto:mikesmit@blm.gov)

**From:** Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]  
**Sent:** Wednesday, October 05, 2011 5:07 PM  
**To:** Smith, Michael A  
**Cc:** Sanchez, Daniel J., EMNRD; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD  
**Subject:** CYRQ Energy (Formerly Raser Technologies) Well Air Lift Message and Lightning Dock Geothermal Discharge Permit (GTHT-001)

Mike:

Got your msg. today regarding CYRQ's plans to conduct an air lift test on Well 47-07 (geothermal production/development well).

On 9/28/2011 during a phone call about another geothermal project you had indicated CRYQ was actively spudding Well 47-07. OCD expressed its surprise about field activity by CYRQ Energy to the OCD. They have yet to contact the after emerging from Chapter 11 Bankruptcy and disclose their new name and/or transfer of well permit.

**Section 22 states, "Transfer of Discharge Permit:** Pursuant to WQCC Regulation Subsection H of 20.6.2.5101 NMAC, the owner/operator and new owner/operator shall provide written notice of any transfer of the permit. Both parties shall sign the notice 30 days prior to any transfer of ownership, control or possession of a facility with an approved discharge permit. In addition, the purchaser shall include a written commitment to comply with the terms and conditions of the previously approved discharge permit. OCD will not transfer brine well operations until proper bonding or financial assurance is in place and approved by the OCD. OCD reserves the right to require a modification of the permit during transfer."

OCD Attorney is looking into the new name change and how it may affect the discharge permit, if at all, and a possible path forward based on the above.

While OCD does not think notification is a requirement for field activities, Section 21(B)(v) below requires OCD approval and OCD has not been contacted. OCD in the past has received daily driller updates when work is ongoing, but this has not occurred on this well.

OCD wanted to look over the permit before contacting you to see if CYRQ Energy (Formerly known as Raser Technologies) was conducting its business at the location in accordance with the OCD G-101 approval with conditions, WQCC discharge permit and geothermal regulations. The well was relocated under OCD procedures. Their APD was approved (expires 2 years from approval date) on 6/11/2010 by the OCD and the well is bonded.

Here's what OCD has identified based on your inquiry:

#### **WQCC Discharge Permit:**

**Section 18. Unauthorized Discharges:** The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3103 NMAC (*Standards for Ground Water of 10,000 mg/L TDS Concentration or Less*) or 20.6.4 NMAC (*Water Quality Standards for Interstate and Intrastate Streams*) unless specifically listed in the permit application and approved herein.

**An unauthorized discharge is a violation of this permit.**

**Section 19. Vadose Zone and Water Pollution:** The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000 through 20.6.2.4116 NMAC (*Prevention and Abatement of Water Pollution*). OCD may require the owner/operator to modify its permit for investigation, remediation, abatement and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement or to submit subsequent reports will constitute a violation of the permit.

**Section 20. Additional Site Specific Conditions - Water Quality Monitoring Program:** The owner/operator shall implement the following water quality monitoring programs.

**B(v). Ground Water and Surface Water Sampling and Monitoring Requirements:** The owner/operator shall comply with the Federal Underground Injection Control requirements for Class V Wells (40 CFR 144 subpart G) and WQCC 20.6.2 NMAC injection well construction standards to protect the Underground Source of Drinking Water (USDW). The owner/operator shall immediately shut down the system and contact the OCD for further instructions if the concentration of any water contaminants in the injection fluids exceed the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, as established for the injection formation at the injection well location pursuant to Clause (i) of Paragraph 21.D, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.

**D. Holding Ponds, Drainage Ditches, Pits and Ponds Monitoring Program:** The owner/operator shall sample the holding ponds, drainage ditches, pits and ponds in accordance with Table 4 of Appendix 1. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of a water sample taken at an unlined ditch or location listed above exceeds the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background. *Note: Table 4 analytes consist of metals and general chemistry only. They do not monitor for "toxic pollutants" as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC.*

**21. Class V Geothermal Injection Wells and Geothermal Production or Development Wells:**

**B. Well Casing and Cementing Requirements:**

- i. The owner/operator shall ensure that all casing and cementing meets or exceeds the requirements of 19.14.27.8 NMAC (*Casing and Cementing Requirements*). Conductor pipe shall be run to a minimum depth of 100 feet.
- ii. Surface casing shall be to a depth of at least 100 feet greater than the deepest fresh water well within one-half mile from the well location.
- iii. Intermediate strings shall be cemented solid to surface.
- iv. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if run. If production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet. The lap shall be cemented solid and it shall be pressure tested to ensure integrity.
- v. The owner/operator shall submit a logging program to OCD for review with the owner/operator depth setting recommendations for its casing program based on the logging program. The owner/operator prior to setting intermediate or production casing in each of the production and injection wells shall run open-hole logs, pursuant to the logging



program, approved by the OCD. Logs must be submitted to the OCD for review with the applicant's recommendations for casing setting depths, and in case of injection wells, for precise definition of the injection interval. The type of tubing installed shall be conducive to the characteristics of the injected fluids determined after initial testing of the injected fluids. The owner/operator shall ensure that the tubing is installed with a packer set within 100 feet of the uppermost injection perforations. The casing-tubing annulus shall be filled with an inert fluid, and a gauge or approved leak-detection device shall be connected to the annulus to detect for leakage in the casing, tubing or packer.

Based on the above, OCD will likely need to communicate with CYRQ Energy soon.

Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

Website: <http://www.emnrd.state.nm.us/ocd/>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at: <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

## **Chavez, Carl J, EMNRD**

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Friday, October 14, 2011 2:20 PM  
**To:** 'Smith, Michael A'  
**Cc:** VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Sanchez, Daniel J., EMNRD  
**Subject:** RE: LDG 53-07 Daily Well Summary (GTHT-001)

Mike:

Good afternoon. Just responding briefly to a couple questions that came up based on your inspection below.

The operator would need to submit a C-103 to the Artesia District Office for Well 53-07 to use the produced water in well activity there. OCD would review the request. If the operator has the water right, the reuse of produced water may be ok? There may be some concerns about additives or chemicals that it may have in it? If there is no water right, in order to use the produced water it would have to be as good or better water quality than the receiving water bearing zone(s). Consequently, the C-103 review process will determine any approvals and/or with conditions.

The fuel tanker truck is mobile and OCD would not likely require any berms, secondary containment, liners, etc.

Please contact me if you have questions. Thank you for the communication.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: CarlJ.Chavez@state.nm.us

Website: <http://www.emnrd.state.nm.us/ocd/>

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<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

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**From:** Smith, Michael A [mailto:michaelsmith@blm.gov]  
**Sent:** Thursday, October 13, 2011 3:25 PM  
**To:** Chavez, Carl J, EMNRD  
**Subject:** RE: LDG 53-07 Daily Well Summary (GTHT-001)

Carl:

BLM staff did visit the Lightning Dock site yesterday. They are currently drilling the 53-07 well and there was no activity at the 45-07 well. The only change was near the 55-07 well where they had lined the large reserve pit to the south in anticipation of the flow test they want to conduct in the future.

Ben Barker was onsite and we discussed the operations. Cyrq is still planning a flow test on the 45-7 well pending Federal & State approval. They have not yet submitted a Federal sundry and, based on my conversations with Mr. Barker, it sounds like they still need to work out some details. Mr. Barker stated they were considering managing the formation water produced during the test in this manner: water from the 45-7 well would be pumped into tanks and subsequently sent to the now-lined pit at the 55-7 site. Then, it would be pumped to the 53-7 site for use as make-up water during drilling. He did emphasize they were only considering this, and I urged him to contact OCD because I don't know if this would constitute re-injection under the state regs.

There was a semi-tanker truck at the 53-7 drill site. We asked if they were fueling up, and Mr. Barker said they had bought in the tanker from the Road-Forks terminal because the roadable drilling rig only had a limited capacity, and they

did not want to bring in a fuel truck every 1-2 days. So it appears they are basically using this truck for on-site fuel storage. I don't know if this would create an issue with your agency. On Federal surface estate, we generally require a liner and berm around fuel storage tanks.

I will send pictures if you request. We usually try to get staff out once a week while a well's being drilled, so I will keep you posted on developments.

Regards,

Michael Smith  
Geologist - BLM  
Las Cruces District Office  
1800 Marquess Street  
Las Cruces, NM 88005  
575-525-4421  
mikesmit@blm.gov

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**From:** Chavez, Carl J, EMNRD [mailto:CarlJ.Chavez@state.nm.us]  
**Sent:** Thursday, October 13, 2011 2:24 PM  
**To:** RigMgrCyrq  
**Cc:** Sanchez, Daniel J., EMNRD; Dade, Randy, EMNRD; Smith, Michael A  
**Subject:** LDG 53-07 Daily Well Summary (GTHT-001)

Mr. Summitt:

I notice an API number discrepancy in the API# for this well on your attached form. Although the OCD has not officially issued an "API#" for the project geothermal wells on its Risk-Based Data Base System (RBDMS), the Discharge Permit API# designation for Well 53-07 is: 30-023-20017.

The API No. on your attached Well Summary Form for 53-07 form is 30-023-20016, which is representative of Well 47-07. Please verify which well you are working on? Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: CarlJ.Chavez@state.nm.us

Website: <http://www.emnrd.state.nm.us/ocd/>

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<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

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**From:** RigMgrCyrq [mailto:rigmgrcyrq@gmail.com]  
**Sent:** Thursday, October 13, 2011 10:11 AM  
**To:** Chavez, Carl J, EMNRD  
**Subject:**

Thank you  
Steve Summitt  
(530)304-5590



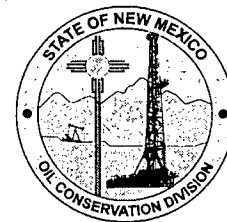
# New Mexico Energy, Minerals and Natural Resources Department

**Susana Martinez**  
Governor

**John Bemis**  
Cabinet Secretary-Designate

**Brett F. Woods, Ph. D.**  
Deputy Cabinet Secretary

**Jami Bailey**  
Division Director  
Oil Conservation Division



**September 15, 2011**

Daniel Manus  
Black Hills Gas Resources  
3200 North 1<sup>st</sup> Street  
Bloomfield, NM 87413

Dear Mr. Manus,

The Oil Conservation Division (“Division”) is in receipt of your request to beneficially use produced water to fracture treat the Jicarilla 464-30 #724. The Division hereby approves the request with the following requirements:

- The produced water cannot be used to drill through or in formations of less than 10,000 TDS without prior authorization from the Division. Prior to fracture treating, Black Hills Gas Resources (“Black Hills”) shall provide the Division with an analysis of the produced water being used and an analysis of the formation water being impacted.
- Black Hills shall submit a specific plan for approval including TDS of the water, volume of water to be used in the fracture treating, a list of wells the produced water originates from, the area it will be used in, the formations it will come in contact with, the process it will be used in and how it will be stored.

If you have any further questions, please feel free to contact Brandon Powell at [Brandon.Powell@state.nm.us](mailto:Brandon.Powell@state.nm.us) or 505-334-6178 xt 116.

Sincerely,

Charlie Perrin  
Aztec District Manager  
1000 Rio Brazos Road  
Aztec, NM 87410



## Chavez, Carl J, EMNRD

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**Subject:** Cyrq Energy, Inc. Lightning Dock Geothermal Communication Meeting  
**Location:** OCD 3rd Floor Conference Room

**Start:** Fri 10/28/2011 8:30 AM  
**End:** Fri 10/28/2011 10:00 AM

**Recurrence:** (none)

**Meeting Status:** Meeting organizer

**Organizer:** Chavez, Carl J, EMNRD  
**Required Attendees:** Ben Barker; VonGonten, Glenn, EMNRD; Carl Chavez; Dade, Randy, EMNRD; Sanchez, Daniel J., EMNRD; Lucero, Stephen A., EMNRD

Please send your agenda items and OCD will add on to it for the meeting. Thanks.

Carl,

Some items for the agenda:

1. Update on corporate structure.

\* Pending OCD Attorney review of recent Cyrq Energy, Inc. e-mail response to OCD October 12, 2011 letter requesting clarification of whether the "Transfer of Ownership" provision of discharge permit applies to new Cyrq company designation, and other issues. -- OCD

2. Update on drilling and testing plans, and their relationship to power plant schedule.

\* Concerns about large open hole completions and potential for upward discharge and comingling with shallow saturated zones and G-101 APD conditions of approval. -- OCD

\* OCD approvals during drilling phase? -- OCD

\* OCD February 2011 Santa Fe Meeting Minutes. -- OCD

3. Regulatory issues associated with relocation of permitted wells, particularly injection wells.

\* New APD (G-101 and G-102) with OCD approval of change(s) to drill/well location. -- OCD

4. Use of formation water in drilling and completion.

\* Acceptable conditions. -- OCD

5. Testing program considerations such as disposal and/or treatment of produced fluids.

\* Discharge Permit. -- OCD

6. Miscellaneous

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Tuesday, March 08, 2011 8:11 AM  
**To:** Brooks, David K., EMNRD  
**Subject:** FW: BLM Handling of Confidential Documents/Information from Lightning Dock Geothermal Project (GTHT-1)  
**Attachments:** CFR-2010-title43-vol2-part3200-subpart3278.pdf; CFR-2010-title43-vol2-part3200-subpart3255.pdf; CFR-2010-title43-vol2-part3200-subpart3266.pdf; pic04346.gif

David:

Here's BLM's "Confidentiality" information.....

Please let me know what you think... Thanks.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau 1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>  
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<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

-----Original Message-----

**From:** [mikesmit@blm.gov](mailto:mikesmit@blm.gov) [<mailto:mikesmit@blm.gov>]  
**Sent:** Sunday, March 06, 2011 2:00 PM  
**To:** Chavez, Carl J, EMNRD  
**Subject:** Re: BLM Handling of Confidential Documents/Information from Lightning Dock Geothermal Project (GTHT-1)

Carl:

Here are the Federal geothermal regulations on that topic:

(See attached file: CFR-2010-title43-vol2-part3200-subpart3278.pdf)(See attached file: CFR-2010-title43-vol2-part3200-subpart3255.pdf)(See attached file: CFR-2010-title43-vol2-part3200-subpart3266.pdf)

There are separate subchapters on confidential information for exploration (3255), drilling (3266) and utilization (3278), but they all lay out similar procedures. For the full Federal Regs, go to:

<http://www.gpo.gov/fdsys/browse/collectionCfr.action?selectedYearFrom=-1&page.go=Go>

I don't know of any disclaimers BLM uses; I'll have to ask the Federal Solicitor about that. I'll be out of the office next week, so we can discuss this further during the week of March 14 if necessary.

Regards

Michael Smith  
Geologist - BLM  
Las Cruces District Office  
1800 Marquess Street  
Las Cruces, NM 88005  
575-525-4421  
[Mike\\_Smith@blm.gov](mailto:Mike_Smith@blm.gov)

"Chavez, Carl J,  
EMNRD"  
<CarlJ.Chavez@state.nm.us> To  
"Mike\_Smith@blm.gov"  
<Mike\_Smith@blm.gov>  
03/04/2011 04:59 PM cc  
"Brooks, David K., EMNRD"  
<david.brooks@state.nm.us>  
Subject  
BLM Handling of Confidential  
Documents/Information from  
Lightning Dock Geothermal Project  
(GTHT-1)

(Embedded image moved to file: pic04346.gif)  
Mike:

Hi. I received a copy of the BLM March 1, 2011 letter to the operator.

Could you please provide the OCD with the BLMs procedures and/or disclaimers for handling "Confidential" documents from the operator?

OCD is wrangling with confidentiality issues and would like to consider BLMs for handling public information requests, etc.

I'm back in next Tuesday.... Thanks in advance.

Have a good weekend! J

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau 1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/oed/index.htm>  
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<http://www.emnrd.state.nm.us/oed/environmental.htm#environmental>)

**Bureau of Land Management, Interior**

**Pt. 3280**

(2) Collect all or part of your bond;  
(3) Order modification or shutdown of your operations; and

(4) Take other enforcement action against a lessee who is ultimately responsible for the noncompliance.

(b) Noncompliance may result in BLM terminating your lease (see §§3213.17 through 3213.19).

**Subpart 3278—Confidential, Proprietary Information**

**§ 3278.10 When will BLM disclose information I submit under these regulations?**

All Federal and Indian data and information submitted to BLM are subject to part 2 of this title. Part 2 includes the regulations of the Department of the Interior covering public disclosure of data and information contained in Department records. Certain mineral information not protected from disclosure under part 2 may be made available for inspection without a Freedom of Information Act (FOIA) request. Examples of information we will not treat as confidential include:

- (a) Facility location;
- (b) Facility generation capacity; or
- (c) To whom you are selling electricity or produced resources.

**§ 3278.11 When I submit confidential, proprietary information, how can I help ensure it is not available to the public?**

When you submit data and information that you believe to be exempt from disclosure under part 2 of this title, you must clearly mark each page that you believe contains confidential information. BLM will keep all data and information confidential to the extent allowed by §2.13(c) of this title.

**§ 3278.12 How long will information I give BLM remain confidential or proprietary?**

The FOIA does not provide a finite period of time during which information may be exempt from public disclosure. BLM will review each situation individually and in accordance with part 2 of this title.

**Subpart 3279—Utilization Relief and Appeals**

**§ 3279.10 When may I request a variance from BLM requirements pertaining to utilization operations?**

(a) You may file a request with BLM for a variance for your approved utilization operations from the requirements of §3200.4. Your request must include enough information to explain:

- (1) Why you cannot comply with the requirements; and
- (2) Why you need the variance to operate your facility, conserve natural resources, or protect public health and safety, property, or the environment.

(b) We may approve your request orally or in writing. If we give you oral approval, we will follow up with written confirmation.

**§ 3279.11 How may I appeal a BLM decision regarding my utilization operations?**

You may appeal our decision affecting your utilization operations in accordance with §3200.5.

**PART 3280—GEOTHERMAL RESOURCES UNIT AGREEMENTS**

**Subpart 3280—Geothermal Resources Unit Agreements—General**

Sec.

3280.1 What is the purpose and scope of this part?

3280.2 Definitions.

3280.3 What is BLM's general policy regarding the formation of unit agreements?

3280.4 When may BLM require Federal lessees to unitize their leases or require a Federal lessee to commit a lease to a unit?

3280.5 May BLM require the modification of lease requirements in connection with the creation and operation of a unit agreement?

3280.6 When may BLM require a unit operator to modify the rate of exploration, development, or production?

3280.7 Can BLM require an owner or lessee of lands not under Federal administration to unitize their lands or leases?

**Subpart 3281—Application, Review, and Approval of a Unit Agreement**

3281.1 What steps must I must follow for BLM to approve my unit agreement?



#### § 3254.10

must send this to BLM within 30 days after you:

- (a) Complete any geophysical exploration operations;
- (b) Complete the drilling of temperature gradient well(s) approved under your approved Notice of Intent to conduct exploration;
- (c) Plug and abandon a temperature gradient well; and
- (d) Plug shot holes and reclaim all exploration sites.

#### Subpart 3254—Inspection, Enforcement, and Noncompliance for Exploration Operations

##### § 3254.10 May BLM inspect my exploration operations?

BLM may inspect your exploration operations to ensure compliance with the requirements of § 3200.4 and the regulations in this subpart.

##### § 3254.11 What will BLM do if my exploration operations are not in compliance with my permit, other BLM approvals or orders, or the regulations in this part?

(a) BLM will issue you a written Incident of Noncompliance and direct you to correct the problem within a set time. If the noncompliance continues or is serious in nature, we will take one or more of the following actions:

- (1) Correct the problem at your expense;
- (2) Direct you to modify or shut down your operations; or
- (3) Collect all or part of your bond.

(b) We may also require you to take actions to prevent unnecessary impacts on the lands. If so, we will notify you of the nature and extent of any required measures and the time you have to complete them.

(c) Noncompliance may result in BLM terminating your lease, if appropriate under §§ 3213.17 through 3213.19.

#### Subpart 3255—Confidential, Proprietary Information

##### § 3255.10 Will BLM disclose information I submit under these regulations?

All Federal and Indian data and information submitted to the BLM are

#### 43 CFR Ch. II (10–1–10 Edition)

subject to part 2 of this title. Part 2 includes the regulations of the Department of the Interior covering public disclosure of data and information contained in Department records. Certain mineral information not protected from disclosure under part 2 may be made available for inspection without a Freedom of Information Act (FOIA) request.

##### § 3255.11 When I submit confidential, proprietary information, how can I help ensure it is not available to the public?

When you submit data and information that you believe to be exempt from disclosure by 43 CFR part 2, you must clearly mark each page that you believe contains confidential information. BLM will keep all data and information confidential to the extent allowed by 43 CFR 2.13(c).

##### § 3255.12 How long will information I give BLM remain confidential or proprietary?

The FOIA (5 U.S.C. 552) does not provide a finite period of time during which information may be exempt from public disclosure. BLM will review each situation individually and in accordance with part 2 of this title.

##### § 3255.13 How will BLM treat Indian information submitted under the Indian Mineral Development Act?

Under the Indian Mineral Development Act of 1982 (IMDA) (25 U.S.C. 2101 *et seq.*), the Department of the Interior will hold as privileged proprietary information of the affected Indian or Indian tribe:

(a) All findings forming the basis of the Secretary's intent to approve or disapprove any Minerals Agreement under IMDA; and

(b) All projections, studies, data, or other information concerning a Minerals Agreement under IMDA, regardless of the date received, related to:

- (1) The terms, conditions, or financial return to the Indian parties;
- (2) The extent, nature, value, or disposition of the Indian mineral resources; or
- (3) The production, products, or proceeds thereof.

## **Title 43: Public Lands: Interior**

PART 2—RECORDS AND TESTIMONY; FREEDOM OF INFORMATION ACT  
Subpart C—Requests for Records under the FOIA

[Browse Previous](#) | [Browse Next](#)

### **§ 2.13 When may the bureau take a time extension to respond to my request?**

(a) The bureau may extend the 20-workday time limit for 10 more workdays when it needs to:

(1) Search for and collect the requested records from multiple offices; or

(2) Search for, collect, and examine a voluminous amount of separate and distinct records sought in a single request; or

(3) Consult with another agency having a substantial interest in the determination of the request or with one or more bureaus of the Department having substantial subject-matter interest in the request.

(b) If the bureau intends to take an extension under this subsection, it will notify you in writing and provide the reason for the extension and the date it expects to make a determination on your request.

(c) If an extension is necessary and the bureau is unable to respond to your request within 30 workdays, it will notify you in writing when you may expect a final response and advise you of your appeal rights. If an extension is taken and you have not received a response in 30 workdays, you may consider the request denied and file an appeal under §2.28(a)(3) or file a lawsuit.

(d) A bureau may not take an extension of time to decide whether to grant a request for a fee waiver.

## Bureau of Land Management, Interior

## § 3260.12

### § 3255.14 How will BLM administer information concerning other Indian minerals?

For information concerning Indian minerals not covered by § 3255.13, BLM will withhold such records as may be withheld under an exemption to the FOIA when it receives a request for information related to tribal or Indian minerals held in trust or subject to restrictions on alienation.

### § 3255.15 When will BLM consult with Indian mineral owners when information concerning their minerals is the subject of a FOIA request?

(a) We use the standards and procedures of § 2.15(d) of this title before making a decision about the applicability of FOIA exemption 4 to information obtained from a person outside the United States Government.

(b) BLM will notify the Indian mineral owner(s) identified in the records of the Bureau of Indian Affairs (BIA), and BIA, and give them a reasonable period of time to state objections to disclosure. BLM will issue this notice following consultation with a submitter under § 2.15(d) of this title if:

(1) BLM determines that the submitter does not have an interest in withholding the records that can be protected under FOIA; and

(2) BLM has reason to believe that disclosure of the information may result in commercial or financial injury to the Indian mineral owner(s), but is uncertain that such is the case.

## Subpart 3256—Exploration Operations Relief and Appeals

### § 3256.10 How do I request a variance from BLM requirements that apply to my exploration operations?

(a) You may submit a request for a variance for your exploration operations from any requirement in § 3200.4. Your request must include enough information to explain:

(1) Why you cannot comply with the regulatory requirement; and

(2) Why you need the variance to control your well, conserve natural resources, or protect public health and safety, property, or the environment.

(b) BLM may approve your request orally or in writing. If we give you an

oral approval, we will follow up with written confirmation.

### § 3256.11 How may I appeal a BLM decision regarding my exploration operations?

You may appeal a BLM decision regarding your exploration operations in accordance with § 3200.5.

## Subpart 3260—Geothermal Drilling Operations—General

### § 3260.10 What types of geothermal drilling operations are covered by these regulations?

(a) The regulations in subparts 3260 through 3267 establish permitting and operating procedures for drilling wells and conducting related activities for the purposes of performing flow tests, producing geothermal fluids, or injecting fluids into a geothermal reservoir. These subparts also address redrilling, deepening, plugging back, and other subsequent well operations.

(b) The operations regulations in subparts 3260 through 3267 do not address conducting exploration operations, which are covered in subpart 3250, or geothermal resources utilization, which is covered in subpart 3270.

### § 3260.11 What general standards apply to my drilling operations?

Your drilling operations must:

(a) Meet all environmental and operational standards;

(b) Prevent unnecessary impacts on surface and subsurface resources;

(c) Conserve geothermal resources and minimize waste;

(d) Protect public health, safety, and property; and

(e) Comply with the requirements of § 3200.4.

### § 3260.12 What other orders or instructions may BLM issue?

BLM may issue:

(a) Geothermal resource operational orders for detailed requirements that apply nationwide;

(b) Notices to Lessees for detailed requirements on a statewide or regional basis;

(c) Other orders and instructions specific to a field or area;

## § 3266.10

is ultimately responsible for non-compliance.

(b) Noncompliance may result in BLM terminating your lease. See §§ 3213.17 through 3213.19.

### **Subpart 3266—Confidential, Proprietary Information**

#### **§ 3266.10 Will BLM disclose information I submit under these regulations?**

All Federal and Indian data and information submitted to the BLM are subject to part 2 of this title. Part 2 includes the Department of the Interior regulations covering public disclosure of data and information contained in Department records. Certain mineral information not protected from disclosure under part 2 of this title may be made available for inspection without a Freedom of Information Act (FOIA) request. BLM will not treat surface location, surface elevation, or well status information as confidential.

#### **§ 3266.11 When I submit confidential, proprietary information, how can I help ensure that it is not available to the public?**

When you submit data and information that you believe to be exempt from disclosure by part 2 of this title, you must clearly mark each page that you believe contains confidential information. BLM will keep all data and information confidential to the extent allowed by § 2.13(c) of this title.

#### **§ 3266.12 How long will information I give BLM remain confidential or proprietary?**

The FOIA does not provide a finite period of time during which information may be exempt from public disclosure. BLM reviews each situation individually and in accordance with part 2 of this title.

### **Subpart 3267—Geothermal Drilling Operations Relief and Appeals**

#### **§ 3267.10 How do I request a variance from BLM requirements that apply to my drilling operations?**

(a) You may file a request for a variance from the requirements of § 3200.4 for your approved drilling operations.

## 43 CFR Ch. II (10–1–10 Edition)

Your request must include enough information to explain:

(1) Why you cannot comply with the requirements of § 3200.4; and

(2) Why you need the variance to control your well, conserve natural resources, or protect public health and safety, property, or the environment.

(b) We may approve your request orally or in writing. If BLM gives you an oral approval, we will follow up with written confirmation.

#### **§ 3267.11 How may I appeal a BLM decision regarding my drilling operations?**

You may appeal our decisions regarding your drilling operations in accordance with § 3200.5.

### **Subpart 3270—Utilization of Geothermal Resources—General**

#### **§ 3270.10 What types of geothermal operations are governed by these utilization regulations?**

(a) The regulations in subparts 3270 through 3279 of this part cover the permitting and operating procedures for the utilization of geothermal resources. This includes:

- (1) Electrical generation facilities;
- (2) Direct use facilities;
- (3) Related utilization facility operations;
- (4) Actual and allocated well field production and injection; and
- (5) Related well field operations.

(b) The utilization regulations in subparts 3270 through 3279 do not address conducting exploration operations, which is covered in subpart 3250, or drilling wells intended for production or injection, which is covered in subpart 3260.

#### **§ 3270.11 What general standards apply to my utilization operations?**

Your utilization operations must:

- (a) Meet all operational and environmental standards;
- (b) Prevent unnecessary impacts on surface and subsurface resources;
- (c) Result in the maximum ultimate recovery of geothermal resources;
- (d) Result in the beneficial use of geothermal resources, with minimum waste;

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Tuesday, April 05, 2011 4:27 PM  
**To:** Lucero, Stephen A., EMNRD  
**Cc:** 'Ben Barker'; Michael Hayter; Brooks, David K., EMNRD; VonGonten, Glenn, EMNRD  
**Subject:** Lightning Dock Geothermal Telephone Conference Call (GTHT-001) Today's Quick Summary of Possible Future Meetings

Steve:

FYI.

- On 4/5 participated in telephone conference call with Raser Technologies, Mike Hayter and Ben Barker, regarding possible meetings. It appears that there may be at least 3 meetings in the horizon each focused on a different stakeholder group. First, the operator is planning to meet independently with Senator Smith about the Lightning Dock Project and issues. Second, Senator Smith may help OCD and ECMD to facilitate a second meeting on the Lightning Dock Project with technical component for educating the agencies on geothermal drilling, issues, etc. This meeting may end with a California Model for agency permitting and interaction. Raser will provide a draft Agenda with stakeholder list of attendees for the second meeting for the agencies to consider and work to finalize. Third a follow-up meeting between Federal and State agencies on cooperation, uniformity to promote efficiency and MOUs on Federal Lands will follow to see if State-State vs. Federal-State cooperation and uniformity in the Lightning Dock Geothermal Project could be established to make it a success. The latter two meetings to be facilitated by OCD and/or ECMD. Raser is also in discussions with the ECMD. Ok.

Please contact me if you have questions. Thank you.

OCD Online File: "Meetings"

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

Website: <http://www.emnrd.state.nm.us/ocd/index.htm>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at: <http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Tuesday, April 05, 2011 5:01 PM  
**To:** Chavez, Carl J, EMNRD; 'Ben Barker'; 'Del Fortner (External)'; 'Roger Bowers (External)'; 'Michael Hayter'; VonGonten, Glenn, EMNRD; Brooks, David K., EMNRD; Myers, Kevin, OSE; 'Mike\_Smith@blm.gov'; Dade, Randy, EMNRD  
**Cc:** 'mikesmit@blm.gov'  
**Subject:** RE: Lightning Dock Geothermal Communication Meeting & Teleconference Draft Meeting Minutes

Gentlemen:

Please find attached the draft meeting minutes from the February 24, 2011 meeting in Santa Fe.

Please contact me if you have questions. Thank you.



Key Meeting Issues  
from 2-24-1...

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
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-----Original Appointment-----

**From:** Chavez, Carl J, EMNRD  
**Sent:** Thursday, February 24, 2011 3:58 PM  
**To:** 'Ben Barker'; Del Fortner (External); Roger Bowers (External); Michael Hayter; VonGonten, Glenn, EMNRD; Brooks, David K., EMNRD; Myers, Kevin, OSE; [Mike\\_Smith@blm.gov](mailto:Mike_Smith@blm.gov); Dade, Randy, EMNRD  
**Cc:** 'mikesmit@blm.gov'  
**Subject:** Lightning Dock Geothermal Communication Meeting & Teleconference  
**When:** Thursday, February 24, 2011 10:15 AM-12:00 PM (GMT-07:00) Mountain Time (US & Canada).  
**Where:** OCD- Santa Fe 1220 South St. Francis Drive, Santa Fe, NM 87507 (Wendell Chino Building- 3rd Floor)

Ladies and Gentlemen:

FYI. The OCD will be generating meeting minutes from today's meeting in order to ensure the QA/QC needed based on the issues that were discussed. Therefore, any interpretations of the agencies responses during the meeting should not be perceived to be final and the meeting minutes will seek accuracy in the meeting minutes where the OCD is to respond back to the operator.

Carl Chavez is working to complete the meeting minutes by next Friday COB and in the process investigate the questions requiring a response.

Thank you.

Please phone into the telephone conference call phone number below if you wish to participate by telephone.

**Conference  
Details**

Scheduled Conference Date: Thursday, February 24, 2011

Scheduled Start Time: 10:15 AM Mountain Std Time

Scheduled End Time: 12:10 PM Mountain Std Time

Scheduled # of Participants: 12

Type of Conference: Web-Scheduled Standard

Dial-in Number: 1-213-289-0500 (Los Angeles)

Participant Access Code: 4509670

Organizer Access Code: ★693464 (you must include the leading star key)

Conference Controls: Conversation Mode (all Participants can be heard)

Entry Chimes - Enabled

Exit Chimes - Enabled

Next week we'll be in Las Cruces, Albuquerque and Santa Fe for a variety of meetings. Would it be convenient for you if Mike Hayter and I stopped by on Thursday, 2/24, to i

- Introduce Del Fortner and perhaps Roger Bowers? They are geothermists of long regulatory and geological experience whom we have engaged to help us with Lightning Dock technical and permit issues. Discharge Permit, Forms, issues....
- I would also like to follow up on our previous conversations about a geothermal show-and-tell for the OCD/OSE technical staff. BLM?

Thanks,  
Ben

VP Resource Management  
Raser Technologies  
5152 N. Edgewood Drive  
Provo, UT 84604

**Lightning Dock Geothermal (Hidalgo County)**  
**OCD Wendell Chino Conference Room, Santa Fe**  
**Draft Meeting Minutes (Completed 4/5/2011)**  
(2/24/2011)

**Attendees:**     OCD: David Brooks, Carl Chavez & Glenn von Gonten  
                  Raser Technologies: Ben Barker, Del Fortner & Michael Hayter

**Purpose:** To resolve the proposed discharge into farm area issue; important issues identified during the meeting; and to develop a path forward on the geothermal project based on those issues.

**Key Issue:** OCD disapproved a discharge of produced water into the nearby farm field from Well 45-07 pump and injection testing. While the operator installed a temporary drill pit for the well, it did not install a permit recovery pond to contain produced fluids for well testing, etc., but feels the water quality without treatment is good. OCD indicated that it was produced water and it would need to be contained and or treated and/or tested for a final disposition determination. Operator would like to line the existing earthen centralized drill pit constructed for Well 55-07 to contain 2-day pump test water from project wells. OCD requested a G-103 with maps and diagrams of construction for "Modification" request.

Note: *OCD meeting issue responses are provided in red italicized print below*

1. OCD provided an agenda and asked that in future meeting requests that agenda items be disclosed in advance of meetings so the attendees could consider the issues and/or questions in advance. This may also enhance communication between state and/or federal agencies.
  - *There was more discussion on this later in the meeting related to state/federal agencies approval of GDPs from BLM and APDs from OCD and how to unify the process to avoid complexity in approvals for drilling, etc. that the operator felt was cumbersome. OCD indicated that the operator would have to meet all ARARs, but that maybe all of the agencies could review drafts submitted to the BLM in consideration of any additional conditions for approval to help streamline the process. It is still unclear as to whether the state and federal agencies would consider this approach to attempting to unify any final BLM/OCD approvals, but it was one consideration. However, the OCD thinks that any operator could begin submitting marginal work products that would require the agencies to do all of the work to mold it into an acceptable work product. Consequently, it is unlikely that the agencies could change its current approach?*
2. Operator introduces Del Fortner (Geothermist). He has regulatory and geological experience and he was hired to help Raser with Lightning Dock technical and permit issues.
  - *Roger Bowers (another Geothermist) was unable to attend the meeting.*
3. OCD Discussion: pits, ponds, discharging to the farm field, forms, discharge permit related issues....
  - Operator indicated that Well 55-7 was a great well, but it was found to be borehole cake damaged and is no good to determine aquifer characteristics now. Operator didn't quite understand how discharge at the farm field was approved for this well and not allowed at Well 45-07? The nearby Burgett facility has discharged water for nursery related practices in the past. Operator also wants to put produced water to beneficial use.



*OCD indicated that the operator must consider fluids removed from the well at the target depth to be "Produced Fluids" that requires containment before final disposition could even be considered. While the TDS is within fresh water range, there are other parameters that exceed WQCC water quality criteria. However, based on the analytical data reviewed by the OCD to date, it supports the OCD's decision to not allow direct discharges onto the land without some guarantee of treatment before discharge to ensure WQCC Regulations and water quality are not exceeded. However, the operator is reluctant to state that it will treat produced fluids before discharge. The permit was approved based on recovery pond installation to contain produced fluids at the facility. The ponds are especially important during the exploration phase of the project before any final determination is made by the operator that it wishes to proceed with use of injection and production wells for power generation. Once the operator decides to begin power generation, the monitor program must be implemented and sampling of produced water before injection into the subsurface can occur.*

- *OCD is also concerned about the sterilization of agricultural land and restoration of it. This was a key consideration in OCD's approval of the permit to discharge into recovery ponds for evaporation or final disposition instead of discharging produced fluids onto the land or into "Waters of the State".*
  - *OCD handed out a package that included pit/pond related correspondence and displayed a map via projector displaying the layout of pits and ponds that had been approved and incorporated into the permit.*
  - *OCD discussed the large volumes of produce water that would be generated from well testing and future routine well testing once well were authorized for injection/production. OCD mentioned that evaporation or storage pond size is 10 acre/ft (§ 19.15.36, 17 (B) (12) NMAC. The volume of produced water may not be completely contained in the pond; consequently, the OCD reminded the operator about the NPDES Permit section in the permit in case the operator sought to discharge into "Waters of the State." This was another option to the final disposition of produced water versus evaporation in ponds during the exploration phase of the project. This would qualify as a "Major Modification" under the permit with public notice and a possible hearing if there are any public comments. The operator discussed the reinjection principle during the production phase of the project; however, the OCD indicated for the exploration phase of the project the permit was approved based on certain conditions. Once the operator was approved for power generation at the facility, the ponds would still be needed for routine geothermal well testing.*
4. Operator would also like to follow up on our previous conversations about a geothermal project status presentation for the OCD/OSE technical staff. BLM?
- *OCD by receipt of these meeting minutes will follow-up with the BLM, OSE, State Land Office (SLO) to solicit interest and participation in the presentation.*
5. Other agency (i.e., OSE) issues or discussions
- *OCD mentioned that there is a provision for a temporary 120 day discharge for "good cause" that it would follow-up with the NMED- GWQB. There would be regular instances for each well when the operator would request a temporary discharge and the*

volumes of produced water that would be discharged would be staggering to the point an NPDES discharge permit from EPA Reg. 6 would likely be needed to discharge into nearby arroyos or "Waters of the State."

- *OSE could provide WQCC examples of temporary permits to discharge related to OSE activities, i.e., aquifer pump tests, etc. Kevin Myers of OSE sent 2 examples of temporary NMED discharge permits to the OCD after the meeting. A preliminary review of the examples indicate that produced water must still be contained and prevented from impacting surface and ground waters until final disposition can be determined. In addition, the OCD has determined that temporary discharges would not apply to this project because there will be numerous instances and different locations where large volumes of produced fluids would need to be discharged on a routine basis.*

*The WQCC provisions for temporary discharge under 20.6.2 NMAC are as follows:*

**20.6.2.3114 FEES: A. FEE AMOUNT AND SCHEDULE OF PAYMENT** - Every facility submitting a discharge permit application for approval or renewal shall pay the permit fees specified in Table 1 of this section and shall pay a filing fee as specified in Table 2 of this section to the Water Quality Management Fund. Every facility submitting a 20.6.2 NMAC 22 request for temporary permission to discharge pursuant to Subsection B of Section 20.6.2.3106 NMAC, or financial assurance pursuant to Paragraph 11 of Subsection A of Section 20.6.2.3107 NMAC shall pay the fees specified in Table 2 of this section to the Water Quality Management Fund.

(11) A closure plan to prevent the exceedance of standards of Section 20.6.2.3103 NMAC or the presence of a toxic pollutant in ground water after the cessation of operation which includes: a description of closure measures, maintenance and monitoring plans, post-closure maintenance and monitoring plans, financial assurance, and other measures necessary to prevent and/or abate such contamination. The obligation to implement the closure plan as well as the requirements of the closure plan, if any is required, survives the termination or expiration of the permit. A closure plan for any underground injection control well must also incorporate the applicable requirements of Sections 20.6.2.5005 and 20.6.2.5209 NMAC.

20.6.2.3114 NMAC Table 2 Filing fee \$ 100 Temporary permission \$ 150 Financial assurance: approval of instrument greater of \$250 or .01%

**20.6.2.3106 APPLICATION FOR DISCHARGE PERMITS AND RENEWALS:**

**A.** Any person who, before or on June 18, 1977, is discharging any of the water contaminants listed in Section 20.6.2.3103 NMAC or any toxic pollutant so that they may move directly or indirectly into ground water shall, within 120 days of receipt of written notice from the secretary that a discharge permit is required, or such longer time as the secretary shall for good cause allow, submit a discharge plan to the secretary for approval; such person may discharge without a discharge permit until 240 days after written notification by the secretary that a discharge permit is required or such longer time as the secretary shall for good cause allow.

**B.** Any person who intends to begin, after June 18, 1977, discharging any of the water contaminants listed in Section 20.6.2.3103 NMAC or any toxic pollutant so that they may move directly or indirectly into ground water shall notify the secretary giving the information enumerated in Subsection B of Section 20.6.2.1201NMAC; the secretary shall, within 60 days, notify such person if a discharge permit is required; upon

submission, the secretary shall review the discharge plan pursuant to Sections 20.6.2.3108 and 20.6.2.3109 NMAC. For good cause shown the secretary may allow such person to discharge without a discharge permit for a period not to exceed 120 days.

C. A proposed discharge plan shall set forth in detail the methods or techniques the discharger proposes to use or processes expected to naturally occur which will ensure compliance with this Part. At least the following information shall be included in the plan: (1) Quantity, quality and flow characteristics of the discharge; (2) Location of the discharge and of any bodies of water, watercourses and ground water discharge sites within one mile of the outside perimeter of the discharge site, and existing or proposed wells to be used for monitoring; (3) Depth to and TDS concentration of the ground water most likely to be affected by the discharge; (4) Flooding potential of the site; (5) Location and design of site(s) and method(s) to be available for sampling, and for measurement or calculation of flow; (6) Depth to and lithological description of rock at base of alluvium below the discharge site if such information is available; (7) Any additional information that may be necessary to demonstrate that the discharge permit will not result in concentrations in excess of the standards of Section 20.6.2.3103 NMAC or the presence of any toxic pollutant at any place of withdrawal of water for present or reasonably foreseeable future use. Detailed information on site geologic and hydrologic conditions may be required for a technical evaluation of the applicant's proposed discharge plan; and (8) Additional detailed information required for a technical evaluation of underground injection control wells as provided in Sections 20.6.2.5000 through 20.6.2. 5299 NMAC, 20.6.2 NMAC 15

D. An applicant for a discharge permit shall pay fees as specified in Section 20.6.2.3114 NMAC.

E. An applicant for a permit to dispose of or use septage or sludge, or within a source category designated by the commission, may be required by the secretary to file a disclosure statement as specified in 74-6-5.1 of the Water Quality Act.

F. If the holder of a discharge permit submits an application for discharge permit renewal at least 120 days before the discharge permit expires, and the discharger is not in violation of the discharge permit on the date of its expiration, then the existing discharge permit for the same activity shall not expire until the application for renewal has been approved or disapproved. A discharge permit continued under this provision remains fully effective and enforceable. An application for discharge permit renewal must include and adequately address all of the information necessary for evaluation of a new discharge permit. Previously submitted materials may be included by reference provided they are current, readily available to the secretary and sufficiently identified to be retrieved. [2-18-77, 6-26-80, 7-2-81, 9-20-82, 8-17-91, 12-1-95; 20.6.2.3106 NMAC - Rn, 20 NMAC 6.2.III.3106, 1-15-01; A, 12-1-01; A, 9-15-02]

## 6. Miscellaneous

- a. Confidentiality: Operator does not want to disclose in the administrative record what it does not need to. If it submits OCD Geothermal Forms, it would like only the cover sheets with signature approvals, etc. to be posted online. Any OSE pump test reports that OCD is not responsible for, it would also not want to provide in order to keep it off record for competitors to gain advantage at their expense. OCD indicated that information associated with the exploration work does not need to be submitted until they request authorization to begin using each production and/or injection well.

- *Geothermal Regs. (GRs) are different than O&G Regulations (OGRs). GRs do not speak to lack of information except to file with custodian until files are submitted to the OCD for authorization to either produce or inject for each well. Nothing says to keep confidential once OCD has information because the statute allows for filing to OCD copies to keep confidential and to add to this is that there are criminal penalties that can be assessed on anyone violating the confidentiality of the documents.*

*The OCD Disclaimer and Policy below have been developed to prevent the release of “Confidential” information and to minimize liability for the accidental release of confidential information under all applicable regulations.*

***Disclaimer:*** *The operator shall demarcate “Confidential” on each page of documents submitted that it believes are Confidential under the OCD Regulations. The OCD shall ultimately determine which documents it shall deem “Confidential” under any/or all applicable regulations upon receipt. A Geothermal Operator shall not withhold relevant and appropriate geothermal information required under the geothermal regulations to the OCD. The OCD shall be under no obligation to agree or disagree with an operator’s stamped document designation of “Confidential” that it receives for record. OCD shall promptly notify operator if it determines that any documents or materials marked “Confidential” will not be treated as confidential. Such documents shall be treated as confidential for a period of 30 calendar days after such notice is given, during which time operator may apply for an administrative hearing to determine confidentiality.*

***OCD Policy on Handling of Geothermal “Confidential” Documents:*** *The operator shall submit all operator signed geothermal related applications, forms (i.e., G-101s, 102s and 103s- Note that these forms with supporting documentation are NOT Confidential) and all required supporting documentation to the OCD to be shared with the General Public. Upon satisfactory documentation of any/or all project related geothermal exploration activity to identify and characterize a geothermal reservoir of suitable temperature for geothermal power generation under an OCD issued Discharge Permit, the operator shall submit all required geothermal signed forms (i.e., G-104 through G-112- Note that the operator must stamp each individual page “Confidential”) that all applicable public record regulations deem “Confidential.” At the point the operator wishes to proceed with geothermal power generation based on exploration work The OCD will ultimately determine which documents it shall consider “Confidential” in the Administrative Records in accordance with all applicable public record regulations until 5 years has elapsed from submittal and/or upon permit expiration without renewal. The OCD is under no obligation to “agree” or “disagree” with an operator’s designation of “Confidential.”*

- b. One solution to No. 3 above is to drill a disposal well into a confined disposal zone (at least 20 feet of non-fractured shale above disposal zone) containing brackish or Brine Fluids. The disposal zone must be deeper than deepest protectable USDW at the project location (Note that the geothermal target zone or Horquilla Fm. is at ~ 3400 ft. bgl and is protectable).
- *Another solution is to submit an NOI for an NPDES discharge with EPA Region 6.*
  - *After containment of produced fluids into a pond(s), the OCD could approve treated discharge(s) to farmland.*

- *After containment of produced fluids into a pond(s), the OCD could approve a treated discharge(s) into a properly permitted UIC Class V disposal well (19.14.35 NMAC- Disposal Produced Water) into a confined disposal zone (brackish and/or brine fluids) somewhere within the project area. This disposal well would be separate from the 3 project geothermal injection wells because the project requires that the operator complete exploration activities to determine whether it wishes to proceed with geothermal power generation. The operator must conduct exploration work first to verify that there is a geothermal reservoir at the project location. Any of the above items may require a "Major Modification" to the discharge permit with public notice, etc. and even the potential for public hearings? The difficulty associated with this project is that it appears to consist of a gigantic hydrogeologically interconnected saturated local, intermediate and regional aquifer system. It is unknown if there are confined disposal zones at deeper depths at this time? The Engineering Bureau seems to recall that there is or was a deep test well drilled in the area? The operator had asked if they could simply start disposing of exploration related produced water down a project Class V Injection Wells? The answer is no. This could only occur under the permit after the exploration phase where the operator makes a decision based on the exploration work to proceed with power generation.—(Carl Chavez)*
  
- *Could one of the geothermal injection wells be drilled and used for disposal or recirculation of produced water back into the formation? No because the permit is written for exploration. One complete and operator decides to produce power based on the exploration results, it will then submit all required forms and information requesting authorization to produce and/or inject at that time and not sooner. Consequently, recovery ponds and/or an NPDES Permit appear to be in order based on the conditions at the facility. The NPDES Permit would allow treated effluent to be reinfiltrated back into the water table while evaporation ponds would not recharge the aquifer system(s) at the project location. However, once wells are authorized for use by the OCD, the recirculation of produced fluids back into the defined geothermal reservoir would occur on a continuous basis instead of into the evaporation ponds (EPs). The EPs still serve the purpose during annual or regularly schedule well testing and/or coupled with the NPDES permit if obtained by the operator.*
  
- c. *It would appear based on the operator's concerns about the pump test at Well 55-07 that the local and regional aquifer thought to be highly fractured with comingled saturated formation may be a tremendous aquifer system that when stressed results in marginal drawdown in nearby and surround wells. However, based on the discussions of water conservation and reinfiltration back into the aquifer and a complaint from the pump test of a 42 ft. drop in water table that the capacity of the aquifer to produce water may be limited? The operator indicated that the Well 55-07 pump test report was recently sent to Tink Jackson of the OSE Deming Office for review. The operator indicated that the pump test on this well was inconclusive because of the borehole coating and they pumped at a reduced 350 gpm for the test and their shareholders weren't satisfied and that is why they want to do the test on Well 45-07, but they did not install an evaporation pond because they thought OCD would allow them to discharge into the farm field similar to Well 55-07.*
  
- *OCD issued a one-time approval to discharge on an existing Burgett well(55-07) that was reworked and tested for investors based on a review of laboratory analytical data results on the produced fluids This well was not included in the discharge permit, but was accepted, bonded, etc. through the OCD procedures to include it. —(Carl Chavez)*

- d. Modifications to the DP would be needed with possible public notice, public comment period, fees, etc. for discharges, since no discharges are allowed into the farm field and an NPDES permit seems essential as the operator appears to not be able to contain all of the produced water that it extracts from the aquifer system and will likely have to eventually discharge to “waters of the state” at the project location. There are concerns about sterilization of the soils in the farm fields due to high pH (~9), SARs, Fluoride, Manganese, and some other metals from analytical data (Burgett Well 2003) attached to the G-103 submittal to discharge into the farm field.
- *This information was placed into the OCD Online “GTHT-1 G-103” folder.—(Carl Chavez)*
- e. Del Fortner wanted to know what agency dealt with management of the Vadose zone. OCD responded it was responsible for this. Also, who is involved with “Unitization” of the land? OCD responded that SLO probably.
- *Unitization is not a regulatory issue for the OCD. It is where land owners, etc. develop a vested interest in developing the geothermal resource(s) for their benefit. The OCD would defer to the SLO on the matter who may inquire with OCD about matters for its customary process that is not regulatory based. No regulations exist on unitization and the way it is handled by the SLO as a formality. OCD could render input to SLO if it enquires.—(David Brooks)*
- f. Solutions to sundry notices and coordination with BLM, OCD and OSE were expressed as a challenge. OCD proposed one solution is to direct drafts to BLM and copy OCD and OSE. BLM could share its conditions with the state agencies to see if there are any instances where the state has to be more stringent? The agencies could then attempt to coordinate conditions that comply with its requirements in one sundry submittal? This may reduce the conflicting requirements of the agencies that the operator is dealing with? Similar issues along the lines of everyday drilling questions that arise on MIT requirements for example. OCD proposed that questions be sent to BLM with a copy to the state agencies for a coordinated response possibly through BLM if they would like to do it this way?
- *A pitfall associated with the above is that the operator relies on the agencies to do its work for them, i.e., propose something ridiculous and then the agencies would have to respond and make things right. The operator requested that all permits be synthesized into one, which is not possible.—(Carl Chavez)*
- g. The operator wants to deliver a half-day “Project Status Presentation” in Santa Fe at OCD (Porter Hall) or OSE in either the first week of April or last week in 2011. OCD will work with the operator and OSE to schedule the meeting with an agenda of what will be discussed. The BLM would be requested to attend.
- *The meeting would help to inform the agencies (Federal & State) about what it thinks about the geothermal resource or status of the project so far. It could help identify regulatory issues down the road that the agencies need to think about. May talk about confidentiality issues?*
  - *On 3/25 OCD sent out a meeting request for the above item to check for interest.*

h. Need policy decision on documentation of meetings.

- *In Geothermal Act operator exception can be made, but OCD can't contemplate exception to rules orally in meetings without documentation. Any approval or disapprovals of requests requiring official action needs to be documented. The Lightning Dock Geothermal Project is the first one and therefore it is precedent setting. It is especially of importance to the OCD in that the issues that crop up could be precedent setting under regulations that are vague or not detailed enough and could be used to develop guidelines and procedures for future projects. My recommendation is that we should document our meetings, but we need to take care of what we state during meetings. --(David Brooks)*

**Memorandum of Understanding Between  
Bureau of Land Management, Colorado State Office and the  
Colorado Department of Natural Resources**

**Concerning Geothermal Leasing, Permitting,  
And Administration in Colorado**

MAR 24 2011

**A. INTRODUCTION**

This MEMORANDUM OF UNDERSTANDING (MOU) is hereby made and entered into by and between the Department of Interior, Bureau of Land Management, Colorado State Office (BLM) and the Colorado Department of Natural Resources (CDNR), together referred to as the Parties.

BLM is responsible for leasing and development of geothermal resources on the federal mineral estate, including such resources beneath National Forest System (NFS) lands. See FS 06-SU-11132428-051 (BLM/FS Geothermal MOU, dated April 14, 2006). The BLM is responsible for effectuating policy goals for renewable energy development on the public lands as well as other lands where the mineral estate is owned by the United States. Sections 211 and 222 of the Energy Policy Act of 2005 (EPAAct) and Secretarial Order 3285 encourage development of renewable energy on public lands, and Section 222(d) of EPAAct directs that all future forest plans and Resource Management Plans for areas with high geothermal resource potential are to consider geothermal leasing and development.

The CDNR is responsible for effectuating the State policy to encourage, by every appropriate means, the full development of the State's natural resources to the benefit of all of the citizens of Colorado and administers State law regarding the development and use of geothermal resources.

**B. PURPOSE**

The Parties expect to develop a successful working relationship in leasing, permitting, and administering geothermal resources in Colorado.

The Parties enter into this MOU to provide for efficient and effective geothermal leasing, permitting, and administration of geothermal resources in Colorado where federal ownership or administration interests are involved. This MOU clarifies the Parties' respective roles and responsibilities in leasing, permitting, and administering such geothermal resources in Colorado.

**C. AUTHORITIES**

The authorities to enter into this MOU are the Federal Land Policy and Management Act, 43 U.S.C. §§ 1701, *et seq.*; the Geothermal Steam Act of 1970, as amended, 30 U.S.C. §§ 1001, *et seq.*; the Energy Policy Act of 2005, P.L. 109-58, §225 (codified at 42 U.S.C.



§15871); and associated federal regulations; and the Colorado Revised Statutes, including the Ground Water Management Act, §§ 37-90-101, *et seq.*, C.R.S., as amended, and the Colorado Geothermal Resources Act, §§ 37-90.5-101, *et seq.*, C.R.S., as amended, and associated state regulations.

This MOU does not supersede existing state or federal law, rule, or regulation. Nothing in this MOU will be construed as affecting the authorities of the Parties or as binding beyond their respective authorities.

**D. RESERVATIONS**

This MOU is entered into without prejudice to, and without waiving, any jurisdiction or other rights, powers, and privileges of any of the Parties thereto.

**E. PARTY CONTACTS**

<b>PARTY</b>	<b>DESIGNATED OFFICIAL</b>	<b>PRINCIPAL CONTACT</b>
<b>BLM</b>	Director, Colorado State Office Bureau of Land Management	BLM Chief, Branch of Fluid Minerals
<b>CDNR</b>	Executive Director Colorado Department of Natural Resources	CDNR Assistant Director for Energy and Minerals

**F. ADMINISTRATION**

**1. Principal Contacts**

Attachment 1 identifies the name and contact information of the Party Contacts set out above. Upon any change to the name or contact information of a Party's Principal Contact, such Party will communicate the new Principal Contact's name and contact information to the other Parties and Attachment 1 will be updated accordingly.

**2. Coordination Meetings**

The Parties will hold annual coordination meetings to discuss implementation of this MOU. Prior to the meeting, each Party's Principal Contact will identify and circulate to the other Parties any matters to be discussed at the meeting.

**3. Rights of Enforcement Between the Parties, or by Non-Parties**

This MOU is not a final agency action by any of the Parties, and is not intended to, and does not create, any right, benefit, or trust responsibility, substantive or procedural, enforceable at law or equity, between the Parties, or by any non-party.

## G. DEFINITIONS

The Parties mutually understand that there is no substantive conflict between the federal and state definitions of various terms relating to geothermal resources, and the parties retain their own definitions.

Definitions relating to geothermal resources may be found in 43 C.F.R. §3200.1 (72 Fed. Reg. 24,357 (May 2, 2007)); Volume I, Chapter 9, Glossary, of the Final Programmatic Environmental Impact Statement for Geothermal leasing in the Western United States dated October, 2008 (Federal); §§ 37-90-103, 37-90.5-103, 37-91-102, 37-91-103, C.R.S.; and Rule 4.2 of the Colorado Department of Water Resources' (CDWR) Geothermal Rules (2 CCR 402-10).

## H. STATEMENTS OF MUTUAL UNDERSTANDING AND AGREEMENT

This MOU does not limit or affect the legal responsibilities or rights of the Parties in any way. While noting that this is a non-exclusive list, the Parties further mutually understand and agree to the following:

1. While geothermal resources are characterized as a mineral resource under federal law, and while Colorado law applies a modified prior appropriation doctrine to the development of geothermal resources, it is agreed that there is no substantive conflict between federal and state definitions of geothermal resources, and the Parties retain their own definitions.
2. As established by *United States v. Union Oil Co. of California*, 549 F.2d 1271 (9th Cir. 1977), the federal government reserved ownership of, and has authority under the Geothermal Steam Act, 30 U.S.C. §§ 1001, *et seq.*, as amended, to issue federal leases for the development and utilization of, the geothermal resources underlying lands whose surface was patented under the Stock-Raising Homestead Act of 1916, 43 U.S.C. §§ 291 *et seq.*, or other lands where such resources are administered by the Secretary of the Interior pursuant to 30 U.S.C. §1002.
3. Prior to and during all lease operations including exploration, development, and utilization of a geothermal resource, a federal geothermal resources lessee must comply with Colorado appropriations law regarding the administration of the geothermal fluid as well as other water that may be necessary for utilization operations, including applicable provisions of the Ground Water Management Act, §§ 37-90-101, *et seq.*, C.R.S., the Colorado Geothermal Resources Act, §§ 37-90.5-101, *et seq.*, C.R.S., the Water Right Determination and Administration Act of 1969, §§ 37-92-101, *et seq.*, C.R.S., §§ 37-91-101, *et seq.*, C.R.S., and

associated rules and regulations, now in existence or as may be modified in the future, consistent with federal lease rights.

4. Appropriative rights of water for the development of geothermal resources are administered by the State Engineer or the Colorado Ground Water Commission, as applicable, pursuant to the Colorado Geothermal Resources Act, §§ 37-90.5-101, *et seq.*, C.R.S., whether the lease is private, state or federal.
5. The grant of a federal lease for geothermal resources pursuant to requirements in federal law, 30 U.S.C. §§ 1001, *et seq.*, does warrant the right to an appropriation of heat energy (*i.e.*, such heat as the lessee may develop and utilize), but does not establish, warrant or guarantee a right to appropriate, under Colorado law, fluids associated with the geothermal resource.
6. The usufructuary nature of ownership of geothermal resources under Colorado law (§37-90.5-104, C.R.S.) does not preclude the United States from granting a federal lease for development and utilization of geothermal resources under lands where such resources are administered by the Secretary of the Interior, or prevent consumptive uses of ground water, including ground water associated with a geothermal resource, where such utilization complies with Colorado law.
7. Under state law, where a geothermal resource is found in association with geothermal fluid which is tributary groundwater, the geothermal resource is a public resource, and the use of water as a material medium to utilize geothermal heat is recognized as a beneficial use of such water, pursuant to §37-90.5-107, C.R.S.

## **I. LEASING**

### **1. Cooperating Agency**

The CDNR may request cooperating agency status, where appropriate under 40 C.F.R. §1501.6, on federal analysis of whether to offer a geothermal lease and under what constraints when the BLM conducts such analysis pursuant to the National Environmental Policy Act of 1969, 42 U.S.C. §§ 4321, *et seq.* (NEPA).

### **2. Notice**

The BLM Principal Contact will notify the CDNR Principal Contact when the BLM receives a nomination to lease a geothermal parcel. Likewise, the CDNR Principal Contact will notify BLM Principal Contact when the State Land Board (SLB) receives a nomination to lease a geothermal parcel, or when another CDNR division seeks to convey rights to geothermal resources.

The Parties will communicate and cooperate during their respective reviews of nominated parcels and whether and under what conditions to offer a nominated parcel for lease.

The BLM will notify surface owners overlying federal geothermal resources that it seeks to lease, consistent with WO IM No. 2009-184, "Courtesy Notification of Surface Owners When Split-Estate Lands are Included in an Oil and Gas Notice of Competitive Lease Sale."

### 3. Stipulations

When offering a federal geothermal lease, the BLM will include a stipulation in the Sale Notice requiring any future lessee to comply with Colorado law. The following is an example of language that would meet the intent of this provision:

#### *LEASE NOTICE*

*The lessee is hereby notified that prior to and during all lease operations including development and utilization of a geothermal resource, the lessee must comply with applicable provisions of the Colorado Geothermal Resources Act, §§ 37-90.5-101, et seq., C.R.S., other state and local statutes, and rules and regulations, now in existence or as may be modified in the future, consistent with lease rights.*

*On the lands described below: <LEGAL DESCRIPTIONS>*

A similar notice will be applied to a SLB geothermal lease requiring lessee to comply with BLM rights-of-way rules and regulations where BLM administers the surface estate.

When offering a federal geothermal lease, the BLM will include a stipulation in the Sale Notice putting the lessee on notice that the BLM may require the lessee to conduct monitoring to ensure lessee activities do not cause material injury to senior water or geothermal rights. The following is an example of language that would meet the intent of this provision:

#### *EXTRACTION STIPULATION*

*To prevent potential material injury to senior water or geothermal rights under Colorado state law, and to ensure that existing geothermal features are protected under the terms of the applicable BLM Resource Management Plan, as amended by the Record of Decision and Resource Management Plan Amendments for Geothermal Leasing in the Western United States, 2008, as appropriate, this lease is restricted as follows:*

*Monitoring of the quantity, quality, or temperature of surface or subsurface water resources by the lessee prior to and during all lease operations, including exploration, development, and utilization of a geothermal resource, may be required as directed by the BLM in consultation with the Colorado State*

*Engineer's Office, and the burden of proof shall be on the lessee to ensure compliance with federal and state statutes, rules, and regulations.*

*Material injury may be determined by the relevant Colorado Water Court, and such an order from the Water Court may result in limitations on the use of the geothermal resource.*

*On the lands described below: <LEGAL\_DESCRIPTIONS>*

#### **4. Hot-Dry Rock**

Should a prospective developer seek to develop a hot-dry rock resource as defined in § 37-90.5-103, C.R.S., lying beneath BLM-owned surface where BLM does not own the mineral estate, the Parties will meet and confer with the prospective developer to advise on proper leasing and right-of-way procedures.

#### **5. Access**

On split-estate lands, a lessee's surface-access rights may depend on the ownership of the surface estate, the rights reserved to the mineral estate, the terms of the lease, and whether the lease is state or federal. The Parties will continue to confer on these issues and may develop a guidance document concerning access rights.

#### **6. Land Exchanges**

In every land exchange involving Federal or State interests in land, the Parties will ensure that the conveyance documents address disposition or retention of the severable mineral estate, including the geothermal resource.

### **J. PERMITTING**

#### **1. Scope**

This discussion of permitting procedures applies to the Parties' consideration of the following permits: CDWR permit to construct a well for geothermal purposes; CDWR permit to appropriate a geothermal fluid; BLM approval of a notice of intent to conduct geothermal exploration operations; and BLM geothermal permit to drill.

The Parties mutually anticipate that the level of their involvement in the other Parties' process may vary, depending on the permit under consideration and the stage of development.

#### **2. Cooperating Agency**

The CDNR may request cooperating agency status, where appropriate under 40 C.F.R. §1501.6, on federal analysis of whether to approve a geothermal drilling permit application and under what constraints when the BLM conducts such analysis pursuant to NEPA.

### **3. Notice**

CDNR will notify the federal or state geothermal lessee of the requirement, pursuant to and consistent with Rule 6.2.2.4 of the CDWR Geothermal Rules (2 CCR 402-10), to give notice of the proposed well construction to the owners or operators of any valid, prior water or geothermal rights that are located within 1/2 mile of the proposed well.

At the time that operations are contemplated on split-estate lands in which the United States holds a property interest, BLM encourages the lessee/operator to contact potentially affected surface owners as early as possible. The lessee/operator is also encouraged to negotiate a surface-use agreement with the surface owner. If, after certifying that good faith effort has been made to a negotiate with the surface owner, a surface-use agreement cannot be reached, the lessee/operator is authorized to enter the lands to develop leased resources by posting a bond to protect the surface owner against reasonable and foreseeable loss or damages to crops, tangible improvements, and the value of land for grazing. During permit review, the surface owner is entitled to the same level of resource protection as that provided for federal lands.

### **4. Preliminary Meeting with Operators**

The BLM will request a preliminary meeting with the federal geothermal lessee and CDNR within 60 days of issuance of the lease to discuss access issues as well as required permitting processes, application requirements, and anticipated timelines for processing such permits.

### **5. Onsite Inspections**

The BLM will notify the federal lessee of the requirement to invite the surface owner to the onsite inspection on a federal exploration notice of intent or geothermal permit to drill, as appropriate.

The BLM will also include CDNR in scheduling any such onsite inspection, and CDNR may invite appropriate CDNR personnel to attend the onsite inspection once it is scheduled. CDNR will provide the BLM with a list of the CDNR personnel that were notified of an onsite inspection.

The Parties will advise CDNR personnel attending onsite inspections to submit recommendations to BLM within a reasonable amount of time after the onsite inspection to facilitate BLM's NEPA review.

## **6. Review of Permits**

During their respective review of permit applications associated with exploration for and development of geothermal resources, the Parties may confer, as necessary, and will share permit applications, approvals, and other information to identify, discuss, and work to resolve any potential concerns that may be addressed by conditions of approval.

CDNR will provide the BLM with API numbers for geothermal drilling permits and temperature gradient wells, upon request.

## **7. Inspection and Enforcement**

On federal geothermal leases, each Party will provide notice of inspections of geothermal operations to the other Party and invite such other Party to participate in such inspections. Additionally, each Party will provide a copy of inspection reports to the other Party, upon request.

If one of the Parties discovers a potential violation of a provision of the other Parties' rules or regulations, that Party will timely notify the other Party of such potential violation.

# **K. PRODUCTION AND UTILIZATION OF GEOTHERMAL RESOURCES**

## **1. Scope**

This discussion of procedures for production and utilization of geothermal resources applies to the Parties' consideration of the following permits: CDWR permit to construct a well for geothermal purposes; CDWR permit to appropriate a geothermal fluid; and BLM utilization plan approval (including submission of a utilization plan for approval, permit to construct a utilization facility and associated ancillary facilities, such as BLM rights-of-way authorization for roads, pipelines, and transmission lines, a BLM and/or FERC site license, and a BLM commercial use permit). These authorizations include the entire geothermal facility, including pipelines, access roads, and the placement of geothermal production and reinjection wells, pursuant to subparts 43 C.F.R. §§ 3270-3274.

The Parties mutually anticipate that the level of their involvement in the other Parties' process may vary, depending on the permit under consideration and the stage of development.

## **2. Cooperating Agency**

The CDNR may request cooperating agency status, where appropriate under 40 C.F.R. §1501.6, on federal analysis of whether to grant a federal utilization plan or federal construction permit and under what constraints when the BLM conducts such analysis pursuant to NEPA.

### **3. Preliminary Meeting with Operators**

The BLM will request a preliminary meeting with the federal geothermal lessee and CDNR within 60 days of application for a federal utilization plan or federal construction permit to discuss required permitting processes, application requirements, and anticipated timelines for processing such permits.

### **4. Review of Permits**

During their respective review of permit applications associated with utilizing federal geothermal resources, constructing a geothermal development project, or commercially using federal geothermal resources, the Parties may confer, as necessary, to identify, discuss, and work to resolve any potential concerns that may be addressed by conditions of approval.

The Parties recognize that CDNR may be asked to comment as part of a local government review process under local land use regulations, where applicable. Where CDNR provides such comments, CDNR will provide copies of any such correspondence concerning development of the federal geothermal estate to the BLM.

## **L. ADMINISTRATION OF MOU**

This MOU takes effect upon the signature of all the Parties thereto. This MOU may be amended upon written request of either, and written concurrence of both, of the Parties. Any Party may terminate this MOU upon thirty (30) days written notice to all other Parties. During this thirty day period the Parties shall make good faith efforts to resolve any disagreement identified in the written notice of intent to terminate, including a meeting between the Designated Officials and Principal Contacts.

## **M. DISPUTE RESOLUTION**

This MOU is not intended to be a binding contract enforceable in a court of law or in an administrative forum. It is intended only to establish a process for further intergovernmental cooperation between the Parties. The Parties agree to work cooperatively to avoid and resolve conflicts that may arise during the term of this MOU related to leasing, permitting and administration of geothermal resources. The Parties further agree that to the extent a conflict cannot be resolved by communication at the staff level, such conflict will be escalated to the Principal Contacts. If, after meeting, the Principal Contacts are unable to resolve the conflict, it will be escalated to the Designated Officials, as listed in Attachment 1, for resolution. The Designated Officials may, at their discretion, choose to involve dispute resolution specialists from each Parties' agency to assist them in resolving the issues associated with the conflict.

## **N. INFORMATION DISCLOSURE**



Any information furnished pursuant to this MOU will be subject to disclosure to the extent allowed under the Freedom of Information Act (5 U.S.C. §552) (FOIA), the Privacy Act (5 U.S.C. §552a), and/or the Colorado Open Records Act (§§ 24-72-201, *et seq.*, C.R.S.) (CORA). Each Party agrees that if it receives any request to produce information or materials (including but not limited to requests made under FOIA or CORA), it will immediately notify and consult with the other Parties and provide not less than three (3) working days notice before the response date.

**O. SIMILAR ACTIVITIES**

This MOU in no way restricts the Parties from participating in similar activities with other public or private agencies, organizations, and individuals.

**P. SEPARATE ACTIVITIES AND RESOURCES**

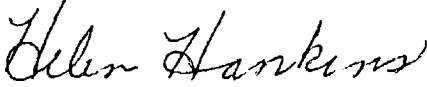
Each of the Parties will handle its own activities and utilize its own resources, including expenditure of its own funds, in implementing this MOU. Each Party will carry out its separate activities in a coordinated and mutually beneficial manner.

**Q. OBLIGATION OF FUNDS**


Nothing in this MOU shall obligate any Party to obligate or transfer any funds. Specific work projects or activities that involve the transfer of funds, services, or property between the Parties will require separate agreements and be contingent upon the availability of appropriated funds. Such agreements must be independently authorized by appropriate Colorado or federal authority. This MOU does not provide that authority. Negotiation, execution, and administration of each such agreement must comply with all applicable federal and Colorado statutes and regulations.

**R. AUTHORIZED REPRESENTATIVES**

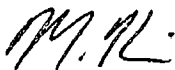
By signature below, each of the Parties certifies that it is authorized to act in its respective areas for matters related to this agreement.



**Helen Hankins, Colorado State Director**  
Bureau of Land Management, Colorado State Office



**Date**



**Mike King, Executive Director**  
Colorado Department of Natural Resources



**Date**

**Attachment 1**

**Designated Officials**

**Helen Hankins**  
State Director  
Bureau of Land Management  
Colorado State Office  
2850 Youngfield Street  
Lakewood, Colorado 80215-7093  
303-239-3700

**Mike King**  
Executive Director  
Colorado Department of Natural Resources  
1313 Sherman St., #718  
Denver, Colorado 80203  
303-866-3311

**Principal Contacts**

**Jerry Strahan**  
Chief, Branch of Fluid Minerals  
Bureau of Land Management  
Colorado State Office  
2850 Youngfield Street  
Lakewood, Colorado 80215-7093  
303-239-3753

**Ginny Brannon**  
Assistant Director for Energy and Minerals  
Colorado Department of Natural Resources  
1313 Sherman St., #718  
Denver, Colorado 80203  
303-866-3311 x8658

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Friday, March 04, 2011 2:44 PM  
**To:** 'Ben Barker'  
**Cc:** Brooks, David K., EMNRD; Dade, Randy, EMNRD  
**Subject:** Meeting Minutes from 2/24 Meeting in Santa Fe

Ben:

Good afternoon.

There has been an internal OCD issue related to documenting the meeting minutes and issues at our last meeting. Upon resolution of the internal issue and authorization to proceed or not to proceed, I will let you know.

Sorry for any inconvenience this may have caused you. Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)

Website: <http://www.emnrd.state.nm.us/ocd/index.htm>

"Why not Prevent Pollution; Minimize Waste; Reduce the Cost of Operations; & Move Forward with the Rest of the Nation?" To see how, go to "Pollution Prevention & Waste Minimization" at:

<http://www.emnrd.state.nm.us/ocd/environmental.htm#environmental>)

# LIGHTNING DOCK GEOTHERMAL PROJECT MEETING (2/24/2011) OCD SANTA FE OFFICE

## AGENDA

Ladies and Gentlemen:

Please phone into the telephone conference call phone number below if you wish to participate by telephone.

Conference Details	
Scheduled Conference Date:	Thursday, February 24, 2011
Scheduled Start Time:	10:15 AM Mountain Std Time
Scheduled End Time:	12:10 PM Mountain Std Time
Scheduled # of Participants:	12
Type of Conference:	Web-Scheduled Standard
Dial-in Number:	1-213-289-0500 (Los Angeles)
Participant Access Code:	4509670
Organizer Access Code:	*693464 (you must include the leading star key)
Conference Controls:	Conversation Mode (all Participants can be heard) Entry Chimes - Enabled Exit Chimes - Enabled

Next week we'll be in Las Cruces, Albuquerque and Santa Fe for a variety of meetings. Would it be convenient for you if Mike Hayter and I stopped by on Thursday, 2/24, to i

- Operator introduces Del Fortner and perhaps Roger Bowers. They are geothermists of long regulatory and geological experience whom we have engaged to help us with Lightning Dock technical and permit issues.
- OCD Discussion: Pits, Discharging to the Farm Field, discharge permit, forms, issues....
- Operator would also like to follow up on our previous conversations about a geothermal show-and-tell for the OCD/OSE technical staff. BLM?
- Other agency (i.e., OSE) issues or discussions
- Miscellaneous

Lightning Dock Geothermal Project Mtg.  
(2/24/2011)

Carl Chavez	OCD	505-476-3490
David Brooks	OCD	505-476-3450
Kevin Myers	OSE	<del>505-476-3450</del> 505-827-3521
Glenn vonGronow	OCD	505-476-3490
Mike Hayter	Raser	801-765-1200
Ben Barker	Raser	801-765-1200
Del Fortner	Raser	775.530.8803

**Oil Conservation Division (OCD)**  
**Geothermal Power Regulations, Application,  
Bonding, Forms & Resource Information**

(Revised: 08/18/2009)

**Geothermal Regulations:**

Chapter 71: Energy & Minerals  
Article 5: Geothermal Resources Conservation Act  
Chapter 71, Article 5 NMSA 1978

Title 19: Natural Resources & Wildlife  
Chapter 14: Geothermal Power  
Title 19, Chapter 14 NMAC (11-15-83 Recompiled 12-31-01)

Geothermal Rules & Regulations

Water Quality Control Commission 20.6.2 NMAC (Class V Injection Well Designation)

**Application Forms:**

Geothermal  
Permit to Inject (C-108)

**Drilling (G-101 & 102) & Bond Forms** (please note that bonds for Class V Injection Wells are handled separately under the WQCC Regulations (UIC Program) while geothermal production or development wells are bonded separately under the “G” Forms and associated geothermal regulations):

Geothermal Exploration & Production Forms (see “Geothermal Well Forms”)  
Bonding (see “Bond Forms” GT-B-1 and GT-B-2)

**Geothermal State Leasing- State Land Office:**

**Legislative Reference:** New Mexico Annotated Code Title 19 Chapter 14-1;  
Title 19 Chapter 2-7; Title 19 Chapter 13-7 to 13-12

**State Agency Responsible for Leasing:** New Mexico State Lands Office (see US Bureau of Land Management links below for Federal lease information)

**Leasing:** Leases are available on a non-competitive basis. However, the Commissioner of Public Lands may at his discretion reject any application and offer the tract or tracts at public auction. Lands classified as “known geothermal fields” are leased through public auction through either sealed or oral bidding procedure.

**Lease Terms:**

**Primary:** 5 years

**Renewal:** Primary term can be renewed for additional 5 years and thereafter so long as geothermal resources are being produced or utilized or are capable of being produced or utilized in commercial quantities.

**Rentals:** \$1.00 per acre or fraction thereof per year (escalates to \$5.00 per acre per year after primary lease term).

**Royalties:** 10 % of the gross revenue from the sale or use of steam, brines or hot water, associated gases or other forms of heat or energy derived from production with a minimum of \$2.00 per acre or fraction thereof per year. A royalty of not less than 2 % nor more than 5 % of the gross revenue received for the sale of mineral products or chemical compounds recovered from geothermal fluids. A royalty of 8 % of the net revenue for the operation of an energy producing plant on the leased land. A royalty of not less than 2 % nor more than 10 % of the gross revenue received from the operation of the geothermal resource for recreational, space heating, or health purposes.

**Geothermal Resources:**

[Geo-Heat Center](#)

[Geothermal Education Office](#)

[Geothermal Energy Association](#)

[Geothermal Heat Pump Consortium](#)

[Geothermal Resources Council Annual Meeting](#)

[New Mexico Bureau of Geology & Mineral Resources](#)

[New Mexico Collocated Resources](#)

[New Mexico Energy Conservation & Management Division Geothermal Website](#)

[New Mexico Geothermal Working Group](#)

<i>GEOHERMAL WELL FORMS</i>			
<b>G-101</b>	Application for Permit to Drill, Deepen or Plug Back	PDF	
<b>G-102</b>	Well Location and Acreage Dedication	PDF	
<b>G-103</b>	Sundry Notice	PDF	
<b>G-104</b>	Certificate of Compliance and Authorization to Produce	PDF	
<b>G-105</b>	Well Log	PDF	
<b>G-106</b>	Well Summary Report	PDF	
<b>G-107</b>	Well History	PDF	
<b>G-108</b>	Monthly Production Report	PDF	
<b>G-109</b>	Monthly Purchaser's Report	PDF	
<b>G-110</b>	Monthly Injection Report	PDF	
<b>G-111</b>	Annual Temperature and Pressure Test	PDF	
<b>G-112</b>	Application to Place Well on Injection	PDF	



OIL CONSERVATION DIVISION

STATE OF NEW MEXICO  
ENERGY AND MINERALS DEPARTMENT

P. O. BOX 2088  
SANTA FE, NEW MEXICO 87501

Form G-104  
Adopted 10-1-74  
Revised 10-1-78

CERTIFICATE OF COMPLIANCE  
AND AUTHORIZATION TO PRODUCE  
GEOTHERMAL RESOURCES

OWNER OR OPERATOR

Name \_\_\_\_\_

Address \_\_\_\_\_

TYPE OF WELL

Geothermal Producer  Low-Temperature Thermal  Injection/Disposal

REASON FOR FILING

New Well  Recompletion

Change in Ownership  Designation of Purchaser

Other (Please Explain)  \_\_\_\_\_

DESCRIPTION OF WELL

Lease Name \_\_\_\_\_ Well No. \_\_\_\_\_ Name of Reservoir \_\_\_\_\_

Kind of Lease (Fee, Fed. or State) \_\_\_\_\_ Lease Number \_\_\_\_\_

LOCATION

Unit Letter \_\_\_\_\_ ; \_\_\_\_\_ feet from the \_\_\_\_\_ line and \_\_\_\_\_ feet from the \_\_\_\_\_ line of

Section \_\_\_\_\_ Township \_\_\_\_\_ Range \_\_\_\_\_

County \_\_\_\_\_

TYPE OF PRODUCT

Dry Steam \_\_\_\_\_ Steam and Water \_\_\_\_\_ Low Temp. Thermal Water \_\_\_\_\_

DESIGNATION OF PURCHASER OF PRODUCT

Name of Purchaser \_\_\_\_\_

Address of Purchaser \_\_\_\_\_

Product Will Be Used For \_\_\_\_\_

CERTIFICATE OF COMPLIANCE

I hereby certify that all rules and regulations concerning geothermal resources wells in the State of New Mexico, as promulgated by the Oil Conservation Division of New Mexico, have been complied with, with respect to the subject well, and that the information given above is true and complete to the best of my knowledge and belief.

Signed \_\_\_\_\_ Position \_\_\_\_\_ Date \_\_\_\_\_

Approved \_\_\_\_\_ Position \_\_\_\_\_ Date \_\_\_\_\_



**OIL CONSERVATION DIVISION**

P. O. BOX 2088

SANTA FE, NEW MEXICO 87501

Form G-106  
Adopted 10-1-74  
Revised 10-1-78

STATE OF NEW MEXICO  
ENERGY AND MINERALS DEPARTMENT

**GEOHERMAL RESOURCES WELL SUMMARY REPORT**

Operator \_\_\_\_\_ Address \_\_\_\_\_  
 Lease Name \_\_\_\_\_ Well No. \_\_\_\_\_  
 Unit Letter \_\_\_\_\_ Sec. \_\_\_\_\_ Twp. \_\_\_\_\_ Rge \_\_\_\_\_  
 Reservoir \_\_\_\_\_ County \_\_\_\_\_

Commenced drilling _____	GEOLOGICAL MARKERS _____	DEPTH _____
Completed drilling _____	_____	_____
Total depth _____ Mugged depth _____	_____	_____
Junk _____	_____	_____
Commenced producing _____ (Date)	Geologic age at total depth: _____	

Date	Static test		Production Test Data									
	Shut-in well head		Total Mass Flow Data					Separator Data				
	Temp. °F	Pres. Psig.	Lbs/Hr	Temp. °F	Pres. Psig.	Enthalpy	Orifice	Water cuft/Hr	Steam Lbs/Hr	Pres. Psig.	Temp. °F	

**CASING RECORD (Present Hole)**

Size of Hole	Size of Casing	Weight of Csg/ft.	Grade of Casing	New or Used	Seamless or Lapweld	Depth of Shoe	Top of Casing	Number of Sacks of Cement	Top of Cement	Cement Top Determined By

**PERFORATED CASING**

(Size, top, bottom, perforated intervals, size and spacing of perforation and method.)

Was analysis of effluent made? \_\_\_\_\_ Electrical log depths \_\_\_\_\_ Temperature log depths \_\_\_\_\_

**CERTIFICATION**

I hereby certify that the information given above and the data and material attached hereto are true and complete to the best of my knowledge and belief.

Signed \_\_\_\_\_ Position \_\_\_\_\_ Date \_\_\_\_\_

# GEOTHERMAL RESOURCES WELL HISTORY FORM G-107

STATE OF NEW MEXICO  
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION  
1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

Form G-107  
Adopted 10-1-74  
Revised 10-1-78

## GEOTHERMAL RESOURCES WELL HISTORY

Operator \_\_\_\_\_ Address \_\_\_\_\_  
Lease Name \_\_\_\_\_ Well No. \_\_\_\_\_  
Unit Letter \_\_\_\_\_ Sec. \_\_\_\_\_ Twp. \_\_\_\_\_ Rge. \_\_\_\_\_  
Reservoir \_\_\_\_\_ County \_\_\_\_\_

It is of the greatest importance to have a complete history of the well. Use this form to report a full account of all important operations during the drilling and testing of the well or during re-drilling, altering of casing, plugging, or abandonment with the dates thereof. Be sure to include such items as hole size, formation test details, amounts of cement used, top and bottom of plugs, perforation details, sidetracked junk, bailing tests, shooting, and initial production data and *stare* temperature. (Attach additional sheets if necessary.)

Date \_\_\_\_\_

### CERTIFICATION

I hereby certify that the information given above and the data and material attached hereto are true and complete to the best of my knowledge and belief.

Signed \_\_\_\_\_ Position \_\_\_\_\_ Date \_\_\_\_\_

OIL CONSERVATION DIVISION  
P. O. BOX 2088  
SANTA FE, NEW MEXICO 87501  
MONTHLY GEOTHERMAL PRODUCTION REPORT

SUBMIT IN DUPLICATE

Month of

Operator					Address								
Lease Name					Reservoir					County			
NOTE: Report actual production (NOT SALES). Use Form G-109 for water injection wells.													
Well No.	Unit Ltr.	Sec.	Twp.	Rge	Total mass produced (Lbs x 10 <sup>6</sup> )	Dry steam produced (Lbs x 10 <sup>6</sup> )	Flow temp. (°F)	Flow pres. (psig)	Water produced (acre-feet)	Minerals produced (type and tons)	Method of Prod (F. or P.)	No. days well prod	If well not on production, state reason
TOTALS													

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

(Signature)

(Title)

(Date)

# MONTHLY GEOTHERMAL PURCHASER'S REPORT FORM G-109

STATE OF NEW MEXICO  
ENERGY AND MINERALS DEPARTMENT

OIL CONSERVATION DIVISION

1220 South St. Francis Drive  
Santa Fe, New Mexico 87505

Form G-109  
Adopted 10-1-74  
Revised 10-1-78

MONTHLY GEOTHERMAL PURCHASER'S REPORT

Month of \_\_\_\_\_

Purchaser's Name					Address					
Place of Utilization			Purpose			Producer's Name				
Lease			Field			County				
WELL NO.	LOCATION				Product* Purchased	Total Mass, Lbs. x 10 <sup>6</sup>	Total Vol., Acre Feet	Total Vol., Gallons †	Temp. °F	Pres. psi
	UL	S	T	R						
Totals										
Residual Water		Acre Feet		Gallons †		Disposition				
Type and Weight of Minerals Extracted						Disposition of Minerals				

\*State type of product: Dry Steam, Geothermal Water, Low-Temp. Thermal Water, etc.

†Total Volume in Gallons for Low-Temp. Thermal Wells Only

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

Remarks: \_\_\_\_\_ Name \_\_\_\_\_

\_\_\_\_\_ Title \_\_\_\_\_ Date \_\_\_\_\_







APPLICATION TO PLACE WELL ON INJECTION-GEOTHERMAL RESOURCES AREA

Operator		Address	
Lease Name	Well No.	Field	County
Location Unit Letter _____ ; Well is Located _____ Feet From The _____ Line And _____ Feet From The _____ Line, Section _____ Township _____ Range _____ NMPM.			

CASING AND TUBING DATA

NAME OF STRING	SIZE	SETTING DEPTH	SACKS CEMENT	TOP OF CEMENT	TOP DETERMINED BY
Conductor Pipe					
Surface Casing					
Long String					
Tubing			Name, Model and Depth of Tubing Packer		
Name of Proposed Injection Formation			Top of Formation	Bottom of Formation	
Is Injection Through Tubing, Casing, or Annulus?		Perforations or Open Hole?	Proposed Interval(s) of Injection		
Is This a New Well Drilled For Injection?	If Answer is No, For What Purpose was Well Originally Drilled?		Has Well Ever Been Perforated in Any Zone Other Than the Proposed Injection Zone?		
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		Is This Injection for Purpose of Pressure Maintenance or Water Disposal? (See Rules 501 and 502)			
Anticipated Daily Injection Volume	Minimum	Maximum	Open or Closed Type System	Is Injection to be by Gravity or Pressure?	Approx. Pressure (psi)
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—			Water to be Injected	Natural Water in Injection Zone	Are Water Analyses Attached?
Name and Address of Surface Owner (or Lessee, if State or Federal Land)					
List Names and Addresses of all Operators Within One-Half (1/2) Mile of This Injection Well					
Have Copies of this Application Been Sent to Each Operator Within One-Half Mile of this Well?		Yes <input type="checkbox"/> No <input type="checkbox"/>			
Are the Following Items Attached to this Application (see Rule 503)		Plat of Area	Electrical Log	Diagrammatic Sketch of Well	
Yes <input type="checkbox"/> No <input type="checkbox"/>		Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	Yes <input type="checkbox"/> No <input type="checkbox"/>	

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

\_\_\_\_\_  
(Signature) (Title) (Date)

NOTE: Should waivers from all operators within one-half mile of the proposed injection well not accompany this application, the New Mexico Oil Conservation Division will hold the application for a period of 20 days from the date of receipt by the Division's Santa Fe office. If at the end of the 20-day waiting period no protest has been received by the Santa Fe office, the application will be processed. If a protest is received, the application will be set for hearing, if the applicant so requests. SEE RULE 503.

District I  
1625 N. French Dr., Hobbs, NM 88240  
District II  
1901 W. Grand Avenue, Artesia, NM 88210  
District III  
1000 Rio Puerco Road, Aztec, NM 87410  
District IV  
1220 S. St. Francis Dr., Santa Fe, NM 87505

State of New Mexico  
Energy Minerals and Natural Resources

Form 1  
May 17

Oil Conservation Division  
1220 South St. Francis Dr.  
Santa Fe, NM 87505

Submit to appropriate District Office

AMENDED RETURN

**APPLICATION FOR PERMIT TO DRILL, RE-ENTER, DEEPEN, PLUGBACK, OR ADD A ZONE**

<sup>1</sup> Operator Name and Address Los Lobos Renewable Power, LLC 5125 North Edgewood Drive Suite 375 Puyco, Utah 84604		<sup>2</sup> OGRID Number  <sup>3</sup> API Number 30 -
<sup>4</sup> Property Code  	<sup>5</sup> Property Name Lightning Dock No 1, HL-01 LLC	<sup>6</sup> Well No 43-07
<sup>7</sup> Proposed Pool 1  		<sup>8</sup> Proposed Pool 2  

**Surface Location**

UL of lot no	Section	Township	Range	Lot Idn	Feet from the	North/South line	Feet from the	East/West line	County
	07	28S	19W		2560.0	South	2378.3	West	Hobbs

**Proposed Bottom Hole Location If Different From Surface**

UL of lot no Same	Section	Township	Range	Lot Idn	Feet from tie	North/South line	Feet from tie	East/West line	County

**Additional Well Information**

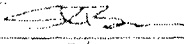
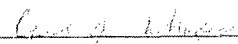
<sup>9</sup> Well Type Code N	<sup>10</sup> Well Type Code (P) Production Well	<sup>11</sup> Cable/Rotary R	<sup>12</sup> Lease Type Code P - Land, BLM - Geothermal	<sup>13</sup> Ground Level Elevation 4106
<sup>14</sup> Multiple See Plan of Operation	<sup>15</sup> Proposed Depth 2,400 feet	<sup>16</sup> Formation	<sup>17</sup> Contractor Layne Christensen Company	<sup>18</sup> Spud Date May 2008
Depth to Groundwater 40 feet		Distance from nearest fresh water well 4 miles		Distance from nearest surface water - None
<sup>19</sup> Liner: Synthetic <input checked="" type="checkbox"/> 45 mils thick Clay <input type="checkbox"/> Closed-Loop System <input checked="" type="checkbox"/>		<sup>20</sup> Pit Volume: 45,000 bbl Drilling Method: Fresh Water <input type="checkbox"/> Brine <input checked="" type="checkbox"/> Diesel/Oil-based <input type="checkbox"/> Gas/Air <input type="checkbox"/>		

**Proposed Casing and Cement Program**

Hole Size	Casing Size	Casing weight/foot	Setting Depth	Sacks of Cement	Estimated TOC
26"	20"	3/8" Wall	63'	150 Sacks	
17.7"	13.375"	54.5 lb/ft	1,500'	750 Sacks	
12.25"	9.625"	36.0 lb/ft	3,400'	980 Sacks	
	7" Liner (IF)	23.0 lb/ft			

<sup>21</sup> Describe the proposed program. If this application is to DEEPEN or PLUG BACK, give the data on the present productive zone and proposed new productive zone. Describe the blowout prevention program, if any. Use additional sheets if necessary.

SEE PLAN OF OPERATION

<sup>22</sup> I hereby certify that the information given above is true and complete to the best of my knowledge and belief. I further certify that the drilling pit will be constructed according to NMOCD guidelines <input type="checkbox"/> , a general permit <input type="checkbox"/> , or an (attached) alternative OGD-approved plan <input type="checkbox"/> . Signature: 	<b>OIL CONSERVATION DIVISION</b> Approved by:  Title: Environmental Engineer Approval Date: 6/11/2010 Expiration Date: 6/11/2012
Printed name: Steven Brown Title: Manager E-mail Address: Steve.Brown@nrc.state.nm.us Date: 4/2/10 Phone: 505 765 1201	Conditions of Approval Attached <input checked="" type="checkbox"/>

**G-101 Lightning Dock Geothermal III-01 LLC Project  
Production/Development Well 45-07 (GTHT-001)**

**OCD G-101 Conditions of Approval  
(06/11/2010)**

- 1) Geothermal exempt work over wastes must be disposed at an OCD approved waste disposal facility in accordance with 19.15.35.8(D) NMAC or OCD permitted treatment or disposal facility (19.15.36 et seq. NMAC).
- 2) All water quality sampling and laboratory methods must be in accordance with the terms and conditions of the discharge permit (GTHT-001). The operator must document the back annulus quality of the ground water to OCD's satisfaction.
- 3) Additional tanks (or large frac tank) will be necessary to circulate the hole for clean sampling representative of the formation to satisfy Condition 2 above. If the operator is unable to document that the ground water produced during the test is adequately "fresh," then it must immediately stop the test and contact OCD-EB.
- 4) All applicable G-Forms documenting well construction, lithology, tests, etc. and request for approval to produce or develop the well and the geothermal resource(s) shall be submitted to OCD-EB for approval.
- 5) The "Smith Corp" Geothermal Data Log from Well TFD-55-7 within the project area indicates that there is stratigraphic or formation variation with depth, i.e., alluvium to ~ 150 ft; ash/tuff to ~1950 ft; siltstone to ~2300 ft; limestone ~ 2950 ft; intrusive dike ~ 3200 ft; limestone ~ 3400 ft; intrusive dike w/ chert ~ 3600 ft; and so on. The project work is within ~ 3500 ft. of surface and the operator believes there is natural hydrogeologic connection between water bearing formations due to fault systems and associated natural rock fracturing in the area. The operator shall implement well completion measures that protect fresh water in accordance with the discharge permit.
- 6) All field work and well completions must comply with the terms and conditions of the discharge permit and associated Geothermal Regulations (Chapter 71, Article 5 NMSA 1978 and Title 19, Chapter 14 NMAC).

*Please be advised that OCD approval does not relieve **Los Lobos Renewable Power, L.L.C.** of responsibility should their operations pose a threat to ground water, surface water, human health or the environment. In addition, OCD approval does not relieve **Los Lobos Renewable Power, L.L.C.** of responsibility for compliance with any other federal, state, or local laws and/or regulations.*

Rule G-108, Casing and Cementing Requirements, 11/1/83.

History of Repealed Material: [RESERVED]

This rule was filed as Rule G-108.

**TITLE 19           NATURAL RESOURCES AND WILDLIFE**  
**CHAPTER 14       GEOTHERMAL POWER**  
**PART 27           CASING AND CEMENTING REQUIREMENTS**

**19.14.27.1       ISSUING AGENCY:** Energy and Minerals Department, Oil Conservation Division, P.O. Box 2088, Santa Fe, New Mexico.  
 [Recompiled 12/31/01]

**19.14.27.2       SCOPE:** [RESERVED]  
 [Recompiled 12/31/01]

**19.14.27.3       STATUTORY AUTHORITY:** [RESERVED]  
 [Recompiled 12/31/01]

**19.14.27.4       DURATION:** [RESERVED]  
 [Recompiled 12/31/01]

**19.14.27.5       EFFECTIVE DATE:** [November 15, 1983]  
 [Recompiled 12/31/01]

**19.14.27.6       OBJECTIVE:** [RESERVED]  
 [Recompiled 12/31/01]

**19.14.27.7       DEFINITIONS:** [RESERVED]  
 [Recompiled 12/31/01]

**19.14.27.8       CASING AND CEMENTING REQUIREMENTS:**

A. All wells drilled for the production of geothermal resources, including low-temperature thermal wells, and all specialty wells, including injection and disposal wells, shall be cased and cemented in such manner as to protect surface waters, if any, useable ground waters, geothermal resources, and life, health and property. Thermal gradient wells shall be drilled, completed and plugged in such a manner as to protect surface waters, in any, and useable ground waters. The division may require casing and cementing as is deemed necessary for such wells.

B. All casing strings reaching the surface shall provide adequate anchorage for blowout prevention equipment, hole pressure control, and protection for all natural resources. Although specifications for casing programs shall be determined on a well-to-well basis, the following general casing requirements should be used as guidelines in submitting form G-101, application for permit to drill, deepen, or plug back-geothermal resources well.

(1) Conductor Pipe: A minimum of 90 feet and a maximum of 200 feet. In special cases the division may allow conductor pipe to be run and cemented at deeper depths. Annular space is to be cemented solid to the surface. An annular blowout-preventer or equivalent approved by the division shall be installed on conductor pipe on exploratory wells and on development wells when deemed necessary by the division. Note: For thermal gradient wells and low-temperature thermal wells the conductor pipe requirement may be reduced or waived by the division. The above conductor pipe requirements are not meant to be applicable to the single or double joint of large diameter pipe often run to keep mud out of the cellar.

(2) Surface Casing: Except in the case of (thermal gradient wells and low-temperature thermal wells, the surface casing hole shall be logged with an electrical or radioactivity log, or equivalent, before running casing. Note: This requirement may vary from area to area, depending upon the amount of subsurface data available, and may be waived under certain conditions. Requests for exceptions to the logging requirement should be noted on form G-101 when applying for a drilling permit. Surface casing shall provide for control of formation fluids, for protection of useable ground water and for adequate anchorage for blowout-prevention equipment. All surface casing shall be, if possible, cemented solid to the surface.

(a) Length of Surface Casing:

(i) In areas where subsurface geological conditions are variable or unknown, surface casing in general shall be set at a depth equalling or exceeding 10 percent of the proposed total depth of the well. A minimum of 200 feet and a maximum of 1,500 feet of surface casing shall be set.

(ii) In areas of known high formation pressure, surface casing shall be set at a depth determined by the division after a careful study of geological conditions. The division will make such a determination within 30 days. Drilling shall not commence until such determination has been made.

(iii) Within the confines of designated geothermal fields, the depth at which surface casing shall be set shall be determined by the division on the basis of known field conditions. Requirements (a)(1) and (a)(2) [now (i) and (ii) of Subparagraph (a) and (b)of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above may be waived for low-

temperature thermal wells.

(b) Cementing Point for Surface Casing:

(i) In areas where subsurface geological conditions are variable or unknown, surface casing shall be set in accordance with (a) (1) [now (i) Subparagraph (a) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above and through a sufficient series of low permeability, competent lithologic units (such as claystone or siltstone) to ensure a solid anchor for blowout-prevention equipment and to protect useable ground water and surface water from contamination. A second string of surface casing may be required if the first string has not been cemented through a sufficient series of low permeability, competent lithologic units and either a rapidly increasing thermal gradient or rapidly increasing formation pressures are encountered.

(ii) In areas of known high formation pressure, surface casing shall be set in accordance with (a) (2) [now (ii) Subparagraph (a) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC] above and through a sufficient series of low permeability, competent lithologic units (such as claystone, siltstone or basalt) to ensure a solid anchor for blowout-prevention equipment and to protect useable ground water and surface water from contamination. A second string of surface casing may be required, before drilling into the known high pressure zone is permitted, if the first string of surface casing has not been cemented through a sufficient series of low-permeability, competent lithologic units.

(iii) Within the confines of designated geothermal fields, cementing point shall be determined by the division on the basis of known field conditions. Requirements (b)(1) and (b)(2) [now (i) and (ii) of Subparagraph (b) of Paragraph (2) of Subsection B of 19.14.27.8 NMAC ] above may be waived for low-temperature thermal wells.

(c) Return mud temperatures: Return mud temperatures shall be entered into the log book after each joint of pipe has been drilled down. See Rule G-106(b) [now Subsection B of 19.14.25.8 NMAC].

(d) Blowout-prevention equipment (BOPE): BOPE capable of shutting in the well during any operation shall be installed on the surface casing and maintained ready for use at all time (see Section H) [see compiler's note].

(3) Intermediate casing: Intermediate casing shall be required for protection against anomalous pressure zones, caveins, washouts, abnormal temperature zones, uncontrollable lost circulation zones or other drilling hazards. Intermediate casing strings shall be, if possible, cemented solid to the surface. This requirement (to circulate cement) may be waived if the production casing will be cemented to the surface.

(4) Production casing: Production casing may be set above or through the producing or injection zone and cemented above the objective zones. Sufficient cement shall be used to exclude overlying formation fluids from the zone, to segregate zones and to prevent movement of fluids behind the casing into zones that contain useable ground water. Production casing shall either be cemented solid to the surface or lapped into intermediate casing, if run. If the production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet, the lap shall be cemented solid, and it shall be pressure tested to ensure its integrity. In order to reduce casing corrosion, production casing used to produce corrosive brine reservoirs shall be of the same nominal inside diameter from the shoe of the casing to the ground surface.

(5) Casing and Cement Tests: All casing strings shall be tested after cementing and before commencing any other operations on the well. Form G-103 shall be filed for each casing string reporting the grade and weight of pipe used. In the case of combination strings utilizing pipe of varied grades or weights, the footage of each grade and weight used shall be reported. The results of the casing test, including actual pressure held on the pipe and the pressure drop observed, shall also be reported on the form G-103. See Rule G-203C(2) [now Paragraph (2) of Subsection C of 19.14.54.8 NMAC].

(a) Casing strings in wells drilled with rotary tools shall be pressure-tested. Minimum casing test pressure shall be approximately one-third of the manufacturer's rated internal yield pressure except that the test pressure shall not be less than 600 pounds per square inch and need not be greater than 1,500 pounds per square inch. In cases where combination strings are involved, the above test pressures shall apply to the lowest pressure-rated casing used. Test pressures shall be applied for a period of 30 minutes. If a drop of more than ten percent of the test pressure should occur, the casing or cement job shall be considered defective and corrective measures shall be taken before commencing any further operations on the well.

(b) Casing strings in wells drilled with cable tools may be tested as outlined in Rule 5(a) [now Subparagraph (a) of Paragraph (5) of Subsection B of 19.14.27.8 NMAC] above, or by bailing the well dry, in which case the well must remain satisfactorily dry for a period of at least one hour before commencing any further operations on the well.

(6) Defective casing or cementing: If the cementing of any casing appears to be defective, or if the casing in any well appears to be defective or corroded or parted, or if there appears to be any underground leakage for whatever other reason, which may cause or permit underground waste, the operator shall proceed with diligence to use the appropriate method or methods to eliminate such hazard. If such hazard of waste cannot be eliminated, the well shall be plugged and abandoned in accordance with a division approved plugging program.

(7) Logging: All wells, except thermal gradient wells and low-temperature thermal wells, shall be logged with an electrical or radioactivity log, or equivalent, from total depth to the surface casing shoe. This requirement may be waived by the division depending upon geological or engineering conditions.

[Recompiled 12/31/01]

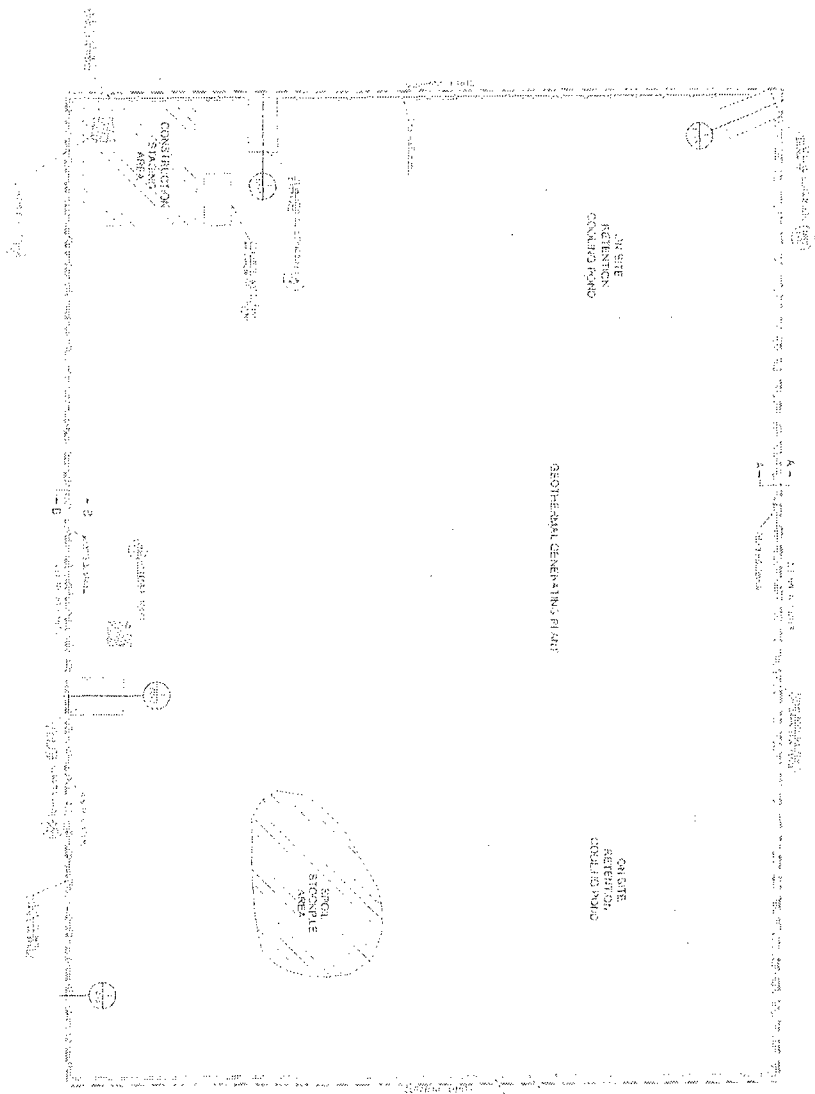
#### **HISTORY OF 19.14.27 NMAC:**

Pre-NMAC History: The material in this Part was derived from that previously filed with the State Records Center and Archives:

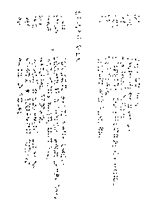
# LIGHTNING DOCK GEOTHERMAL GENERATING PLANT

## TYPICAL EROSION CONTROL PLAN

SCALE 1" = 30'



SECTION AA



LEGEND	
[Symbol]	ON-SITE RETENTION CONTROL POND
[Symbol]	GEOTHERMAL GENERATING PLANT
[Symbol]	CONSTRUCTION STAGING AREA
[Symbol]	ON-SITE RETENTION CONTROL POND
[Symbol]	GEOTHERMAL GENERATING PLANT
[Symbol]	CONSTRUCTION STAGING AREA
[Symbol]	ON-SITE RETENTION CONTROL POND
[Symbol]	GEOTHERMAL GENERATING PLANT
[Symbol]	CONSTRUCTION STAGING AREA



PROJECT	EROSION CONTROL PLAN
CLIENT	LIGHTNING DOCK GEOTHERMAL GENERATING PLANT
DATE	1/25/07
SCALE	1" = 30'
PROJECT NO.	EC-1
LOCATION	HIDALGO COUNTY, NEW MEXICO
DESIGNED BY	ALB
CHECKED BY	ALB
DATE	1/25/07
PROJECT NO.	EC-1

SECTION AA

SECTION BB



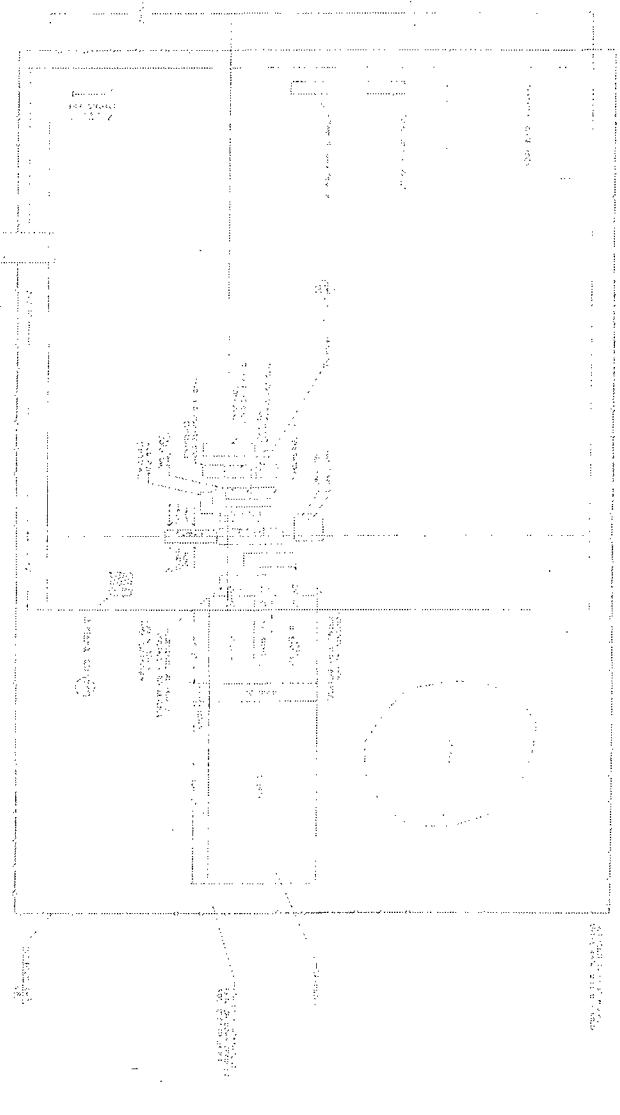
NOTES:

1. ALL EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
2. THE EROSION CONTROL PLAN SHALL BE REVIEWED AND APPROVED BY THE LOCAL AND STATE AGENCIES.
3. THE EROSION CONTROL PLAN SHALL BE REVIEWED AND APPROVED BY THE LOCAL AND STATE AGENCIES.
4. THE EROSION CONTROL PLAN SHALL BE REVIEWED AND APPROVED BY THE LOCAL AND STATE AGENCIES.
5. THE EROSION CONTROL PLAN SHALL BE REVIEWED AND APPROVED BY THE LOCAL AND STATE AGENCIES.

# LIGHTNING DOCK GEOTHERMAL WELL PAD

## EROSION CONTROL PLAN

SCALE 1" = 50'



SECTION 180

DATE: 01/17/08  
 DRAWN BY: [Name]  
 CHECKED BY: [Name]

NO.	DESCRIPTION	DATE
1	ISSUED FOR PERMIT	01/17/08
2	REVISION	
3	REVISION	
4	REVISION	
5	REVISION	
6	REVISION	
7	REVISION	
8	REVISION	
9	REVISION	
10	REVISION	

THIS PLAN IS A PRELIMINARY DESIGN AND IS SUBJECT TO CHANGE WITHOUT NOTICE. THE USER OF THIS PLAN SHALL BE RESPONSIBLE FOR OBTAINING ALL NECESSARY PERMITS AND FOR VERIFYING THE ACCURACY OF ALL DATA AND CONDITIONS. THE ENGINEER ASSUMES NO LIABILITY FOR ANY DAMAGE OR INJURY RESULTING FROM THE USE OF THIS PLAN.



EROSION CONTROL PLAN  
 LIGHTNING DOCK GEOTHERMAL  
 WELL PAD  
 HIS DPW  
 HIDALGO COUNTY NEW MEXICO  
 SECTION 180  
 01/17/08  
 EC - 2



# LIGHTNING DOCK GEOTHERMAL GENERATING PLANT

## EROSION CONTROL PLAN DETAILS

**EROSION DUST AND ROAD EROSION CONTROL - GENERAL NOTES**

1. EROSION CONTROL MEASURES SHALL BE INSTALLED AND MAINTAINED THROUGHOUT THE CONSTRUCTION PERIOD.
2. EROSION CONTROL MEASURES SHALL BE DESIGNED TO PREVENT SOIL EROSION AND TO CONTROL DUST AND SEDIMENTATION.
3. EROSION CONTROL MEASURES SHALL BE DESIGNED TO PREVENT SOIL EROSION AND TO CONTROL DUST AND SEDIMENTATION.
4. EROSION CONTROL MEASURES SHALL BE DESIGNED TO PREVENT SOIL EROSION AND TO CONTROL DUST AND SEDIMENTATION.
5. EROSION CONTROL MEASURES SHALL BE DESIGNED TO PREVENT SOIL EROSION AND TO CONTROL DUST AND SEDIMENTATION.



**CROSS SECTION OF STABILIZED CONSTRUCTION ENTRANCE**



**STABILIZED TRAIL**



**STABILIZED TRAIL**



NO.	DESCRIPTION	DATE	BY	CHECKED

**EROSION CONTROL PLAN  
DETAILS**

**LIGHTNING DOCK GEOTHERMAL  
GENERATING PLANT**

**HIDALGO COUNTY, JMW MEXICO**

**NO SCALE**

**EC - 3**

## Chavez, Carl J, EMNRD

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**From:** Jay Hamilton [hamiltonenviro@yahoo.com]  
**Sent:** Thursday, December 11, 2008 11:32 AM  
**To:** Chavez, Carl J, EMNRD; Price, Wayne, EMNRD; Fesmire, Mark, EMNRD  
**Cc:** Steve Brown; Michael Hayter; Jim Fosser; Brent Cook  
**Subject:** Re: Lightning Dock - Solid Wastes

Carl,

Thanks, for the information.

Regarding the Reserve and Well pits. It is the intent of Raser to have the smallest footprint as possible for the pits. During the drilling process the Reserve Pit needs to be approximately 250' X 100'. After the drilling and testing has been completed soil samples will be collected of the waste at the bottom of the pit. Raser will dispose of these wastes by meeting all local, state and federal regulations. Depending on the well at each location the Reserve Pit may be modified to meet the dimensions of the proposed Well Pits 100' x 80'. It may become necessary to cover the Reserve Pit because of site conditions and excavate a Well Pit for the site specific needs of the completed well. Please keep in mind Carl the the liner specifications are different for the Reserve and Well Pits. The liner in the Well Pits needs to have a life of 30 years. The final footprint of Well Pit at each location will be 100' x 80' for the life of the well.

On December 5, 2008 an email was forward to Mike Hayter about the OCD's request for a meeting with the geologist. I talked to Mike on Monday or Tuesday of this week, he said that he had called Wayne but did not make contact. He said he would follow-up on calling and talking to Wayne. I know that Mike considers this meeting extremely important. He will be getting a hold of Wayne in the next couple of days if his has not already.

Please, if there other concerns than the geology make a list and I will address them immediately.

Thanks,

Jay

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**From:** "Chavez, Carl J, EMNRD" <CarlJ.Chavez@state.nm.us>  
**To:** Jay Hamilton <hamiltonenviro@yahoo.com>; "Price, Wayne, EMNRD" <wayne.price@state.nm.us>; "Fesmire, Mark, EMNRD" <mark.fesmire@state.nm.us>; "VonGonten, Glenn, EMNRD" <Glenn.VonGonten@state.nm.us>  
**Cc:** Steve Brown <steve.brown@rasertech.com>; Michael Hayter <Michael.Hayter@rasertech.com>; Brent Cook <Brent.Cook@rasertech.com>  
**Sent:** Wednesday, December 10, 2008 4:40:43 PM  
**Subject:** RE: Lightning Dock - Solid Wastes

Jay:

Thanks for the clarification on OCD waste concerns. This information was provided to Mr. Nelson (NMED- Solid Waste Bureau) to determine which facilities may accept waste from your facility.

Regarding the reserve pit vs. well pit. I was under the impression one reserve pit would be constructed and used for annual well testing, etc. too. If Raser thinks 2 pits at each well location are needed, this is ok; however, you would reduce your footprint by constructing only 1 pit. Of course, drill cuttings would likely need to be removed from the reserve pit within 6 months of well completion in order to be reused. Think about it.

I have drafted a list of items from the hearing that the OCD needs to discuss with Raser's and AmeriCulture's experts. Mr. Wayne Price sent out an e-mail requesting a meeting to discuss the facility with our Senior Hydrologist, Mr. Glenn von Gonten. Wayne will be back next week, but he was hoping to hear back from Raser and AmeriCulture to facilitate a meeting to discuss draft items in an agenda and any hydrologic details that Mr. von Gonten raises. Let me know if I need to resend Wayne's e-mail from last week requesting a meeting. If not, please respond to the e-mail with a proposed date and time for meeting where we can meet in person to discuss here in Santa Fe or perhaps and telephone conference call may suffice?

Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3491  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>  
(Pollution Prevention Guidance is under "Publications")

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**From:** Jay Hamilton [mailto:[hamiltonenviro@yahoo.com](mailto:hamiltonenviro@yahoo.com)]  
**Sent:** Wednesday, December 10, 2008 2:15 PM  
**To:** Chavez, Carl J, EMNRD; Price, Wayne, EMNRD; Fesmire, Mark, EMNRD  
**Cc:** Steve Brown; Michael Hayter; Brent Cook  
**Subject:** Fw: Lightning Dock - Solid Wastes

Carl

Thanks, for your input regarding OCD's concerns with the handling of solid wastes that may be generated at the Lightning Dock facility.

Please refer to the original submission of the Plan of Operations dated February 1, 2008, where Raser Technologies outlined "Methods of Waste Materials" and April 21, 2008 when the "Discharge Plan Application for Brine Extraction" was submitted to the OCD. Refer to the following sections in the Discharge Plan Application for details:

- Type and Quantities of Fluids Stored or Used at the Facility
- Transfer, Storage and Disposal of Fluids and Solids
- Solid Disposal
- Off-site Disposal

I believe this information should address your concerns.

A local waste contractor will provide a disposal container and serve the disposal needs for Lightning Dock. After construction of the facility, the plant will generate very limited amounts of solid waste in the form of paper, rubbish, etc. The plant will be in operation 24/7 but will be manned by only 2-4 employees.

We believe as does OCD the possibility exists that some some geothermal waste may need to be hauled off-site and disposed of according to local, state and federal regulations and with the approval of OCD (see "Discharge Plan Application for Brine Extraction"). Raser understands some solid wastes may need to be hauled to an

adjoining county or state. Raser will identify a landfill that will fulfill their disposal needs and meet local, state and federal regulations.

At each site where Raser Technologies has completed geothermal drilling, geothermal reservoirs have had varied fluid chemistry. At each location drill cuttings and geothermal fluids have been dried, tested and met local, state and federal regulation and were approved to be closed in place with no hauling required.

Raser understands at the Lightning Dock site geothermal fluids chemistry has not yet been determined at the proposed drilling depths.

As stated in the previous documents, Raser will collect geothermal fluids at the appropriate depths and have them analyzed for the chemical constituents of concern. Raser will then dispose of the drill cuttings and geothermal fluids in a manner that meets local, state and federal regulations and only with the approval of the OCD.

In the large site map presented to OCD the Lightning Dock site shows a Reserve Pit and Well Pit at each well location. The Reserve Pit (approx. 250' x 100') is used during the drilling and testing process and will be closed after the process is completed. The Well Pit (100' x 80') is used to supplement the operation of the well. If during maintenance, testing or replacement of well components the well needs to shut down it may be necessary to drain the piping into the Well Pit. The Well Pits will be monitored during the life of the well. The Reserve and Well Pits will be constructed and lined according to the pond construction detail and pond liner specifications as presented to OCD in the supplemental information dated August 1, 2008.

Carl, I talked to Mike and he mentioned that during the hearing OCD stated there were some concerns they would like to have addressed before the final permit approval. Would you gather those concerns in a list and forward them on to me. I will get the information to you in the next week.

Thanks,

Jay

**Chavez, Carl J, EMNRD**

**From:** Gum, Tim, EMNRD  
**Sent:** Tuesday, May 06, 2008 2:28 PM  
**To:** Chavez, Carl J, EMNRD  
**Cc:** Price, Wayne, EMNRD; Gum, Tim, EMNRD  
**Subject:** RE: APDs & OCD Approval Lightening Dock Geothermal No. HI-01 (Hidalgo County)

Carl,

We have not received any APD's as of this date.

Has there been a change in procedure ? District II has never approved Geothermal wells up to this point.

Please advise.

TWG

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Tuesday, May 06, 2008 9:11 AM  
**To:** Gum, Tim, EMNRD  
**Cc:** Price, Wayne, EMNRD; Jones, William V., EMNRD; Jay Hamilton; Phillips, Dorothy, EMNRD  
**Subject:** APDs & OCD Approval Lightening Dock Geothermal No. HI-01 (Hidalgo County)

Tim:

Good morning. I inspected the power plant facility location on 5/1/08 w/ Jay Hamilton (Los Lobos) & Jim Rosser (Raser Geothermal Engineer). Jay informed me that the APDs for the wells were mailed to you at the facility. Lightening Dock needs to register very soon as an operator in NM at <http://www.emnrd.state.nm.us/ocd/FAQs.htm#OpHow> to receive an OGRID number for bond tracking, etc. from Dorothy Phillips (Bond Coordinator) at (505) 476-3461 for the geothermal development or production wells. Dorothy please create note in file that geothermal wells can only be authorized to be plugged by the Environmental Bureau in Santa Fe. It is an online process. Once the APDs are approved and API#s are issued, the previously discussed bonds (WQCC) for the injection wells will need to be procured by the owner/operator and submitted to me in Santa Fe. The bonds (single & multi-well) for the development or production wells may also be sent to me and I will coordinate with Dorothy to file and track bonds for geothermal development/production wells. Remember that API# should be referenced on the bonds and the OCD should only receive the original or duplicate original of the bonds for our files.

OCD AOR & Well Info. for APDs for your consideration of the APDs below.

Development/Production Well (5) Flow Rates ~ 3000 gpm per well (estimated total ~15,000 gpm)  
 Injection Well (3) Rates ~ Unknown at the time of the inspection (Raser contends that injection pressure regulation is a moot point for fractured reservoirs). OCD estimates ~ 5500 gpm per well (estimated 16,500 gpm)  
 Fresh Water Demand ~ 1500 gpm  
 Cooling Tower Blowdown ~ 425 gpm

The OCD's Area of Review of ½ mile radius from all proposed geothermal resource wells conducted by the OCD Engineering Bureau concluded that no wells exist that lack cement in the proposed geothermal reservoir. Based on the facility (20 acre x 20 acre) location and geologic information provided by Los Lobos (see attachment), the OCD Environmental Bureau is deferring to OCD District 2 (Artesia) approval with any conditions for the 3 injection wells and 5 development or production wells set in the Horquilla Formation (suspected fractured limestone between intrusive volcanics) to an estimated depth of 3400 ft. bgl. with reservoir temperatures at 250 – 300 F.

However, I am a little puzzled by page 5 of the attachment, which displays multiple production zones from 2500 – 3100 ft. and from 3600 – 4008 ft. bgl. During the inspection, I was under the impression that the geothermal

reservoir was the Horquilla Formation? Jay could you please respond to this? Based on page 5, the production wells appear to open to formations above and below the Horquilla Formation.

Los Lobos and Raser were informed that cement would be required from top to bottom and they are planning to pressure up on all drilling strings during the course of drilling operations to test integrity during the well construction process. There may be an issue with the structural integrity of the formations based on structural integrity of lithologies, potential blow-outs and detection of H<sub>2</sub>S during and after drilling, and Los Lobos is aware of this. The question of where to set the casing shoe came up? I think the casing shoe should be set above any fractured zones near the geothermal reservoir, but it is OCD District 2 decision on approval of APDs with conditions. Tim could you please send me the signed APDs for the online file when or if you approve the APDs? Raser explained that regulation of injection pressure is a moot point for highly fractured reservoirs that are required for geothermal reservoirs. Consequently, the EPA 5 Yr. MIT at minimum 600 psig for 30 minutes and after workovers is planned for the OCD discharge permit.

Other Issues:

Large evaporation ponds for conducting geothermal well tests (liners with good thermal characteristics should be considered). A presentation on pits rule suggestions was e-mailed out to Los Lobos earlier this morning for consideration. Los Lobos had proposed a couple of ponds in the facility process area (one was for cooling tower blow down ~425 gpm), but since the cooling tower is not closed-loop and chemicals are needed to prevent scaling of the unit, Los Lobos is looking at options (i.e., biodegradable chemicals, treatment before injection, injection into the geothermal reservoir, and disposal into a deeper formation). If Los Lobos drills with reserve pits, the land disturbance will be much greater. Then they will still need a very large pit(s) (> 1 M gallons for well testing). They had not considered this in their process area diagram.

Onsite/Offsite Disposal of Drill Cuttings?

Los Lobos is working to procure water well drilling rights to consider installing a freshwater well within its facility process area. Although, there are several freshwater wells that are already drilled that could be upgraded to provide freshwater at the site; however, are located outside of its facility process area.

Tim, Los Lobos Contact Info. is provided below.

Jay Hamilton

Hamilton Environmental, L.L.C.

485 West 1400 North

Orem, Utah 84057

Office (801) 224-4585

Fax (801) 224-1893


Cell (801) 361-2102

e-mail [hamiltonenviro@yahoo.com](mailto:hamiltonenviro@yahoo.com)

I am working on a final e-mail with action items for the "Administrative Completeness" determination and other issues identified during the facility inspection. I hope to send this out Wednesday, but it appears that much of the info. discussed during the facility inspection was submitted by Los Lobos. There will need to be some revisions to the reports to include H<sub>2</sub>S for equipment, emergencies, etc., binary cycle power plant specs in the equipment list, etc. Please contact me if you have questions. Thank you.

5/21/2008

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3491  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>  
(Pollution Prevention Guidance is under "Publications")



New Mexico Energy, Minerals and Natural Resources Department

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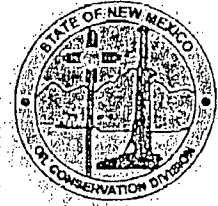
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**Bill Richardson**

Governor

Joanna Prukop  
Cabinet Secretary

Mark Fesmire  
Division Director  
Oil Conservation Division



July 1, 2009

Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
5152 North Edgewood Drive, Suite 375  
Provo, Utah 84604

**RE: LOS LOBOS RENEWABLE POWER, L.L.C. - LIGHTNING DOCK  
GEOTHERMAL NO. 1 (HI-01) DISCHARGE PERMIT (GTHT-001)  
NE/4 SW/4 OF SECTION 7, TOWNSHIP 25 SOUTH, RANGE 19 WEST,  
NMPM, HIDALGO COUNTY, NEW MEXICO  
CLASS V INJECTION WELLS AND GEOTHERMAL PRODUCTION OR  
DEVELOPMENT WELLS, TOWNSHIP 25 SOUTH, RANGES 19 AND 20 WEST,  
NMPM, HIDALGO COUNTY, NEW MEXICO**

Dear Mr. Brown:

Pursuant to the Water Quality Control Commission (WQCC) Regulations 20.6.2.3104 through 20.6.2.3114 NMAC (*Permitting and Ground Water Standards*) and 20.6.2.5000 through 20.6.2.5299 NMAC (*Underground Injection Control*), the Oil Conservation Division (OCD) hereby approves the discharge permit for of three (3) Class V geothermal injection wells and authorizes the operation of five (5) production or development wells for the Los Lobos Renewable Power, L.L.C. (**owner/operator**) for the above referenced site, contingent upon the conditions specified in the enclosed **Attachment 1 to the Discharge Permit**. The owner/operator of the geothermal power plant is located in the NE/4 SW/4 of Section 7, Township 25 South, Range 19 West, NMPM, Hidalgo County, New Mexico. The Class V geothermal injection wells and the production or development wells are located in Township 25 South, Ranges 19 and 20 West, NMPM, Hidalgo County, New Mexico.

**Class V Injection Wells**

Well 42-18 is located in the NE/4, NW/4 of Section 18 (1307 FNL and 2123 FWL)  
Well 51-07 is located in the NW/4, NE/4 of Section 07 (169.2 FNL and 2406.9 FEL)  
Well 53-12 is located in the SW/4, NE/4 of Section 12 (1574.8 FNL and 3350 FWL)

Oil Conservation Division \* 1220 South St. Francis Drive

\* Santa Fe, New Mexico 87505

\* Phone: (505) 476-3440 \* Fax (505) 476-3462 \* <http://www.emnrd.state.nm.us>





Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
July 1, 2009  
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### Geothermal Production or Development Wells

Well 13-07 is located in the SW/4, NW/4 of Section 7 (3781 FSL and 530 FWL)  
Well 33-07 is located in the SE/4, NW/4 of Section 7 (3721 FSL and 1789 FWL)  
Well 45-07 is located in the NE/4, SW/4 of Section 7 (2360 FSL and 2278 FWL)  
Well 47-07 is located in the SE/4, SW/4 of Section 7 (1219 FSL and 2266 FWL)  
Well 53-07 is located in the SW/4, NE/4 of Section 7 (3775 FSL and 3052 FWL)

Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the Oil Conservation Division (OCD) Santa Fe Office within 30 days of receipt of this letter.**

Please be advised that approval of this permit does not relieve the owner/operator of responsibility should operations result in pollution of surface water, ground water or the environment. Nor does approval of the permit relieve the owner/operator of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions, please contact Carl Chavez of my staff at (505-476-3490) or E-mail carlj.chavez@state.nm.us. On behalf of the staff of OCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,



Mark Fesmire  
Oil Conservation Division Director

MF/cc

Attachments - 1

xc: OCD District Office

**ATTACHMENT 1**  
**LIGHTNING DOCK GEOTHERMAL NO. 1 (HI-01) (GTHT-001)**  
**DISCHARGE PERMIT APPROVAL CONDITIONS**

- 1. Payment of Discharge Plan Fees:** All discharge permits are subject to WQCC Regulations. Every billable facility that submits a discharge permit application will be assessed a filing fee of \$100.00 plus a renewal flat fee (see WQCC Regulation 20.6.2.3114 NMAC). The Oil Conservation Division (OCD) has received the required \$100.00 filing fee and the \$1700.00 Class V Geothermal Well permit fee.
- 2. Permit Expiration and Renewal:** Pursuant to WQCC Regulation Paragraph 4 of Subsection H of 20.6.2.3109 NMAC, this permit is valid for a period of five years. **This permit will expire on August 4, 2014** and an application for renewal should be submitted no later than 120 days before that expiration date. Pursuant to WQCC Regulation Subsection F of 20.6.2.3106 NMAC, if a discharger submits a discharge permit renewal application at least 120 days before the discharge permit expires and is in compliance with the approved permit, then the existing discharge permit will not expire until the application for renewal has been approved or disapproved. *Expired permits are a violation of the Water Quality Act {Chapter 74, Article 6 NMSA 1978} and civil penalties may be assessed accordingly.*
- 3. Permit Terms and Conditions:** Pursuant to WQCC Regulation 20.6.2.3104 NMAC, when a permit has been issued, the owner/operator must ensure that all discharges shall be consistent with the terms and conditions of the permit. In addition, all facilities shall abide by the applicable rules and regulations administered by OCD pursuant to the Geothermal Resources Conservation Act (71-5-1 through 71-5-24 NMSA) and the Geothermal Power regulations (19.14.1 through 19.14.132 NMAC).
- 4. Owner/Operator Commitments:** The owner/operator shall abide by all commitments submitted in its May 12, 2008 discharge permit application, including attachments and subsequent amendments and these conditions. Permit applications that reference previously approved plans on file with OCD shall be incorporated in this permit and the owner/operator shall abide by all previous commitments of such plans and these conditions for approval.
- 5. Modifications:** WQCC Regulations Subsection C of 20.6.2.3107 NMAC, 20.6.2.3109 NMAC and Subsection I of 20.6.2.5101 NMAC address possible future modifications of a permit. The owner/operator (discharger) shall notify OCD of any facility expansion, production increase or process modification that would result in any significant modification in the discharge of water contaminants. The Division Director may require a permit modification if any water quality standard specified at WQCC Regulation 20.6.2.3103 NMAC is being or will be exceeded or if a toxic pollutant as defined in WQCC Regulation 20.6.2.7 NMAC is present in ground water at any place of withdrawal for present or reasonably foreseeable future use or that the Water Quality Standards for Interstate and Intrastate streams as specified in WQCC Regulation 20.6.4 NMAC (*Water Quality Standards for Interstate and Intrastate Streams*) are being or may be violated in surface water in New Mexico.

**6. Waste Disposal and Storage:** The owner/operator shall dispose of all wastes at an OCD-approved facility. Only geothermal RCRA-exempt wastes (*e.g.* geothermal production fluids, hydrogen sulfide abatement wastes from geothermal energy production, *etc.*) may be disposed of by injection in a Class II salt water disposal well. RCRA non-hazardous, non-exempt geothermal wastes may be disposed of at an OCD-approved facility upon proper waste determination pursuant to 40 CFR part 261. Any waste stream that is not listed in the discharge permit application must be approved by OCD on a case-by-case basis.

**A. Disposal Of Certain Non-Domestic Waste At Solid Waste Facilities:** Pursuant to 19-15-35-8 NMAC disposal of certain non-domestic waste without notification to OCD is allowed at NMED permitted solid waste facilities if the waste stream has been identified in the discharge permit and existing process knowledge of the waste stream does not change.

**B. Waste Storage:** The owner/operator shall store all waste in an impermeable bermed area, except waste generated during emergency response operations for up to 72 hours. All waste storage areas shall be identified in the discharge permit application. Any waste storage area not identified in the permit shall be approved on a case-by-case basis only. The owner/operator shall not store geothermal waste on-site for more than 180 days unless approved by OCD.

**7. Drum Storage:** The owner/operator must store drums, including empty drums, or drums containing materials other than fresh water on an impermeable pad with curbing. The owner/operator must store empty drums on their sides with the bungs in place and lined up on a horizontal plane. The owner/operator must store chemicals in other containers, such as tote tanks, sacks or buckets on an impermeable pad with curbing.

**8. Process, Maintenance and Yard Areas:** The owner/operator shall either pave and curb or have some type of spill collection device incorporated into the design at all process, maintenance and yard areas which show evidence that water contaminants from releases, leaks and spills have reached the ground surface.

**9. Above-Ground Tanks:** The owner/operator shall ensure that all aboveground tanks have impermeable secondary containment (*e.g.* liners and berms), which will contain a volume of at least one-third greater than the total volume of the largest tank or all interconnected tanks. The owner/operator shall retrofit all existing tanks before discharge permit renewal. Tanks that contain fresh water or fluids that are gases at atmospheric temperature and pressure are exempt from this condition.

**10. Labeling:** The owner/operator shall clearly label all tanks, drums and containers to identify their contents and other emergency notification information. The owner/operator may use a tank code numbering system, which is incorporated into their emergency response plans.

## 11. Below-Grade Tanks/Sumps and Pits/Ponds.

A. All below-grade tanks and sumps must be approved by OCD prior to installation and must incorporate secondary containment with leak detection into the design. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal. Owner/operator must test all existing below-grade tanks and sumps without secondary containment and leak detection annually, or as specified herein. For all systems that have secondary containment with leak detection, owner/operator shall perform a monthly inspection of the leak detection system to determine if the primary containment is leaking. Small sumps or depressions in secondary containment systems used to facilitate fluid removal are exempt from these requirements if fluids are removed within 72 hours.

B. All pits and ponds, including modifications and retrofits, shall be designed by a registered professional engineer and approved by OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.

C. The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted or otherwise rendered non-hazardous to wildlife, including migratory birds. Where netting is not feasible, routine witnessing and/or discovery of dead wildlife and migratory birds shall be reported by the owner/operator to the appropriate wildlife agency with notification also provided to OCD in order to assess and enact measures to prevent the above from reoccurring.

D. The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure and/or visual inspection of cleaned tanks and/or sumps or other OCD-approved methods. The owner/operator shall notify OCD at least 72 hours prior to all testing.

## 12. Underground Process/Wastewater Lines:

A. The owner/operator shall test all underground process/wastewater pipelines at least once every five (5) years to demonstrate their mechanical integrity, except lines containing fresh water or fluids that are gases at atmospheric temperature and pressure. The owner/operator shall submit a comprehensive listing of process/wastewater pipelines to OCD within three months of the date of the permit issuance. The owner/operator shall test pressure rated pipe by pressuring up to



one and one-half times the normal operating pressure, if possible or for atmospheric drain systems to 3 pounds per square inch greater than normal operating pressure and pressure held for a minimum of 30 minutes with no more than a 1% loss/gain in pressure. The owner/operator may use other methods for testing if approved by OCD.

**B.** The owner/operator shall maintain underground process and wastewater pipeline schematic diagrams or plans showing all drains, vents, risers, valves, underground piping, pipe type, rating, size and approximate location. All new underground piping must be approved by OCD prior to installation. The owner/operator shall report any leaks or loss of integrity to OCD within 15 days of discovery. The owner/operator shall maintain the results of all tests at the facility covered by this discharge permit and they shall be available for OCD inspection. The owner/operator shall notify OCD at least 72 hours prior to all testing.

**13. Class V Wells:** With the exception of Class V geothermal energy injection wells associated with the recovery of geothermal energy for heating, aquaculture, and production of electrical power, the owner/operator shall close all Class V wells (e.g., septic systems, leach fields, dry wells, etc.) that inject non-hazardous industrial wastes or a mixture of industrial wastes and domestic sanitary effluent wastes, unless it can be demonstrated that ground water will not be impacted in the reasonably foreseeable future. Leach fields and other wastewater disposal systems at OCD-regulated facilities that inject sanitary effluent and non-hazardous fluid into or above an underground source of drinking water are considered Class V injection wells under the EPA UIC program. Class V wells that inject domestic sanitary effluent waste only must be permitted by the New Mexico Environment Department (NMED).

**14. Housekeeping:** The owner/operator shall inspect all systems designed for spill collection/prevention and leak detection at least monthly to ensure proper operation and to prevent over-topping or system failure. All spill collection and/or secondary containment devices shall be emptied of fluids within 72 hours of discovery. The owner/operator shall maintain all records at the facility and available for OCD inspection.

**15. Spill Reporting:** The owner/operator shall report all unauthorized discharges, spills, leaks and releases and shall conduct corrective actions pursuant to WQCC Regulation 20.6.2.1203 NMAC and 19.15.29 NMAC. The owner/operator shall notify both OCD District Office and the Santa Fe Office within 24 hours and file a written report within 15 days. The owner/operator shall notify OCD of any fire, break, leak, spill or blowout occurring at any geothermal drilling, producing, transporting, treating, and disposal or utilization facility in the State of New Mexico by the person operating or controlling the facility pursuant to 19.14.36.8 NMAC.

**16. OCD Inspections:** OCD may impose additional requirements on the facility and modify the permit conditions based on OCD inspections.

**17. Storm Water:** The owner/operator shall implement and maintain run-on and runoff plans and controls. The owner/operator shall not discharge any water contaminant that exceeds the WQCC standards specified in WQCC Regulations 20.6.2.31.03 NMAC or 20.6.4 NMAC including

Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
July 1, 2009  
Page 7

any oil sheen, in any storm water run-off. The owner/operator shall notify OCD within 24 hours of discovery of any releases and shall take immediate corrective action(s) to stop the discharge.

**18. Unauthorized Discharges:** The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3103 NMAC (*Standards for Ground Water of 10,000 mg/L TDS Concentration or Less*) or 20.6.4 NMAC (*Water Quality Standards for Interstate and Intrastate Streams*) unless specifically listed in the permit application and approved herein.

*An unauthorized discharge is a violation of this permit.*

**19. Vadose Zone and Water Pollution:** The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000 through 20.6.2.4116 NMAC (*Prevention and Abatement of Water Pollution*). OCD may require the owner/operator to modify its permit for investigation, remediation, abatement and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement or to submit subsequent reports will constitute a violation of the permit.

**20. Additional Site Specific Conditions - Water Quality Monitoring Program:** The owner/operator shall implement the following water quality monitoring programs.

**A. Aquatic Toxicity Testing:** Prior to the startup of geothermal operations, the owner/operator shall conduct an aquatic toxicity test (ATT) on the Tilapia fish species present at the AmeriCulture aquaculture facility located down-gradient from the owner/operators proposed Class V injection well locations with all NALCO cooling-tower chemical constituents. The chemicals used in the ATT shall consist of the high range application of all mixed Nalco chemicals proposed during the hearing on December 1, 2008, to determine the LD<sub>50</sub> under a worst-case scenario. OCD will use the results of the ATT as a tool to help assess the threat to Aquaculture and wildlife near the facility.

**B. Ground Water and Surface Water Sampling and Monitoring Requirements:**

- i. The owner/operator shall submit a ground water monitoring program work plan that includes a well installation and monitoring plan and a sampling and analysis plan for the monitor wells to the OCD Santa Fe Office for approval at least 3 months before system startup. The owner/operator shall conduct all water quality monitoring using low-flow purging and sampling methods where monitor well screens do not exceed 15 feet with 5 feet of screen placed above the water table (potential for water table draw-down addressed at subpart 20(B)(iii)). If multiple isolated fresh water aquifers are found to exist, the owner/operator shall include a provision in the work plan for the installation of additional monitor wells.

- to monitor for contamination in any different fresh water aquifer system(s)
- ii. The owner/operator shall submit a Background and Compliance Report reflecting the first 6 months of sampling conducted to the OCD within 30 days of completion of the first 6 months of sampling that includes the results of the initial sampling conducted in accordance with Permit Conditions 20 and 21 to determine background water quality conditions at the facility and compliance with WQCC 20.6.2.3.103 NMAC and Subparagraph W.W. of 20.6.2.7 NMAC. The report shall specify all monitoring locations, including nested wells, hydrogeology, piezometric and/or potentiometric ground water flow direction, hydraulic gradient and water quality data from all monitoring locations and down-gradient locations from potential point sources at the facility (*i.e.* cooling tower blow-down combined with spent production water at all Class V Well injection locations). The report shall note all exceedences of the standards specified in WQCC 20.6.2.3.103 NMAC or background, or if any toxic pollutant as defined in WQCC Subparagraph W.W. of 20.6.2.7 NMAC has been detected.
  - iii. The owner/operator shall implement the ground water monitoring program specified in the applicable Tables in Appendix I. The owner/operator shall monitor static water levels from monitoring locations at least quarterly to assess ground water flow direction and hydraulic gradient at the facility. If draw-down of the water table below the screen level in any monitor well occurs at and/or nearby production or development well locations, the owner/operator shall deepen wells within 30 days to provide for monitoring and the OCD and Office of the State Engineer (OSE) District Supervisor shall be notified within 24 hours of having knowledge of the above. In addition, the Owner/Operator shall provide a written statement of whether the water resource in the Animas Valley is or is not adequate to sustain steady-state production of the geothermal resource within 60 days of the original notification above. The OCD and OSE may require the owner/operator to perform corrective action(s) to private water user wells that are adversely affected by geothermal operations. The OCD and/or OSE may require the owner/operator to implement corrective action(s) to private water wells depending on the situation.
  - iv. The owner/operator shall gauge and sample nested monitor well head elevations (accuracy to 0.01 ft.) recorded to establish the natural vertical hydrogeologic gradient(s) within the aquifer(s) or between reservoir(s) and to monitor for any potentially upwelling contamination to nearby down-gradient pumping domestic and commercial water supply wells.

- v. The owner/operator shall comply with the Federal Underground Injection Control requirements for Class V Wells (40 CFR 144 subpart G) and WQCC 20.6.2 NMAC injection well construction standards to protect the Underground Source of Drinking Water (USDW). The owner/operator shall immediately shut down the system and contact the OCD for further instructions if the concentration of any water contaminants in the injection fluids exceed the greater of the standards specified in WQCC 20.6.2.3103 NMAC or background, as established for the injection formation at the injection well location pursuant to Clause (i) of Paragraph 21.D, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected.
- vi. The owner/operator shall construct all monitor wells with at least 15 feet of screen with 10 feet of screen positioned below the water table (~ 60 – 70 feet bgs). The screen slot size must facilitate the collection of low turbidity samples. Low-flow ground water sampling may be used with stabilization monitoring for temperature, oxygen reduction potential (ORP) and dissolved oxygen (DO) prior to and during sample collection, if wells are constructed for low-flow sampling techniques. Otherwise, the owner/operator shall purge the wells of three well volumes prior to sampling.
- vii. The owner/operator shall triangulate seasonal piezometric surface flow across the facility, including surveying all well locations (TOC and ground elevations, Mean Sea Level) to the nearest 0.01 feet. The owner/operator shall measure static water levels at least quarterly for 2 years to determine ground water flow direction. The owner/operator shall submit plots of ground water flow direction with estimates of hydraulic gradients from quarterly monitoring.
- viii. The owner/operator shall notify the Santa Fe OCD office immediately after having knowledge that the concentration of a monitor well sample exceeds the greater of the water quality standards specified in WQCC 20.6.2.3103 NMAC or background established at that well's location pursuant to the monitoring program described in this paragraph or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, is detected. In the event of an exceedence, the owner/operator may be required to shut down the operation for such time as may be necessary to allow the owner/operator and OCD to investigate the cause of the exceedence. If the cause is associated with geothermal operations, the OCD may invoke the permit modification provision for treatment provided herein, and may require additional conditions.



**C. Water Supply Wells Monitoring Program:**

- i. The owner/operator shall sample all water supply wells in accordance with Table 3 of Appendix I prior to owner/operator startup to establish background water quality conditions and thereafter at least annually to demonstrate that the water quality of the water supply wells does not exceed the greater of the standards specified in WQCC 20:6-2-3.103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20:6-2-7 NMAC, is present.
- ii. The owner/operator shall determine the depth to water, ground elevation, and well elevation to an accuracy of 0.01 foot.
- iii. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of the ground water sample exceeds the greater of the standards specified in WQCC 20:6-2-3.103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20:6-2-7 NMAC, is detected.

**D. Holding Ponds, Drainage Ditches, Pits and Ponds Monitoring Program:** The owner/operator shall sample the holding ponds, drainage ditches, pits and ponds in accordance with Table 4 of Appendix I. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of a water sample taken at an unlined ditch or location listed above exceeds the greater of the standards specified in WQCC 20:6-2-3.103 NMAC or background. *Note: Table 4 analytes consist of metals and general chemistry only. They do not monitor for toxic pollutants, as defined in WQCC Subparagraph WW of 20:6-2-7 NMAC.*

**E. Spent Produced Water and Cooling-Tower Blow-Down Water Monitoring Program:**

- i. The owner/operator shall submit a flow diagram to the OCD Santa Fe Office that depicts where the commingled spent produced water and cooling-tower blow-down water will be sampled in-line before injection, as well as specification of injection well sample port locations used for the in-line sampling at least 30 days before system startup.
- ii. The owner/operator shall sample and analyze the commingled spent produced water and cooling-tower blow-down water daily for 10 business days at system startup, weekly for two months, and thereafter the sampling frequency shall be based on correlation that the owner/operator established with the 3D Trecar Control Monitoring System in accordance with Table 5 of Appendix I to this discharge permit. Injection wells shall be sampled

monthly for 6 months in accordance with the analytical suite in Table 2 of Appendix 1.

- iii. The owner/operator shall inject commingled spent produced water and cooling-tower blow-down water only if it meets either the standards for ground water specified at Subparagraph WW of 20.6.2.7 NMAC and 20.6.2.3103 NMAC or the background concentration as established from the first sampling event. In-line sample ports or devices shall be installed at each injection well to enable owner/operator to perform the in-line sampling required herein, to ensure that the specified requirements for spent produced water and cooling-tower blow-down water are met.
  - iv. The owner/operator shall not discharge untreated chemicals to storm water and/or "Waters of the State." Any discharge to a rip-rap area(s) is an illegal discharge. The owner/operator shall inform the OCD Santa Fe office within 72 hours of discovery of a discharge to a rip-rap basin. Discharges shall be routed to lined pits or evaporation pond areas whenever possible.
  - v. The owner/operator may only discharge into "Waters of the State" in accordance with a National Pollutant Discharge Elimination System (NPDES) Permit issued by EPA Region 6. The OCD must approve the discharge concurrently with EPA. The applicant must comply with all of the Federal NPDES monitoring, treatment, and reporting requirements specified in its NPDES permit.
- F. Annual Water Quality Monitoring Program Report:** The owner/operator shall submit an Annual Water Quality Monitoring Program Report by January 31 of each year. The report shall include the following information:
- i. Cover sheet marked as "Annual Water Quality Monitoring Program Report, name of owner/operator, Discharge Permit Number, API number(s) of well(s), date of report and the name of the person submitting report.
  - ii. Comprehensive summary of all water quality monitoring data.
  - iii. Summary charts and tables depicting the constituents that have ever exceeded the standards specified in WQCC 20.6.2.3103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected.
  - iv. Description and reason for any remedial or work on well(s), ponds, ditches, etc.
  - v. Copies of the chemical analyses in accordance with Permit Condition 20.

- vi. A copy of any leaks and spills reports submitted in accordance with Permit Condition 15 above.
- vii. A "Miscellaneous" section to include any other issues that should be brought to OCD's attention.
- viii. Discharge Permit Signatory Requirements pursuant to WQCC Regulation Subsection G of 20.6.2-5101 NMAC.

**21. Class V Geothermal Injection Wells and Geothermal Production or Development Wells.**

**A. Well Identification:**

**Class V Geothermal Injection Wells:**

- Well No. 42-18 (API No. 30-023-20018)
- Well No. 51-07 (API No. 30-023-20020)
- Well No. 53-12 (API No. 30-023-20019)

**ii. Geothermal Production or Development Wells:**

- Well No. 13-07 (API No. 30-023-20013)
- Well No. 33-07 (API No. 30-023-20014)
- Well No. 45-07 (API No. 30-023-20015)
- Well No. 47-07 (API No. 30-023-20016)
- Well No. 53-07 (API No. 30-023-20017)

**B. Well Casing and Cementing Requirements:**

- i. The owner/operator shall ensure that all casing and cementing meets or exceeds the requirements of 19.14.27.8 NMAC (*Casing and Cementing Requirements*). Conductor pipe shall be run to a minimum depth of 100 feet.
- ii. Surface casing shall be to a depth of at least 100 feet greater than the deepest fresh water well within one-half mile from the well location.
- iii. Intermediate strings shall be cemented solid to surface.
- iv. Production casing shall either be cemented solid to the surface or lapped into intermediate casing if run. If production casing is lapped into an intermediate string, the casing overlap shall be at least 50 feet. The lap shall be cemented solid and it shall be pressure tested to ensure integrity.

- v. The owner/operator shall submit a logging program to OCD for review with the owner/operator depth setting recommendations for its casing program based on the logging program. The owner/operator prior to setting intermediate or production casing in each of the production and injection wells shall run open-hole logs, pursuant to the logging program, approved by the OCD. Logs must be submitted to the OCD for review with the applicant's recommendations for casing setting depths, and in case of injection wells, for precise definition of the injection interval. The type of tubing installed shall be conducive to the characteristics of the injected fluids determined after initial testing of the injected fluids. The owner/operator shall ensure that the tubing is installed with a packer set within 100 feet of the uppermost injection perforations. The casing-tubing annulus shall be filled with an inert fluid, and a gauge or approved leak-detection device shall be connected to the annulus to detect for leakage in the casing, tubing or packer.
- C. **Formation Fracturing Fluids:** The owner/operator shall ensure that all fluids used in the fracturing of formations shall not harm human health, wildlife or the environment. The owner/operator shall ensure that all fluids used to fracture shall be swabbed back, collected and properly disposed.
- D. **Class V Geothermal Injection Wells and Geothermal Production/Development Wells Monitoring Program:**
  - i. The owner/operator shall sample the groundwater at all injection and production/development wells prior to owner/operator startup in accordance with Table 2 of Appendix 1 to establish background water quality conditions.
  - ii. The owner/operator shall sample cooling tower effluent (and not the groundwater) at all injection wells monthly for the first six months with dynamic water level (DWL) recordings in accordance with Table 2 of Appendix 1 to demonstrate that the injection fluid meets the standards specified in WQCC 20.6.2.3103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected.
  - iii. If after the first six months the owner/operator demonstrates that the in-line injection well samples meet the standards specified in WQCC 20.6.2.3103 NMAC or background, and that no toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2.7 NMAC, has been detected, then the owner/operator shall then sample ground water annually in accordance with the other annual monitoring events.



- iv. The owner/operator shall determine the depth to water, ground elevation and well elevation to an accuracy of 0.01 foot. The owner/operator shall notify the OCD Santa Fe office within 72 hours of its determination that the concentration of the ground water sample exceeds the greater of the standards specified in WQCC 20.6.2-3.103 NMAC or background, or if any toxic pollutant, as defined in WQCC Subparagraph WW of 20.6.2-7 NMAC, is detected.
- E. Well Workover Operations:** The owner/operator shall obtain OCD's approval prior to performing remedial work, pressure test or any non-routine work. The owner/operator shall request approval on form G-103, "*Sundry Notice*", pursuant to 19.14.52 NMAC, with copies provided to both the OCD Artesia District II Office and the Santa Fe Office.
- F. Production/Injection Method:** The production/injection method that the owner/operator shall follow is as follows: High temperature (>250 °F) geothermal water shall be brought to surface from the Horquilla Formation or geothermal reservoir at approximately 3,400 feet below ground level by five (5) production or development wells at approximately 3,000 gpm per well. Hot water shall be routed in parallel and in series through approximately 50 binary cycle (self-contained heat exchanger, evaporator and condenser) power generation units. Condensed produced or effluent water (approximately 225 °F) shall be routed directly to three (3) Class V geothermal wells and into the same depth within the Horquilla Formation or geothermal reservoir.
- G. Well Pressure Limits:** The owner/operator shall ensure that the operating surface injection and/or test pressure for each injection well measured at the wellhead shall be at a flow rate and pressure (psi) that will not exceed 0.2 psi per foot of depth from the surface to the top of injection interval, unless the owner/operator secures OCD approval for an increase based on demonstration that the increase will not involve a hazard of formation fracture and/or adversely affect public health, the environment and the correlative rights of any geothermal operators in the high temperature geothermal reservoir. The Owner/Operator shall report the intended maximum injection pressure to the Division for approval after testing the injection formation and prior to the commencement of injection in accordance with Form G-112. Re-injected fluids shall be confined to the aquifer where production is occurring and shall not adversely impact another aquifer(s). The owner/operator shall have working pressure limiting devices or controls to prevent overpressure. The owner/operator shall report any pressure that causes damage to the system to OCD within 24 hours of discovery.
- H. Mechanical Integrity Testing:** At least once every five years and after any well work over, the geothermal reservoir will be isolated from the casing or tubing annulus and the casing pressure tested at a minimum of 600 psig for 30 minutes.

A passing test shall be within +/- 10% of the starting test pressure. All pressure tests must be performed in accordance with the testing schedule shown below and witnessed by OCD staff unless otherwise approved.

Testing Schedule:

2009: Prior to system start-up, a 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing), and

2013: A 30 minute casing pressure test at a minimum of 600 psig (set packer above casing shoe to isolate formation from casing)

- I. **Capacity/Reservoir Configuration and Subsidence Survey:** The owner/operator shall provide information on the size and extent of the geothermal reservoir and geologic/engineering data demonstrating that continued geothermal extraction will not cause surface subsidence, collapse or damage to property or become a threat to public health and the environment. This information shall be supplied to OCD in each annual report. OCD may require the owner/operator to perform additional well surveys, tests, etc. A subsidence monitoring section is required in the annual report and shall include well top-of-casing and ground elevation surveying (Accuracy: 0.01 ft.) before start-up and on an annual basis in order to demonstrate that there are no subsidence issues. If the owner/operator cannot demonstrate the stability of the system to the satisfaction of OCD, then OCD may require the owner/operator to shut-down, close the site and properly plug and abandoned the wells. The owner/operator shall report any subsidence to the OCD Santa Fe office within 24 hours of discovery.
- J. **Production/Injection Volumes:** After placing a geothermal well on production, the owner/operator shall file in duplicate a monthly production report form G-108, with the OCD Santa Fe office by the 20th day of each month and also with the annual reports. The owner/operator shall also document the production from each well and each lease during the preceding calendar month.
- K. **Analysis of Injection and Geothermal Reservoir Fluids:** After placing any well on injection in a geothermal resources field or area, the owner/operator shall file in duplicate a monthly injection report, form G-110, with the OCD Santa Fe office by the 20th day of each month and also with the annual report. The owner/operator shall specify the zone or formation into which injection is being made, the volume injected, the average temperature of the injected fluid and the average injection pressure at the wellhead.
- L. **Area of Review (AOR):** The owner/operator shall report within 24 hours of discovery of any new wells, conduits or any other device that penetrates or may

penetrate the injection zone within one-quarter mile from a Class V Geothermal Injection Well. *Note: AOR applies specifically to Class V Injection Wells.*

**M. Annual Geothermal Temperature and Pressure Tests:** The owner/operator shall test its production or development wells at least annually and submit the results to the OCD Santa Fe office on form G-111 within 30 days of the completion of the test. The owner/operator shall record the flowing temperatures and flowing pressure tests at the wellhead for a minimum of 72 hours of continuous flow at normal producing rates. The owner/operator shall then shut in the well for 24 hours and record the shut-in pressures at the wellhead. The owner/operator shall submit the results of these tests in duplicate to the OCD Santa Fe office.

**N. Loss of Mechanical Integrity:** The owner/operator shall report to the OCD Santa Fe Office within 24 hours of its discovery of any failure of the casing, tubing or packer or movement of fluids outside of the injection zone. The owner/operator shall cease operations until proper repairs are made and the owner/operator receives OCD approval to re-start injection operations.

**O. Bonding or Financial Assurance:**

i. **Class V Geothermal Injection Wells:** The owner/operator shall maintain at a minimum a cash bond (*i.e.*, Assignment of Cash Collateral Deposit or Multi-Well Cash Financial Assurance Bond Geothermal Injection) in the amount of \$50,000.00 to restore the site and/or plug and abandon wells pursuant to OCD rules and regulations.

ii. **Geothermal Production or Development Wells:** The owner/operator shall maintain at a minimum a cash bond (*i.e.*, \$10,000.00 Multi-Well (4 wells) and/or \$5,000.00 (1 well) Geothermal Plugging Bonds). If warranted, OCD may require additional financial assurance for closure of the power plant or facility (see Permit Condition 34 below).

**P. Annual Geothermal Well Report:** The owner/operator shall submit an Annual Geothermal Well Report by January 31 of each year. The report shall include the following information:

i. Cover sheet marked as "Annual Geothermal Well Report," name of owner/operator, Discharge Permit Number, API number(s) of well(s), date of report and the name of the person submitting report.

ii. Comprehensive summary of all geothermal well operations, including description and reason for any remedial or work on the well(s). The

owner/operator shall include copies of the form G-103s that it submitted to the OCD Santa Fe office.

- iii. Production and injection volumes in accordance with Permit Condition 21.J, including a running total to be carried over each year. The owner/operator shall report the total mass produced, dry steam produced, flow rates, temperatures and pressures, average injection pressures, temperatures, *etc.*
- iv. A copy of the chemical analyses in accordance with Permit Condition 21.K.
- v. A copy of any mechanical integrity test chart, including the type of test, (*i.e.*, EPA 5-Year casing test), date, time, *etc.*, in accordance with Permit Conditions 21.H.
- vi. A copy of the annual subsidence survey data results in accordance with Permit Condition 21.I.
- vii. Brief explanation describing deviations from normal production methods.
- viii. A copy of any leaks and spills reports submitted in accordance with Permit Condition 15 above.
- ix. A copy of analytical data results from annual groundwater monitoring including the QA/QC Laboratory Summary.
- x. An updated Area of Review (AOR) summary (WQCC Regulation 20.6.2 NMAC) when any new wells are drilled within 1/4 mile of any UIC Class V Geothermal Injection Well.
- xi. A "Miscellaneous" section to include any other issues that should be brought to the OCD's attention.
- xii. Discharge Permit Signatory Requirements pursuant to WQCC Regulation Subsection G of 20.6.2.5101 NMAC.

**22. Transfer of Discharge Permit:** Pursuant to WQCC Regulation Subsection H of 20.6.2.5101 NMAC, the owner/operator and new owner/operator shall provide written notice of any transfer of the permit. Both parties shall sign the notice 30 days prior to any transfer of ownership, control or possession of a facility with an approved discharge permit. In addition, the purchaser shall include a written commitment to comply with the terms and conditions of the previously approved discharge permit. OCD will not transfer brine well operations until proper



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bonding or financial assurance is in place and approved by the OCD. OCD reserves the right to require a modification of the permit during transfer.

**23. Closure:** The owner/operator shall notify OCD when operations of the facility are to be discontinued for a period in excess of six months. Prior to closure of the facility, the owner/operator shall submit for OCD approval a closure plan including a completed C-103 form for plugging and abandonment of the well(s). Closure and waste disposal shall be in accordance with the statutes, rules and regulations in effect at the time of closure. OCD may require additional financial assurance if surface water and/or ground water is impacted pursuant to WQCC Regulation Paragraph (F) of Subsection A of 20.6.2.3.107 NMAC.

**24. Certification:** Los Lobos Renewable Power, L.L.C. (Owner/Operator), by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. Owner/Operator further acknowledges that OCD may, for good cause shown, as necessary to protect fresh water, public health, safety and the environment, change the conditions and requirements of this permit administratively.

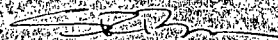
**Conditions accepted by:** *I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.*

Los Lobos Renewable Power, L.L.C.

Company Name - print name above

Steven Brown, Manager

Company Representative - print name



Company Representative - signature

Title MANAGER

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**APPENDIX 1**  
**WATER QUALITY MONITORING PROGRAM**

Table 1  
 Ground Water Monitoring Program

ID	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-1	Annual	GW	Analyze for dissolved fraction of all 20 6,2,3,10,3 NMAC Constituents	Shallow MW (water table) located ~100 downgradient (North) of Class V IW 42-18 and associated pits (OCD)
MW-3	Annual	GW	VOCs (8260B) SVOGs (8270C)	Shallow MW (water table) located ~100 downgradient (North) of Class V IW 51-07 and associated pits (OCD)
MW-2	Annual	GW	PAHs (8310)	Shallow MW (water table) located ~100 downgradient (North) of Class V IW 53-12 and associated pits (OCD)
MW-4	Annual	GW	TPH (418.1)	Shallow MW located ~1500' (Northwest) of DW 45-07 directly downgradient from facility (OCD)
MW-5	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods) Mercury (7470A/7471A)	Shallow MW (water table) located ~1000 upgradient (South) of the nursery greenhouses 3 & 4 to monitor background (OCD)
MW-6	Annual	GW	General Chemistry (Methods specified at 40 CFR 136.3)	Shallow MW (water table) located ~100 downgradient (North) of DW 53-07 and associated pits (OCD)
MW-7	Annual	GW	Uranium (6010B/6020) Radioactivity (E903/E904) Radon (by EPA Method or method approved by OCD)	Shallow MW (water table) located ~100 downgradient (North) of DW 13-07 and associated pits (OCD)

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ID	Frequency	Media	Analytical Suite/Method	Approximate Well location
MW-S 1	Annual	GW		Shallow MW (water table) located ~100' downgradient (North) of DW 33-07 and associated pits (OCD)
NW-1 1	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-2 1	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.
NW-3 1	Annual	GW		Similar to monitoring & sampling plan from Los Lobos.



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Table 2  
 Geothermal Injection Wells and  
 Production/Development Wells Monitoring Program

ID	Frequency	Media	Analytical Suite/Method	Approximate Well Location
DW 13-07	Annual	GW	Analyze for dissolved fraction of all 20 6-2-3-103 NMAC Constituents	As Proposed in Application
DW 33-07	Annual	GW	VOCs (8260B)	
DW 45-07	Annual	GW	SVOCs (8270C)	
DW 47-07	Annual	GW	PAHs ( 8310)	
DW 53-07	Annual	GW	TPH (418.1)	
IW 42-18	Annual	GW	Metals dissolved (6010B/6020) including Bromide, Lithium, Rubidium and Tungsten (by approved EPA methods)	
IW 51-07	Annual	GW	Mercury (7470A/7471A)	
IW 53-12	Annual	GW	General Chemistry (Methods specified at 40 CFR 136.3)	
			Uranium (6010B/6020); Radioactivity (E903/E904)	
			Radon (by EPA Method or method approved by OCD)	

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Table 3  
 Water Supply Wells Monitoring Program

ID	Frequency	Media	Analytical Suite/Method	Approximate Location
TG 52-07	Annual	GW	Analyze for dissolved fraction of all 20.6.2.3103 NMAC Constituents	Similar to monitoring & sampling plan from Los Lobos.
AmeriCulture No. 1 Federal	Annual	GW	VOCs (8260B)	
AmeriCulture State Well No. 2	Annual	GW	SVOCs (8270C)	
McCants No. 1 State	Annual	GW	PAHs ( 8310)	
Burgett No. 1 State	Annual	GW	TPH (418.1)	
Burgett Greenhouse No. 2	Annual	GW	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)	
			Mercury (7470A/7471A)	
			General Chemistry (Methods specified at 40 CFR 136.3)	
			Uranium (6010B/6020),	
			Radioactivity (E903/E904)	
			Radon (by EPA Method or method approved by OCD)	

Table 4  
 Holding Ponds, Drainage Ditches, Pits and Ponds Monitoring Program

ID	Frequency	Media	Analytical Suite/Method	Approximate Location
GH Holding Pond No. 1	Quarterly	SW	Metals: dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)	Similar to monitoring & sampling plan from Los Lobos
GW Holding Pond No. 2	Quarterly	SW	General Chemistry (Methods specified at 40 CFR 136.3)	
Drainage Ditch No. 1 (East)	Quarterly	SW		
Retention Pond No. 1	Quarterly	SW		
Bermed Canal No. 1	Quarterly	SW		
Pit Associated with Well 13-07	Within 30 days of use	SW		
Pit Associated with DW 33-07	Within 30 days of use	SW		
Pit Associated with DW 45-07	Within 30 days of use	SW		
Pit Associated with DW 47-07	Within 30 days of use	SW		
Pit Associated with DW 53-07	Within 30 days of use	SW		
Pit Associated with IW 42-18	Within 30 days of use	SW		
Pit Associated with IW 51-07	Within 30 days of use	SW		

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ID	Frequency	Media	Analytical Suite/Method	Approximate Location
P11 Associated with IW 53-12	Within 30 days of use	SW		



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Table 5  
 Cooling Tower Effluent Monitoring Program

ID	Frequency	Media	Analytical Suite/Method	Approximate Location
Cooling Tower Effluent	Daily	Effluent	Metals - dissolved (6010B/6020) including Bromide, Lithium, Rubidium, and Tungsten (by approved EPA methods)  BOD <sub>5</sub> (405.1/5210B) COD (410.2)  General Chemistry (Methods specified at 40 CFR 136.3)	Similar to monitoring & sampling plan from Los Lobos

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BOD<sub>5</sub>: Biochemical Oxygen Demand  
COD: Chemical Oxygen Demand  
DW: Development/Production Well  
DWL: Dynamic Water Level  
GH: Greenhouse  
GW: Ground Water  
IW: Injection Well  
MSL: Mean Sea-Level  
MW: Monitor Well  
NW: Nested Well  
SW: Surface Water  
SWL: Static Water Level

\* Quarterly Static Water Level (SWL): MSL to nearest 0.01 feet prior to sampling event

1. Wells must be installed in advance of system startup and sampled.
2. Semi-Annual groundwater monitoring event must be completed no more than 30 days prior to the start of the irrigation season but no later than April 30 of each year. Monitoring must be conducted no later than 30 days after the conclusion of the irrigation season but no later than November 15 of each year.
  3. One time sampling event with static water level (SWL) mean sea-level (0.01 ft. accuracy) measurements in advance of system start-up. Thereafter, monthly sampling for the first six months with dynamic water level (DWL) recording is required. After six months of monthly monitoring, the sampling shall be conducted at least annually.
  4. Sample quarterly while in use. If organics are evident, sampling with analytical methods similar to MWs shall be implemented during the sampling event.
  5. Daily for 10 business days at system startup; thereafter weekly for two months; thereafter based on establishing correlation with the 3D Tresar Control Monitoring System.

Note: All wells with phase-separated hydrocarbons (PSHs) must be checked at a minimum of once per month and recorded on a spreadsheet. The data must be presented in table form listing all of the impacted wells, date inspected, product thickness measured to 0.01 of a foot, and amount of product/water recovered. If PSHs are observed in a monitoring well, then appropriate steps must be taken to recover the PSHs using the best available technology.

DOWNHOLE CONDITIONS OF APPROVAL FOR GDP-050-08-05  
Well 53-07  
Federal Lease NM-34790  
Lightning Dock  
Hidalgo County, New Mexico

Unless otherwise authorized by the Las Cruces Field Office Manager:

General:

1. All operations shall be conducted in accordance with lease stipulations, Federal Regulations (43 CFR 3260), Geothermal Resource Operational (GRO) Orders, and the attached Drilling Plan, as amended by Conditions of Approval.
2. A daily drilling report shall be given by FAX, telephone, or email to John Besse, Glen Garnand, and Rich Estabrook, Monday through Friday, by 8:30 am, until the well is completed or abandoned.

Name	Telephone	Fax	e-mail
John Besse	505-525-4363	505-525-4412	John_Besse@nm.blm.gov
Glen Garnand	575-627-0209	575-627-0276	Glen_Garnand@nm.blm.gov
Rich Estabrook	707-468-4052	707-468-4095	restabro@ca.blm.gov

3. Within 30 days of well completion, a complete well history, all directional surveys taken, and all logs run shall be mailed or delivered to:

John Besse  
Bureau of Land Management  
1800 Marquess St.  
Las Cruces, NM 88005

with a copy of all of the above going to:

Rich Estabrook  
Bureau of Land Management  
2550 N. State St.  
Ukiah, CA 95482

4. A copy of this permit, attached conditions, the approved operations/drilling plan, and any relevant Sundry Notices shall be retained at the wellsite for reference.
5. In case of downhole emergency, Richard Estabrook (home phone: 707-459-5711) shall be notified. In case of a spill or surface-related emergency, John Besse (home phone: 575-644-8324X) shall be notified.
6. Variances from the approved well program shall be approved by the Las Cruces Field Office



February 18, 2011

Mr. Edward Seum  
Supervisory Multi-Resources Specialist  
Division of Multi-Resources  
Las Cruces District Office  
Bureau of Land Management  
1800 Marquess Street  
Las Cruces, New Mexico 88005-3371

RE: BLM requests additional information for Sundry Notice filed on January 7, 2011;  
Case Number: NMNM 034790; Lightning Dock Geothermal HI-01, LLC (LDG)

Dear Mr. Seum;

This letter is in response to your letter of January 18, 2011 received by our office on January 24, 2011. In your letter you request additional information to complete your review of a Sundry Notice filed in your office on January 7, 2011. The Sundry was filed by LDG as required by order of the Las Cruces District Manager and addressed the operations on lease NM-34790 involving well 55-7 located in Sec.7, T.25S., R.19W., NMPM, Hidalgo County, New Mexico.

Your letter leads LDG to believe your office desires well 55-7 to be plugged and abandoned and that BLM does not recognize the value of this well as a well capable of production in commercial quantities. According to regulations at 3207.10(b), a well capable of producing geothermal resources in commercial quantities may serve to extend the lease beyond its primary term. It is our desire that each well we drill under the drilling program submitted to BLM and approved by BLM and the State will result in production potential similar to that of well 55-7.

It is the intent of LDG to develop and then place lease NM-34790 into a utilization phase of development. The stated objective by LDG to connect the well to a power plant only refers to this intention, and not to a specific activity we are proposing at this time. LDG is requesting approval, through the Sundry already submitted, to maintain the well in its present condition.

We have submitted various permit applications for the drilling, testing and monitoring of

well 55-7 pursuant to Subpart 3260. We are requesting approval of only those operations which may be granted pursuant to Subpart 3260. Your letter requests additional information which can only be reviewed and authorized pursuant to Subpart 3270. As you indicate in your letter, we may not conduct any utilization operations until permit applications required pursuant to Subpart 3270 are approved by your office.

In response to your questions: 1) Our intention is for well 55-7 to remain in its current configuration and be used to test and monitor the resource, as requested under the GDP and Sundry already submitted; 2) Prior to connecting the well to a power plant, we must submit complete permit applications required at Subpart 3270; it is not known when we will submit these applications or how long it will take your office to review and approve them; 3) We already have secured the well from unauthorized uses, as required by both regulations and lease terms. We believe leaving the well in its current configuration, as described in the Sundry is the best means to secure the well.

Your letter suggests our operational bond be increased to an unspecified amount to cover reclamation costs related to abandonment of well 55-7, and that we provide an itemized cost estimate for the bond amount. The regulation you cite at 3214.14(a)(4) states BLM may increase a bond amount when "Our inspection of the property determines that the bond amount is too low to cover the estimated reclamation cost." Did your inspection lead you to conclude the current lease bond is inadequate? We strive to ensure the environment on location is better than when we arrived. We believe we have been successful.

Lease records indicate that BLM has accepted a bond in the amount of \$45,000 to cover operations on the lease. This amount is \$35,000 more than required at 3261.18(a)(1). In fact, 3261.18 (a)(2) allows for all of LDG's Statewide operations to be bonded by a \$50,000 surety or personal bond. Please allow us the opportunity to discuss your concerns regarding bond amounts and address those through performance and accomplishment.

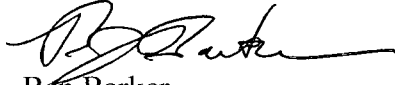
Typically, increased bonds authorized by regulations at 3214 are a result of a history of non-compliance, previous claims against the surety for failure to plug and abandon a well and reclaim the surface, failure to pay royalties to ONRR (previously MMS), or a failed inspection. LDG has no history of failed environmental performance, and currently has no surface issues or operations causing an unacceptable environmental impact on this lease. Your letter did not indicate that the well, in its current configuration, has any mechanical problems or is causing unacceptable environmental issues, or that there are outstanding surface issues. LDG believes any decision to pull the pump or abandon well 55-7, are premature at this time pending the completion of other technical and administrative reviews by LDG.

As offered previously, we believe that an opportunity to discuss this project with you would be an effective way to further our joint coordination efforts in facilitating the efficient review and approval of appropriate renewable energy projects, as mandated by both national policy and Congressional intent. LDG requests an opportunity to meet with

you and your staff, present our information to BLM and discuss our plans for the field, this lease and well 55-7.

If you have any questions regarding this response to your letter, please contact me at (801) 765-1200.

Sincerely,



Ben Barker  
Vice President, Resource Management

Cc:

Mr. Carl Chavez

Mr. Randy Dade

## Chavez, Carl J, EMNRD

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**From:** Chavez, Carl J, EMNRD  
**Sent:** Friday, January 07, 2011 6:50 AM  
**To:** Ben Barker  
**Cc:** VonGonten, Glenn, EMNRD; Dade, Randy, EMNRD; Brooks, David K., EMNRD  
**Subject:** Lightning Docker Geothermal Project (GTHT-1) Documentation of Recent Meeting on 1/5/2011 & Phone Call on 1/6/2011

Ben:

Good morning. This e-mail is being sent to briefly document our impromptu meeting on Wednesday, January 5, 2011 and phone call regarding well testing and disposition of produced water review of OCD hearing records on January 6, 2011.

### January 5, 2011 Meeting in Santa Fe:

You called me while in Santa Fe for another meeting with another agency and had some time to meet with OCD to discuss the project. The project terms and conditions have been documented in the OCD discharge permit (GTHT-1) on electronic file at OCD Online and from OCD Geothermal Regulations at <http://www.emnrd.state.nm.us/ocd/documents/OilConservationDivisionGeothermalApplicationProcess8-18-2009.pdf>. The Regulations address all of your questions during our meeting.

We met and discussed the following:

- 1) Timeframe for submittal of OCD well logs, forms, etc. I promised to follow-up to address your concerns about proprietary information and timeframe for disclosure of OCD forms. In response to this, please go to: 19.14.56 NMAC (Geothermal Resources Well Log (Form G-105) at <http://www.nmcpr.state.nm.us/nmac/title19/T19C014.htm>.
- 2) OCD APDs for production and injection wells under the GTHT-1 permit are specified in the approved G-101 Forms w/ conditions. If Raser wishes to deviate from the discharge permit and approved G-101s, i.e., surface casing depths, it must provide documentation citing the applicable sections of the permit and regulations with its technical basis for any deviation requests and/or approvals by the OCD. Changing the discharge permit may require a "Minor" or "Major Modification" with public notice, etc. under 20.6.2 NMAC. As with any OCD reviews, upon closer scrutiny of the request, the OCD reserves the right where necessary to make prior approvals more stringent if there is more scientific information that is considered during any review or deviation by the operator to the permit.

Some discussion of Raser's reason for questioning the surface casing and cement depths was considered. OCD went over 19.14.27 NMAC (Casing and Cementing Requirements) with Raser. Regulations require well to be set in competent bedrock and OCD discussed OCD's mandate under 20.6.2 NMAC to protect fresh waters of the state. The project is complex because the Animas Basin appears to be largely comingled due to faulting with fresh water conditions prevalent at depth (< 10,000 ppm TDS). The brackish zone has yet to be discovered at depth.

- 3) Raser indicated that it would like to use the farm field to discharge produced water (i.e., fresh water with exception of Fluorides that are believed to be naturally elevated in project area).
- 4) OCD reminded Raser about documentation of the entire project with OCD Geothermal Forms and OCD encouraged Raser to take OCD Forms and make them electronic for data entry and to include any attachments that don't fit on the forms, etc. This was a specific condition in the G-101 APD approvals.
- 5) OCD requested that Raser document any questions it has with OCD so it could adequately respond to project questions and issues that may arise and that there can be no questions about perceived approvals by the OCD during the meeting. Raser agreed to document any questions or issues in writing to the OCD.

### January 6, 2011 Phone Call:

- 1) In order to research how OCD determine the 1500 ft. cement and surface casing depth in the APDs, Raser wanted to review the OCD permit file and hearing records. OCD Online contains most of the project information; however, Raser was referred to Florene Davidson to schedule a date and time to review the physical hearing records for the project.
- 2) Regarding the rationale for OCD approving project well testing produced water to be discharged into the farm field, similar to the most recent Burgett well testing in 2010, Raser wanted to know how produced water in the San Juan Basin is handled? After providing Case # 14246 and Order # R-13127, Raser was referred to Charlie Perrin of OCD for more information. OCD Geothermal Regulations are cited in 19.14.35 NMAC. Raser indicated that production and injection well testing would generate a much greater volume of produced water than the most recent well testing on the Burgett Well in 2010. The issues were the Fluoride and TDS levels in the project area that are believed to be on the order of background levels.
- 3) Raser suggested that its Hydrogeologist investigate the casing issue raised during the meeting held the day before as Raser believes the surface casing with cement depths may be too great and based on the open bore-hole construction it wished the production interval to extend into fault zones, etc.

Please contact me if you have questions about the above.

Thank you.

Carl J. Chavez, CHMM  
New Mexico Energy, Minerals & Natural Resources Dept.  
Oil Conservation Division, Environmental Bureau  
1220 South St. Francis Dr., Santa Fe, New Mexico 87505  
Office: (505) 476-3490  
Fax: (505) 476-3462  
E-mail: [CarlJ.Chavez@state.nm.us](mailto:CarlJ.Chavez@state.nm.us)  
Website: <http://www.emnrd.state.nm.us/ocd/index.htm>  
(Pollution Prevention Guidance is under "Publications")



Raser Meeting.

Friday 3/19/2010

<u>Name</u>	<u>Company</u>	<u>ph</u>	<u>E-mail</u>
Carl Chavez	NM OF-D	505-476-3490	Carl.j.Chavez@state.nm.us
M. Hayter	Raser	801-765-1200	michael.hayter@rasertech.com
Ben Barker	Raser	801-765-1200	ben.barker@rasertech.com
G. Lewis von Gadow	OCD	476-3488	

## DISCUSSION OVERVIEW

- Basics of geothermal systems in southern Basin and Range Rio Grande rift.
- Total natural heat loss at Lightning Dock.
- Structure controls for the geothermal system at Lightning Dock.
- Summary of subsurface geology.
- Water chemistry of thermal water.
- Isotopic composition of thermal water.
- Summary of findings.
- Recommendations

# GEO THERMAL DOMAINS

Red

Convective  
Systems

Light Blue

Deep Conductive  
Systems in Tertiary  
Basins

Dark Blue

Deep Conductive  
Systems in  
Paleozoic and  
Mesozoic Basins

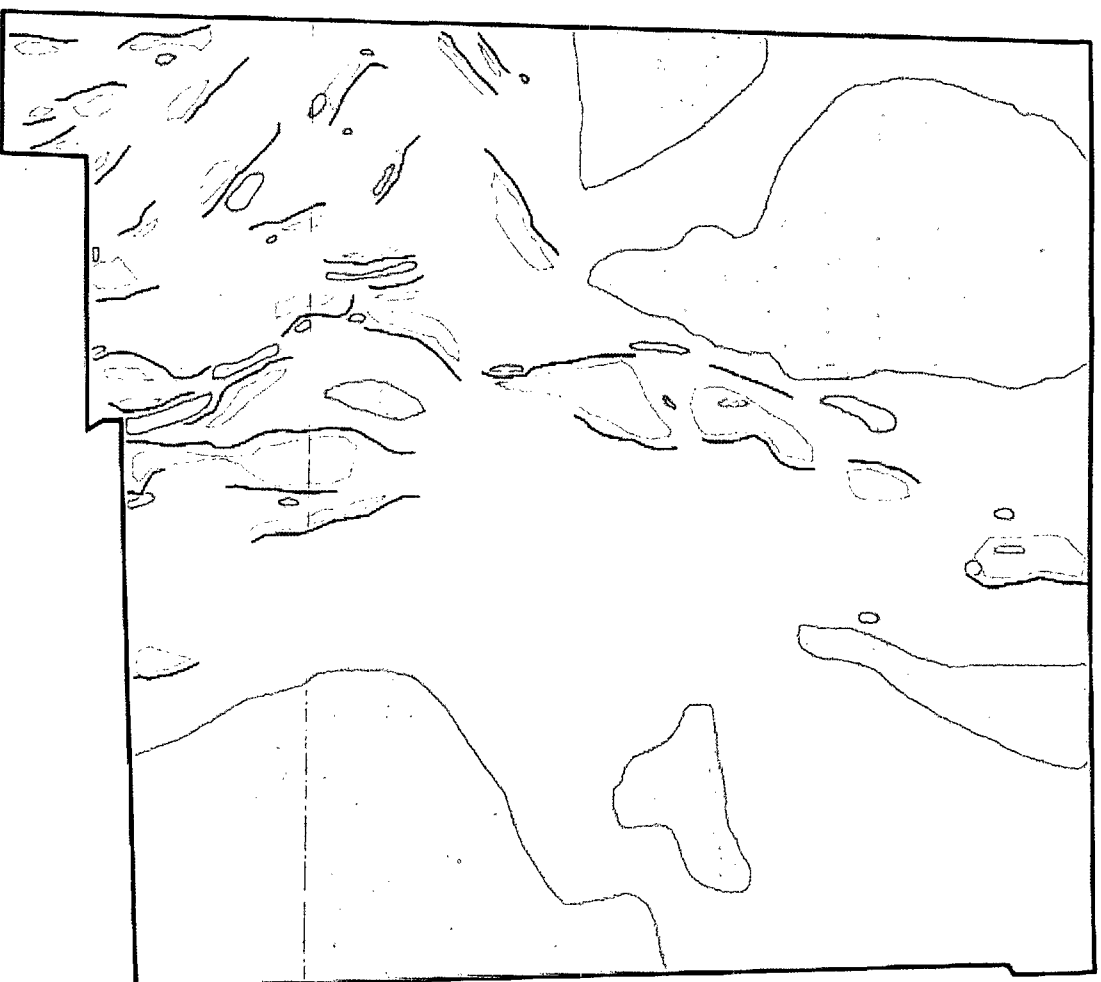


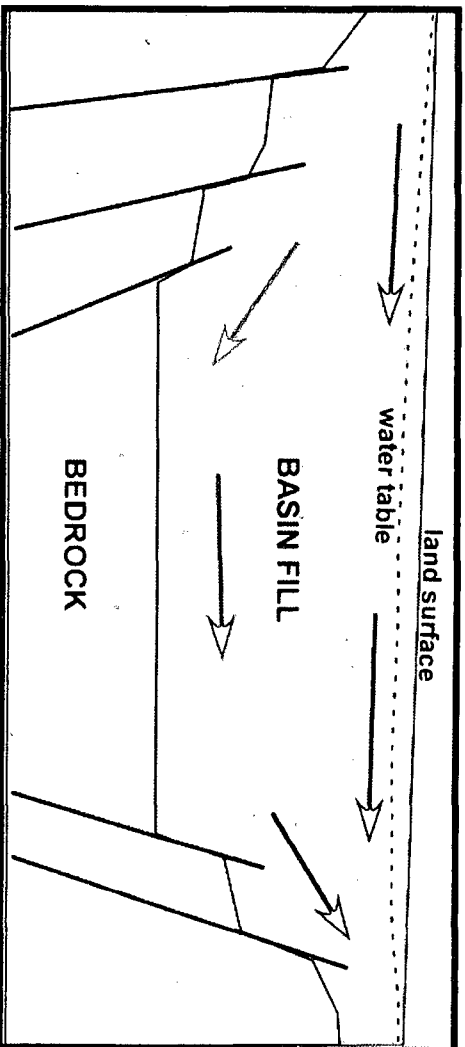
EXHIBIT 2

# **TYPICAL CONVECTIVE GEOTHERMAL SYSTEM CONTROLS**

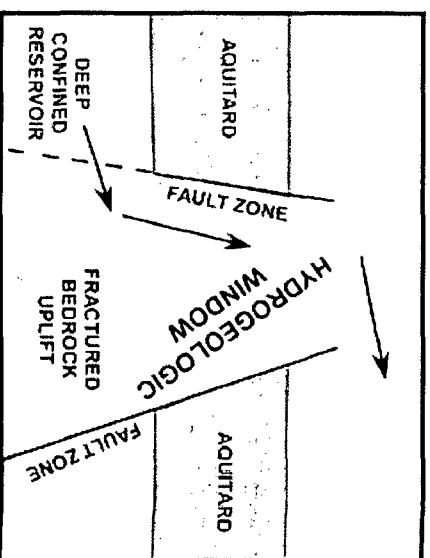
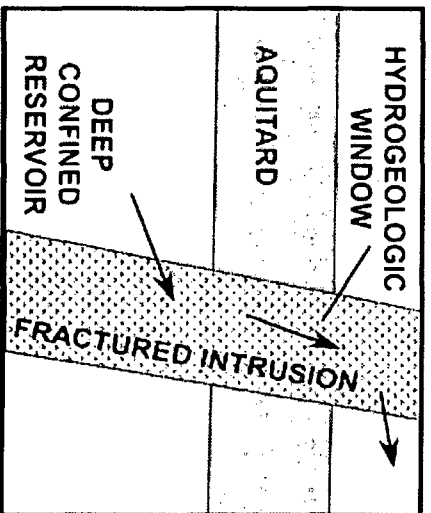
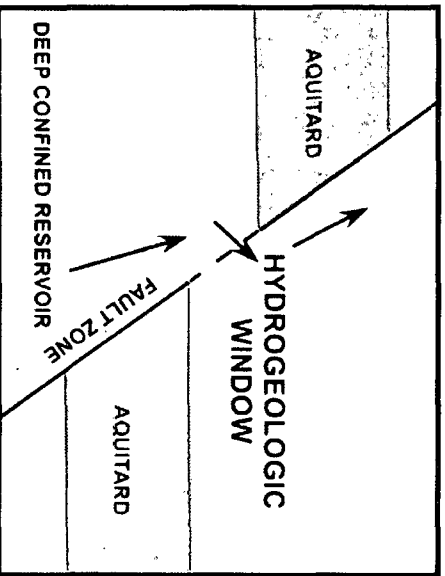
- **Heat Source**
- **Structure**
  - fracture permeability (reservoir permeability and storage)
  - hydrogeologic windows (primary discharge site)
- **Flow Dynamics**
  - Free convection (density driven flow)
  - Forced convection (ground water head driven flow)
    - ✓ deep seated regional ground water flow systems
    - ✓ thermal sweep of background regional heat flow

# HYDROGEOLOGY

Rift basin ground water flow constrictions (or outlets)

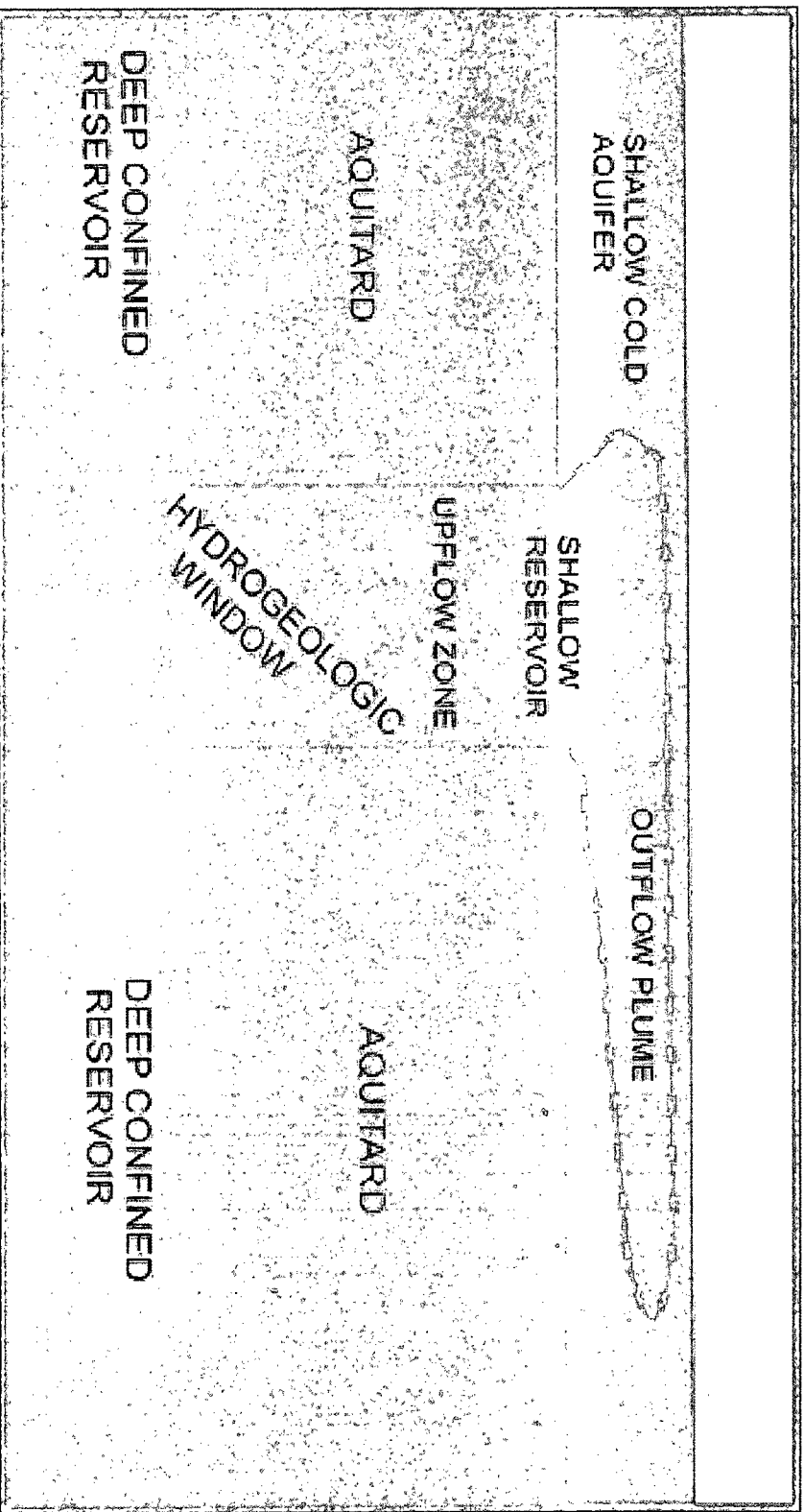


## Hydrogeologic windows



# OUTFLOW PLUME DYNAMICS

- Mixing with near surface ground water.
- Flow direction follows shallow hydraulic gradient.

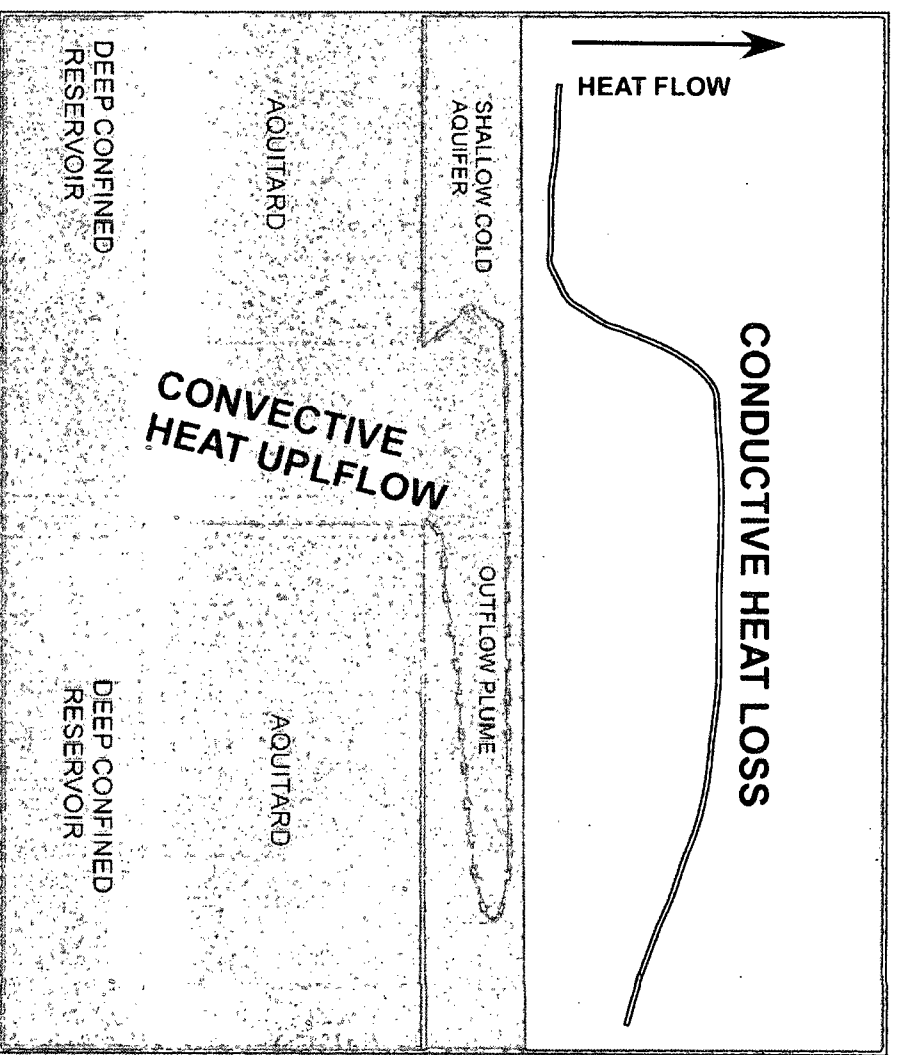


# TOTAL

## CONDUCTIVE

### HEAT LOSS

- $q_z = k(dT/dz)$ 
  - $q_z$  conductive heat flow ( $mW/m^2$ )
  - $k$  thermal conductivity ( $W/m^{\circ}K$ )
  - $dT/dz$  temperature gradient ( $^{\circ}C/km$ )
  - $k = 1.8 W/m^{\circ}K$  basin fill
  - $k = 2.2 W/m^{\circ}K$  volcanics
- $Q = \int q_z dA = \int q_b dA$ 
  - $Q$  total system heat loss
  - $q_b$  regional heat flow ( $90 mW/m^2$ )
  - $dA$  area of integration ( $km^2$ )



#### Assumptions:

- All heat is lost by conduction over top of outflow plume.
- Estimated thermal conductivity does not introduce excessive error.
- Borehole density is adequate to characterize system.

# EXAMPLE OF GEOTHERMAL SYSTEM SUBSURFACE THERMAL REGIME

- Annual temperature wave near surface
- Conductive gradient above water table or geothermal system
- Temperature "rollover" in outflow plume

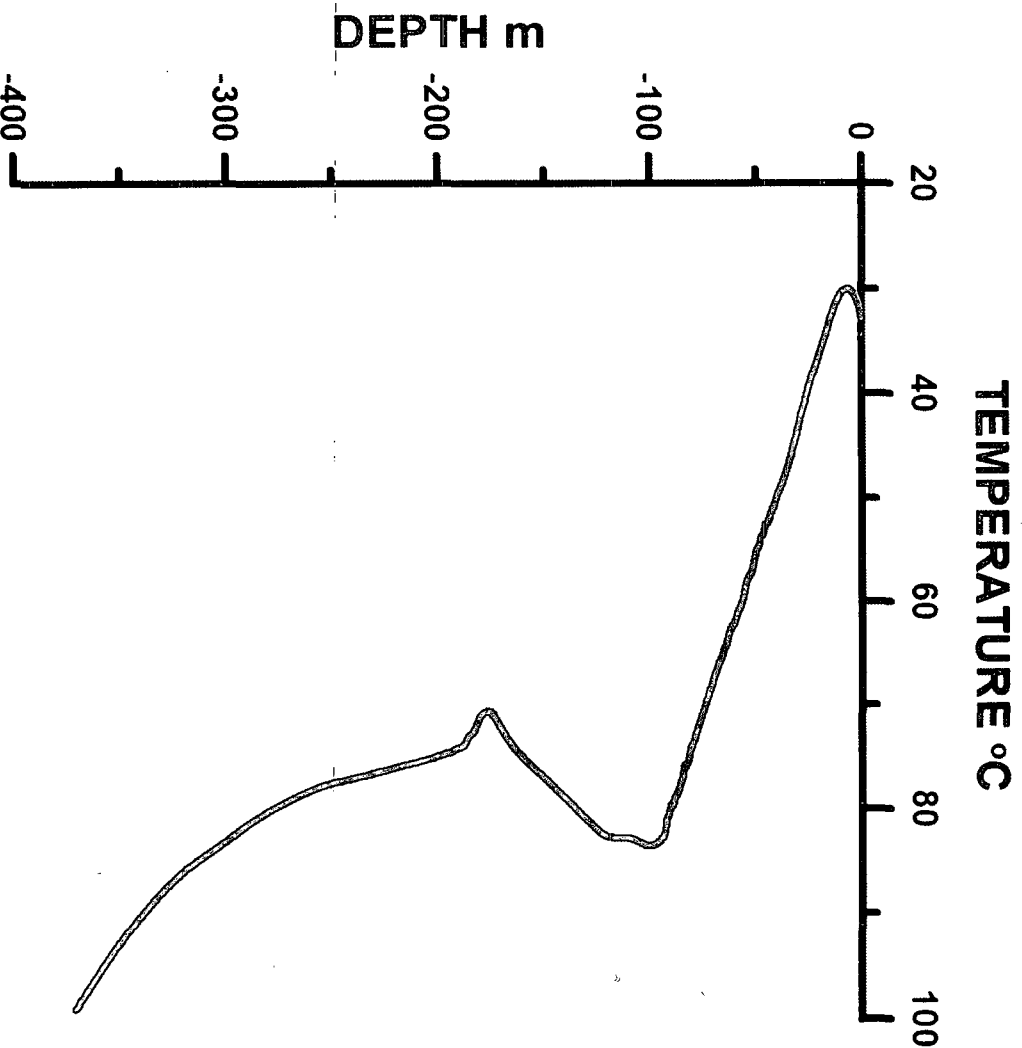
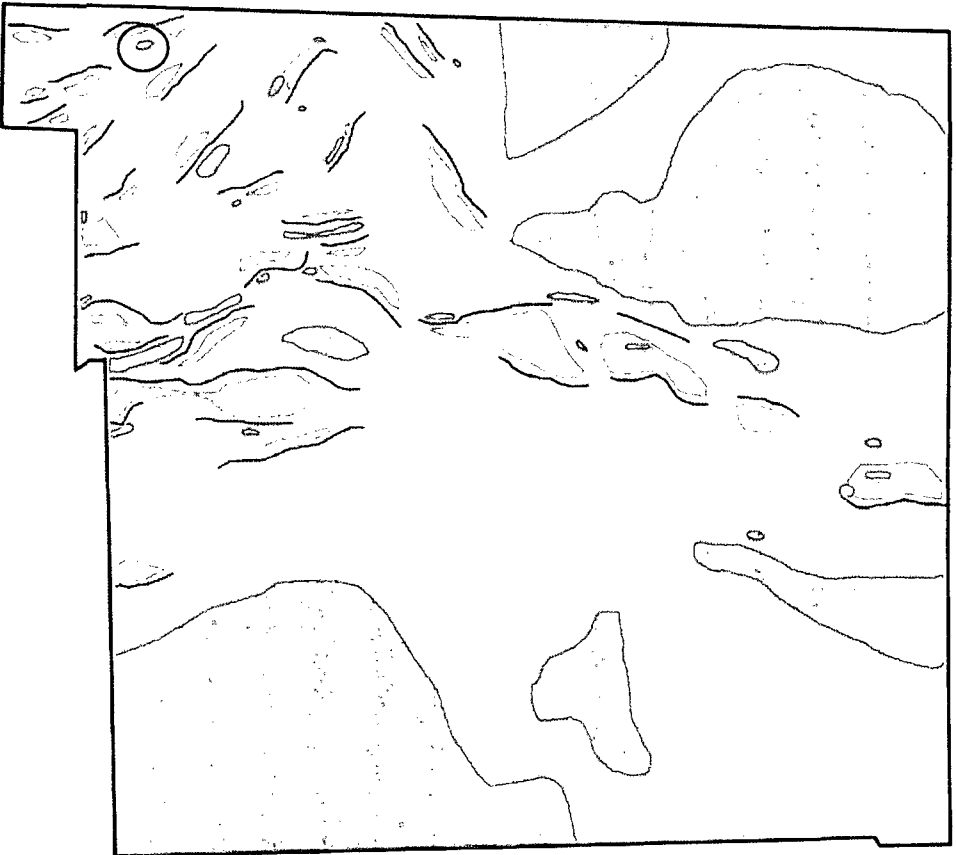


EXHIBIT 7



# LIGHTNING DOCK



**EXHIBIT 8**

# LIGHTNING DOCK HEAT FLOW

- Maximum Heat Flow  
2543 mW/m<sup>2</sup>
- Area of Heat Flow  
over 90 mW/m<sup>2</sup>  
17 km<sup>2</sup>
- Reservoir Volume  
<4 km<sup>3</sup>
- Heat Loss  
<10 MWt

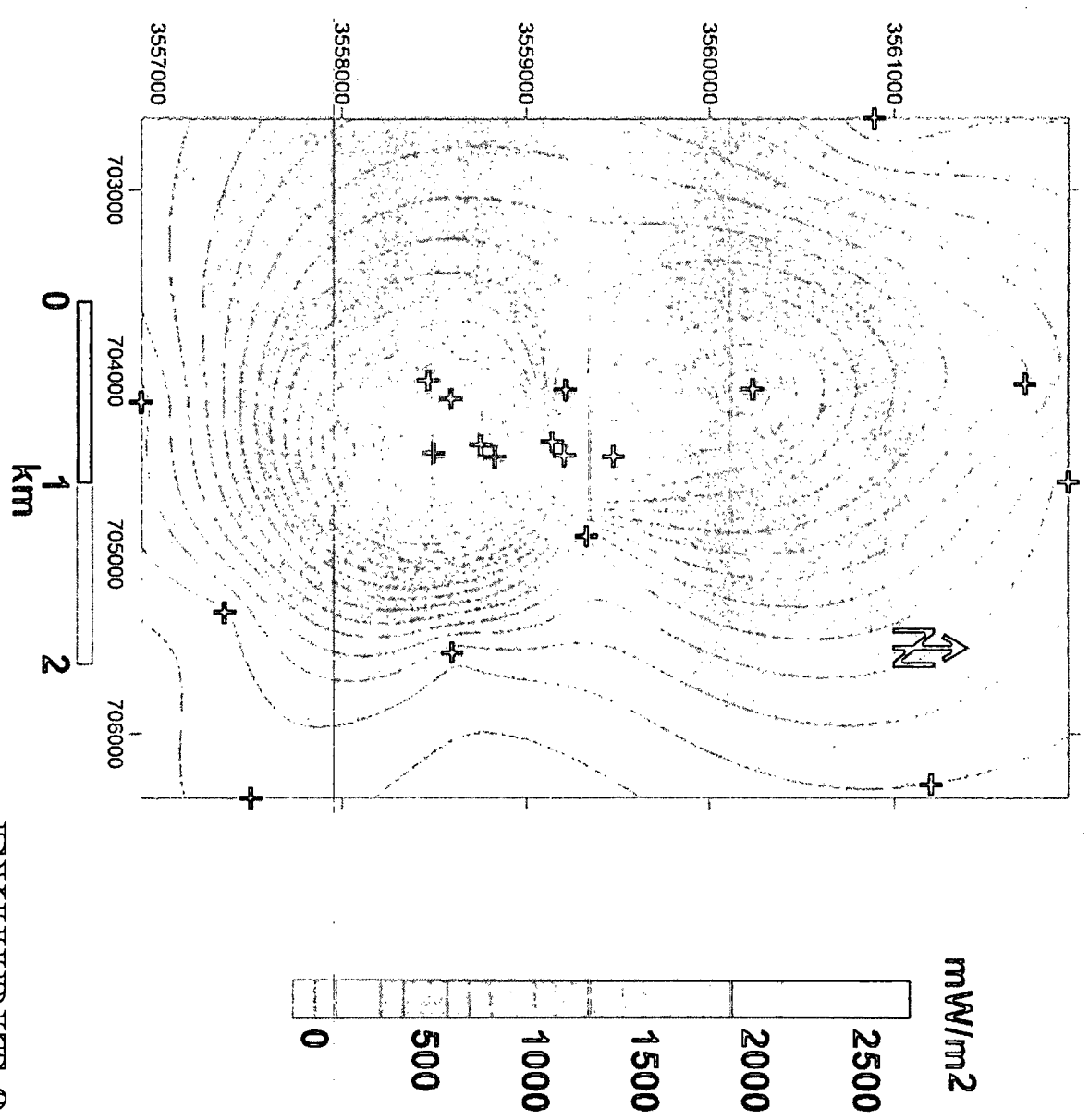
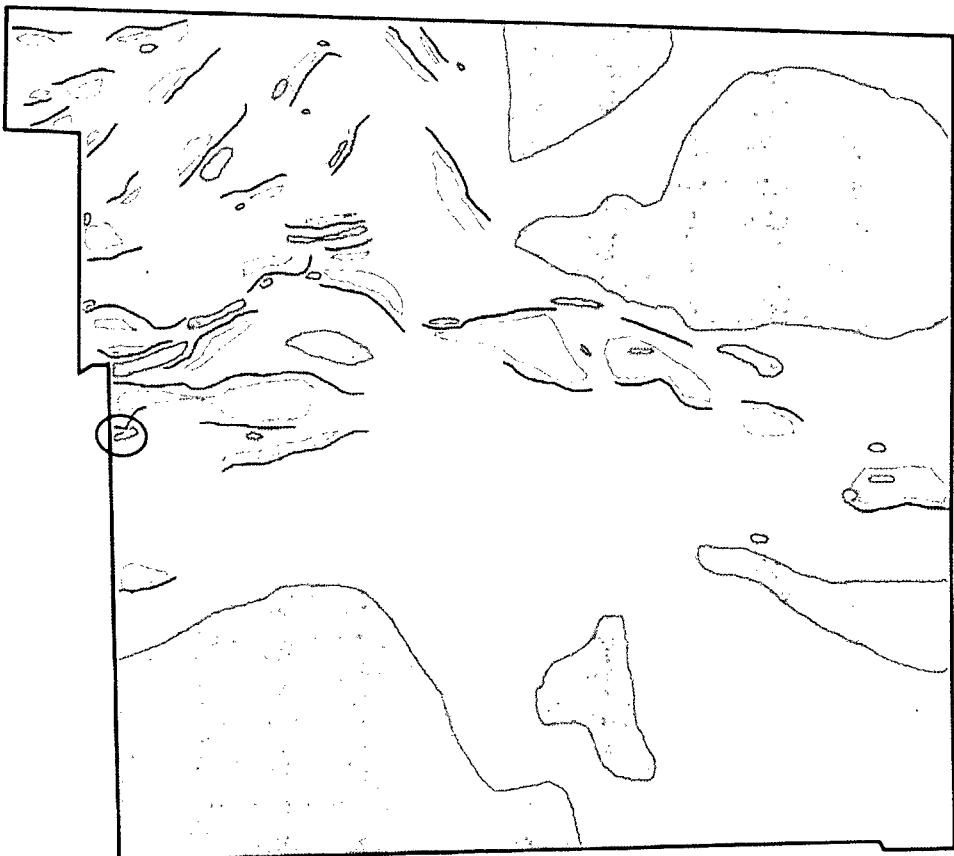


EXHIBIT 9

# MCGREGOR



**EXHIBIT 10**

# MCGREGGOR HEAT FLOW

- Maximum Heat Flow  
454 mW/m<sup>2</sup>
- Area of Heat Flow  
over 90 mW/m<sup>2</sup>  
100 km<sup>2</sup>
- Reservoir Volume  
>50 km<sup>3</sup>
- Heat Loss  
>16 MWh

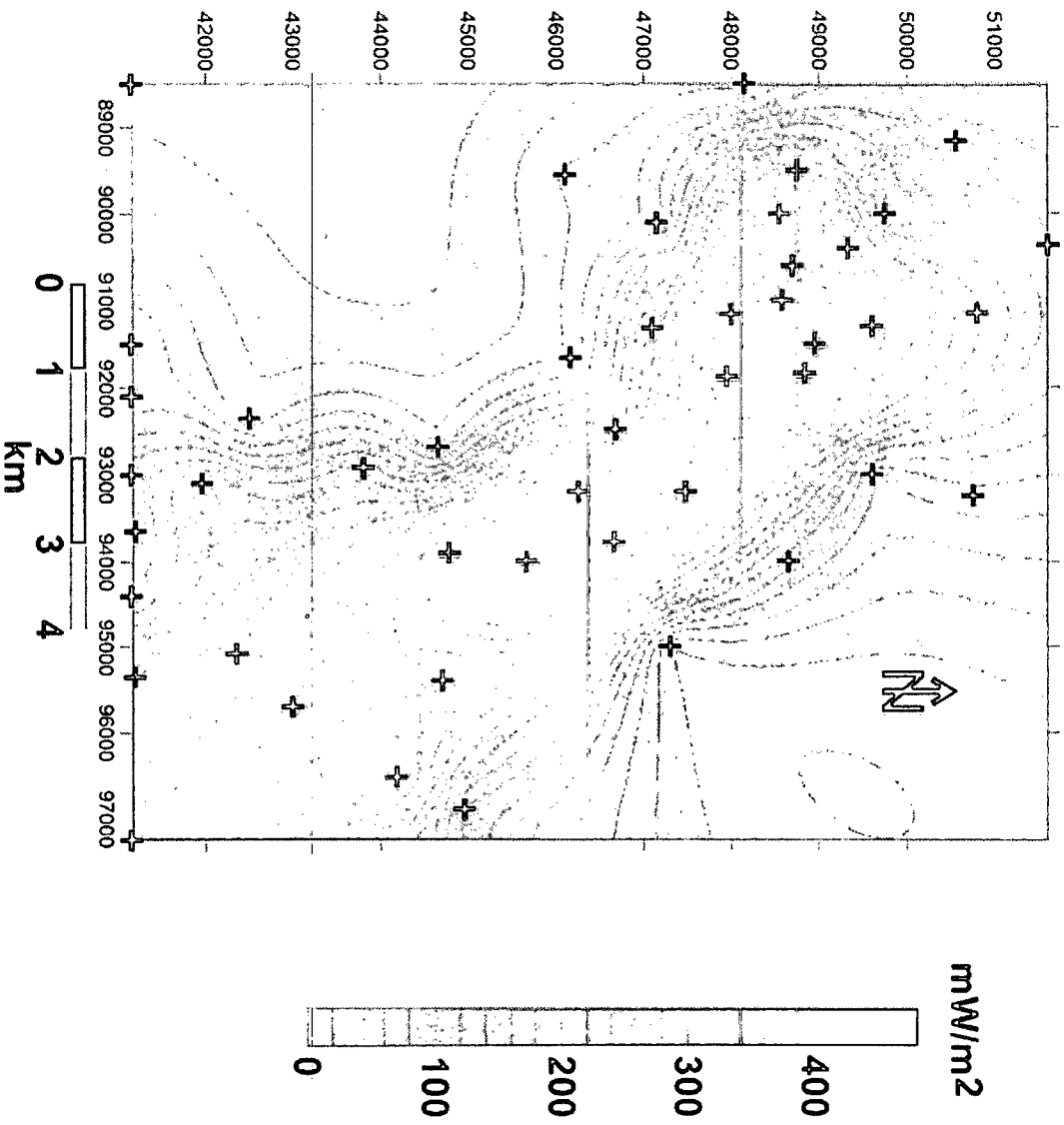


EXHIBIT 11

# STRUCTURAL SETTINGS

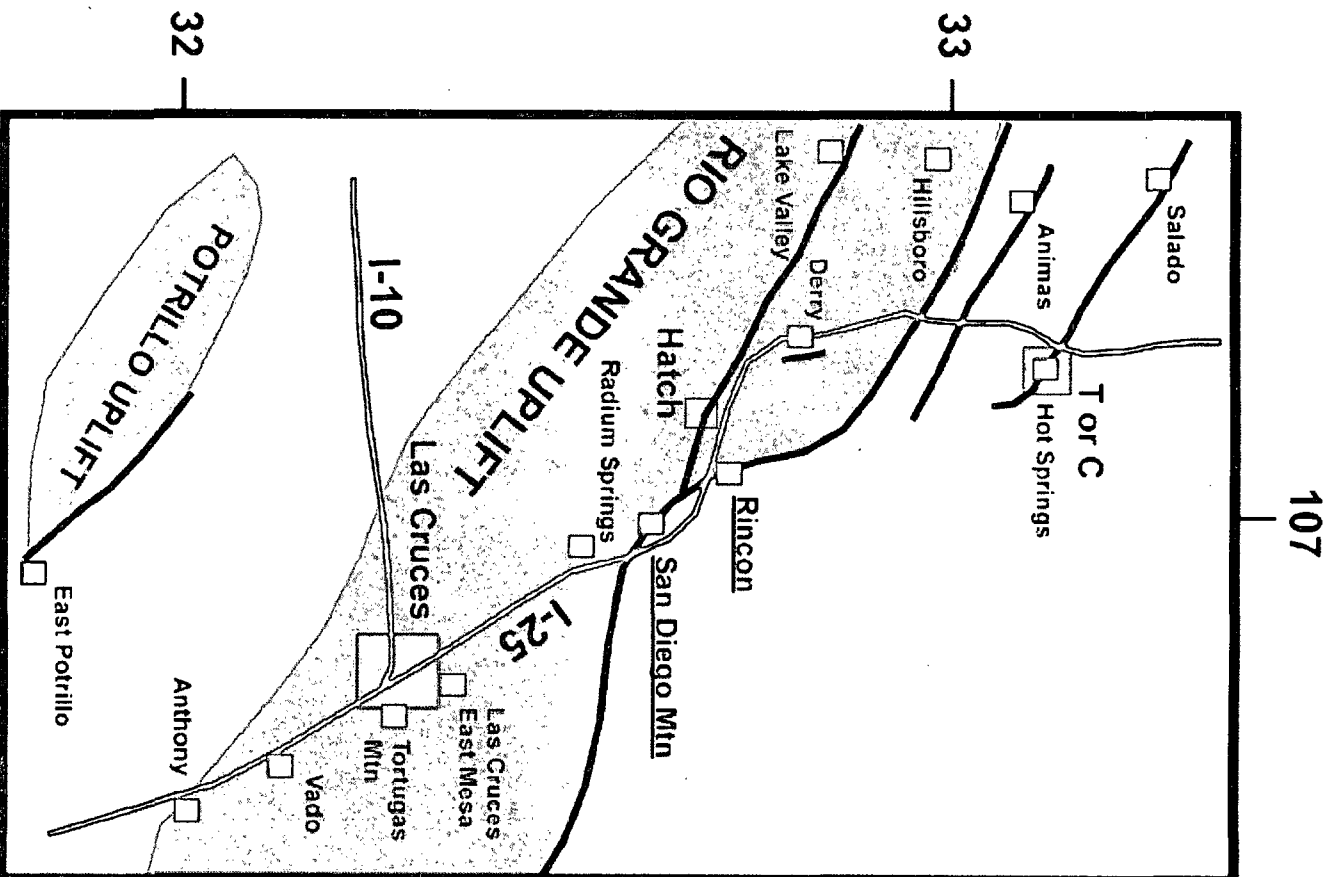
- Pleistocene/Holocene rift normal faults
  - Lightning Dock
- Ring fracture zones of Tertiary cauldrons
  - Lightning Dock
- Rift accommodation zones/normal fault transfer zones
  - Lightning Dock
- Laramide basement-cored compression uplift
  - Lightning Dock

# GEO THERMAL SYSTEMS AROUND THE LARAMIDE RIO GRANDE UPLIFT

System located on  
Laramide basement-cored  
uplift:

- San Diego Mtn
- Hot Springs
- Rincon
- Lake Valley
- Animas
- Salado
- Radium Springs
- Derry
- East Potrillo

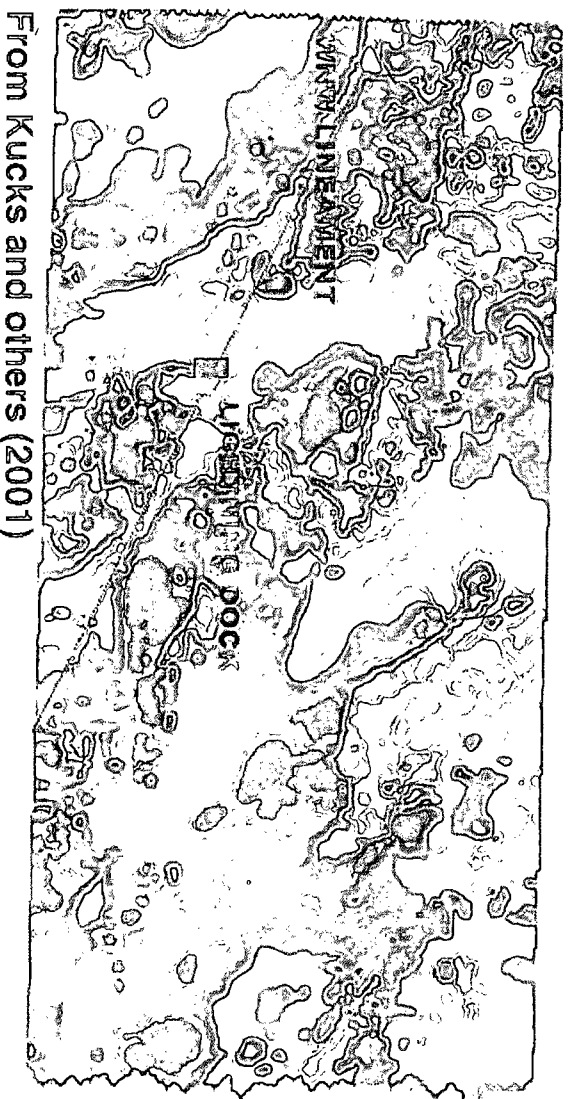
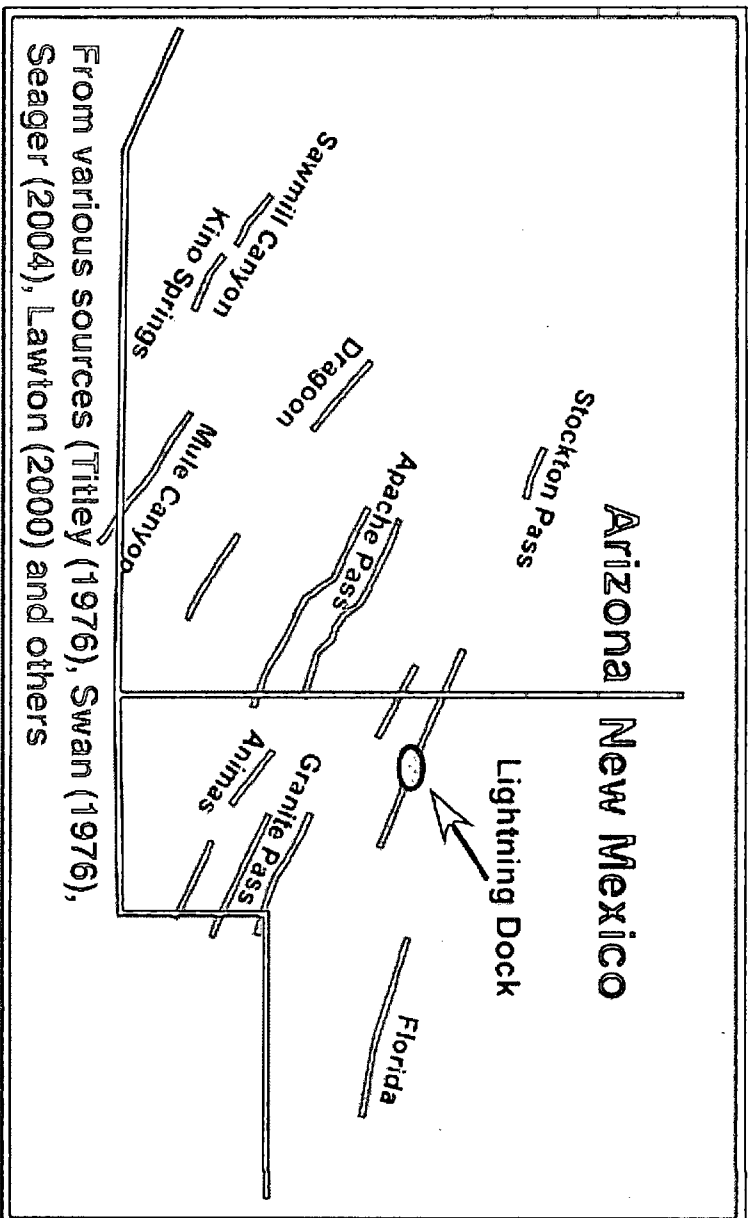
## EXHIBIT 13



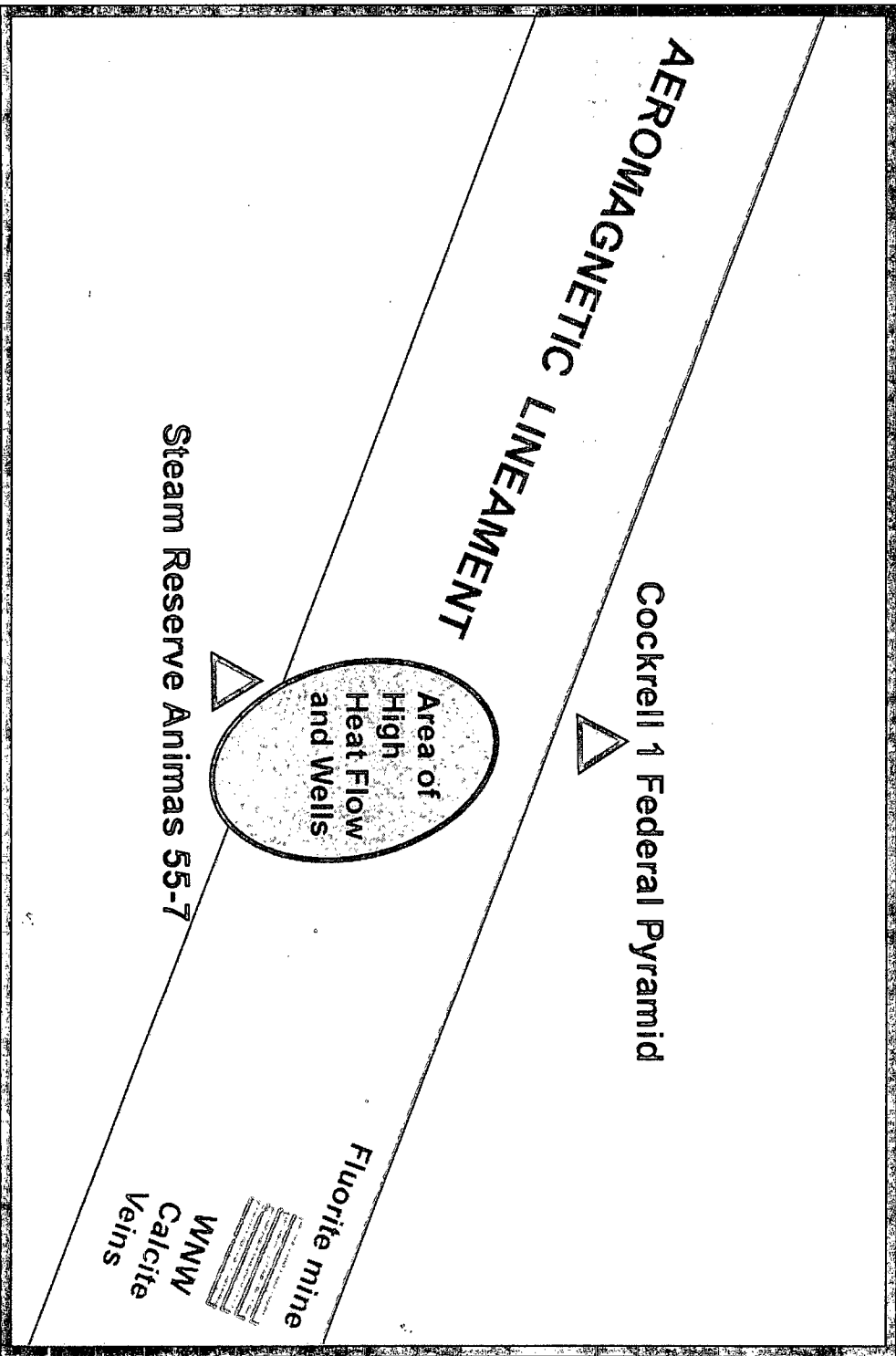
Modified from Seager and Mack (2003)

# LIGHTNING DOCK REGION

- Potential for deep seated fracture permeability
- Structures have long and repeated deformation history



# A WNW STRUCTURE CONTROL AT LIGHTNING DOCK





# DIAGRAMMATIC CROSS SECTION OF DEEP SUBSURFACE AND MAJOR TECTONIC INVERSION OF A WNW FAULT

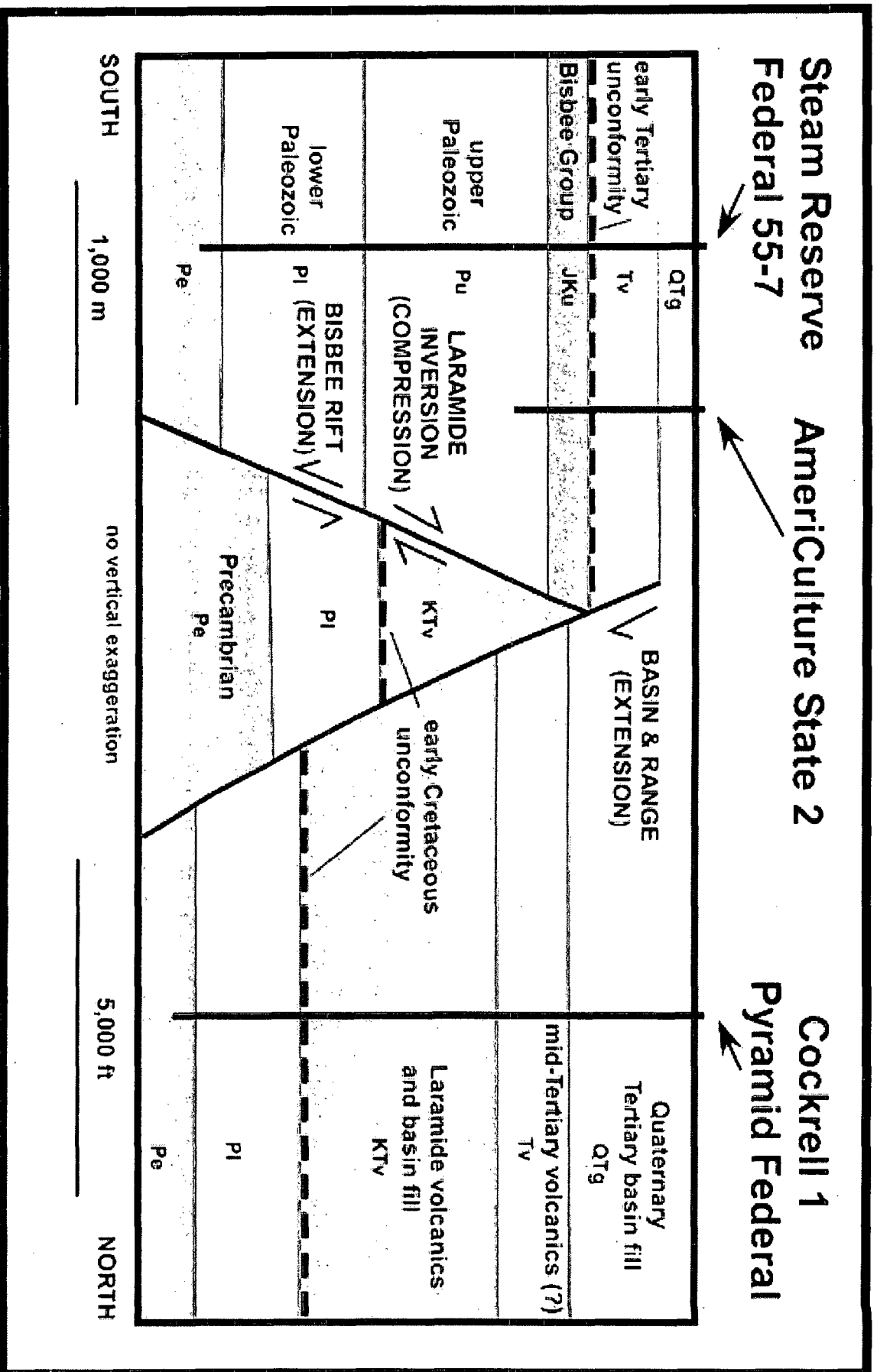
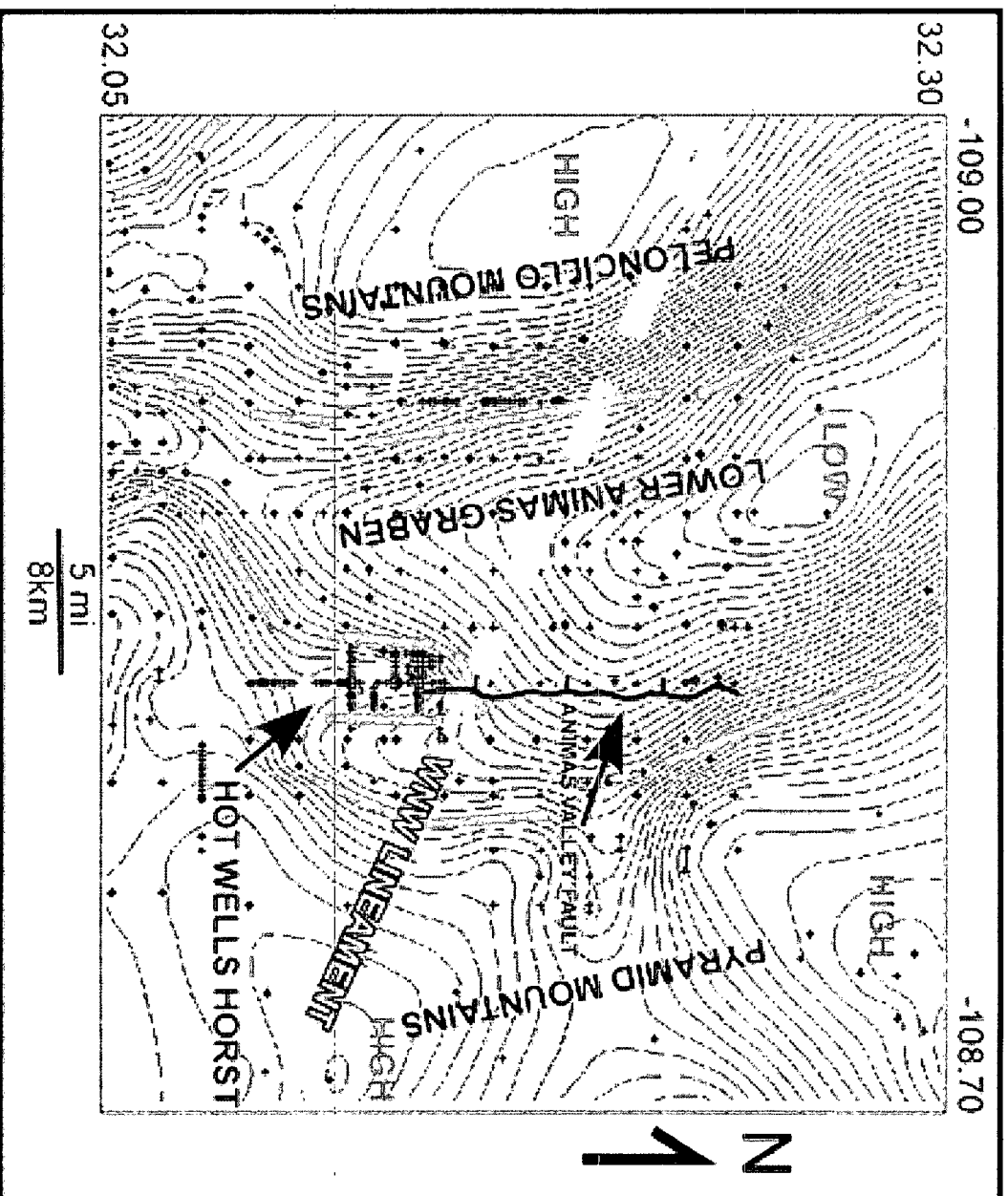


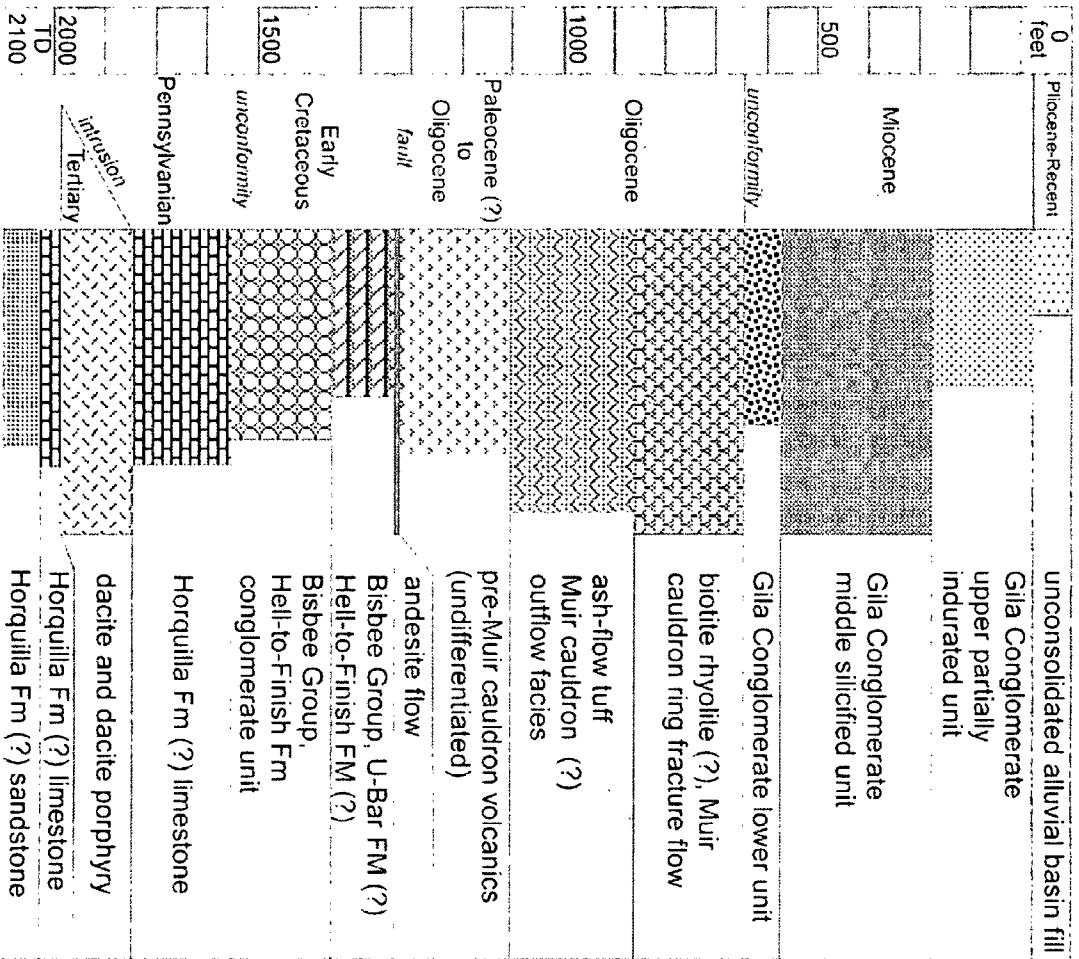
EXHIBIT 16

# COMPLETE BOUGUER GRAVITY MAP OF LIGHTNING DOCK REGION

Geothermal system is  
contained within a  
buried intrabasin horst  
Block.

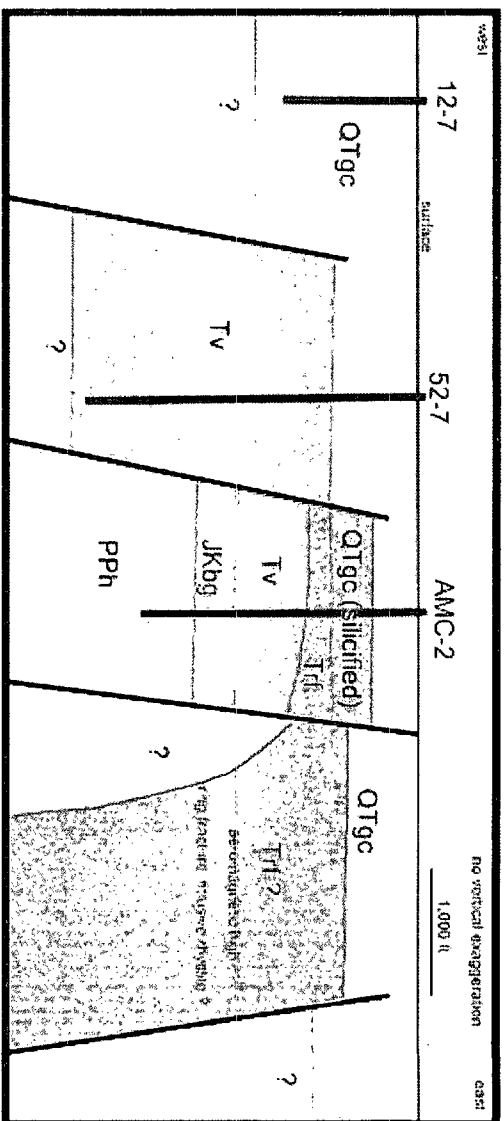


# SUMMARY GEOLOGIC LOG OF THE AMERICULTURE 2 WELL



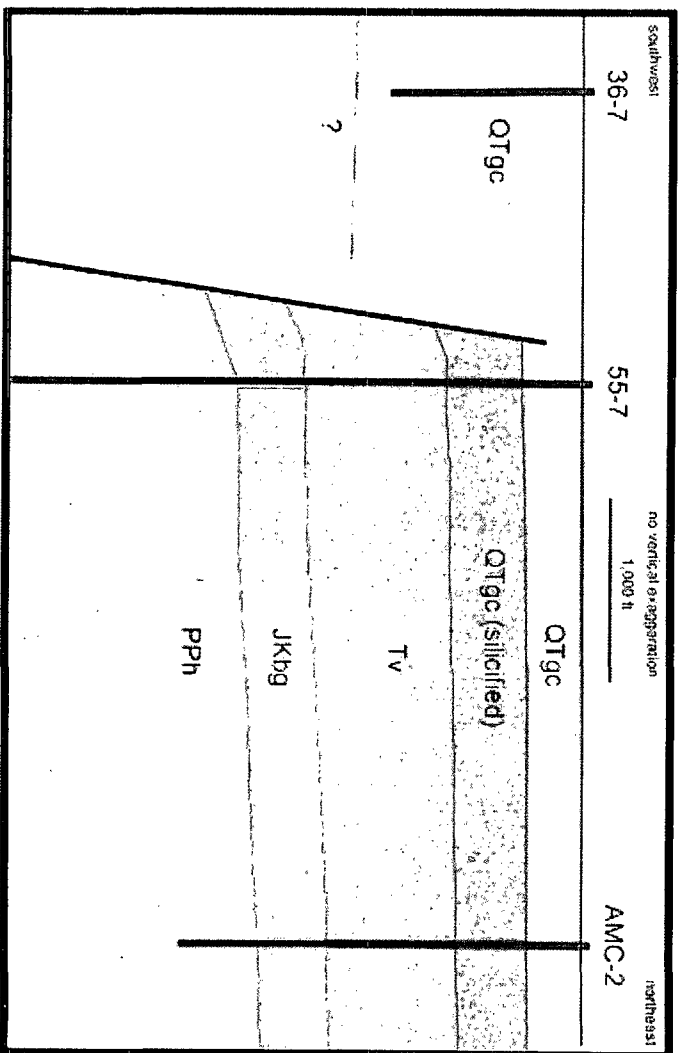
# GEOLOGIC CROSS SECTION 1

- QTgc – basin fill/Gila Conglomerate
- Trf – ring fracture zone rhyolite
- Tv – Tertiary volcanics
- JKbg – Mesozoic Bisbee Group
- PPh – Paleozoic limestone

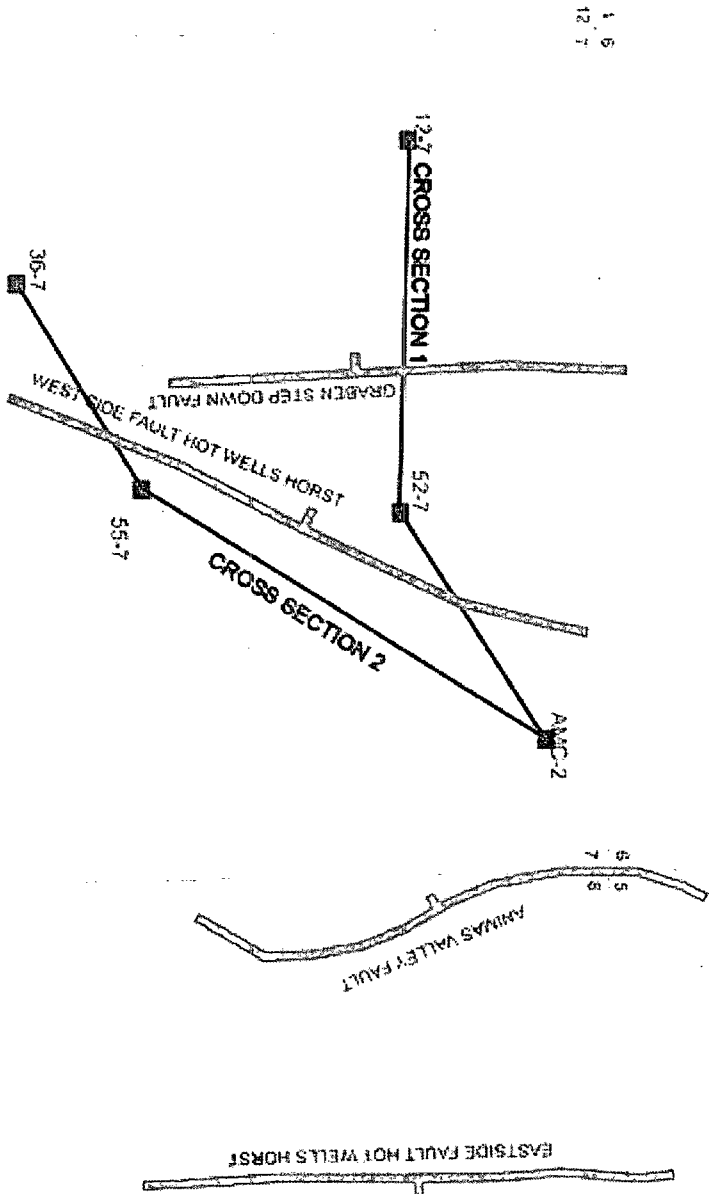


# GEOLOGIC CROSS SECTION 2

- QTgc – basin fill/Gila Conglomerate
- Tv – Tertiary volcanics
- JKbg – Mesozoic Bisbee Group
- PPh – Paleozoic limestone



# LOCATION MAP OF WELLS, FAULTS, AND CROSS SECTION LINES



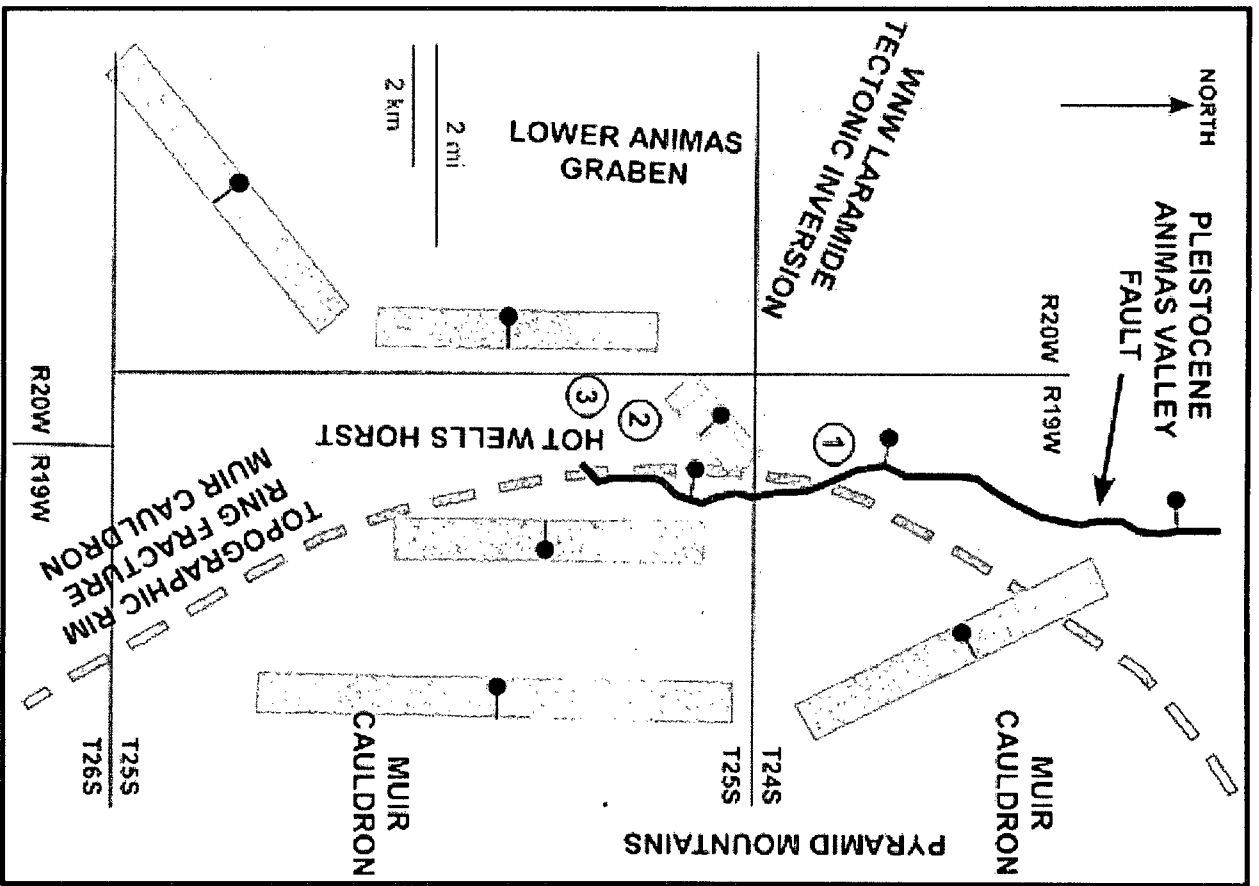
1, 6  
12, 7

12, 7  
13, 18

7, 8  
18, 17

# SUMMARY OF LIGHTNING DOCK STRUCTURAL ELEMENTS

- 1) Cockrell 1 Pyramid
- 2) AmeriCulture 2
- 3) Steam Reserve 55-7

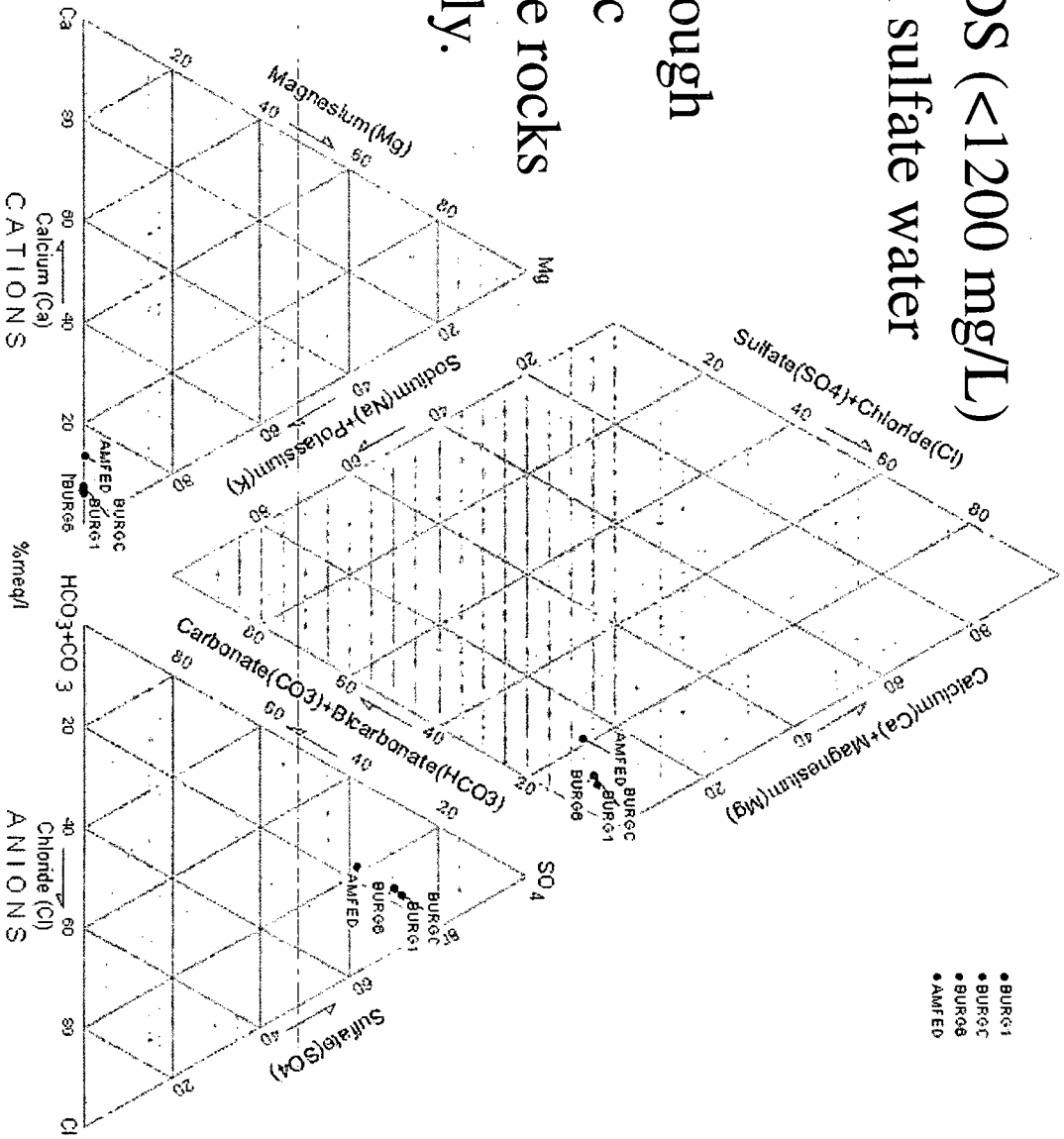


**EXHIBIT 22**

# PIPER DIAGRAM OF THERMAL WATER CHEMISTRY

- Low TDS (<1200 mg/L)
- Sodium sulfate water

Flow through  
Paleozoic  
carbonate rocks  
is unlikely.





# OXYGEN AND HYDROGEN ISOTOPES ANIMAS VALLEY

Blue cross – non thermal water  
 Red triangle – thermal water

## INTERPRETATION

- 1) Thermal and non thermal waters are meteoric water.
- 2) Shift to right of Global Mean Water Line is evaporation and (possibly subsurface boiling).

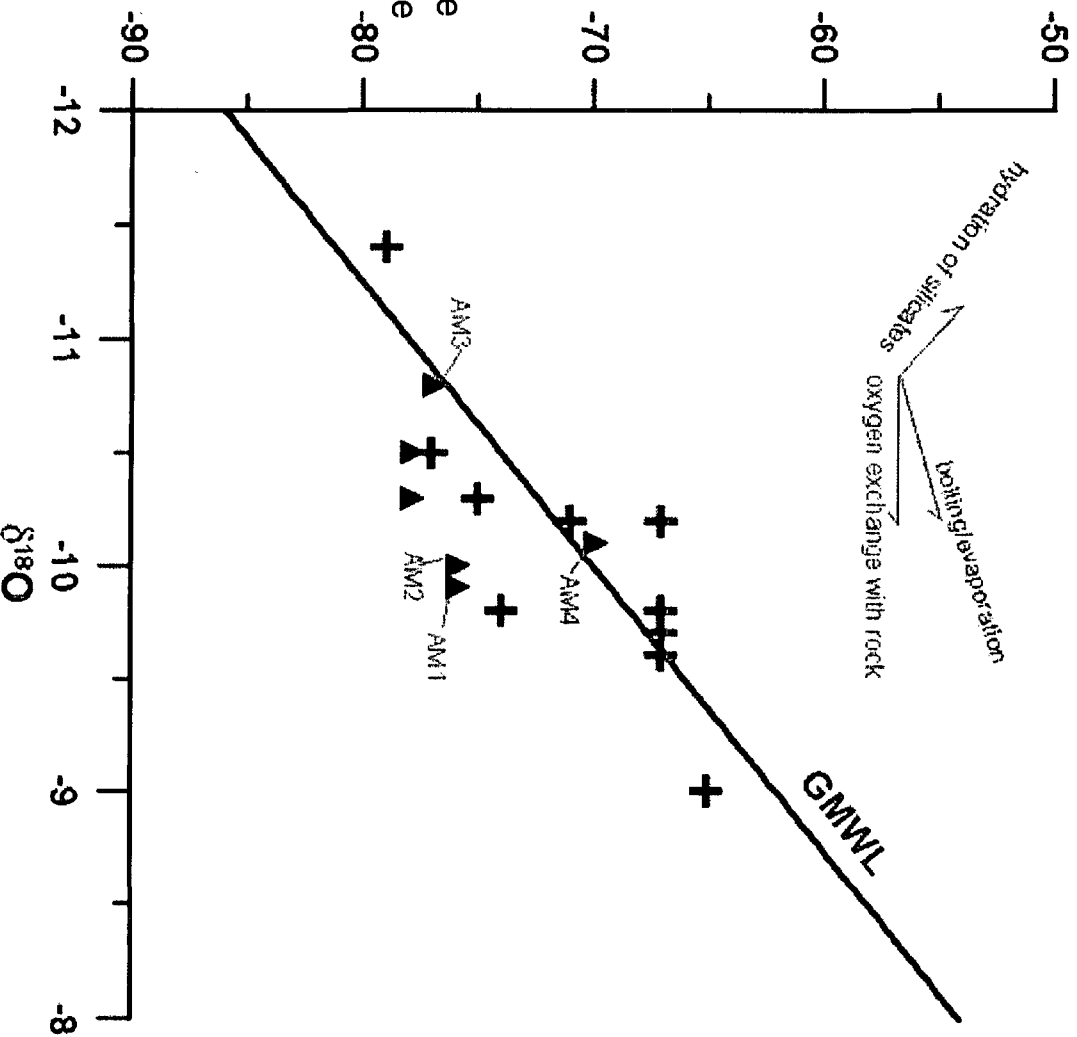


EXHIBIT 24

# ISOTOPIC EVIDENCE FOR RESERVOIR AND FLOW PATH

SAMPLE	SITE	D/H	18O/16O	13C/12C	34S/32S	87Sr/86Sr
AM1	Burgett #1	-76	-9.9	-10.6	8.50	0.728344
AM2	Burgett #C	-76	-10.0	-8.6	8.55	0.725616
AM3	Burgett #6	-77	-10.8	n/a	8.34	0.727433
AM4	Americulture Fed	-70	-10.1	-10.0	8.84	0.728861

- Carbon isotopes are too low for water that has flowed through Paleozoic carbonate rocks (0 to +6)
- Sulfur isotopes show very little variation and suggest a single mineral source such as pyrite. The sulfur isotope ratio is too low for Paleozoic marine sulfate (+10 to +30) and is consistent with magmatic ratios (accessory pyrite in volcanics and intrusives).
- Strontium isotope ratios are too high for flow through Paleozoic carbonate rocks and mafic and intermediate volcanic rocks (<0.710) and indicates flow through rhyolite and granite of mid-Tertiary to Precambrian age.

# SUMMARY OF FINDINGS

- The Lightning Dock system is a very small geothermal system and will not sustain power production greater than 2 or 3 MW.
- The nature of the upflow zone is not well defined except to infer that it is very localized and may be less than a few tens of acres in planar cross section area.
- The geothermal fluids do not flow across or originate in Paleozoic carbonate rocks.
- Proposed injection and production wells are located from one another in dramatically different hydrogeologic domains.
- Characterization of deep resource potential is not well defined and can only be classified in an immature exploration stage.
- Excessive production and injection or improperly located wells will quench the current resource.

## RECOMMENDATIONS

- APD's should not be approved for injection purposes. No reservoir hydraulic information is available to assess impact on reservoir for thermal break through and injection well spacing.
- APD's should not be approved for production purposes. Without reservoir testing, viable well spacing, and deep water chemistry is unknown. Projected reservoir hosts in Paleozoic limestone will have dramatically different and more saline water chemistry than current production from silicic volcanic and intrusive rocks.
- APD's should be approved only for test or exploration drilling with permit approval to injection and production contingent upon detailed reservoir hydraulics and chemistry information. Injected chemicals should be limited to approved substances potable water.

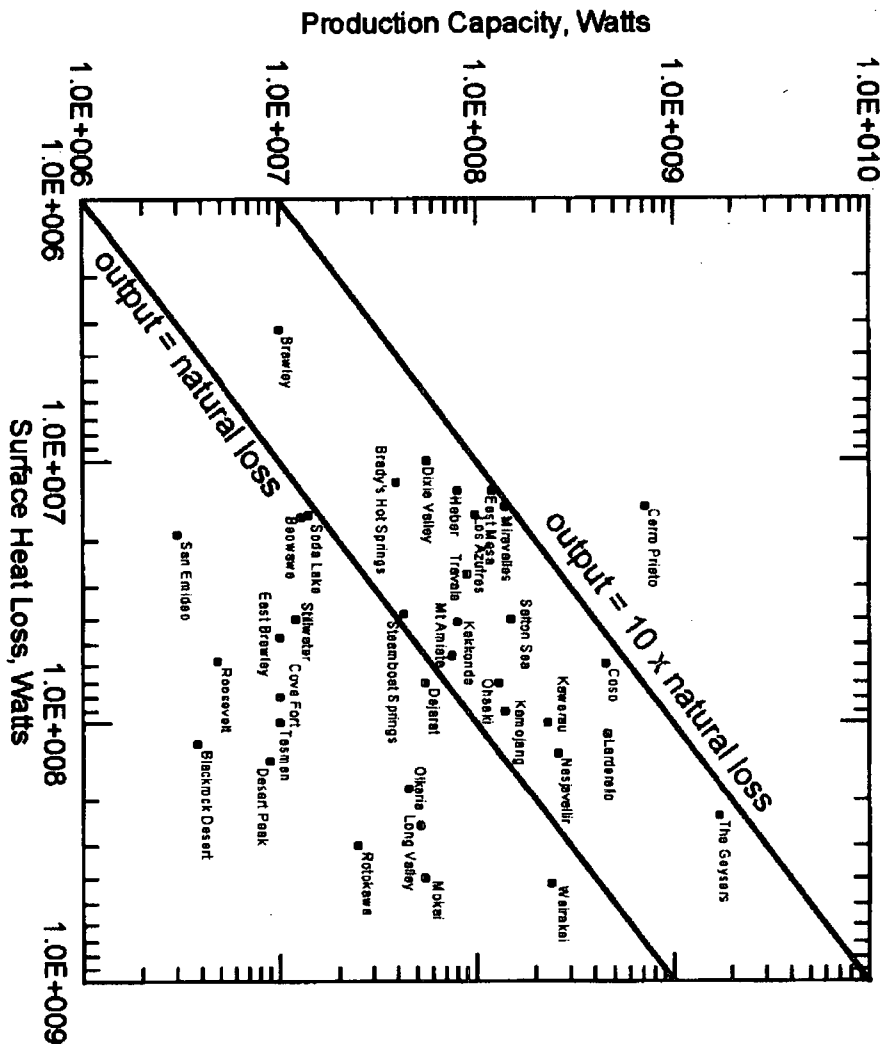


EXHIBIT 28

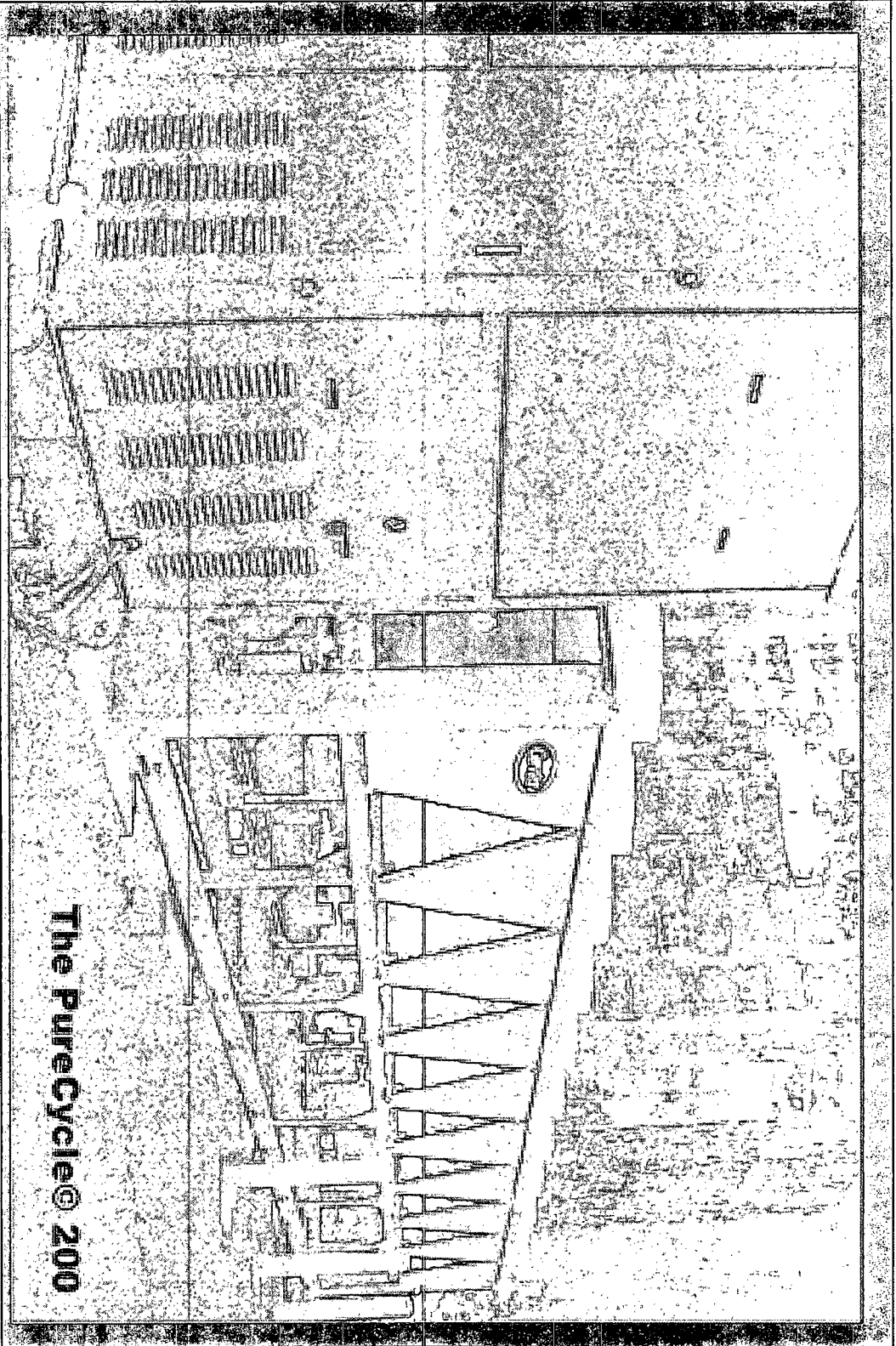


EXHIBIT 29

1/27/2009

LDG-1 Meeting (GTHT-1)

~~Names~~

Name	Company	ph.	e-mail
Carl Chavez	OCD	505-476-3490	Carl.j.Chavez@state.nm.us
D Seawright	Americulture	505-672-5220	damon@vtc.net
Michael Hayter	Raser	801-589-1872	mike.hayter@rasertech.com
JOHN SHOMAKER	RASER	505-345-3407	jshomaker@shomaker.com
JAMES WITCER	AMEN CULTURE	575-521-0146	JIMWITCER@PERNET.COM
John F. Esquibel	RASER	602-758-7530	LaChama@npg.ca.bb.ca
GLENN VAN GINZEN	OCD	505-476-3488	
Gary Seawright	Americulture	505-672-3739	g/seawright@msn.com
W.R. Jones	OCD	505-476-3448	WILLIAM N. JONES @STATE.NM.US
W. P. -	"		

**OCD Lightning Dock Geothermal (GTHT-1) Senior Hydrologist Meeting**  
**OCD Conference Room (3<sup>rd</sup> Floor) Wendell Chino Bldg., Santa Fe, NM**  
Tuesday, January 27, 2009 (1:00 p.m. – 5:30 p.m.)

**ATTENDEES:**

AmeriCulture, Inc.  
Los Lobos Renewable Power, L.L.C.  
Oil Conservation Division

**MEETING ISSUES**

- 1) Jim Witcher (AmeriCulture, Inc.) Presentation: Major Tectonic Inversion WNW Fault
  - a. Los Lobos: Don't know until we drill.
  - b. AmeriCulture, Inc.: Gross lack of subsurface information in project area.
  - c. OCD: Carl Chavez draft handout related to water quality monitoring #7 for the draft discharge permit requires sampling of all production and injection wells upon installation.
  
- 2) Mike Hayter (Los Lobos) Presentation: Location of injection well 51-07
  - a. Los Lobos: Drill 45-07 to first analyze all data. Step out w/ next well. Will have drilling information to proceed forward. Production wells could become injection wells.
  - b. AmeriCulture, Inc.: Not enough information to do anything. There is a problem with state permitting these wells without water chemistry and formation depth information.
  
- 3) Mike Hayter Presentation: Water Quality Monitoring (WQM)
  - a. Los Lobos: Hand out "Monitoring & Sample Plan" (December 2008)
  - b. AmeriCulture, Inc.: Concerned about water quality monitoring.
  - c. OCD: Carl Chavez handed out draft "Additional Requirements" for draft discharge permit that addresses WQM to attendees to consider. OCD will review





# New Mexico Energy, Minerals and Natural Resources Department

**Bill Richardson**

Governor

**Joanna Prukop**  
Cabinet Secretary  
**Reese Fullerton**  
Deputy Cabinet Secretary

**Mark Fesmire**  
Division Director  
Oil Conservation Division



## NOTICE OF PUBLICATION

### STATE OF NEW MEXICO ENERGY, MINERALS AND NATURAL RESOURCES DEPARTMENT OIL CONSERVATION DIVISION

Notice is hereby given that pursuant to New Mexico Water Quality Control Commission Regulations (20.6.2.3106 NMAC); the following discharge permit application(s) has been submitted to the Director of the New Mexico Oil Conservation Division ("NMOCD"), 1220 S. Saint Francis Drive, Santa Fe, New Mexico 87505, Telephone (505) 476-3440:

**(GT-001) Lightning Dock Geothermal No. 1 (HI-01). Mr. Steve Brown, Los Lobos Renewable Power, L.L.C., 5152, North Edgewood Drive Suite 375, Provo, Utah 84604 has submitted an application for a new discharge permit for the Lightning Dock Geothermal No. 1 (HI-01) "Binary Cycle" 15 10 MWe Geothermal Power Plant (5 Production/Development Wells & 3 Class V Geothermal Injection Wells). Development wells are located in the NW/4, NE/4, and SW/4 of Section 7. Injection wells are located in the NE/4 of Section 7; SW/4 of Section 12, and NW/4 of Section 18, Township 25 South, Range 19 West, NMPM, Hidalgo County, New Mexico. The plant is located approximately 10 miles south of I-10 on CR 338 (east side of Geothermal Road). Development wells will produce approximately 15,000 gpm of 250-300 °F geothermal water with a total dissolved solids (TDS) concentration of at least 1,300 mg/L or higher fresh ground water from the Horquilla Formation (geothermal carbonate reservoir) or other fractured formations at a depth of greater than or less than 3400 feet below ground level. Geothermal water will be routed in parallel and series into 50 portable self-contained (with heat exchanger, evaporator & condenser) binary cycle power generation units with the potential for 20 more units. Approximately 1500 gpm of shallow ground water with a TDS concentration of approximately 300 mg/L will be cycled through the cooling tower unit. Of this, approximately 425 gpm of cooling tower blow-down effluent along with the remainder of produced water (180-225 °F) will be injected into the geothermal reservoir at a maximum injection rate of between 4,000 to 5,000 gpm, and average pressure of about 75 psig per Class V Well.**

Oil Conservation Division \* 1220 South St. Francis Drive

\* Santa Fe, New Mexico 87505

\* Phone: (505) 476-3440 \* Fax (505) 476-3462\* <http://www.emnrd.state.nm.us>



**Lined evaporation ponds at the surface will temporarily store any excess produced or well test water for reinjection into the geothermal reservoir. Groundwater most likely to be affected by a spill, leak, or accidental discharge to the surface is at a depth of approximately 60 feet with a TDS of approximately 300 mg/L. The discharge plan addresses well construction, operation, monitoring, testing of the wells, associated surface facilities, and provides a contingency plan in the event of accidental spills, leaks and other accidental discharges in order to protect fresh water.**

The NMOCD has determined that the application is administratively complete and has prepared a draft permit. The NMOCD will accept comments and statements of interest regarding this application and will create a facility-specific mailing list for persons who wish to receive future notices. Persons interested in obtaining further information, submitting comments or requesting to be on a facility-specific mailing list for future notices may contact the Environmental Bureau Chief of the Oil Conservation Division at the address given above. The administrative completeness determination and draft permit may be viewed at the above address between 8:00 a.m. and 4:00 p.m., Monday through Friday, or may also be viewed at the NMOCD web site <http://www.emnrd.state.nm.us/ocd/>. Persons interested in obtaining a copy of the application and draft permit may contact the NMOCD at the address given above. Prior to ruling on any proposed discharge permit or major modification, the Director shall allow a period of at least thirty (30) days after the date of publication of this notice, during which interested persons may submit comments or request that NMOCD hold a public hearing. Requests for a public hearing shall set forth the reasons why a hearing should be held. A hearing will be held if the Director determines that there is significant public interest.

If no public hearing is held, the Director will approve or disapprove the proposed permit based on information available, including all comments received. If a public hearing is held, the director will approve or disapprove the proposed permit based on information in the permit application and information submitted at the hearing.

Para obtener más información sobre esta solicitud en español, sirvase comunicarse por favor: New Mexico Energy, Minerals and Natural Resources Department (Depto. Del Energia, Minerals y Recursos Naturales de Nuevo México), Oil Conservation Division (Depto. Conservación Del Petróleo), 1220 South St. Francis Drive, Santa Fe, New México (Contacto: Dorothy Phillips, 505-476-3461)

GIVEN under the Seal of New Mexico Oil Conservation Commission at Santa Fe, New Mexico, on this 28<sup>th</sup> Day of May 2008.

STATE OF NEW MEXICO  
OIL CONSERVATION DIVISION

January 26, 2009  
Page 3

S E A L

Mark Fesmire, Director



# New Mexico Energy, Minerals and Natural Resources Department

**Bill Richardson**  
Governor

**Joanna Prukop**  
Cabinet Secretary  
**Reese Fullerton**  
Deputy Cabinet Secretary

**Mark Fesmire**  
Division Director  
Oil Conservation Division



January 27, 2009

Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
5152 North Edgewood Drive, Suite 375  
Provo, Utah 84604

Re: **Lightning Dock Geothermal No. 1 HI-01 Discharge Permit (GTHT-001)**  
**Class V Geothermal Injection Wells (3)**  
**Production or Development Wells (5)**

Dear Mr. Brown:

Pursuant to all applicable parts of the Water Quality Control Commission (WQCC) Regulations 20.6.2 NMAC and more specifically 20.6.2.3104 - 20.6.2.3999 discharge permit, and 20.6.2.5000-.5299 Underground Injection Control, the Oil Conservation Division (OCD) hereby approves the discharge permit and authorizes the operation and injection for the **Lightning Dock Geothermal No. 1 (HI-01) (Owner/Operator)**. The power plant is located in the NE/4 SW/4 of Section 7, Township 25 South and Range 19 West, NMPM, Hidalgo County, New Mexico. The wells are located in Township 25 South and Range 19 West, NMPM, Hidalgo County, New Mexico.

### **Class V Geothermal Injection Wells**

51-07 located in the NW/4, NE/4 of Section 07, 169.2 FNL 2406.9 FEL ????

53-12 located in the NE/4, SW/4 of Section 12, 1574.8 FNL 3350 FWL ????

42-18 located in the NE/4, NW/4 of Section 18, 1307 FNL 2123 FWL

### **Production or Development Wells**

13-07 located in the SW/4, NW/4 of Section 7, 3781 FSL 530 FWL

33-07 located in the SE/4, NW/4 of Section 7, 3721.2 FSL 1789.4 FWL

45-07 located in the NE/4, SW/4 of Section 7, 2360 FSL 2278.2 FWL

47-07 located in the SE/4 SW/4 of Section 7, 1219.1 FSL 2266.3 FWL

53-07 located in the SW/4 NE/4 of Section 7, 3775.3 FSL 3052.1 FWL



Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
January 26, 2009  
Page 2

The approval is under the conditions specified in the enclosed **Attachment To The Discharge Permit**. Enclosed are two copies of the conditions of approval. **Please sign and return one copy to the New Mexico Oil Conservation Division (OCD) Santa Fe Office within 30 working days of receipt of this Letter including permit fees.**

Please be advised that approval of this permit does not relieve the owner/operator of responsibility should operations result in pollution of surface water, ground water or the environment. Nor does approval of the permit relieve the owner/operator of its responsibility to comply with any other applicable governmental authority's rules and regulations.

If you have any questions, please contact Carl Chavez of my staff at (505-476-3491) or E-mail [carlj.chavez@state.nm.us](mailto:carlj.chavez@state.nm.us). On behalf of the staff of the OCD, I wish to thank you and your staff for your cooperation during this discharge permit review.

Sincerely,

Wayne Price  
Environmental Bureau Chief

LWP/cc  
Attachments-1  
xc: OCD District Office

**DRAFT**  
**ATTACHMENT TO THE DISCHARGE PERMIT**  
**Lightning Dock Geothermal No. 1 (HI-01) (GTHT-001)**  
**DISCHARGE PERMIT APPROVAL CONDITIONS**

January 27, 2009

**Water Quality Management Fund**  
**C/o: Oil Conservation Division**  
**1220 S. Saint Francis Drive**  
**Santa Fe, New Mexico 87505**

- 1. Payment of Discharge Plan Fees:** All discharge permits are subject to WQCC Regulations. Every billable facility that submits a discharge permit application will be assessed a filing fee of \$100.00, plus a renewal flat fee (see WQCC Regulation 20.6.2.3114 NMAC). The Oil Conservation Division ("OCD") has received the required \$100.00 filing fee and \$1700.00 Class V Geothermal Well permit fee.
- 2. Permit Expiration and Renewal:** Pursuant to WQCC Regulation 20.6.2.3109.H.4 NMAC, this permit is valid for a period of five years. **The permit will expire on May 29, 2014** and an application for renewal should be submitted no later than 120 days before that expiration date. Pursuant to WQCC Regulation 20.6.2.3106.F NMAC, if a discharger submits a discharge permit renewal application at least 120 days before the discharge permit expires and is in compliance with the approved permit, then the existing discharge permit will not expire until the application for renewal has been approved or disapproved. ***Expired permits are a violation of the Water Quality Act {Chapter 74, Article 6, NMSA1978} and civil penalties may be assessed accordingly.***
- 3. Permit Terms and Conditions:** Pursuant to WQCC Regulation 20.6.2.3104 NMAC, when a permit has been issued, the owner/operator must ensure that all discharges shall be consistent with the terms and conditions of the permit. In addition, all facilities shall abide by the applicable rules and regulations administered by the OCD pursuant to the Geothermal Resources Conservation Act (Chapter 71, Article 5 NMSA 1978, et seq.), Sections §71-5-1 through §71-5-24; and Geothermal Power (Title 19, Chapter 14 NMAC 1983, et seq.) Parts §19.14.1 through §19.14.132.
- 4. Owner/Operator Commitments:** The owner/operator shall abide by all commitments submitted in its May 12, 2008 discharge permit application, including attachments and subsequent amendments and these conditions for approval. Permit applications that reference previously approved plans on file with the

division shall be incorporated in this permit and the owner/operator shall abide by all previous commitments of such plans and these conditions for approval.

**5. Modifications:** WQCC Regulation 20.6.2.3107.C, 20.6.2.3109 and 20.6.2.5101.I NMAC addresses possible future modifications of a permit. The owner/operator (discharger) shall notify the OCD of any facility expansion, production increase or process modification that would result in any significant modification in the discharge of water contaminants. The Division Director may require a permit modification if any water quality standard specified at 20.6.2.3103 NMAC is being or will be exceeded, or if a toxic pollutant as defined in WQCC Regulation 20.6.2.7 NMAC is present in ground water at any place of withdrawal for present or reasonably foreseeable future use, or that the Water Quality Standards for Interstate and Intrastate streams as specified in 20.6.4 NMAC are being or may be violated in surface water in New Mexico.

**6. Waste Disposal and Storage:** The owner/operator shall dispose of all wastes at an OCD-approved facility. Only geothermal RCRA-exempt wastes may be disposed of by injection in a Class II well. RCRA non-hazardous, non-exempt geothermal wastes may be disposed of at an OCD-approved facility upon proper waste determination pursuant to 40 CFR Part 261. Any waste stream that is not listed in the discharge permit application must be approved by the OCD on a case-by-case basis.

**A. OCD Rule 712 Waste:** Pursuant to OCD Rule 712 (19.15.9.712 NMAC) disposal of certain non-domestic waste without notification to the OCD is allowed at NMED permitted solid waste facilities if the waste stream has been identified in the discharge permit and existing process knowledge of the waste stream does not change.

**B. Waste Storage:** The owner/operator shall store all waste in an impermeable bermed area, except waste generated during emergency response operations for up to 72 hours. All waste storage areas shall be identified in the discharge permit application. Any waste storage area not identified in the permit shall be approved on a case-by-case basis only. The owner/operator shall not store geothermal waste on-site for more than 180 days unless approved by the OCD.

**7. Drum Storage:** The owner/operator must store all drums, including empty drums, containing materials other than fresh water on an impermeable pad with curbing. The owner/operator must store empty drums on their sides with the bungs in place and lined up on a horizontal plane. The owner/operator must store chemicals in other containers, such as tote tanks, sacks, or buckets on an impermeable pad with curbing.

**8. Process, Maintenance and Yard Areas:** The owner/operator shall either pave and curb or have some type of spill collection device incorporated into the design at all process, maintenance, and yard areas which show evidence that water contaminants from releases, leaks and spills have reached the ground surface.

**9. Above Ground Tanks:** The owner/operator shall ensure that all aboveground tanks have impermeable secondary containment (e.g., liners and berms), which will contain a volume of at least one-third greater than the total volume of the largest tank or all interconnected tanks. The owner/operator shall retrofit all existing tanks before discharge permit renewal. Tanks that contain fresh water or fluids that are gases at atmospheric temperature and pressure are exempt from this condition.

**10. Labeling:** The owner/operator shall clearly label all tanks, drums, and containers to identify their contents and other emergency notification information. The owner/operator may use a tank code numbering system, which is incorporated into their emergency response plans.

**11. Below-Grade Tanks/Sumps and Pits/Ponds.**

**A.** All below-grade tanks and sumps must be approved by the OCD prior to installation and must incorporate secondary containment with leak detection into the design. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal. All existing below-grade tanks and sumps without secondary containment and leak detection must be tested annually or as specified herein. Systems that have secondary containment with leak detection shall have a monthly inspection of the leak detection system to determine if the primary containment is leaking. Small sumps or depressions in secondary containment systems used to facilitate fluid removal are exempt from these requirements if fluids are removed within 72 hours.

**B.** All pits and ponds, including modifications and retrofits, shall be designed by a certified registered professional engineer and approved by the OCD prior to installation. In general, all pits or ponds shall have approved hydrologic and geologic reports, location, foundation, liners, and secondary containment with leak detection, monitoring and closure plans. All pits or ponds shall be designed, constructed and operated so as to contain liquids and solids in a manner that will protect fresh water, public health, safety and the environment for the foreseeable future. The owner/operator shall retrofit all existing systems without secondary containment and leak detection before discharge permit renewal.



**C.** The owner/operator shall ensure that all exposed pits, including lined pits and open top tanks (8 feet in diameter or larger) shall be fenced, screened, netted, or otherwise rendered non-hazardous to wildlife, including migratory birds. Where netting is not feasible, routine witnessing and/or discovery of dead wildlife and migratory birds shall be reported to the appropriate wildlife agency with notification to the OCD in order to assess and enact measures to prevent the above from reoccurring.

**D.** The owner/operator shall maintain the results of tests and inspections at the facility covered by this discharge permit and available for OCD inspection. The owner/operator shall report the discovery of any system which is found to be leaking or has lost integrity to the OCD within 15 days. The owner/operator may propose various methods for testing such as pressure testing to 3 pounds per square inch greater than normal operating pressure and/or visual inspection of cleaned tanks and/or sumps, or other OCD-approved methods. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

## **12. Underground Process/Wastewater Lines:**

**A.** The owner/operator shall test all underground process/wastewater pipelines at least once every five (5) years to demonstrate their mechanical integrity, except lines containing fresh water or fluids that are gases at atmospheric temperature and pressure. A comprehensive listing of process/wastewater pipelines shall be submitted to the OCD within 3 months of permit issuance. Pressure rated pipe shall be tested by pressuring up to one and one-half times the normal operating pressure, if possible, or for atmospheric drain systems, to 3 pounds per square inch greater than normal operating pressure, and pressure held for a minimum of 30 minutes with no more than a 1% loss/gain in pressure. The owner/operator may use other methods for testing if approved by the OCD.

**B.** The owner/operator shall maintain underground process and wastewater pipeline schematic diagrams or plans showing all drains, vents, risers, valves, underground piping, pipe type, rating, size, and approximate location. All new underground piping must be approved by the OCD prior to installation. The owner/operator shall report any leaks or loss of integrity to the OCD within 15 days of discovery. The owner/operator shall maintain the results of all tests at the facility covered by this discharge permit and they shall be available for OCD inspection. The owner/operator shall notify the OCD at least 72 hours prior to all testing.

**13. Class V Wells:** The owner/operator shall close all Class V wells (e.g., septic systems, leach fields, dry wells, etc.) that inject non-hazardous industrial wastes or a mixture of industrial wastes and domestic sanitary effluent wastes, unless it can be demonstrated that ground water will not be impacted in the reasonably foreseeable future. Leach fields and other wastewater disposal

systems at OCD-regulated facilities that inject sanitary effluent and non-hazardous fluid into or above an underground source of drinking water are considered Class V injection wells under the EPA UIC program. Class V wells that inject domestic sanitary effluent waste only, must be permitted by the New Mexico Environment Department (NMED).

**14. Housekeeping:** The owner/operator shall inspect all systems designed for spill collection/prevention and leak detection at least monthly to ensure proper operation and to prevent over topping or system failure. All spill collection and/or secondary containment devices shall be emptied of fluids within 72 hours of discovery. The owner/operator shall maintain all records at the facility and available for OCD inspection.

**15. Spill Reporting:** The owner/operator shall report all unauthorized discharges, spills, leaks and releases and conduct corrective action pursuant to WQCC Regulation 20.5.12.1203 NMAC; OCD Rule 116 (19.15.3.116 NMAC). The owner/operator shall notify both the OCD District Office and the Santa Fe Office within 24 hours and file a written report within 15 days. The Division shall in compliance with 19.14.36.8 NMAC be notified of any fire, break, leak, spill or blowout occurring at any geothermal drilling, producing, transporting, treating, disposal or utilization facility in the State of New Mexico by the person operating or controlling the facility.

**16. OCD Inspections:** The OCD may place additional requirements on the facility and modify the permit conditions based on OCD inspections.

**17. Storm Water:** The owner/operator shall implement and maintain run-on and runoff plans and controls. The owner/operator shall not discharge any water contaminant that exceeds the WQCC standards specified in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) including any oil sheen in any storm water run-off. The owner/operator shall notify the OCD within 24 hours of discovery of any releases and shall take immediate corrective action(s) to stop the discharge.

**18. Unauthorized Discharges:** The owner/operator shall not allow or cause water pollution, discharge or release of any water contaminant that exceeds the WQCC standards listed in 20.6.2.3101 NMAC or 20.6.4 NMAC (Water Quality Standards for Interstate and Intrastate Streams) unless specifically listed in the permit application and approved herein.

**An unauthorized discharge is a violation of this permit.**

**19. Vadose Zone and Water Pollution:** The owner/operator shall address any contamination through the discharge permit process or pursuant to WQCC 20.6.2.4000-.4116 NMAC (Prevention and Abatement of Water Pollution). The OCD may require the owner/operator to modify its permit for investigation, remediation, abatement, and monitoring requirements for any vadose zone or water pollution. Failure to perform any required investigation, remediation, abatement and submit subsequent reports will be a violation of the permit.

**20. Additional Site Specific Conditions.**

**A. Formation Fracturing Fluids:** Fluids used in the fracturing of formations shall not harm human health, wildlife and the environment. Fluid volumes used to fracture shall be properly swabbed back, collected and disposed.

**B.** See OCD attached draft with additional proposed conditions.

**21. Geothermal Well(s) Identification, Operation, Monitoring, Bonding and Reporting.**

**C. Geothermal Well Identification:**

Class V Geothermal Injection Wells:

Well # 51-07 (API # 30-023-20019) ?

Well # 53-12 (API # 30-023-20020) ?

Well # 42-18 (API # 30-023-20018)

Production or Development Wells:

Well # 13-07 (API # 30-023-20013) ?

Well # 33-07 (API # 30-023-20014) ?

Well # 45-07 (API # 30-023-20015) ?

Well # 47-07 (API # 30-023-20016) ?

Well # 53-07 (API # 30-023-20017) ?

**D. Well Work Over Operations:** OCD approval will be obtained prior to performing remedial work, pressure test or any other work. Approval will be requested on OCD Form G-101 "Application Permit To Drill, Deepen, or Plug Back- Geothermal Resources Well" (OCD Rule 19.14.52 NMAC) with appropriate copies sent to the OCD Environmental Bureau and District Office.

- E. Production/Injection Method:** High temperature (250 – 300 °F) geothermal water is brought to surface from the Horquilla Formation or geothermal reservoir at 3,400 feet below ground level by 5 production or development wells (~ 3,000 gpm per well). Hot water is routed in parallel and series through 50 binary cycle (self-contained heat exchanger, evaporator & condenser) power generation units. Condensed produced or effluent water (~ 225 °F) is routed to a lined evaporation pond(s) for injection (~ 75 psig per well) via 3 Class V geothermal wells into the geothermal reservoir.
- F. Well Pressure Limits:** The operating surface injection and/or test pressure per injection well measured at the wellhead shall be at a flow rate and pressure that will not adversely affect public health, the environment, and the correlative rights of future geothermal operators in the high temperature geothermal reservoir. The operator shall have a working pressure limiting device or controls to prevent overpressure. Any pressure that causes damage to the system shall be reported to OCD within 24 hours of discovery.
- G. Mechanical Integrity Testing:** At least once every five years and after any well work over, the geothermal reservoir will be isolated from the casing or tubing annulars and the casing pressure tested at a minimum of 600 psig for 30 minutes. A passing test shall be within +/- 10% of the starting test pressure. All pressure tests must be performed per the scheduled shown below and witnessed by OCD unless otherwise approved.

**Testing Schedule:**

- |       |   |
|-------|---|
| 2008- | 30 minute @ minimum 600 psig casing test only (set packer above casing shoe to isolate formation from casing) |
| 2013- | 30 minute @ minimum 600 psig casing test only (set packer above casing shoe to isolate formation from casing) |

- H. Capacity/ Cavity Configuration and Subsidence Survey:** The operator shall provide information on the size and extent of the geothermal reservoir and geologic/engineering data demonstrating that continued geothermal extraction will not cause surface subsidence, collapse or damage to property, or become a threat to public health and the environment. This information shall be supplied in each annual report. OCD may require the operator to perform additional well surveys, tests, and installation of subsidence monitoring in order to demonstrate the integrity of the system. If the operator cannot demonstrate the integrity of the system to the satisfaction of the Division then the

operator may be required to shut-down, close the site and properly plug and abandoned the wells.

**Any subsidence must be reported within 24 hours of discovery.**

- I. **Production/Injection Volumes:** After placing any geothermal well on production, the owner or operator thereof shall file in duplicate a monthly production report, Form G-108, which report shall be due in the Santa Fe office of the division by the 20th day of each month or included in the annual report. The operator shall also document the production from each well and each lease during the preceding calendar month.
- J. **Analysis of Injection and Geothermal Reservoir Fluids:** After placing any well on injection or disposal in a geothermal resources field or area, the owner or operator thereof shall file in duplicate a monthly injection report, Form G-110, which report shall be due in the Santa Fe office of the division by the 20th day of each month or included in the annual report. The operator shall show the zone or formation into which injection is being made, the volume injected, the average temperature of the injected fluid and the average injection pressure at the wellhead. The analysis of the injection and geothermal reservoir fluids shall be recorded monthly and submitted with Form G-110. Analysis will be for General Chemistry (method 40 CFR 136.3) using EPA methods.
- K. **Area of Review (AOR):** The operator shall report within 24 hours of discovery of any new wells, conduits, or any other device that penetrates or may penetrate the injection zone within ¼ mile from a Class V Geothermal Injection Well.
- L. **Annual Geothermal Temperature and Pressure Tests:** Production or development wells shall undergo an annual test that shall be submitted on Form G-111 by the operator within 30 days of the completion of the test. Flowing temperatures and flowing pressure tests at the wellhead shall be recorded after at least 72 hours of continuous flow at normal producing rates. The well shall then be shut in for 24 hours and shut-in pressure at the wellhead recorded. Results of these tests shall be submitted in duplicate to the Santa Fe office of the division.
- M. **Loss of Mechanical Integrity:** The operator shall report within 24 hours of discovery of any failure of the casing, tubing or packer, or movement of fluids outside of the injection zone. The operator shall cease

operations until proper repairs are made and the operator receives OCD approval to re-start injection operations.

**N. Bonding or Financial Assurance:**

**Class V Geothermal Injection Wells:** The operator shall maintain at a minimum a cash bond (i.e., Assignment of Cash Collateral Deposit or Multi-Well Cash Financial Assurance Bond Geothermal Injection) in the amount of \$50,000.00 to restore the site, plug and abandon wells, pursuant to OCD rules and regulations.

**Production or Development Wells:** The operator shall maintain at a minimum a cash bond (i.e., \$10,000.00 Multi-Well (4 wells) Geothermal Plugging Bond and/or \$5,000.00 (1 well) Geothermal Plugging Bond).

If warranted, OCD may require additional financial assurance for closure of the power plant or facility (see Section 23 below).

**M. Annual Report:**

All operators shall submit an annual report due on January 31 of each year. The report shall include the following information:

1. Cover sheet marked as "Annual Geothermal Well Report, name of operator, GT permit #, API# of well(s), date of report, and person submitting report.
2. Brief summary of geothermal well operations including description and reason for any remedial or major work on the well(s). Copy of Form G-101.
3. Production and injection volumes as required above in 21.G. including a running total should be carried over to each year. The total mass produced, dry steam produced, flow rates, temperatures and pressures, average injection pressures, temperatures, etc.
4. A copies of the chemical analyses as required above in 21.H.
5. A copies of any mechanical integrity test chart, including the type of test, i.e., EPA 5-Yr. casing test, date, time, etc. as required above in 21 E and 21J.

6. Brief explanation describing deviations from normal production methods.
7. A copy of any leaks and spills reports, information provided under Section 15 above.
8. If applicable, results of any groundwater monitoring.
9. Information required from cavity/subsidence 21.F. above.
10. An updated Area of Review (AOR) summary (20.6.2 NMAC) when new wells are drilled within ½ mile of the power plant.
11. A "Miscellaneous" section to include any other issues that needs to be brought to the Division's attention.
12. Sign-off requirements pursuant to WQCC Subsection G 20.6.2.5101.

**22. Transfer of Discharge Permit:** Pursuant to WQCC 20.6.2.5101.H the owner/operator and new owner/operator shall provide written notice of any transfer of the permit. Both parties shall sign the notice 30 days prior to any transfer of ownership, control or possession of a facility with an approved discharge permit. In addition, the purchaser shall include a written commitment to comply with the terms and conditions of the previously approved discharge permit. OCD will not transfer brine well operations until proper bonding or financial assurance is in place and approved by the division. OCD reserves the right to require a modification of the permit during transfer.

**23. Closure:** The owner/operator shall notify the OCD when operations of the facility are to be discontinued for a period in excess of six months. Prior to closure of the facility, the operator shall submit for OCD approval, a closure plan including a completed C-103 form for plugging and abandonment of the well(s). Closure and waste disposal shall be in accordance with the statutes, rules and regulations in effect at the time of closure.

**24. Certification: Lightning Dock Geothermal No. 1 (HI-01) LLC (Owner/Operator),** by the officer whose signature appears below, accepts this permit and agrees to comply with all submitted commitments, including these terms and conditions contained here. **Owner/Operator** further acknowledges that the OCD may, for good cause shown, as necessary to protect fresh water, public health, safety, and the environment, change the conditions and requirements of this permit administratively.

Mr. Steve Brown  
Los Lobos Renewable Power, L.L.C.  
January 26, 2009  
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Conditions accepted by: "I certify under penalty of law that I have personally examined and am familiar with the information submitted in this document and all attachments and that, based on my inquiry of those individuals immediately responsible for obtaining the information, I believe that the information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information including the possibility of fine and imprisonment."

\_\_\_\_\_  
Company Name-print name above

\_\_\_\_\_  
Company Representative- print name

\_\_\_\_\_  
Company Representative- signature

Title \_\_\_\_\_



**Lightning Dock Geothermal Project**  
**OCD Discharge Permit: Section 20 Additional Site Specific Conditions**  
**Carl Chavez**  
**January 27, 2009**  
**DRAFT**

**Ground Water & Surface Water Monitoring:**

- 1) Establish a water table ground water monitoring program down gradient and upgradient from Class V injection wells and potential point source areas from the power facility.
- 2) A monitoring work plan shall be submitted for OCD approval that documents hydrogeology (piezometric and potentiometric surface ground water flow direction, hydraulic gradient and water quality) at upgradient and downgradient locations from potential points sources at the geothermal plant (i.e., cooling tower blow-down w/ spent production water at Class V Well injection locations) with water quality monitoring. Low-flow purge sampling methods may be approved if monitor well screens do not exceed 15 ft. with 5 ft. of screen placed above the water table.
- 3) Nested monitor wells to establish the vertical gradient(s) within the aquifer(s) or reservoir(s) and to monitor for any potentially upwelling contamination to nearby pumping domestic and commercial water supply wells (Los Lobos may have addressed this?).
- 4) All casing strings shall be constructed and completed in accordance with "Title 19, Chapter 14 NMAC 1983 (Recompiled 12/31/01)", i.e., full cementing w/ minimum overlap of at least 50 ft. between casing strings to TD. Conductor pipe shall be set at a depth of at least 100 ft below ground level.
- 5) Monitor wells shall be constructed with at least 15 ft. of screen with 10 ft. of screen positioned below the water table (~ 60 – 70 ft.). The screen slot size shall facilitate the collection of low turbidity samples. Low-flow ground water sampling may be used with stabilization monitoring for Temperature, ORP and DO in advance of sampling. Otherwise, the standard 3 volume well evacuation sample method will work.
- 6) Triangulate seasonal piezometric surface flow across the facility which must include surveying in well locations (TOC & ground elevations- Mean Sea Level) to the nearest 0.01 ft. Static water levels must be collected quarterly for 2-yrs. to document ground water flow direction. Plots of ground water flow direction with estimates of hydraulic gradients from quarterly monitoring are required to understand basic hydrogeology, i.e., ground water flow velocity, etc.) beneath and surrounding the geothermal facility.

7) Sample development or production and injection wells during the first sampling event to establish background water quality conditions before operations begin. Triangulate potentiometric flow direction and hydraulic gradient from SWL (MSL) to nearest 0.01 ft.

**Table 1  
Lightning Dock Geothermal No. 1 (HI-01) Groundwater Monitoring Schedule**

Monitoring Well ID*	Sampling Frequency**	Water Quality Parameters	Analytical Suite	Approximate Well location
MW-1 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	S. of 47-07
MW-2 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	S. of the nursery greenhouse # 3 & 4
MW-3 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Between 45-07 & 55-07
MW-4 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Between 45-07 & 55-07
MW-5 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	N. of 45-07
MW-6 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	W. of 45-07
MW-7 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Downgradient location from facility
NW-1 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Well location proposed by Raser
NW-2 <sup>1</sup>	Semi - annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Well location proposed by Raser

Monitoring Well ID*	Sampling Frequency**	Water Quality Parameters	Analytical Suite	Approximate Well location
NW-3 <sup>1</sup>	Semi-annual <sup>2</sup>	pH, Cond, Temp, ORP, DO	EPA Methods 8260 (VOCs), 8270 (SVOC), 8013 (PAH), 418.1 (TPH) EPA, RCRA metals, General Chemistry (major cations & anions, nitrates/nitrites....)	Well location proposed by Raser
IW 51-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
IW 53-12 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
IW 42-18 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
13-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
33-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
45-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
47-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application
53-07 <sup>3</sup>	One-time	General Chemistry	General Chemistry (major cations & anions)	Proposed in application

MW= Monitor Well

NW= Nested Well

DW= Development/Production Well

IW= Injection Well

\*Quarterly Static Water Level (SWL) mean sea-level to nearest 0.01 ft. in advance of sampling event

\*\* Sampling may be reduced to annual after 2 years

<sup>1</sup>= Monitor wells must be sampled if they do not contain measurable phase-separated hydrocarbons.

<sup>2</sup>= Semi-Annual groundwater monitoring event must be completed no more than 30 days prior to the start of the irrigation season but no later than April 30 of each year. Monitoring must be conducted no later than 30 days after the conclusion of the irrigation season but no later than November 15 of each year.

<sup>3</sup>= One-time sampling event with static water level (SWL) mean sea-level (0.01 ft. accuracy) and general chemistry collected during the first sample event.

**Note:** All wells with phase-separated hydrocarbons (PSHs) must be checked at a minimum of once per month and recorded on a spreadsheet. The data must be presented in table form listing all of the impacted wells, date inspected, product thickness measured to 0.01 of a foot, and amount of product/water recovered. If PSHs are observed in a monitoring well, then appropriate steps must be taken to recover the PSHs using the best available technology.

### Aquatic Toxicity & Monitoring:

An aquatic toxicity test with all cooling-tower blow-down chemical constituents is requested on the Tilapia fish species present at the Aquaculture facility downgradient from the proposed Class V well injection locations. The chemicals shall consist of the high range application of Nalco chemicals proposed during the hearing on 12/1/2008.

### **Waste Characterization & Disposal Monitoring:**

A flow diagram illustrating the location(s) where spent produced water comingled with cooling-tower blow-down will be stored and tested. Daily monitoring of pH, specific conductivity, TDS and general chemistry for at least 7 days of full scale operation reduced to weekly thereafter is required upon startup of operations. The applicant may request to reduce the frequency of general chemistry sampling if it can establish a correlation between Nalco's 3D TRASAR® Systems monitoring parameters and laboratory general chemistry, i.e., specific conductivity vs. chlorides and TDS. Analytical data results to be reported within 30 days of sampling.

### **Water Quality Standards:**

- 1) Disposal or injection of cooling tower blow-down comingled with spent production water shall meet WQs or background as established from the first sampling event.
- 2) No discharge of untreated chemicals is allowed to storm water and/or or "Waters of the State". Therefore, any discharge to rip-rap areas near the cooling tower(s) as displayed in engineering drawings should be routed to the lined evaporation pond(s) and not the rip-rap areas.
- 3) The applicant may discharge into "Waters of the State" under a National Pollutant Discharge Elimination System (NPDES) Permit via NOI submittal to the USEPA Region 6 where treatment is applied. The OCD would be required to approve the discharge concurrently with the USEPA. The applicant will be required to address all of the federal NPDES monitoring and reporting requirements of the NPDES permitting process.



**MONITORING AND SAMPLING PLAN  
FOR  
INJECTION OF COOLING TOWER WATER  
AND  
GROUNDWATER AND SURFACE WATERS**

**LIGHTNING DOCK GEOTHERMAL NO. 1, HI-01 LLC**

**HIDALGO COUNTY, NEW MEXICO**

**Prepared By:**

**Los Lobos Renewable Power, LLC  
5152 North Edgewood Drive. Uite 375  
Provo, Utah**

**DECEMBER 2008**

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MONITORING AND SAMPLING PLAN  
FOR  
INJECTION OF COOLING TOWER WATER  
AND  
GROUNDWATER AND SURFACE WATERS

LIGHTNING DOCK GEOTHERMAL NO. 1, HI-01 LLC  
HIDALGO COUNTY, NEW MEXICO

## 1.0 INTRODUCTION

Los Lobos Renewable Power, LLC (LLRP) is the owner/operator of the Lightning Dock Geothermal No.1 facility comprising about 2,501 acres in the Animas Valley of Hidalgo County, New Mexico. This general location includes a shallow and relatively high-temperature geothermal resource that has been developed for direct heating of greenhouses and a fish farm. A deep well drilled in 1984 found high temperatures and significant water flow at a depth of about 1,000 feet. LLRP is proposing to install an exploratory well to gather necessary data to evaluate the lateral extent and shallow and deeper characteristics of the geothermal reservoir. This data will assist LLRP in determining the viability of producing geothermal resources in commercial quantities from the proposed facility, including five production wells to supply a 10 MW geothermal power plant and three injection wells to return the fluids to the geothermal reservoir.

The purpose of this document is to define the sampling and monitoring plan for the Lightning Dock facility. The plan has been divided into two sections. The first section will include the monitoring of the cooling tower water before it is introduced into the facility injection system. Water will be delivered to the cooling tower from an off site cold water well, treated, monitored and injected into the geothermal injection system. The second section will be to gather data from the exploratory well, production wells, injection wells, monitoring wells, private wells and surface water. The data collected will further the understanding of the local hydrology, provide insight into the rate, volume and flow paths of geothermal water and heat, and detect any impacts to the shallow or deep thermal aquifers. The data will also provide water chemistry of the geothermal fluids. See Map 1 for location of proposed production, injection, monitoring, private wells and surface waters selected for monitoring.

## 2.0 GEOLOGIC SETTING

The Animas Valley of southwestern New Mexico is in the Mexican Highland part of the Basin and Range Province of the Western United States. The complexity of the Animas Valley area is demonstrated by the widely differing structures, stratigraphy, and ages of rocks exposed in the surrounding mountain ranges. The Animas Valley is a topographic low and a structural graben, and is bounded on the west by the Peloncillo Mountains and on the east by the Pyramid Mountains. The primary structural trends in the area are the north-trending Basin and Range features and an inferred caldera ring-fracture zone. Relatively young basaltic volcanism is widespread in the area with the most recent activity being a small cinder cone dated at 140,000 years old on the west side of the valley. These Cenozoic features are superimposed on a Laramide thrust belt setting that in turn occurs at the

edge of the Paleozoic cratonic region of North America (Chang et al, 199; Corbitt and Woodward 1973, and Woodward and Duchene, 1981). Elston, et al, (1983) give a good overview of the geology and provide a thorough geochemical analysis of the water of the Lightning Dock KGRA.

According to Blackwell and Wisian (2001), gravity data illustrates the basement and fault structures of Animas Valley. North-trending, range-bounding faults define the valley on the west and east. An east-northeast-trending fault with a right-lateral component appears to cut across the valley through the production area. Blackwell and Wisian also filtered and inverted the gravity data to produce a depth-to basement map that highlights the northeast-southwest structure trend across the Animas Valley.

Rocks exposed in the bordering mountain ranges include Precambrian granodiorite, Paleozoic and Mesozoic sedimentary rocks. Tertiary/Cretaceous volcanic rocks, Tertiary intrusive rocks, Tertiary conglomerate, Quaternary/Tertiary basalt flows, and Quaternary/Tertiary conglomerate (O'Brien and Stone, 1984). The Pyramid Mountains, composed of rocks primarily of Cretaceous age and younger (Flege, 1959), form a complex volcanic sequence known as the Muir cauldron (Deal and others, 1978, and Elston et al, 1983). In contrast, the Peloncillo Mountains consist of a Precambrian granite core, a complete Paleozoic section, Cretaceous sedimentary rocks, and Tertiary intrusive and eruptive rock (Gillerman, 1958, Dane and Bachman, 1961, and Dane and Bachman, 1965).

### **3.0 COOLING TOWER WATER TREATMENT, MONITORING AND REINJECTION**

The Geothermal Water System is intended to consist of up-to five (5) Production and three (3) Reinjection Wells and a Closed Piping System that circulates through the Geothermal Energy Generators which produce Electrical Energy via the Binary Rankin Cycle. The Geothermal Water is circulated at various flows (based upon the Resource Temperature) from about 11,000GPM to 13,000GPM. This Power Generation Process also requires a Cooling Water System to complete the Rankin Cycle process to heat and cool the Cycle Media/Refrigerant. The Cooling Water system will draw water from either Plant Wells or an Existing Local Source and circulate through the Generators and a Cooling Tower at varying Flow-Rates of about 46,000GPM to 50,000GPM.

The inherent designed Mechanical/Physical cooling characteristics of the Cooling Tower evaporate approximately 2% to 4% of the Cooling Water flow (1,000GPM to 2,000GPM), dependant mainly upon local weather conditions at any point in time. This evaporation tends to concentrate the Cooling Water; therefore, at any level of water chemistry/quality from potable to non-potable, the constant evaporation of the Cooling Tower will concentrate water to levels which are not acceptable for the Generation Equipment, Cooling Tower, and/or the piping of which contain the water itself in the closed system. To offset this concentration "Fresh" Cooling Water can be added to the cooling loop at a rate of double, triple, or more than the evaporation rate. To decrease the amount of additional water needed, the Cooling Water Loop can be Chemically or Mechanically Treated to allow for higher levels of compatibility with the Equipment and Piping Materials. In either of these two cases, some water will need to be discharged in a form of a Blow-Down Stream consisting of concentrated Dissolved and Suspended Solids that were originally present in the Cooling Water Source.

To maintain the Project Zero Discharge, Minimal Evaporation, and Minimal Water Consumption characteristics, this Blowdown Stream will be injected into the Geothermal Reinjection Well Stream. To assure that the Quality of this Cooling Water Blowdown water and to assure that any Chemical Addition of the Water Treatment System does not exceed the "original chemistry" of the Geothermal Water Stream, a Geothermal Water / Cooling Tower Blowdown Water Quality Monitoring System will be included in the Design. This System will employ real-time monitoring equipment capable of on-line monitoring and recording of Water Chemistry for both Historical and Reporting requirements. This data collection and reporting will also include the reporting to the Plant PLC Controller which will adjust not only the Cooling Water and Chemical Injection Systems; but, will also be able to administratively (1) Limit the amount of Blowdown Flow, (2) divert some or all flow to the Plant Evaporation Pond, or (3) take other steps to limit and/or stop Cooling Tower Blowdown Flow to the Geothermal Water Reinjection; up-to and including a total Plant Shut-Down until such time as the Chemistry of the Injection Flow is within acceptable Range. This "Acceptable Range" can be set and/or regulated administratively, as stipulated in/by Permit; however, the Chemistry of the Geothermal Reinjection Flow shall not exceed those levels as found in the Production/Reinjection Well Stream.

#### **3.1 Proposed Cooling Tower Chemicals**

The proposed chemicals to be used in the cooling tower will include bleach for primary biocide control, sulfuric acid for pH control, Nalco 3DT189 for scale and corrosion control, along with Nalco 960 as required for supplemental biocide. Nalco 7408 - As a precautional measure, a Nalco 7408 feed

system will be set up to scavenge any excess residual oxidant prior to effluent re-jection. See Attachment A for the product bulleting and MSDS for the Nalco specialty chemicals specified.

### **3.2 Sampling Protocol**

The sampling protocol will be continuous monitoring of chemistry using a 3D Trasar control system. A bulletin summarizing the various control capabilities of the 3 Trasar system can be reviewed in Attachment B. The pH sensor will control the acid injection pump as to maintain tower pH between 7.8-8.0. The conductivity sensor will control Cooling Tower conductivity between 1900-2000 mmhos, as to maintain a <1360 TDS in the Blow Down at all times. The controller will also activate the inhibitor pump as to maintain our target dosage of 75-80 ppm of Nalco 3DT189. The ORP sensor will activate the bleach pump as to maintain a free residual halogen level of 0.2-0.3 ppm. Operations will sample tower water daily and test for conductivity, TDS and pH using a daily calibrated hand held Myron L 6P analyzer, 3DT 189 inhibitor level using a handheld Fluorometer, and free residual oxidant using a Hach DR-890 spectrophotometer test. This will ensure control systems are working properly and within calibration tolerance. All continuously monitored parameters from the controller will be sent to the control room via a 4-20 mA output. This will allow continuous monitoring and any alarms will be viewed and addressed immediately.

### **3.3 Controller Location**

The controller sample point and grab sample location will be on the cooling tower return header.

### **3.4. 3D Trasar Monitoring System**

The 3D Trasar unit is able to continuously sample the cooling water and adjust the chemical feed system based on the parameter setting specified above. The 3D Trasar system is a complete water treatment control and monitoring system, which continuously measures key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. With strict effluent chemistry restrictions it will be very important to focus on controlling the blowdown as closely as possible to maintain targets at all times. Real-time monitoring of specific conductance will allow the system to blow down and make up water as necessary to maintain the required chemistry in the system by preventing the system from over-cycling and breaking the permitted ion concentration. Typical treatment and control strategies to cooling towers can allow over-treated or over-cycled and under-treated or under-cycled at times to be discharged. With the 3DTrasar system we will be able to monitor all of these variables independently and maintain each one separately.

### **3.5 Cooling Tower Discharge**

The water discharged from the cooling tower will be limited to 3.5 cycles of concentration, or approximately 1900-2000 mmhos; which calculates to approximately 1300-1350 ppm TDS, with a max. of 1400 ppm. At these cycles of concentration, TDS of the cooling tower blowdown will never exceed the levels of dissolved solids measured in the Hot Well 55-7, thereby ensuring that the cooling tower blowdown reinjected with the Hot Brine will not contribute any additional solids to the aquifer.

### **3.6 Monitoring of Cooling Tower Water**

LLRP will use automation along with daily wet testing to ensure all of the above protocols are maintained. It is anticipated that our primary water treatment company will be Nalco. Their technical engineering staff out of El Paso, TX. will provide technical consulting on a twice per month or TBD basis. They will provide routine testing, operations training, and SPC and graphical monitoring of the water systems at the plant. Daily log sheets, along with DCS controller data and Nalco's Service Reports will be used to verify that the systems are being properly treated and that all state guidelines are being maintained as permitted.

Previous studies and geologic mapping have inferred the presence of fault structures at depth to near surface. Communication between aquifers is uncertain, and is one of the questions that may be answered by data acquired in drilling and this monitoring program.

## 4.0 MONITORING AND SAMPLING OF PRIVATE WELLS, LLRP WELLS, AND SURFACE WATERS

### 4.1 Water Sampling

#### 4.1.1 Monitoring of Private Wells

Monitoring of private wells shown in Table 2 shall be conducted by LLRP for temperature, fluid levels, and chemistry at the schedule shown. Some wells will be monitored daily (D), semi-annually (S) and others annually (A) for the chemistry constituents shown on Tables 4 (Level I) and 5 (Level II). Semi-annual measurements shall be conducted as follows: winter measurement in February or early March prior to the start of the irrigation season; and summer measurement in August or September prior to the end of the irrigation season. A selection of private wells penetrating the intermediate thermal aquifer are identified in Table 2 for daily monitoring of temperature and static water levels. All other monitored private wells will be tested for temperature and static fluid level semi-annually.

These wells will be flowed or pumped long enough for the temperature reading to stabilize. Permission will be obtained by LLRP from each leaseholder or private well owner prior to monitoring. Should LLRP be denied access to any wells selected for monitoring, New Mexico Oil Conservation Division (OCD) will be notified and well(s) in question will be removed from the well monitoring table. A replacement well may be added to the well monitoring table.

#### 4.1.2 Monitoring of LLRP Wells

Production and injection wells will be monitored per the schedule outlined in Table 1. All new wells used for production or injection will be monitored according to Table 1.

The proposed construction of the monitoring wells will be a nested piezometer approach. The casing strings for the wells will be at least 4-inch, in order to accommodate pumps that can handle the water temperature. A maximum of two casing strings in a single borehole; one string for monitoring the deep aquifer, and 1 string for an intermediate zone. Another borehole to be drilled immediately adjacent to the nested string, and a single well would be completed in the shallow aquifer. Monitoring Wells will be monitored per the schedule outlined in Table 1.

#### 4.1.3 Surface Water Sampling

Surface water drainages and canal sites will also be monitored as defined on Table 3. For the canals semi-annual measurements shall be made after the start of the irrigation season sometime in early May or the near the end of the season in September or October before delivery canals are shut off. Since drain water quality is highly variable, drain measurements shall be conducted quarterly with two samples during the non-irrigation season and two during the irrigation season. Approximate drain collection times would be roughly as follows: December 15, March 1, June 15 and September 15.

The Well Pits will be monitored as defined on Table 3. Each surface structure mentioned in Table 3 will be inspected by a professional engineer on an annual basis.

#### 4.1.4 Surface Discharge of Deep Thermal Aquifer Fluids

Any discharge of deep thermal aquifer fluid during drilling, testing or operation of production, injection or monitoring wells whereby discharge is routed to an approved discharge pit shall be tested mid-way through the test for the constituents identified under Level II water quality testing on Table 5. The total volume of fluid discharge during each test shall also be reported. Discharge into approved pits due to power plant upset conditions will be recorded for date of discharge and total volume.

#### 4.1.5 Changes in Monitoring

The schedule of monitoring outlined in Tables 1-3 and/or constituents for analysis listed in Tables 4 and 5 may be subject to change depending on circumstances. They may be increased or relaxed pending prior results or trends in the data. Monitoring procedures shall be conducted pursuant to the following sub-sections:

### 4.2 **Data Collection**

#### 4.2.1 Water Level Measurement

Prior to ground water sampling from each well, depth to water will be measured with a sonic depth sounder, standard well sounder, or air-line, as may be appropriate. A pressure gauge will be used to determine hydraulic head of the well is artesian. Measurement shall be from some set consistent measuring point (MP) such as the top of casing or other suitable permanent feature. Height of the MP above ground surface shall also be recorded and all water levels reported as depth above or below ground surface and elevation AMSL. Elevation of the wellhead shall be surveyed to and accuracy of one (1) foot. Water level elevations must be reported within an accuracy of one (1) foot.

For water level measurements on private wells, every attempt will be made to collect measurements after sufficient recovery time has elapsed following possible recent pumping. If water levels cannot be measured due to well head completions or lack of a sounding tube, a sounding tube or air-line will be installed the next time the pump is removed for service or repair. Duplicate water level measurements will be made at least ten (10) minutes apart to ensure water level is not recovering or drawing down. The intent is to collect static levels in the private and LLRP monitoring wells. For injection and production wells, the pumping or injection status should be noted during water level data collection.

#### 4.2.2 Downhole Temperature Measurements

Downhole temperature profiles shall be obtained on LLRP wells whenever pumps are pulled or new wells constructed. Downhole temperature profiles will be run on selected private wells, penetrating the intermediate thermal aquifer, chosen based on location, depth, accessibility and landowner agreeability. Upon selection, those wells will be added to Table 1. Profiles will be continuous or periodic, with distance between readings not to exceed ten (10) feet, and the temperature allowed to stabilize between readings.

#### 4.2.3 Monitor or Private Well Purging

Subsequent to measuring the water levels, those wells that are not in active use will be purged. Well purging will be performed according to standard professional practices, with a minimum of three casings volumes of water purging using a dedicated ground water pump, or until pH, temperature, and conductivity have stabilized to within 10% for three consecutive readings spaced at least one (1) minute apart. The well will be purged at a relatively low flow rate to minimize the possibility of purging the well dry. If a well is purged dry, the sample will not be collected until the well has recovered to a minimum 50% of its initial volume. All ground water sampling equipment will be thoroughly rinsed with fresh water. Any deviation from the procedure will be performed according to standard professional practices and pre-approved by OCD.

#### 4.2.4 Field Parameter Collection

Prior to collection of the ground water sample, at each monitor or private well, temperature, pH, and electrical conductivity will be measured. These parameters will be obtained using calibrated temperature, pH and electrical conductivity probes according to standard professional practices.

#### 4.2.5 Ground Water Sample Collection

Once the well is satisfactorily purged, water samples will be collected from each well. Water samples will be collected from the dedicated ground water pumps and stored in laboratory-prepared sample containers with appropriate preservatives. The samples will be properly labeled (sample identification, sampler initials, date, time of collection, site location, and requested analyses), placed in an ice chest with wet ice, and delivered to an analytical laboratory within the prescribed time for the particular constituent analysis.

#### 4.2.6 High Temperature Sample Collection

Pumped geothermal and any injection flow lines that are at a temperature high enough to boil and lose steam during sample collection should be sampled from a port of the side of the flow line, using a cooling coil under pressure to prevent boiling and steam separation prior to sample collection. Flow line temperature will be recorded.

Flowing two-phase geothermal production wells should be sampled either: (a) from the water phase outlet of the dedicated production-sized steam-water separator, using a cooling coil under pressure, and with recorded pressure or temperature of phase separation, or (b) if there is a no steam-water separator dedicated to the well, then samples should be collected from the two-phase flow line close to the wellhead, using a portable steam-water separator according to the methods specified by ASTM Standard E1675-04e1, Standard Practice for Sampling Two-Phase Geothermal Fluid for Purposes of Chemical Analysis.

#### 4.2.7 Silica

If directed by the OCD sample splits for analysis of silica (SiO<sub>2</sub>) would be preserved by dilution and/or pH adjustments, according to whatever method is preferred by the laboratory. If none, sample



splits for analysis of silica would be diluted 1:10 with a de-ionized, silica-free water, preferably by the following procedure: (I) weigh the clean, empty and dry sample bottle (125 ml or 4 oz. Plastic bottle): (ii) add 90 ml of de-ionized, silica-free water and re-weigh, (iii) collect the sample by adding 10 ml of sample, measured with a clean and pre-rinsed plastic pipet, to the 90 ml of de-ionized, silica-free water, (iv) re-weigh to determine exact dilution factor. Any deviation from the procedure by LLRP consultants or contractors will be performed according to standard professional practices and pre-approved by OCD.

#### 4.2.8 Field Records

Daily Field Report records will be maintained by staff personal to provide daily records of significant event events, observations, and measurements during field investigations. Observations shall be recorded which may explain data anomalies. These documents will contain information such as: personnel present, site conditions, sampling procedures, measurement procedures, calibration records, etc. Field measurements will be recorded on the appropriate forms. All entries on the data forms will be signed and dated. The data forms will be kept as permanent records.

### 4.3 **Chain of Custody Procedure**

Sample identification documents will be carefully prepared so identification and chain of custody can be maintained and sample disposition can be controlled. The sample collection identification documents include Chain-of-Custody (COC) records and Daily Field Report forms. COC procedures are outlined as follows:

#### 4.3.1 Field Custody Procedures

The field sampler is personally responsible for the care and custody of the samples collected until they are properly transferred. All samples will have individual labels. The information in these labels will correspond to the COC which shows the identification of individual samples and the contents of the shipping container. The original COC will accompany the shipment, and a copy will be retained by the sampler for the client.

#### 4.3.2 Transfer of Custody and Shipment

A COC will accompany all samples. When transferring samples, the individuals relinquishing and receiving the samples will sign, date, and note the time on the COC. This COC documents the sample custody transfer. Samples are to be properly packaged and dispatched to the appropriate laboratory for analysis with a separate COC accompanying each shipment. All shipments are accompanied by the original COC. Samples will be delivered by LLRP personnel or consultant to the laboratory.

### 4.4 **Irrigation Monitoring**

Division of Minerals review indicates irrigation activity plays a large part in the annual fluctuations of the shallow non-thermal reservoir, and the USGS OFR 82-345 made similar findings in their water budget analysis. Irrigation deliveries and irrigated acreage to fields within the study area shown on Map 1 shall be reported in the annual reports as well as a map showing fields irrigated. Irrigated fields

shall be designed with imagery acquired during current irrigation season flights conducted by NRCS or BOR aerial photographs or Landsat images, should they be available on an annual basis. Provided imagery is publically available. A seepage testing may be required by OCD. A review of meter records of pumping for irrigated agriculture to file with the New Mexico Office of the State Engineer will also be made to the extent that it is available.

#### **4.5 Landowner/Lessor Contact**

##### **4.5.1 Communication Log**

A detailed communication log shall be kept whenever there is a contact with any adjacent land or well owner recording the date, time, and nature of the dialogue, concerns and any mitigation efforts offered by LLRP.

##### **4.5.2 Landowner Reporting**

LLRP shall supply the landowners that have wells participating in this monitoring program a simple summary report of data that was collected at their individual well or wells. The information shall include but is not limited to:

- Date and Time information was collected
- Recorded Pressure
- Recorded Temperature
- Recorded Fluid Level
- Copy of water chemistry results from well or wells.

## 5.0 Laboratory Analysis

Collected groundwater samples will be submitted to a New Mexico certified laboratory for the analyses detailed in Tables 4 and 5. As described above, pH, temperatures and electrical conductivity measurements will be collected in the field during purging of the well.

## 6.0 Annual Review And Reporting

All well identification, sample dates, temperatures, water levels, field parameters and laboratory data will be compiled in a single Excel database for reporting and review. Water level, temperature and laboratory reports shall be reviewed upon collection or reporting and compared to the historical record to that particular site to determine any significant deviations from prior reports or measurements. Water level elevations, temperature and selected fluid chemistry parameters including TDS, pH, Ec, Silica, and Na/K concentrations shall be charted with historical data for the site on Excel spreadsheets. The Excel database will be distributed to OCD. Any information LLRP submits to OCD that is deemed confidential or proprietary will be water marked or labeled as such and will be subject to a confidentiality agreement entered into by LLRP and OCD.

A GIS (ArcGIS) mapping product shall be produced and included in the annual report at a scale of 1:12,000 of the study area. The map shall include all wells and features shown on Map1 plus any new wells constructed or added to the monitoring program that particular year. One base map shall be the USGS 1:24,000 quad maps and a second containing aerial photographs coverage acquired during that particular irrigation season assuming that coverage can be obtained from a publicly available source.

LLRP will provide a detailed annual report summarizing all requested data which will be prepared by a qualified expert to provide review and interpretation of the data collected the past year to observe variations in chemistry, fluid level, temperature of field parameters within the context of the past ten years' trends in recorded data. The annual report and databases shall contain all prior data collected as required by this monitoring plan plus historical data. The intent of the annual report is to provide a complete package detailing past, present, and future anticipated conditions (quantity, quality, thermal) relating to a geothermal power production operations at the Lightning Dock site.

An annual report shall be submitted to OCD by February 15 summarizing the prior calendar year and historical data required in the plan. Should LLRP personnel, consultants, ODC or surrounding property owners observe any significant changes during the course of the year, in interim report may be required or more frequent status reports and/or monitoring schedule may be required.



# Lighting Dock Area of Review Animas Valley, NM

Well # 13-07  
Well # 33-07  
Well # 45-07  
Well # 51-07  
Well # 53-07  
Well # 47-07  
Well # 42-18  
Well # 53-12  
Well # 13-07  
Well # 33-07  
Well # 45-07  
Well # 51-07  
Well # 53-07  
Well # 47-07  
Well # 42-18  
Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
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- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

- 1 HPC - Federal
- 2 Exploratory Well - Federal
- 3 Agriculture Well - Federal
- 4 Well No. 1 - State - Burgett
- 5 Well No. 2 - State - Burgett
- 6 Well No. 3 - State - Burgett
- 7 Well No. 4 - State - Burgett
- 8 HP-Home Heating - Federal
- 9 HP-Home Heating - Federal
- 10 Metered Production Well (No. 6 Well) - Federal
- 11 Metered Production Well (No. 3 East) - Federal
- 12 HP-Home Heating - Federal
- 13 HP-Home Heating - Federal
- 14 Exploratory Well - Federal
- 15 Abandoned Well - Federal
- 16 Metered Prod. Well (No. 1 Disc. Well) - Federal
- 17 Abandoned Well - Federal
- 18 Abandoned Well - Federal
- 19 Abandoned Well - Federal
- 20 Deep Exploratory Well (55-7) - Federal
- 21 HP-Home Heating - Federal
- 22 Abandoned Well - Federal
- 23 Washing Well - Federal
- 24 Abandoned Well - Federal
- 25 Metered Production Well (No. 3 Well) - Federal
- 26 Abandoned Well - Federal
- 27 HP-Packing Plant - Federal
- 28 Exploratory Well (35-7) - Federal
- 29 Abandoned Well - Federal
- 30 Exploratory Well (55-7) - Federal
- 31 Vacant
- 32 Well No. 7 - State - Burgett
- 33 State Well - Agriculture
- 34 State Well - Agriculture
- 35 State Well - Agriculture
- 36 State Well - Agriculture
- 37 State Well - Agriculture
- 38 Exploratory Well (12-7) - Federal
- 39 McCains Well - Federal
- 40 McCains Well Home Heating - Federal
- 41 McCains Well Home Heating - Federal

## Proposed Wells

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

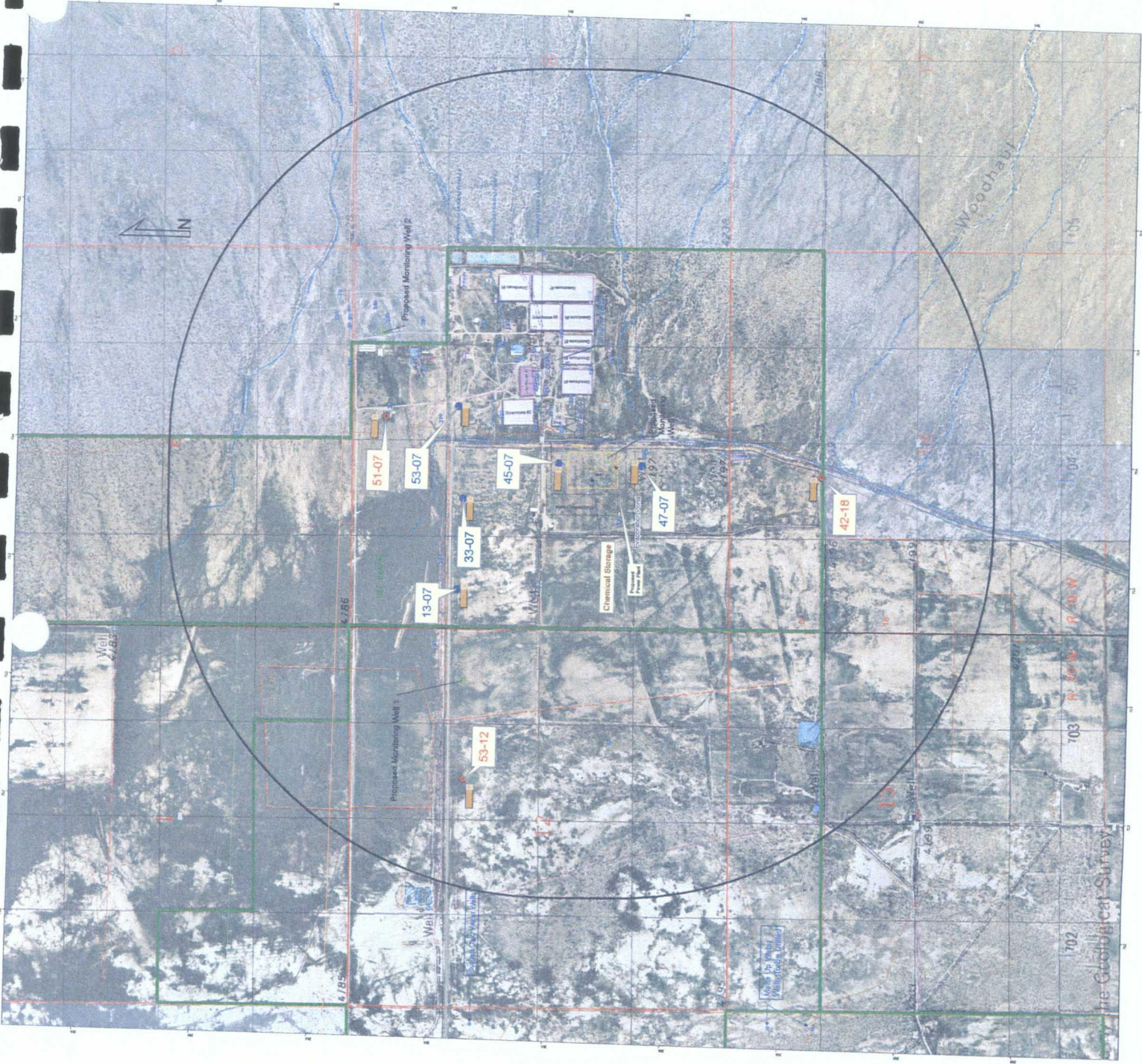
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- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12

## Proposed Wells

- Well # 13-07
- Well # 33-07
- Well # 45-07
- Well # 51-07
- Well # 53-07
- Well # 47-07
- Well # 42-18
- Well # 53-12



**Legend**

- Injection
- Production
- Proposed Monitoring Wells
- Project Area 1 Mile Buffer (Geothermal Lease)
- Geothermal Lease
- Proposed Power Plant
- Building Footprints
- Raser Federal Geothermal Lease
- Bureau of Land Management
- Private
- State

Scale: 0 0.1 0.2 0.3 0.4 Miles  
0 0.25 0.5 0.75 Km

Coordinate System: UTM Zone 12 NAD83





Proposed Monitoring Well 2

Proposed Monitoring Well 1

51-07

53-07

45-07

33-07

13-07

53-12

Chemical Storage

Proposed Power Plant

Evaporation Pond

Shallow Wells

Proposed Monitoring

NM 034780

Greenhouse Holding Pond #1

Greenhouse Holding Pond #2

Drainage Ditch #1 (East)

Retention Pond #7

Parquet Home

Geometal Lease

Deep Gap

Shop

Standby Generator

Tractor

Tractor

Tractor

Tractor

Tractor

Tractor

Tractor

Tractor

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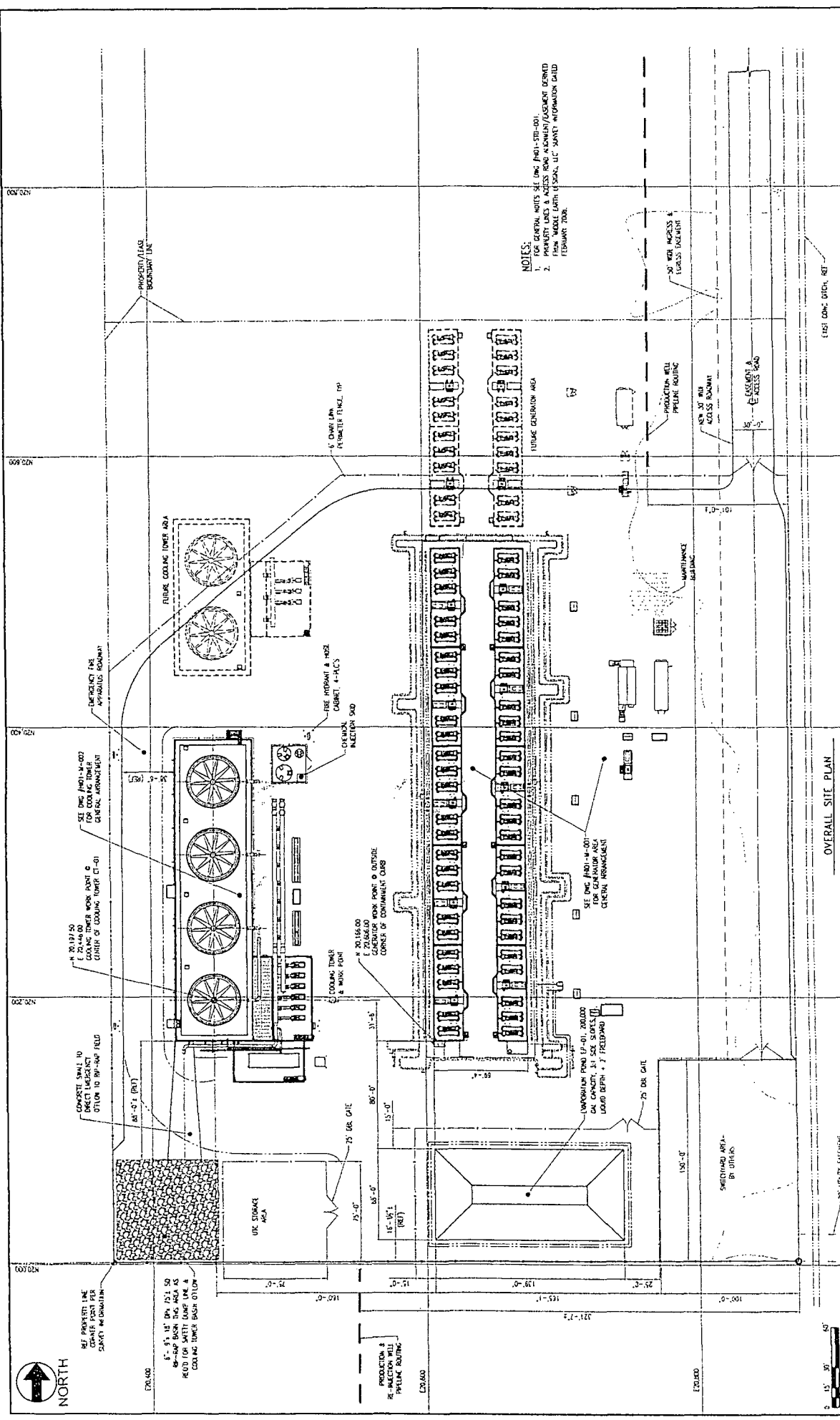
Tractor

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Tractor





**NOTES:**  
 1. GENERAL NOTES SEE (ENC. 10411-SP-100)  
 2. PROPERTY LINES & ACCESS ROAD ALIGNMENT/ASSUMED DERIVED FROM MIDDLE EARTH SURVEY, LLC SURVEY INFORMATION DATED FEBRUARY 2008.

REVISION		REFERENCE DRAWING	NUMBER	CONFIDENTIAL
2	11-11-08	ENC 10411-SP-100	1	CONFIDENTIAL
1	02-25-09	ENC 10411-SP-100	1	
0	02/25/09	ENC 10411-SP-100	1	

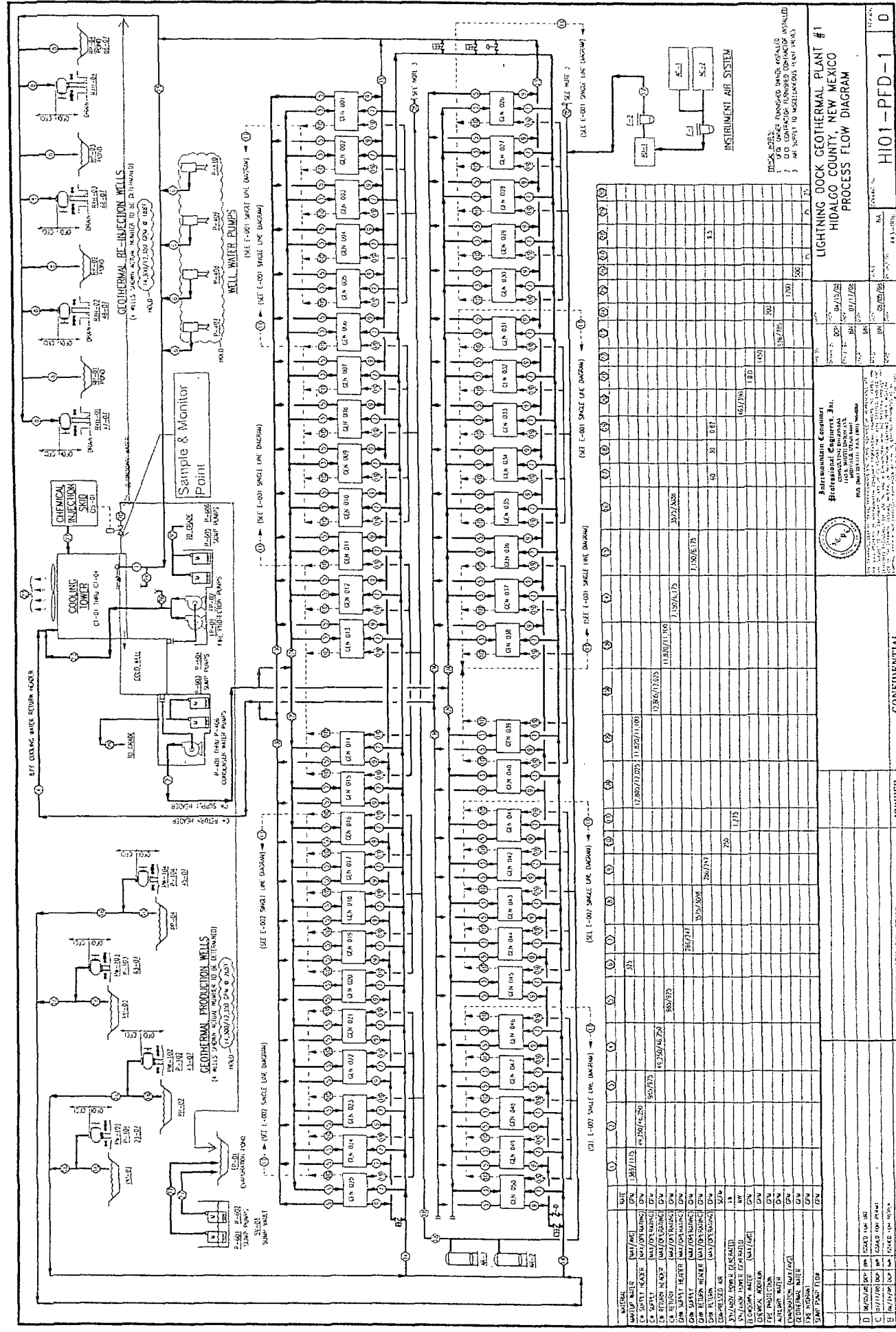
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ENC 10411-SP-100	ENC 10411-SP-100	ENC 10411-SP-100	ENC 10411-SP-100	ENC 10411-SP-100

<b>Lightning Dock Geothermal Plant #1</b> HIDALGO COUNTY, NEW MEXICO GENERAL ARRANGEMENT GENERATING AREA SITE PLAN		SHEET NO. 443-008 OF 443-008
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SCALE: 1" = 30'-0"

ENC 10411-SP-100



DATE	BY	REVISION
12/20/71	WJ	1
01/25/72	WJ	2
03/22/72	WJ	3
07/17/72	WJ	4
08/29/72	WJ	5
09/11/72	WJ	6
09/26/72	WJ	7
10/10/72	WJ	8
10/24/72	WJ	9
11/07/72	WJ	10
11/21/72	WJ	11
12/05/72	WJ	12
12/19/72	WJ	13
01/02/73	WJ	14
01/16/73	WJ	15
01/30/73	WJ	16
02/13/73	WJ	17
02/27/73	WJ	18
03/13/73	WJ	19
03/27/73	WJ	20
04/10/73	WJ	21
04/24/73	WJ	22
05/08/73	WJ	23
05/22/73	WJ	24
06/05/73	WJ	25
06/19/73	WJ	26
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11/06/73	WJ	36
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01/29/76	WJ	94
02/12/76	WJ	95
02/26/76	WJ	96
03/12/76	WJ	97
03/26/76	WJ	98
04/09/76	WJ	99
04/23/76	WJ	100

**LIGHTNING DOCK GEOTHERMAL PLANT #1**  
**HIDALGO COUNTY, NEW MEXICO**  
**PROCESS FLOW DIAGRAM**

H101-PFD-1

**Instrumentation Engineer**  
**Professional Engineer, Jr.**  
**CONSULTING ENGINEER**  
**1000 SOUTH 10TH AVENUE, SUITE 100**  
**ALBUQUERQUE, NEW MEXICO 87102**  
**PH 505-263-1111**



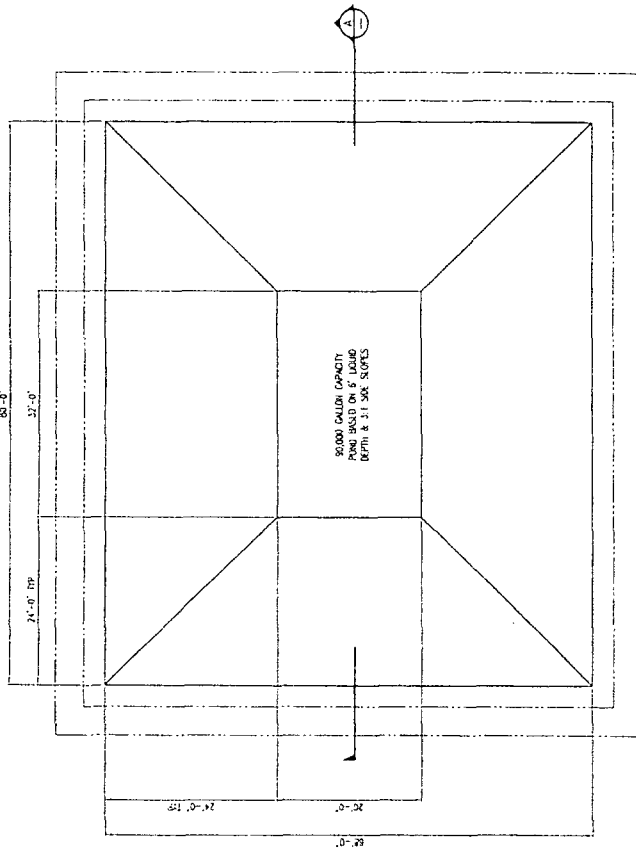
CONFIDENTIAL

REFERENCE DRAWING

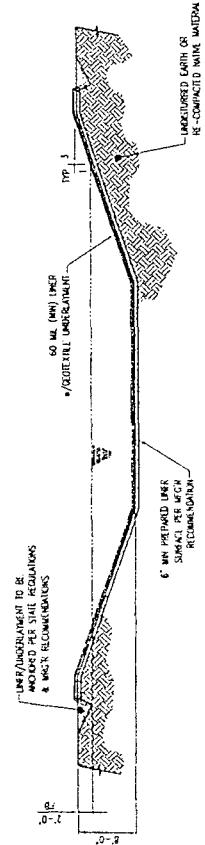
REVISION

DATE LIST APPL





PLAN  
1/8" = 1'-0"



SECTION A-A  
1/8" = 1'-0"

NOTES:  
1. REFER TO CONSTRUCTION WITH ASSURANCE (1022) FOR CONSTRUCTION POND DETAILS.

NO.	DATE	BY	REVISION
A	10-21-08	BC	ISSUED FOR REVIEW & COMMENT
REFERENCE DRAWING			
			NUMBER
CONFIDENTIAL			
Professional Engineer Professional Engineers, Inc. 1000 UNIVERSITY AVENUE SALT LAKE CITY, UTAH 84103 ALL RIGHTS RESERVED			THERMO GEOTHERMAL GENERATING PLANT #1 BEAVER COUNTY, UTAH 90,000 GAL CAP CONTAINMENT POND PLAN & SECTION
Project No: 413-000 Drawing No: BE01-CV-102 Scale: 1/8" = 1'-0"			SHEET NO. 1 TOTAL SHEETS 1

**TABLE 1  
LLRP GEOTHERMAL PRODUCTION, INJECTION, MONITORING WELLS**

WELL	USE	STATUS	DATE DRILLED	DEPTH	MONITORING FREQUENCY				
					TEMP.	DYNAMIC FLUID LEVEL*	FLOW RATE AND VOLUME	CHEMISTRY LEVEL 1	CHEMISTRY LEVEL 2
13-07	Production	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
33-07	Production	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
45-07	Production	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
47-07	Production	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
53-07	Production	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
47-07	Injection	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
47-07	Injection	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
47-07	Injection	To Be Drilled	N/A	3,400	Daily	Daily	Daily	S	A
MW-#1	Monitoring	To Be Drilled	N/A	TBD	Daily	Daily	Daily	S	A
MW-#2	Monitoring	To Be Drilled	N/A	TBD	Daily	Daily	Daily	S	A
MW-#3	Monitoring	To Be Drilled	N/A	TBD	Daily	Daily	Daily	S	A

Frequency: S = Semi-annually, A = Annually, D = Daily (gauge reading)  
 \* Denotes fluid level during well production  
 Note - All injection fluid is mixed, thus only one sample point is required for Chemistry Level



TABLE 3  
SURFACE WATER MONITORING SITES

ID#	NAME	UTM Zone 12 NAD27 EASTING	UTM Zone 12 NAD27 Northing	CHEMISTRY LEVEL I	CHEMISTRY LEVEL II	STRUCTURAL INTEGRITY
13-07	13-07 Well Pit	703484	3558684	Q (while in use)	A (30 days after use)	A
33-07	33-07 Well Pit	703849	3558668	Q (while in use)	A (30 days after use)	A
53-07	53-07 Well Pit	704245	3558698	Q (while in use)	A (30 days after use)	A
45-07	45-07 Well Pit	703987	3558296	Q (while in use)	A (30 days after use)	A
47-07	47-07 Well Pit	704025	3557969	Q (while in use)	A (30 days after use)	A
42-18	42-18 Well Pit	703977	3557204	Q (while in use)	A (30 days after use)	A
53-12	53-12 Well Pit	702640	3558638	Q (while in use)	A (30 days after use)	A
51-07	51-07 Well Pit	704183	3559081	Q (while in use)	A (30 days after use)	A
	Greenhouse Holding Pond #1	704864	3558753			
	Greenhouse Holding Pond #2	704867	3558601			
	Drainage Ditch #1 (East)	704832	3558413			
	Retention Pond #1	704265	3558101			
	Bermed Canal #1	704096	3558570			

FREQUENCY: S = Semi-annually, A = Annually, Q = Quarterly  
 Monitor Canals at beginning of irrigation season in May and near end in September/October  
 Monitor Drains quarterly so there are two measurements during irrigation season and two during non-irrigation season  
 Monitor Well Pits while in use and within 30 after Pit has been emptied

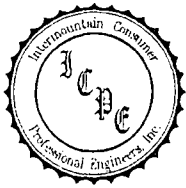
TABLE 4  
LEVEL I FLUID CHEMISTRY CONSTITUENTS TO BE ANALYZED

ITEM	DESCRIPTION
1	TDS
2	EC
3	pH
4	Temperature ° F
5	Arsenic
6	Bicarbonate
7	Boron
8	Calcium
9	Chloride
10	Carbonate
11	Chloride
12	Fluoride
13	Lithium
14	Magnesium
15	Potassium
16	Silica
17	Sodium
18	Sulfate
19	Chlorine

**TABLE 5**  
**LEVEL II FLUID CHEMISTRY CONSTITUENTS TO BE ANALYZED**

ITEM	DESCRIPTION
1	TDS
2	EC
3	pH
4	Temperature ° F
5	Animony
6	Arsenic
7	Bicarbonate
8	Boron
9	Calculm
10	Carbonate
11	Chloride
12	Copper (total)
13	Fluoride
14	Iron (total)
15	Lithium
16	Magnesium
17	Manganese
18	Mercury (total)
19	Potassium
20	Radon
21	Rubidium
22	Selenium (total)
23	Silica
24	Sodium
25	Sulfate
26	Thallium
27	Tungsten
28	Zinc

(total) = Total combined concentration



LIGHTNING DOCK #1 LLC  
GEOTHERMAL GENERATION PLANT

SPECIFICATION  
15252  
Rev 2

## CONTAINMENT POND LINERS

Approval: BN

Original Issue Date: 04/15/08

Current Revision Date: 08/28/08

### PART 1 - GENERAL

#### 1.1. DESCRIPTION

##### A. Scope of Work:

1. This Specification covers: Part 1 – General, Part 2 – Products, engineering, design, fabrication, inspection, testing, and shipping, and Part 3 – Execution installation of liners may be offered by the Vendor.

##### B. Definitions:

1. Capacity : US gallons
2. Pressure: Pounds per square inch (PSIG)
3. Buyer: Lightning Dock #1 LLC
4. Owner : Lightning Dock #1, LLC
5. Seller: Vendor, Supplier, Manufacturer, Fabricator or Bidder as hereinafter referred to as Seller. Seller will supply the specified items as required by Part 1 –General and Part 2 – Products of this specification.
6. Contractor: The Owner will provide a Contractor to provide the installation services and interconnecting piping as required in Part 3 – Execution of this specification.

##### C. Operating conditions:

1. Ponds PP-01; PP-02; PP-03; PP-04; EP-01; RP-01; RP-02; RP-03; RP-04.
  - Number of ponds: Nine
  - Dimensions: Refer to Drawings
  - Capacity: Refer to Drawings
  - Water Temperature: 266 degrees F.  
300 degrees F Spike (upset condition)
  - Use: Receives Geothermal well water. A pond liner is required for each listed pond.

#### 1.2. DESIGN CONDITIONS

- A. Refer to specification section 01010 for Project Site Conditions.

#### 1.3. SUBMITTALS

- A. Product Data: Include specifications, samples, and reference installations.
- B. Installation Detail: For the type of liners proposed.
- C. Maintenance Data: For the type of liners proposed.

#### 1.4. QUALITY ASSURANCE

- A. In accordance with ASTM tests for thickness, breaking strength, flexibility, tear strength, UV resistance, and adhesions.

#### 1.5. DELIVERY, STORAGE, AND HANDLING

- A. Retain shipping protective covers and protective coatings during storage.
- B. Protect units against damage during shipment.
- C. Comply with manufacturer's rigging instructions for handling.

### PART 2 - PRODUCTS

#### 2.1. MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
  - 1. Lange Containment
  - 2. Watersaver Company, Inc.
  - 3. Firestone.
  - 4. Or approved equal.

#### 2.2. GENERAL

- A. The liner material shall be:
  - 1. UV resistant
  - 2. Tear resistant
  - 3. Puncture resistant.
  - 4. Suitable for water temperatures specified.
  - 5. Maintain flexibility in cold weather (-20°F)
- B. The minimum liner thickness shall be 60 mil.
- C. Provide a geotextile underlayment for the sloped sides of each pond. Side slopes shall be 3 feet (horizontal) to 1 foot (vertical).
- D. Where possible the liners will be seamless. Where seaming is performed, the seams will be hot-wedge with double track weld with a 4-6 inch overlap. The seaming will be performed by a qualified individual.
- E. The factory assembled units shall be folded and rolled on coves not to exceed a width of 10' 8".
- F. Provide an installation plan for each pond lining and label each roll with the membrane type, thickness, dimensions, and an arrow indicating the direction for unrolling.
- G. Include the requirements for perimeter anchor trenches. Backfill will be provided by others. The manufacturer shall recommend any intermediate slope anchoring, toe of slope anchoring and/or bottom ballast requirements.
- H. Include all adhesives and primers necessary for the installation of the liners.
- I. Include the services of a field representative to supervise and provide instruction during the installation and inspection of the linings.

#### 2.3. MATERIALS



- A. The following liners have been selected to be used on the site because of their thermal properties: Chlorosulfonated Polyethylene-Reinforced (CSPE-R), Ethylene Propylene Diene Monomer (EPDM) and Flexible Polypropylene (PPF). No other liners will be selected unless approved.

#### **2.4. WORK BY OTHERS**

- A. Site preparation, including soil compaction, and backfill.
- B. Removal of all vegetation.
- C. Underlay installation
- D. Lining installation including lap seaming
- E. Anchoring including ballast, and any recommended intermediate and/or toe slope anchors.
- F. Chain link perimeter fencing.

### **PART 3 - EXECUTION**

#### **3.1. INSTALLATION**

- A. Follow manufacturer's written instructions for laying, seam welds and perimeter details, for underlayment and linings.
- B. Prepare the pond surfaces to be smooth, dry, free of rocks, roots, vegetation and any foreign material.
- C. Survey the ponds prior to the start of installation.
- D. Use sand bags as required to hold down the liners in windy conditions.

#### **3.2. ADDITIONAL SPECIFICATIONS**

Work shall conform to the appropriate sections of the following specifications.

- 02100 – Site Preparation and Earthwork

END OF SPECIFICATION 443-006-15252

- B. Removal of all vegetation.
- C. Underlay installation
- D. Lining installation including lap seaming
- E. Anchoring including ballast, and any recommended intermediate and/or toe slope anchors.
- F. Chain link perimeter fencing.

### **PART 3 - EXECUTION**

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#### **3.2. ADDITIONAL SPECIFICATIONS**

Work shall conform to the appropriate sections of the following specifications.

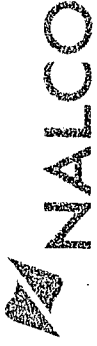
- 02100 – Site Preparation and Earthwork

END OF SPECIFICATION 443-006-15252

**Attachment B**

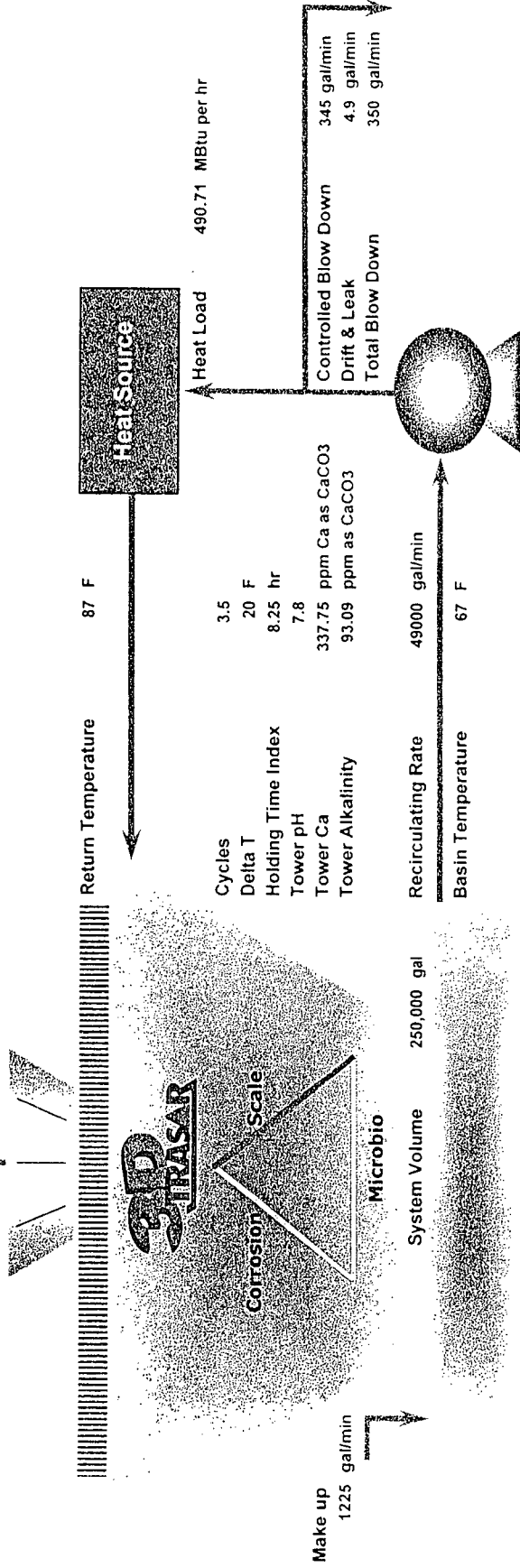
**3D Trasar Control System**

# System Summary



Customer : Lightning Dock  
 Location : Lordsburg, NM  
 System : Cooling Tower

Evaporation Efficiency : 90 %  
 Evaporation Rate : 875 gal/min



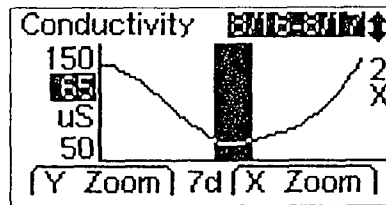
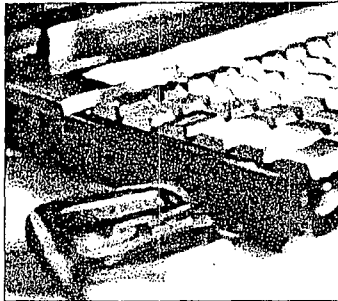
Product Category or Control Parameter	Product Number or Additive	Dosage or Control Set Point	Control Method	Annual Usage	Units	Price per Unit	Annual Cost
Cycles of Concentration		3.5	Conductivity Set Point				
pH	H2SO4	7.8	Automatic	522,553	lb/Year	\$ 0.15	\$ 78,383
Multifunctional	3DT189	75 ppm	TRASAR	114,929	lb/Year	\$ 1.57	\$ 180,439
Scale Inhibitor					lb/Year	\$	
Copper Corrosion Inhibitor	1336	4.2 ppm	Slaved	6,436	lb/Year	\$ 2.54	\$ 16,348
Mild Steel Corrosion Inhibitor					lb/Year	\$	
Oxidizing Biocide	Bleach	0.8 ppm	ORP Control	171,627	lb/Year	\$ 0.20	\$ 34,325
Bromine					lb/Year	\$	
Non-Oxidizing Biocide	7330	100 ppm		2,000	lb/Year	\$ 3.50	\$ 7,000
Algaecide					lb/Year	\$	
Biocidespersant					lb/Year	\$	
Bioreporter					lb/Year	\$	
Scale & Corrosion Control						\$	\$ 196,786
pH Control Agent						\$	\$ 78,383
Primary Oxidizing Biocide						\$	\$ 34,325
Other Bio Control Programs						\$	\$ 7,000
<b>Total Treatment Costs</b>							<b>\$ 316,494</b>

## 3D TRASAR Benefits - Continued

**3D TRASAR Data Management** offers continuous access to real-time data from your cooling water system. You can access this data in a format that you find most useful:

### *At the Controller*

View data directly on the 3D TRASAR 5500's display.

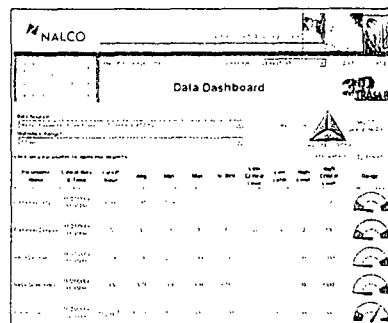


### *On the Go*

Get alarms wherever you are via text message.

### *Via the Internet*

Access your data from anywhere in the world via the 3D TRASAR Web. 3D TRASAR sends data to the Internet using phone, LAN or wireless technology.



### *At your Facility*

Send real-time data and alarms to your DCS or SCADA.

In addition, when 3D TRASAR is used in conjunction with Nalco's full Risk Management Solutions program for cooling water, you have the data required to demonstrate due diligence and compliance with best practices associated with *Legionella* Risk Reduction. For more information please refer to [www.nalco.com/ehs](http://www.nalco.com/ehs).

#### **NALCO COMPANY OPERATIONS**

**North America:** Headquarters - 1601 West Diehl Road • Naperville, Illinois 60563 • USA  
Energy Services Division - 7705 Highway 90-A • Sugar Land, Texas 77487 • USA  
**Europe:** Ir.G.Tjalmaweg 1 • 2342 BV Oegstgeest • The Netherlands  
**Asia Pacific:** 2 International Business Park • #02-20 The Strategy Tower 2 • Singapore 609930  
**Latin America:** Av. das Nações Unidas 17.891 • 6° Andar 04795-100 • São Paulo • SP • Brazil

[www.nalco.com](http://www.nalco.com)

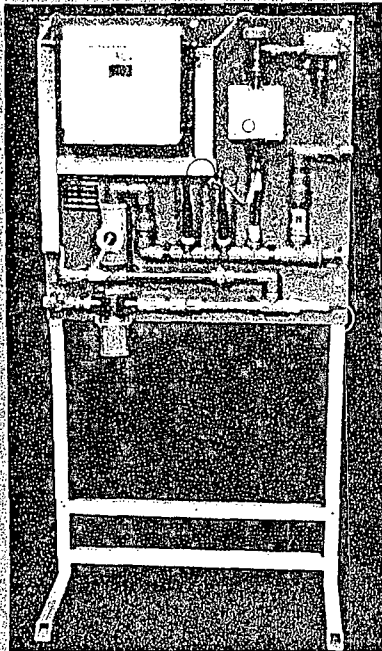
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## 3D TRASAR® Systems

### Stress and Data Management for Cooling Systems



3D TRASAR

The 3D TRASAR system is a complete water treatment control and monitoring system. 3D TRASAR continuously measures key system parameters, detects upsets, takes appropriate corrective action and communicates with system users. 3D TRASAR minimizes total cost of operation (TCO) and prevents operational problems.

#### 3D TRASAR Benefits

**3D TRASAR Scale Control** continuously monitors the scaling potential of your cooling water. By maximizing cycles of concentration,

you save water and chemicals. Control action prevents system degradation.

**3D TRASAR Corrosion Monitoring** continuously monitors corrosion trends, alerting you and your Nalco Sales Engineer to any abnormal corrosion conditions.

**3D TRASAR Bio-Control** applies biocide based on the measured bio-activity in your cooling system. 3D TRASAR Bio-Control measures and controls both sessile and planktonic bio-activity, a capability unique to 3D TRASAR.

**Table 1** – 3D TRASAR delivers complete Stress Management for Cooling Systems. Fully upgradeable and customizable

	3D TRASAR
3D TRASAR Fluorometer	X
Modem	X
Web Accessibility	X
Conductivity Measurement and Control	X
pH Measurement and Control	X
ORP Measurement and Control	X
Biocide Timers	X
Nalco Scale Control	X
Nalco Bio-Control	X
Nalco Corrosion Monitoring	X

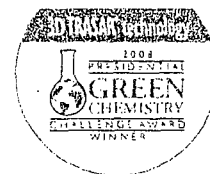
(Continued on Reverse Side)



## Nalco 3D TRASAR® Technology for Cooling Water Wins 2008 Presidential Green Chemistry Challenge Award

### U.S. Presidential Green Chemistry Challenge Award

Nalco 3D TRASAR Technology for Cooling Water has been recognized with a 2008 Presidential Green Chemistry Challenge Award. The honor was given in the area of greener reaction conditions.



chemical design, manufacture and use. An independent panel of experts convened by the American Chemical Society selected the winners from nearly 100 nominations. Nalco is proud to be a 2008 winner of this prestigious award.



*Nalco representatives accept the 2008 Presidential Green Chemistry Challenge Award at a ceremony held in Washington, D.C. on June 24, 2008.*

### Innovative 3D TRASAR Technology for Cooling Water

Cooling water touches many facets of human life, including cooling for comfort in commercial buildings and cooling industrial processes. Cooling systems require treatment programs to control microbiological growth, mineral deposits and corrosion. Nalco developed 3D TRASAR technology for on-line monitoring of the condition of cooling water continuously, adding appropriate chemicals only when needed, rather than on a fixed schedule.

Since 1996, the Presidential Green Chemistry Challenge Award has been given by the United States Environmental Protection Agency for outstanding chemical technologies that incorporate the principles of green chemistry into

*(Continued on Reverse Side)*

3D TRASAR programs provide the ultimate proactive defense against corrosion, scale and fouling for water systems. There is no other offering like the patented 3D TRASAR program.

Nalco's 3D TRASAR technology:

- Integrates the technologies necessary to anticipate system variability and then automatically responds to keep the system in perfect balance.
- Combines unique detection technologies, proprietary software, automated feed, advanced chemistries and instant communications into a single package.

- Takes a system to a new dimension of total control, giving complete peace of mind and allowing customers to focus on other priorities.

The technique saves water and energy, optimizes the use of water-treatment chemicals, reduces air and wastewater emissions and extends equipment life. Further, a 3D TRASAR-equipped cooling system operates closer to its capabilities by virtue of eliminating the system variability and thereby offering savings in energy costs to the user.

In 2007, more than 5,000 customer locations in the United States, Canada and Europe used 3D TRASAR technology for their cooling systems, saving an estimated 40.2 billion gallons (152 million cubic meters) of water. That's equal to the annual domestic water use for the combined populations of Atlanta, Boston and Denver.

Besides cooling water applications, the 3D TRASAR platform has been expanded to control and optimize conditions in boiler operations, reverse osmosis systems and process applications for a broad range of industrial and institutional customers.



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Product Bulletin

## 3D TRASAR<sup>®</sup> 3DT189

### Cooling Water Corrosion and Deposit Inhibitor

#### PRODUCT DESCRIPTION AND APPLICATION

*3D TRASAR products are part of an innovative water treatment program that uses proven technology to prevent operational problems. 3D TRASAR compensates for both routine and special causes of system variation. 3D TRASAR programs provide a return on your investment through their unique control and diagnostic capabilities.*

3D TRASAR 3DT189 is designed for use in systems with recirculating water calcium concentrations between 50 and 1000 ppm (as CaCO<sub>3</sub>) at the targeted cycles when the pH is less than 8.7. Because 3D TRASAR 3DT189 contains no molybdate or zinc, it should be considered as a more environmentally friendly chemistry to meet the regulatory needs of many customers.

3D TRASAR 3DT189 is a balanced blend of corrosion and scale inhibitors designed for use in open recirculating water systems.

3D TRASAR 3DT189 contains:

- Dual function phosphonate inhibitor for both cathodic (pitting) corrosion and calcium carbonate scale. The active material is a patented, proprietary chemical called Phosphinosuccinic Oligomer (PSO).
- Phosphoric Acid inhibitor for anodic corrosion
- Organic High Stress Polymer (HSP) dispersant.
- Blend of both benzotriazole (BZT) and tolyltriazole (TT) for copper corrosion inhibition.

3D TRASAR 3DT189 provides a superior alternative to traditional cooling water inhibitor blends containing pyrophosphate, orthophosphate, zinc, molybdate, etc. PSO is superior to pyrophosphate in that it will not revert to orthophosphate and is stable in the presence of oxidizing biocides. As a result, 3D TRASAR 3DT189 delivers lower total phosphate concentrations and less polymer demand. Additionally, because PSO does not revert to orthophosphate, 3D TRASAR 3DT189 can be effectively used in systems with long holding time indices (HTI's).

3D TRASAR 3DT189 contains a blend of Tolyltriazole (TT) and Benzotriazole (BZT). This blend of azoles is more halogen stable and provides improved copper and yellow metals corrosion protection.

#### PHYSICAL & CHEMICAL PROPERTIES

These properties are typical. Refer to the Material Safety Data Sheet (MSDS), SECTION 9, for the most current data.

Form	Liquid
Density	9.5 - 10.0 lb/gal
Specific Gravity @ 60°F (16°C)	1.17
pH (Neat)	1.8
Freeze-Thaw Recovery	Complete
Flash Point	Not Applicable

Odor	None
Freeze Point	18°F (-8°C)
Solubility in Water	Complete
Appearance	Light Yellow

## ACTIVE CONSTITUENTS

Active	Function
Phosphoric Acid	Mild steel corrosion inhibition
Tagged High Stress Polymer (THSP)	Dispersant
Phosphinosuccinic Oligomer (PSO)	Mild steel corrosion and CaCO <sub>3</sub> scale inhibition
Benzotriazole (BZT)/Tolyltriazole (TT)	Copper corrosion inhibition
TRASAR Technology	Product Monitoring and Control

## REGULATORY APPROVALS

Please refer to SECTION 15 of the Material Safety Data Sheet (MSDS) for the most recent approval information. This product is intended for industrial use only. It must not be fed to potable water systems of any type.

## MATERIALS OF COMPATIBILITY

The following data is for the product as supplied and should be useful in specifying materials of construction of tanks, pumps, valves, piping, etc. used for storing, feeding, or transporting material.

Compatible	Not Compatible
Buna-N	Brass
Hypalon	304 SS
EPDM	Neoprene
Polyethylene	Viton
Polypropylene	Polyurethane
CPVC	Coated steel drum
PORTA-FEED <sup>®</sup> Liner	316 SS (Welded)
HDPE	Mild Steel
Plasite 4300 liner (vinyl ester resin)	
Plasite 7122 liner (epoxy phenolic)	
316 SS (Unwelded)	

Nalco recommends the use of certain polymer-based materials for the feed system, specifically rigid polyethylene, polypropylene, PVC and CPVC, or possibly lined metal tubing. The use of 316SS feed systems is not preferred, as tests designed specifically for storage applications conducted at elevated temperatures indicated susceptibility to pitting in some instances. However, the attack was confined to the welded regions on 316SS specimens. 316SS tubing and components without welds, such as pump heads and feed lines, which we expect to always be flooded with product, may be acceptable.

## DOSAGE AND FEEDING

For complete dosage and feeding recommendations, consult your Nalco representative.

## ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD <sub>5</sub> )	9240 ppm
Chemical Oxygen Demand (COD)	190,000 ppm
Total Organic Carbon (TOC)	62,000 ppm

Refer to SECTIONS 11 and 12 of the MSDS for all available mammalian and aquatic toxicity information.

## SAFETY AND HANDLING

3D TRASAR 3DT189 is an acidic product and may cause skin and eye irritation. Chemical-resistant gloves and safety goggles should be worn when handling 3D TRASAR 3DT189. Read SECTION 8 of the Material Safety Data Sheet for specific personal protective equipment (PPE) recommendations and SECTION 3 for health effects information.

## STORAGE

3D TRASAR 3DT189 should be stored in a location where the product temperature can be maintained between 22°F (-6°C) and 110°F (43°C). In cold climates, heat tracing and insulation of exposed containers and transfer lines may be necessary.

The recommended in-plant storage limit for 3D TRASAR 3DT189 is twelve months.

3D TRASAR 3DT189 should be protected from freezing.

## REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at [www.nalco.com](http://www.nalco.com).

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

## ADDITIONAL INFORMATION

3D TRASAR, TRASAR, PORTA-FEED and NALCO are registered trademarks of Nalco Company (5-27-05)

Nalco Company, 1601 West Diehl Road, Naperville, Illinois 60563-1198

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# MATERIAL SAFETY DATA SHEET

## PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)  
(800) 424-9300 (24 Hours) CHEMTREC

### 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : 3D TRASAR 3DT189  
APPLICATION : COOLING WATER TREATMENT  
COMPANY IDENTIFICATION : Nalco Company  
1601 W. Diehl Road  
Naperville, Illinois  
60563-1198  
EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC  
NFPA 704M/HMIS RATING  
HEALTH : 2 / 2 FLAMMABILITY : 0 / 1 INSTABILITY : 0 / 0 OTHER :  
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

### 2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Substituted aromatic amine	Proprietary	1.0 - 5.0
Phosphoric Acid	7664-38-2	1.0 - 5.0
Sulfuric Acid	7664-93-9	1.0 - 5.0

### 3. HAZARDS IDENTIFICATION

#### \*\*EMERGENCY OVERVIEW\*\*

#### WARNING

Irritating to eyes.  
Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water.  
Wear suitable protective clothing.  
May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of sulfur (SOx) under fire conditions.  
May evolve oxides of phosphorus (POx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :  
Eye, Skin

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :  
Irritating, and may injure eye tissue if not removed promptly.



## MATERIAL SAFETY DATA SHEET

PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)  
(800) 424-9300 (24 Hours) CHEMTREC

**SKIN CONTACT :**  
Can cause mild irritation.

**INGESTION :**  
Not a likely route of exposure. No adverse effects expected.

**INHALATION :**  
Not a likely route of exposure. No adverse effects expected.

**SYMPTOMS OF EXPOSURE :**  
**Acute :**  
A review of available data does not identify any symptoms from exposure not previously mentioned.  
**Chronic :**  
A review of available data does not identify any symptoms from exposure not previously mentioned.

**HUMAN HEALTH HAZARDS - CHRONIC :**  
No adverse effects expected other than those mentioned above.

### 4. FIRST AID MEASURES

**EYE CONTACT :**  
Immediately flush eye with water for at least 15 minutes while holding eyelids open. If symptoms develop, seek medical advice.

**SKIN CONTACT :**  
Flush affected area with water. If symptoms develop, seek medical advice.

**INGESTION :**  
Get medical attention. Do not induce vomiting without medical advice. If conscious, washout mouth and give water to drink. If reflexive vomiting occurs, rinse mouth and repeat administration of water.

**INHALATION :**  
Remove to fresh air, treat symptomatically. If symptoms develop, seek medical advice.

**NOTE TO PHYSICIAN :**  
Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

### 5. FIRE FIGHTING MEASURES

**FLASH POINT :** Not applicable

**EXTINGUISHING MEDIA :**  
This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Use extinguishing media appropriate for surrounding fire.



## MATERIAL SAFETY DATA SHEET

### PRODUCT

**3D TRASAR 3DT189**

### EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

#### FIRE AND EXPLOSION HAZARD :

May evolve oxides of carbon (COx) under fire conditions. May evolve oxides of sulfur (SOx) under fire conditions. May evolve oxides of phosphorus (POx) under fire conditions.

#### SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :

In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

## 6. ACCIDENTAL RELEASE MEASURES

#### PERSONAL PRECAUTIONS :

Restrict access to area as appropriate until clean-up operations are complete. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Stop or reduce any leaks if it is safe to do so. Ventilate spill area if possible. Ensure clean-up is conducted by trained personnel only. Do not touch spilled material. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Notify appropriate government, occupational health and safety and environmental authorities.

#### METHODS FOR CLEANING UP :

**SMALL SPILLS:** Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. **LARGE SPILLS:** Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Clean contaminated surfaces with water or aqueous cleaning agents. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

#### ENVIRONMENTAL PRECAUTIONS :

Do not contaminate surface water.

## 7. HANDLING AND STORAGE

#### HANDLING :

Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Do not breathe vapors/gases/dust. Keep the containers closed when not in use. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labeled.

#### STORAGE CONDITIONS :

Store in suitable labeled containers. Store the containers tightly closed.

#### SUITABLE CONSTRUCTION MATERIAL :

Buna-N, Hypalon, EPDM, Polyethylene, Polypropylene, HDPE (high density polyethylene), PVC, Epoxy phenolic resin

#### UNSUITABLE CONSTRUCTION MATERIAL :

Brass, Stainless Steel 304, Neoprene, Viton, Polyurethane, 100% phenolic resin liner, Stainless Steel 316L

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

#### OCCUPATIONAL EXPOSURE LIMITS :

Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below.



# MATERIAL SAFETY DATA SHEET

## PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

### ACGIH/TLV :

Substance(s)

Phosphoric Acid      TWA: 1 mg/m3  
                                 STEL: 3 mg/m3

Sulfuric Acid              TWA: 0.2 mg/m3 Thoracic fraction

### OSHA/PEL :

Substance(s)

Phosphoric Acid      TWA: 1 mg/m3  
                                 STEL: 3 mg/m3

Sulfuric Acid              TWA: 1 mg/m3

### ENGINEERING MEASURES :

General ventilation is recommended.

### RESPIRATORY PROTECTION :

Where concentrations in air may exceed the limits given in this section, the use of a half face filter mask or air supplied breathing apparatus is recommended. A suitable filter material depends on the amount and type of chemicals being handled. Consider the use of filter type: Multi-contaminant cartridge. with a Particulate pre-filter. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

### HAND PROTECTION :

When handling this product, the use of chemical gauntlets is recommended., The choice of work glove depends on work conditions and what chemicals are handled, but we have positive experience under light handling conditions using gloves made from, PVC, ., Gloves should be replaced immediately if signs of degradation are observed., Breakthrough time not determined as preparation, consult PPE manufacturers.

### SKIN PROTECTION :

Wear standard protective clothing. See general advice.

### EYE PROTECTION :

When handling this product, the use of splash chemical goggles is recommended.

### HYGIENE RECOMMENDATIONS :

Use good work and personal hygiene practices to avoid exposure. Keep an eye wash fountain available. Keep a safety shower available. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Always wash thoroughly after handling chemicals. When handling this product never eat, drink or smoke.

## 9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE      Liquid

APPEARANCE              Yellow

Nalco Company 1601 W. Diehl Road • Naperville, Illinois 60563-1198 • (630)305-1000

For additional copies of an MSDS visit [www.nalco.com](http://www.nalco.com) and request access



# MATERIAL SAFETY DATA SHEET

## PRODUCT

**3D TRASAR 3DT189**

## EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

ODOR	None
SPECIFIC GRAVITY	1.151 @ 77 °F / 25 °C
DENSITY	9.56 lb/gal
SOLUBILITY IN WATER	Complete
pH (100 %)	1.8
VISCOSITY	5.4 cst
INITIAL BOILING POINT	212 °F / 100 °C
VAPOR PRESSURE	0.5 mm Hg @ 100 °F / 37.8 °C
VOC CONTENT	0.4 % Calculated

Note: These physical properties are typical values for this product and are subject to change.

## 10. STABILITY AND REACTIVITY

### STABILITY :

Stable under normal conditions.

### HAZARDOUS POLYMERIZATION :

Hazardous polymerization will not occur.

### CONDITIONS TO AVOID :

Freezing temperatures.

### MATERIALS TO AVOID :

Bases Contact with strong alkalis (e.g. ammonia and its solutions, carbonates, sodium hydroxide (caustic), potassium hydroxide, calcium hydroxide (lime), cyanide, sulfide, hypochlorites, chlorites) may generate heat, splattering or boiling and toxic vapors. Contact with reactive metals (e.g. aluminum) may result in the generation of flammable hydrogen gas.

### HAZARDOUS DECOMPOSITION PRODUCTS :

Under fire conditions: Oxides of carbon, Oxides of sulfur, Oxides of phosphorus, Oxides of nitrogen

## 11. TOXICOLOGICAL INFORMATION

No toxicity studies have been conducted on this product.

### SENSITIZATION :

This product is not expected to be a sensitizer.

### CARCINOGENICITY :

None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).





# MATERIAL SAFETY DATA SHEET

PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

## HUMAN HAZARD CHARACTERIZATION :

Based on our hazard characterization, the potential human hazard is: Low

## 12. ECOLOGICAL INFORMATION

### ECOTOXICOLOGICAL EFFECTS :

The following results are for the product.

### ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Fathead Minnow	96 hrs	3,750 mg/l	Product
Rainbow Trout	96 hrs	1,830 mg/l	Product

### ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Daphnia magna	48 hrs		1,908 mg/l	Product
Ceriodaphnia dubia	48 hrs	1,875 mg/l		Product

### PERSISTENCY AND DEGRADATION :

Total Organic Carbon (TOC) : 62,000 mg/l

Chemical Oxygen Demand (COD) : 190,000 mg/l

### Biological Oxygen Demand (BOD) :

Incubation Period	Value	Test Descriptor
5 d	9,240 mg/l	Product

The organic portion of this preparation is expected to be readily biodegradable.

### MOBILITY :

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

### BIOACCUMULATION POTENTIAL

This preparation or material is not expected to bioaccumulate.



# MATERIAL SAFETY DATA SHEET

PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)  
(800) 424-9300 (24 Hours) CHEMTREC

## ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION

Based on our hazard characterization, the potential environmental hazard is: Low

If released into the environment, see CERCLA/SUPERFUND in Section 15.

## 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous Waste: D002

Hazardous wastes must be transported by a licensed hazardous waste transporter and disposed of or treated in a properly licensed hazardous waste treatment, storage, disposal or recycling facility. Consult local, state, and federal regulations for specific requirements.

## 14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

The presence of an RQ component (Reportable Quantity for U.S. EPA and DOT) in this product causes it to be regulated with an additional description of RQ for road, or as a class 9 for road and air, ONLY when the net weight in the package exceeds the calculated RQ for the product.

### LAND TRANSPORT :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s) :	PHOSPHORIC ACID, SULFURIC ACID
UN/ID No :	UN 3264
Hazard Class - Primary :	8
Packing Group :	III

Flash Point :	Not applicable
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DOT Reportable Quantity (per package) :	71,530 lbs
DOT RQ Component :	Sulfuric Acid

### AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.
Technical Name(s) :	PHOSPHORIC ACID, SULFURIC ACID
UN/ID No :	UN 3264
Hazard Class - Primary :	8
Packing Group :	III
IATA Cargo Packing Instructions :	820



# MATERIAL SAFETY DATA SHEET

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**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

IATA Cargo Aircraft Limit : 60 L (Max net quantity per package)

## MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : CORROSIVE LIQUID, ACIDIC, INORGANIC, N.O.S.  
Technical Name(s) : PHOSPHORIC ACID, SULFURIC ACID  
UN/ID No : UN 3264  
Hazard Class - Primary : 8  
Packing Group : III

## 15. REGULATORY INFORMATION

### NATIONAL REGULATIONS, USA :

#### OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :

Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Substituted aromatic amine : Eye irritant  
Phosphoric Acid : Corrosive  
Sulfuric Acid : Corrosive

#### CERCLA/SUPERFUND, 40 CFR 117, 302 :

This product contains the following Reportable Quantity (RQ) Substance. Also listed is the RQ for the product. If a reportable quantity of product is released, it requires notification to the NATIONAL RESPONSE CENTER, WASHINGTON, D.C. (1-800-424-8802).

<u>RQ Substance</u>	<u>RQ</u>
Sulfuric Acid	71,530 lbs

### SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

#### SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :

This product contains the following substance(s) which is listed in Appendix A and B as an Extremely Hazardous Substance. Listed below are the statutory Threshold Planning Quantity (TPQ) for the substance(s) and the Reportable Quantity (RQ) of the product. If a reportable quantity of product is released, it requires notification to your State Emergency Response Commission. You may also be required to notify the National Response Center - See CERCLA/SUPERFUND, above.

<u>Extremely Hazardous Substance</u>	<u>TPQ</u>	<u>RQ</u>
Sulfuric Acid	1,000 lbs	71,530 lbs

#### SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :

Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
-	Delayed (Chronic) Health Hazard



# MATERIAL SAFETY DATA SHEET

## PRODUCT

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EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

- Fire Hazard
- Sudden Release of Pressure Hazard
- Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

### SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :

This product contains the following substance(s), (with CAS # and % range) which appear(s) on the List of Toxic Chemicals

<u>Hazardous Substance(s)</u>	<u>CAS NO</u>	<u>% (w/w)</u>
Sulfuric Acid	7664-93-9	1.0 - 5.0

### TOXIC SUBSTANCES CONTROL ACT (TSCA) :

The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :

This product contains the following substances listed in the regulation:

<u>Substance(s)</u>	<u>Citations</u>
<ul style="list-style-type: none"><li>• Phosphoric Acid</li><li>• Sulfuric Acid</li></ul>	Sec. 311

CLEAN AIR ACT, Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :

This product may contain trace levels (<0.1% for carcinogens, <1% all other substances) of the following substance(s) listed under the regulation:

<u>Substance(s)</u>	<u>Citations</u>
<ul style="list-style-type: none"><li>• Methanol</li></ul>	Sec. 112, Sec. 111

### CALIFORNIA PROPOSITION 65 :

This product does not contain substances which require warning under California Proposition 65.

### MICHIGAN CRITICAL MATERIALS :

None of the substances are specifically listed in the regulation.

### STATE RIGHT TO KNOW LAWS :

The following substances are disclosed for compliance with State Right to Know Laws:

Other ingredients determined not to be hazardous, including water	Proprietary
Phosphoric Acid	7664-38-2

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# MATERIAL SAFETY DATA SHEET

PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

Sulfuric Acid  
Substituted aromatic amine

7664-93-9  
Proprietary

## NATIONAL REGULATIONS, CANADA :

### WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

### WHMIS CLASSIFICATION :

E - Corrosive Material, D2A - Materials Causing Other Toxic Effects - Very Toxic Material

### CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :

This product contains substance(s) which are found on the Non-Domestic Substances List (NDSL).

## INTERNATIONAL CHEMICAL CONTROL LAWS

### AUSTRALIA

All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

### EUROPE

The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

### KOREA

All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

## 16. OTHER INFORMATION

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

## REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.



## MATERIAL SAFETY DATA SHEET

PRODUCT

**3D TRASAR 3DT189**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

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Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight# (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

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Prepared By : Product Safety Department

Date issued : 02/14/2007

Version Number : 1.6



Product Bulletin

# Towerbrom<sup>®</sup> 960

## Cooling Water Biocide

### PRODUCT DESCRIPTION AND APPLICATION

Towerbrom 960 is a quick dissolving, broad-spectrum, granular oxidizing biocide. It is a dry blend of stabilized chlorine and sodium bromide. The quick dissolving feature of Towerbrom 960 makes it ideal for slug feed biological control or shock feed system clean-up.

When Towerbrom 960 is introduced into a system, it initially forms stabilized chlorine, providing the *oxidizing* power needed for effective biological slime removal at any pH. Simultaneously, the hypochlorous acid begins converting the bromide to hypobromous acid, which is more effective as a *biocide* when the system pH is above 7.5, and when certain contaminants such as ammonia are present. As the hypobromous acid is used up, it reverts to bromide ion, where it can be reactivated to hypobromous acid by any hypochlorous acid still in the system. This process continues to provide a powerful mixed oxidant system until all the hypochlorous acid is consumed. Then the system continues as a "bromine system" until all the hypobromous acid is consumed and reverts to bromide ion.

Typical Towerbrom 960 Uses:

- **Daily Slug Feed** - Slug dose daily for cost-effective biological control. Automate with an Automated Towerbrom Feeder. The slug dosed program is a BIO-MANAGE<sup>™</sup> best practice recommendation to vary the stress on a system to maximize biological control.
- **Shock Halogenation** - Complement an existing biocide treatment when clean-up is needed.

### PHYSICAL & CHEMICAL PROPERTIES

These properties are typical. Refer to Material Safety Data Sheet (MSDS), SECTION 9, for the most current data.

Form	Dry, Granular Solid
Appearance	White Granular
Bulk Density	63 lb/Ft <sup>3</sup> [1010 kg/m <sup>3</sup> ]
pH ( 1% Solution )	6 - 7
Solubility	10%
VOC Content	0.0 %
Odor	Oxidant - Chlorine

### ACTIVE CONSTITUENTS

Sodium dichloroisocyanurate	90%
Sodium bromide	7%
Available Halogen	57% available halogen as chlorine

## REGULATORY APPROVALS

Towerbrom 960 must be applied according to appropriate national and local regulations.

As with all biocides applied in the United States, Towerbrom 960 is regulated by the U.S. EPA under The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). It is a violation of federal law to use this product or any biocide in a manner inconsistent with its product label. Individual states also require registration in addition to the federal registration. State registrations must be verified prior to use.

U.S. EPA Registration Number 935-71-1706 is approval for Towerbrom 960 use in:

Recirculating water systems:

Air washer water systems, commercial/industrial water cooling systems, evaporative condenser water systems, ornamental ponds and aquaria, heat exchange water systems, lakes/ponds/reservoirs (without human or wildlife use), industrial scrubbing systems, industrial auxiliary water systems, industrial process water, industrial waste disposal systems, pasteurizer/warmer/cannery cooling water systems.

Pulp and paper mill water systems

Once-through water systems (open or closed cycle, fresh or salt water)

Towerbrom 960 is not approved for use in potable water, swimming pools or spas. Towerbrom 960 is registered for use in Canada. Registration number: 27663

## MATERIALS OF COMPATIBILITY

### For Concentrated Towerbrom 960 Solutions

Compatible	Not Compatible
PVC	Polypropylene
CPVC	Mild Steel/Cast Iron
Kynar (PVDF)	304/316/C-20 Stainless Steel
Teflon (PTFE, TFE)	Copper/Bronze/Brass
Polyethylene	Aluminum
Hastelloy -C	Buna-N (Nitrile)
Viton (FPM)	Natural Rubber
Ceramic	Hypalon
Graphite	Nordel (EPDM)
Linear Polyethylene	Neoprene
FRP (Bisphenol)	Cross Linked Polyethylene
FRP (Derakane)	FRP (Isophthalic)
Plasite 4100 (Vinyl Ester)	

## DOSAGE AND FEEDING

The specific dosage of Towerbrom 960 will vary depending on the characteristics of your system and the BIO-MANAGE objectives for your microbio control program. Your Nalco representative will recommend the optimum dosage for cost-effective control and results.



## ENVIRONMENTAL AND TOXICITY DATA

Biological Oxygen Demand (5-day BOD <sub>5</sub> )	Not Available
Chemical Oxygen Demand (COD)	Not Available
Total Organic Carbon (TOC)	Not Available

CERCLA/SUPERFUND, 40 CFR 117, 302: Notification of spills of this product is not required. Refer to MSDS, SECTIONS 11 and 12, for all mammalian and aquatic information.

## SAFETY AND HANDLING

Handling/Exposure to product:

1. Refer to the MSDS, SECTION 8 for personal protection information and SECTION 3 for health effects information before handling.

Some standard use guidelines are listed here:

- Do not get in eyes, on skin or on clothing
- Use with adequate ventilation
- Avoid breathing dust from product
- Protect hands with PVC, Neoprene or Butyl gloves
- Protect eyes with a face shield and chemical splash goggles
- Protect clothing with a chemical resistant apron

2. Spills

Clean up all spills promptly by sweeping and scooping up spilled material. Use recovered material in system normally treated with product according to label instructions. **Do not return recovered material to storage container.** Do not place recovered material in trash or combine with any other materials. Wash down any remaining minor quantities of spilled product with large volume of water. Refer to MSDS SECTION 13 for disposal considerations.

## STORAGE

Always store Towerbrom 960 in the original shipping container and away from heat and open flames. For pails, keep lid tightly closed when not in use and do not allow moisture or any other contaminants to enter the stored material. Never return spilled or damp material to a storage container. Store pails and bins indoors or in a protected area when not in use. Be sure bins are stored where water cannot collect under the outlet valve. Do not rinse bins prior to returning.

## REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at [www.nalco.com](http://www.nalco.com).

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

## ADDITIONAL INFORMATION

BIO-MANAGE and NALCO are registered trademarks of Nalco Company (10-22-04)  
Towerbrom is a registered trademark of, and is used under license from Occidental Chemical Company  
pHREEdom is a registered trademark of Calgon Corporation

Nalco Company, 1601 West Diehl Road, Naperville, Illinois 60563-1198

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# MATERIAL SAFETY DATA SHEET

PRODUCT

**TOWERBROM® 960**

EMERGENCY TELEPHONE NUMBER(S)  
(800) 424-9300 (24 Hours) CHEMTREC

## 1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME : TOWERBROM® 960

APPLICATION : BIOCIDEBIOCID

COMPANY IDENTIFICATION :  
Nalco Company  
1601 W. Diehl Road  
Naperville, Illinois  
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING

HEALTH : 3/3 FLAMMABILITY : 1/1 INSTABILITY : 2/2 OTHER : OXIDIZER  
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme

## 2. COMPOSITION/INFORMATION ON INGREDIENTS

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Sodium Dichloroisocyanurate	2893-78-9	60.0 - 100.0
Sodium Bromide	7647-15-6	5.0 - 10.0

## 3. HAZARDS IDENTIFICATION

### \*\*EMERGENCY OVERVIEW\*\*

#### DANGER

CORROSIVE. CAUSES EYE AND SKIN DAMAGE. IRRITATING TO NOSE AND THROAT. HARMFUL OR FATAL IF SWALLOWED. Prolonged ingestion of large amounts may cause adverse central nervous system effects. Strong Oxidizer.

Do not get in eyes, on skin, on clothing. Remove contaminated clothing and wash before reuse.

Wear goggles and face shield and rubber gloves when handling.

Not flammable but can act as an oxidizing agent, enhancing the burning rate of other materials. Water Reactive; material will react with water and may release a flammable or toxic gas. In addition, nitrogen trichloride, which can present an explosion hazard, can be generated slowly by the reaction of small quantities of water with a high concentration of this product. Decomposes; flammable and/or toxic gases will form at elevated temperatures (thermal decomposition).

PRIMARY ROUTES OF EXPOSURE :

Eye, Skin



## MATERIAL SAFETY DATA SHEET

PRODUCT

**TOWERBROM® 960**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

### HUMAN HEALTH HAZARDS - ACUTE :

#### EYE CONTACT :

Corrosive. Will cause eye burns and permanent tissue damage.

#### SKIN CONTACT :

May cause severe irritation or tissue damage depending on the length of exposure and the type of first aid administered.

#### INGESTION :

Not a likely route of exposure. Corrosive; causes chemical burns to the mouth, throat and stomach. Can cause central nervous system depression, nausea, dizziness, vomiting, or unconsciousness.

#### INHALATION :

Not a likely route of exposure. Irritating, in high concentrations, to the eyes, nose, throat and lungs. Toxic by inhalation.

#### SYMPTOMS OF EXPOSURE :

##### Acute :

A review of available data does not identify any symptoms from exposure not previously mentioned.

##### Chronic :

Excessive exposure may cause central nervous system effects, nausea, vomiting, anesthetic or narcotic effects.

#### AGGRAVATION OF EXISTING CONDITIONS :

A review of available data does not identify any worsening of existing conditions.

## 4. FIRST AID MEASURES

#### EYE CONTACT :

PROMPT ACTION IS ESSENTIAL IN CASE OF CONTACT. Immediately flush eye with water for at least 15 minutes while holding eyelids open. Get immediate medical attention.

#### SKIN CONTACT :

Remove contaminated clothing. Wash off affected area immediately with plenty of water. Get immediate medical attention.

#### INGESTION :

DO NOT INDUCE VOMITING. If conscious, washout mouth and give water to drink. Get immediate medical attention.

#### INHALATION :

Remove to fresh air, treat symptomatically. Get medical attention.

#### NOTE TO PHYSICIAN :

Probable mucosal damage may contraindicate the use of gastric lavage. Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.



## MATERIAL SAFETY DATA SHEET

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**TOWERBROM® 960**

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### 5. FIRE FIGHTING MEASURES

FLASH POINT : None

**EXTINGUISHING MEDIA :**

Use water spray to cool containers exposed to fire and massive quantities of water to dilute material involved in a fire or spilled from containers. Do not use ABC or other dry chemical fire extinguishers since there is the potential for a violent reaction.

**FIRE AND EXPLOSION HAZARD :**

Not flammable but can act as an oxidizing agent, enhancing the burning rate of other materials. Water Reactive; material will react with water and may release a flammable or toxic gas. In addition, nitrogen trichloride, which can present an explosion hazard, can be generated slowly by the reaction of small quantities of water with a high concentration of this product. Decomposes; flammable and/or toxic gases will form at elevated temperatures (thermal decomposition).

**SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :**

In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

### 6. ACCIDENTAL RELEASE MEASURES

**PERSONAL PRECAUTIONS :**

Restrict access to area as appropriate until clean-up operations are complete. Ensure clean-up is conducted by trained personnel only. Ensure adequate ventilation. Do not touch spilled material. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

**METHODS FOR CLEANING UP :**

Sweep up and shovel. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations). DO NOT allow water to come into contact with this material.

**ENVIRONMENTAL PRECAUTIONS :**

This product is toxic to fish. Do not discharge effluent containing this active ingredient into lakes, streams, ponds, estuaries, oceans or other waters, unless in accordance with the requirements of a National Pollutant Discharge Elimination System (NPDES) permit and the permitting authority has been notified in writing prior to discharge. Do not discharge effluent containing this product to sewer systems without previously notifying the local sewage treatment plant authority. For guidance contact your State Water Board or Regional Office of the EPA.

### 7. HANDLING AND STORAGE

**HANDLING :**

Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. Avoid generating dusts. Keep the containers closed when not in use.

**STORAGE CONDITIONS :**

Store the containers tightly closed. Store in suitable labelled containers. Store separately from bases. Keep in dry place. Store away from organic chemicals and other oxidizable materials, reducing agents, acids and alkalis. DO NOT allow water to come into contact with this material.



# MATERIAL SAFETY DATA SHEET

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**TOWERBROM® 960**

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(800) 424-9300 (24 Hours) CHEMTREC

## SUITABLE CONSTRUCTION MATERIAL :

Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use.

## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### OCCUPATIONAL EXPOSURE LIMITS :

This product does not contain any substance that has an established exposure limit.

### ENGINEERING MEASURES :

General ventilation is recommended. Local exhaust ventilation may be necessary when dusts or mists are generated.

### RESPIRATORY PROTECTION :

If dusts are generated, use an approved air-purifying respirator. An organic vapor/acid gas cartridge with dust/mist prefilter may be used. In event of emergency or planned entry into unknown concentrations a positive pressure, full-facepiece SCBA should be used. If respiratory protection is required, institute a complete respiratory protection program including selection, fit testing, training, maintenance and inspection.

### HAND PROTECTION :

Neoprene gloves, PVC gloves, Butyl gloves

### SKIN PROTECTION :

Wear chemical resistant apron, chemical splash goggles, impervious gloves and boots. A full slicker suit is recommended if gross exposure is possible.

### EYE PROTECTION :

Wear a face shield with chemical splash goggles.

### HYGIENE RECOMMENDATIONS :

Eye wash station and safety shower are necessary. If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse.

### HUMAN EXPOSURE CHARACTERIZATION :

Based on our recommended product application and personal protective equipment, the potential human exposure is: Low

## 9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE	Crystalline, Granular
APPEARANCE	White
ODOR	Slight Pungent
SOLUBILITY IN WATER	Moderate
pH (1 %)	6 - 7
MELTING POINT	Decomposes 460 - 480 °F / 240 - 250 °C

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# MATERIAL SAFETY DATA SHEET

PRODUCT

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(800) 424-9300 (24 Hours) CHEMTREC

VOC CONTENT 0.0 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

## 10. STABILITY AND REACTIVITY

### STABILITY :

Stable under normal conditions.

### HAZARDOUS POLYMERIZATION :

Hazardous polymerization will not occur.

### CONDITIONS TO AVOID :

Moisture

Avoid temperatures greater than 400 °F

### MATERIALS TO AVOID :

Do not bring in contact with organic materials and reducing agents. DO NOT allow water to come into contact with this material.

### HAZARDOUS DECOMPOSITION PRODUCTS :

Oxides of nitrogen (NO<sub>x</sub>), disodium oxide, bromine, and traces of phosgene (under fire conditions); chlorine (released in presence of moisture) and other chlorine containing compounds; hypobromous acid, hypochlorous acid, and cyanuric acid (released when dissolved in water); nitrogen trichloride, an explosion hazard (generated slowly by the reaction of small quantities of water with high concentration of this product).

## 11. TOXICOLOGICAL INFORMATION

The following results are for the product.

### ACUTE ORAL TOXICITY :

Species	LD50	Test Descriptor
Rat	710 mg/kg	

### ACUTE DERMAL TOXICITY :

Species	LD50	Test Descriptor
Rabbit	> 2g/kg	

### ACUTE INHALATION TOXICITY :

Species	LC50	Test Descriptor
Rat	0.6 mg/l (4 hrs)	

### PRIMARY SKIN IRRITATION :

Draize Score	Test Descriptor
7.2 / 8.0	



MATERIAL SAFETY DATA SHEET

PRODUCT

TOWERBROM® 960

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

SENSITIZATION :

This product is not expected to be a sensitizer.

CARCINOGENICITY :

None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

HUMAN HAZARD CHARACTERIZATION :

Based on our hazard characterization, the potential human hazard is: Moderate

12. ECOLOGICAL INFORMATION

ECOTOXICOLOGICAL EFFECTS :

The following results are for the product along with results on the active substances.

ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Fathead Minnow	96 hrs	0.7 mg/l	50% Active Ingredient
Sheepshead Minnow	96 hrs	3.42 mg/l	
Inland Silverside	96 hrs	2.7 mg/l	50% Active Ingredient

ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Daphnia magna	48 hrs	2.5 mg/l		50% Active Ingredient
Mysid Shrimp (Mysidopsis bahia)	48 hrs	3.54 mg/l		
Mysid Shrimp (Mysidopsis bahia)	96 hrs	4.4 mg/l		50% Active Ingredient
Ceriodaphnia dubia	48 hrs	1.02 mg/l		Product

MOBILITY :

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM , provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	50 - 70%	30 - 50%

The portion in water is expected to float on the surface.

BIOACCUMULATION POTENTIAL

This preparation or material is not expected to bioaccumulate.





# MATERIAL SAFETY DATA SHEET

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## ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION

Based on our hazard characterization, the potential environmental hazard is: High

Based on our recommended product application and the product's characteristics, the potential environmental exposure is: Moderate

If released into the environment, see CERCLA/SUPERFUND in Section 15.

## 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it could meet the criteria of a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261. Before disposal, it should be determined if the waste meets the criteria of a hazardous waste.

Hazardous Waste: D001, D003

Pesticide wastes are acutely hazardous. Improper disposal of excess pesticide, spray mixture, or rinsate is a violation of Federal law. If these wastes cannot be disposed of by use according to label instructions, contact your State Pesticide or Environmental Control Agency, or the Hazardous Waste Representative at the nearest EPA Regional Office for guidance.

## 14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.

### LAND TRANSPORT :

Proper Shipping Name :	DICHLOROISOCYANURIC ACID, SALTS, MIXTURE
Technical Name(s) :	Sodium Dichloroisocyanurate
UN/ID No :	UN 2465
Hazard Class - Primary :	5.1
Packing Group :	II

Flash Point :	None
---------------	------

### AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name :	DICHLOROISOCYANURIC ACID, SALTS, MIXTURE
Technical Name(s) :	Sodium Dichloroisocyanurate
UN/ID No :	UN 2465
Hazard Class - Primary :	5.1
Packing Group :	II
IATA Cargo Packing Instructions :	511
IATA Cargo Aircraft Limit :	25 KG (Max net quantity per package)

### MARINE TRANSPORT (IMDG/IMO) :

**Nalco Company** 1601 W. Diehl Road • Naperville, Illinois 60563-1198 • (630)305-1000

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PRODUCT

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Proper Shipping Name :	DICHLOROISOCYANURIC ACID, SALTS, MIXTURE
Technical Name(s) :	Sodium Dichloroisocyanurate
UN/ID No :	UN 2465
Hazard Class - Primary :	5.1
Packing Group :	II

## 15. REGULATORY INFORMATION

NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :

Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Sodium Dichloroisocyanurate : Oxidizer, Irritant  
Sodium Bromide : Eye irritant

CERCLA/SUPERFUND, 40 CFR 117, 302 :

Notification of spills of this product is not required.

SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :

This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :

Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

X	Immediate (Acute) Health Hazard
-	Delayed (Chronic) Health Hazard
X	Fire Hazard
-	Sudden Release of Pressure Hazard
X	Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :

This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :

The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

NSF NON-FOOD COMPOUNDS REGISTRATION PROGRAM (former USDA List of Proprietary Substances & Non-Food Compounds) :

NSF Registration number for this product is : 121816

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This product is acceptable for treatment of cooling and retort water (G5) in and around food processing areas.

**FEDERAL INSECTICIDE, FUNGICIDE AND RODENTICIDE ACT (FIFRA) :**

EPA Reg. No. 935-71-1706

In all cases follow instructions on the product label.

**FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :**

None of the substances are specifically listed in the regulation.

**CLEAN AIR ACT, Sec. 111 (40 CFR 60, Volatile Organic Compounds), Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :**

None of the substances are specifically listed in the regulation.

**CALIFORNIA PROPOSITION 65 :**

This product does not contain substances which require warning under California Proposition 65.

**MICHIGAN CRITICAL MATERIALS :**

None of the substances are specifically listed in the regulation.

**STATE RIGHT TO KNOW LAWS :**

This product is a registered biocide and is exempt from State Right to Know Labelling Laws.

Heterocyclic salt

Proprietary

**NATIONAL REGULATIONS, CANADA :**

**WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :**

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

**WHMIS CLASSIFICATION :**

Pesticide controlled products are not regulated under WHMIS.

**CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :**

The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

**INTERNATIONAL CHEMICAL CONTROL LAWS**

**EUROPE**

The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

**16. OTHER INFORMATION**

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's



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general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

\* The human risk is: Low

\* The environmental risk is: Moderate

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

### REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Ariel Insight# (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.



MATERIAL SAFETY DATA SHEET

PRODUCT

**TOWERBROM® 960**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

Prepared By : Product Safety Department  
Date issued : 07/13/2005  
Version Number : 1.11



Product Bulletin

# NALCO<sup>®</sup> 7408

## *Dechlorination Chemical*

### PRODUCT DESCRIPTION AND APPLICATION

NALCO 7408 is a fast-acting dechlorination agent used to reduce the levels of residual chlorine in chlorinated water supplies without increasing objectionable chloramines. NALCO 7408 is a bisulfite-based material that reacts instantaneously with chlorine. It does not include any catalyst and, therefore, reacts more slowly with oxygen.

Its primary use is dechlorination of water, feedwater for reverse osmosis (RO), feedwater to ion exchange units, and waste water. NALCO 7408 is also used for chlorine and oxygen scavenging in systems that cannot tolerate the presence of a catalyst.

### PHYSICAL & CHEMICAL PROPERTIES

These properties are typical.

Form:	Liquid
Density @77°F [25°C]:	11.4 lb/gal [1.37 kg/L]
Specific Gravity @77°F [25°C]:	1.37
Odor:	Pungent sulfurous
pH (1% Solution):	4.1
Freeze-Thaw Recovery:	Unstable
Flash Point (PMCC):	None
Crystallization Point:	37°F [3°C]
Freeze Point (precipitation point)	30°F [-1°C]
VOC	None

### ACTIVE CONSTITUENTS

Sodium Bisulfite

### REGULATORY APPROVALS

See MSDS for regulatory information.

### MATERIALS OF COMPATIBILITY

Compatible	Not Compatible	Not Tested
Polyethylene	Aluminum	Plasite 4005
Fiberglass DK-411	Brass	Plasite 6000
PVC	Mild Steel	Plasite 7122
Buna-N	Nickel	Copper
Polypropylene	Neoprene	Polyurethane
Natural Rubber	Hypalon	
Teflon	Stainless Steel 304	
Viton	Stainless Steel 316	

Plexiglas  
Vinyl

## DOSAGE AND FEEDING

### PRODUCT FEEDING AND PROGRAM COMPATIBILITY

NALCO 7408 should be fed at a point where thorough instantaneous mixing is available as close to the chlorine contact point as feasible. NALCO 7408 can be fed neat or diluted.

### CONSEQUENCES OF UNDERFEED

#### Dechlorination

Underfeed of NALCO 7408 will cause free chlorine to remain in the water going to the ion exchanger or reverse osmosis (RO) membrane. This chlorine will react with the resin or membrane structure causing degradation and/or hydrolysis (check manufacturing specifications).

#### Oxygen Scavenging

Underfeed of NALCO 7408 will result in serious oxygen corrosion to the feedwater system. The greatest damage will occur in the economizer or feedwater preheaters. Oxygen corrosion will also increase iron levels in the feedwater. Iron deposits will form in the high heat flux areas of the boiler causing tube failures.

### CONSEQUENCES OF OVERFEED

#### Dechlorination

Moderate overfeed of NALCO 7408 will cause no permanent damage to any part of the boiler feed system. It will exchange out on the ion exchange resin or be removed by the RO membrane and cause reduced run lengths that would be directly proportional to the extent of overfeed. Slight overfeed should have no noticeable effect on the operation of the ion exchangers or RO membranes since the vast majority of ionic load would be coming from the water itself.

## ENVIRONMENTAL AND TOXICITY DATA

Please see the Material Safety Data Sheet.

## SAFETY AND HANDLING

Read the Material Safety Data Sheet before using this product.

**Caution:** May cause irritation to skin and eyes. Avoid contact with skin, eyes and clothing. Do not take internally. In case of contact, wash skin with soap and water; for eyes, immediately flush with large amounts of water for at least 15 minutes, and get medical attention. Remove contaminated clothing and wash before re-use.

The maximum storage temperature is 120°F [49°C]. Keep from freezing. At temperatures below 30°F [-1°C], product will precipitate. NALCO 7408 is not freeze-thaw stable. Bulk NALCO 7408 should be stored in lined or fiberglass tanks. Avoid excessive aeration. Fill bulk tanks from the bottom.

## STORAGE

NALCO 7408 has a maximum recommended in-plant storage life of six months in factory-sealed containers.

## REMARKS

If you need assistance or more information on this product, please call your nearest Nalco Representative. For more news about Nalco Company, visit our website at [www.nalco.com](http://www.nalco.com).

For **Medical and Transportation Emergencies** involving Nalco products, please see the Material Safety Data Sheet for the phone number.

## ADDITIONAL INFORMATION

NALCO is a registered trademark of Nalco Company (11-14-05)

Nalco Company, 1601 West Diehl Road, Naperville, Illinois 60563-1198

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**MATERIAL SAFETY DATA SHEET**

PRODUCT

**NALCO® 7408**

EMERGENCY TELEPHONE NUMBER(S)

(800) 424-9300 (24 Hours) CHEMTREC

**1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION**PRODUCT NAME : **NALCO® 7408**

APPLICATION : CHLORINE SCAVENGER

COMPANY IDENTIFICATION :  
Nalco Company  
1601 W. Diehl Road  
Naperville, Illinois  
60563-1198

EMERGENCY TELEPHONE NUMBER(S) : (800) 424-9300 (24 Hours) CHEMTREC

NFPA 704M/HMIS RATING

HEALTH : 1 / 2 FLAMMABILITY : 0 / 0 INSTABILITY : 0 / 0 OTHER :  
0 = Insignificant 1 = Slight 2 = Moderate 3 = High 4 = Extreme**2. COMPOSITION/INFORMATION ON INGREDIENTS**

Our hazard evaluation has identified the following chemical substance(s) as hazardous. Consult Section 15 for the nature of the hazard(s).

Hazardous Substance(s)	CAS NO	% (w/w)
Sodium Bisulfite	7631-90-5	30.0 - 60.0

**3. HAZARDS IDENTIFICATION****\*\*EMERGENCY OVERVIEW\*\*****WARNING**

Harmful if swallowed. Contains Sulfite. Causes asthmatic signs and symptoms in hyper-reactive individuals. Do not get in eyes, on skin, on clothing. Do not take internally. Use with adequate ventilation. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. After contact with skin, wash immediately with plenty of water. Wear suitable protective clothing. May evolve oxides of sulfur (SOx) under fire conditions.

PRIMARY ROUTES OF EXPOSURE :  
Skin, Eye, Inhalation

HUMAN HEALTH HAZARDS - ACUTE :

EYE CONTACT :  
Can cause mild irritation.SKIN CONTACT :  
Can cause mild irritation.



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### INGESTION :

Not a likely route of exposure. May cause asthmatic-like attack.

### INHALATION :

Irritant to respiratory system. Causes asthmatic signs and symptoms in hyper-reactive individuals.

### SYMPTOMS OF EXPOSURE :

#### Acute :

A review of available data does not identify any symptoms from exposure not previously mentioned.

#### Chronic :

A review of available data does not identify any symptoms from exposure not previously mentioned.

### AGGRAVATION OF EXISTING CONDITIONS :

A review of available data does not identify any worsening of existing conditions.

### HUMAN HEALTH HAZARDS - CHRONIC :

Ingestion of sulfite can cause a severe allergic reaction in asthmatics and some sulfite sensitive individuals. The resulting symptoms can include difficulty in breathing, flushed skin and a rash. Chronic exposure to sulfites may cause symptoms of upper respiratory disease and affect sense of taste and smell.

## 4. FIRST AID MEASURES

### EYE CONTACT :

Immediately flush eye with water for at least 15 minutes while holding eyelids open. If irritation persists, repeat flushing. Get immediate medical attention.

### SKIN CONTACT :

Immediately flush with plenty of water for at least 15 minutes. If symptoms persist, call a physician.

### INGESTION :

Induce vomiting if the patient is fully conscious. If conscious, washout mouth and give water to drink. Get medical attention.

### INHALATION :

Remove to fresh air, treat symptomatically. If breathing is difficult, administer oxygen. Get medical attention.

### NOTE TO PHYSICIAN :

Based on the individual reactions of the patient, the physician's judgement should be used to control symptoms and clinical condition.

## 5. FIRE FIGHTING MEASURES

FLASH POINT : None

### EXTINGUISHING MEDIA :

This product would not be expected to burn unless all the water is boiled away. The remaining organics may be ignitable. Keep containers cool by spraying with water. Use extinguishing media appropriate for surrounding fire.



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### FIRE AND EXPLOSION HAZARD :

May evolve oxides of sulfur (SO<sub>x</sub>) under fire conditions.

### SPECIAL PROTECTIVE EQUIPMENT FOR FIRE FIGHTING :

In case of fire, wear a full face positive-pressure self contained breathing apparatus and protective suit.

## 6. ACCIDENTAL RELEASE MEASURES

### PERSONAL PRECAUTIONS :

Restrict access to area as appropriate until clean-up operations are complete. Ensure clean-up is conducted by trained personnel only. Ensure adequate ventilation. Do not touch spilled material. Stop or reduce any leaks if it is safe to do so. Use personal protective equipment recommended in Section 8 (Exposure Controls/Personal Protection). Notify appropriate government, occupational health and safety and environmental authorities.

### METHODS FOR CLEANING UP :

**SMALL SPILLS:** Soak up spill with absorbent material. Place residues in a suitable, covered, properly labeled container. Wash affected area. **LARGE SPILLS:** Contain liquid using absorbent material, by digging trenches or by diking. Reclaim into recovery or salvage drums or tank truck for proper disposal. Wash site of spillage thoroughly with water. Contact an approved waste hauler for disposal of contaminated recovered material. Dispose of material in compliance with regulations indicated in Section 13 (Disposal Considerations).

### ENVIRONMENTAL PRECAUTIONS :

Do not contaminate surface water.

## 7. HANDLING AND STORAGE

### HANDLING :

Avoid eye and skin contact. Do not take internally. Do not get in eyes, on skin, on clothing. Have emergency equipment (for fires, spills, leaks, etc.) readily available. Ensure all containers are labelled. Keep the containers closed when not in use. Use with adequate ventilation.

### STORAGE CONDITIONS :

Protect product from freezing. Store the containers tightly closed. Store separately from acids. Store in suitable labelled containers. Amine and sulphite products should not be stored within close proximity or resulting vapors may form visible airborne particles.

### SUITABLE CONSTRUCTION MATERIAL :

HDPE (high density polyethylene), Compatibility with Plastic Materials can vary; we therefore recommend that compatibility is tested prior to use., Brass, Neoprene, Polyurethane, Viton, Hypalon, EPDM, Polypropylene, Polyethylene, PVC

### UNSUITABLE CONSTRUCTION MATERIAL :

Stainless Steel 304, Buna-N, Epoxy phenolic resin, 100% phenolic resin liner



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## 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

### OCCUPATIONAL EXPOSURE LIMITS :

Exposure guidelines have not been established for this product. Available exposure limits for the substance(s) are shown below. Exposure limits are listed for sulfur dioxide (SO<sub>2</sub>) since this product evolves SO<sub>2</sub> when open to the atmosphere.

### ACGIH/TLV :

Substance(s)

Sodium Bisulfite TWA: 5 mg/m<sup>3</sup>

Sulfur Dioxide TWA: 2 ppm , 5.2 mg/m<sup>3</sup>  
STEL: 5 ppm , 13 mg/m<sup>3</sup>

### OSHA/PEL :

Substance(s)

Sodium Bisulfite TWA: 5 mg/m<sup>3</sup>

Sulfur Dioxide TWA: 2 ppm , 5 mg/m<sup>3</sup>  
STEL: 5 ppm , 13 mg/m<sup>3</sup>

### ENGINEERING MEASURES :

General ventilation is recommended. Local exhaust ventilation may be necessary when dusts or mists are generated.

### RESPIRATORY PROTECTION :

If significant mists, vapors or aerosols are generated an approved respirator is recommended. An approved respirator must be worn if the occupational exposure limit is likely to be exceeded.

### HAND PROTECTION :

Neoprene gloves, Nitrile gloves, Butyl gloves, PVC gloves

### SKIN PROTECTION :

Wear standard protective clothing.

### EYE PROTECTION :

Wear chemical splash goggles.

### HYGIENE RECOMMENDATIONS :

If clothing is contaminated, remove clothing and thoroughly wash the affected area. Launder contaminated clothing before reuse. Keep an eye wash fountain available. Keep a safety shower available.

### HUMAN EXPOSURE CHARACTERIZATION :

Based on our recommended product application and personal protective equipment, the potential human exposure is: Low

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**9. PHYSICAL AND CHEMICAL PROPERTIES**

PHYSICAL STATE	Liquid
APPEARANCE	Yellow
ODOR	Pungent
SPECIFIC GRAVITY	1.37 @ 77 °F / 25 °C
DENSITY	11.4 lb/gal
BULK DENSITY	11.4 lb/ft <sup>3</sup>
SOLUBILITY IN WATER	Complete
pH (1 %)	4.1
VISCOSITY	2.8 cps @ 77 °F / 25 °C
FREEZING POINT	34 °F / 1.1 °C
BOILING POINT	219 °F / 104 °C
VAPOR PRESSURE	32 mm Hg @ 77 °F / 25 °C 76 mm Hg @ 99.9 °F / 37.7 °C
VAPOR DENSITY	2.2 (Air = 1)
VOC CONTENT	0.00 % EPA Method 24

Note: These physical properties are typical values for this product and are subject to change.

**10. STABILITY AND REACTIVITY****STABILITY :**

Stable under normal conditions.

**HAZARDOUS POLYMERIZATION :**

Hazardous polymerization will not occur.

**CONDITIONS TO AVOID :**

Freezing temperatures.

**MATERIALS TO AVOID :**

Contact with strong oxidizers (e.g. chlorine, peroxides, chromates, nitric acid, perchlorate, concentrated oxygen, permanganate) may generate heat, fires, explosions and/or toxic vapors. Contact with strong acids (e.g. sulfuric, phosphoric, nitric, hydrochloric, chromic, sulfonic) may generate heat, splattering or boiling and toxic vapors. SO<sub>2</sub> may react with vapors from neutralizing amines and may produce a visible cloud of amine salt particles.

**HAZARDOUS DECOMPOSITION PRODUCTS :**

Under fire conditions: Oxides of sulfur

**11. TOXICOLOGICAL INFORMATION**

The following results are for a similar product.



# MATERIAL SAFETY DATA SHEET

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### ACUTE ORAL TOXICITY :

Species LD50 Test Descriptor  
Rat 4.1 g/kg Similar Product  
Rating : Non-Hazardous

### ACUTE DERMAL TOXICITY :

Species LD50 Test Descriptor  
Rabbit 3 g/kg Similar Product  
Rating : Non-Hazardous

### PRIMARY SKIN IRRITATION :

Draize Score Test Descriptor  
1.0 / 8.0 Similar Product  
Rating : Slightly irritating

### PRIMARY EYE IRRITATION :

Draize Score Test Descriptor  
9.4 / 110.0 Similar Product  
Rating : Practically non-irritating

### SENSITIZATION :

Sulfites can cause an allergic reaction in sensitive individuals.

### CARCINOGENICITY :

None of the substances in this product are listed as carcinogens by the International Agency for Research on Cancer (IARC), the National Toxicology Program (NTP) or the American Conference of Governmental Industrial Hygienists (ACGIH).

### HUMAN HAZARD CHARACTERIZATION :

Based on our hazard characterization, the potential human hazard is: Low

## 12. ECOLOGICAL INFORMATION

### ECOTOXICOLOGICAL EFFECTS :

The following results are for the product and a similar product.

### ACUTE FISH RESULTS :

Species	Exposure	LC50	Test Descriptor
Rainbow Trout	96 hrs	> 100 mg/l	Product
Fathead Minnow	96 hrs	382 mg/l	Similar Product

### ACUTE INVERTEBRATE RESULTS :

Species	Exposure	LC50	EC50	Test Descriptor
Daphnia magna	48 hrs	275 mg/l		Product
Daphnia magna	48 hrs	728 mg/l		Similar Product



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## CHRONIC FISH RESULTS :

Species	Exposure	NOEC / LOEC	End Point	Test Descriptor
Fathead Minnow	7 Days	250 mg/l / 500 mg/l	Growth	Product

## CHRONIC INVERTEBRATE RESULTS :

Species	Test Type	NOEC / LOEC	End Point	Test Descriptor
Ceriodaphnia dubia	3 Brood	250 mg/l / 500 mg/l	Reproduction	Product

## MOBILITY :

The environmental fate was estimated using a level III fugacity model embedded in the EPI (estimation program interface) Suite TM, provided by the US EPA. The model assumes a steady state condition between the total input and output. The level III model does not require equilibrium between the defined media. The information provided is intended to give the user a general estimate of the environmental fate of this product under the defined conditions of the models. If released into the environment this material is expected to distribute to the air, water and soil/sediment in the approximate respective percentages;

Air	Water	Soil/Sediment
<5%	30 - 50%	50 - 70%

The portion in water is expected to be soluble or dispersible.

## BIOACCUMULATION POTENTIAL

This preparation or material is not expected to bioaccumulate.

## ENVIRONMENTAL HAZARD AND EXPOSURE CHARACTERIZATION

Based on our hazard characterization, the potential environmental hazard is: Low

Based on our recommended product application and the product's characteristics, the potential environmental exposure is: High

If released into the environment, see CERCLA/SUPERFUND in Section 15.

## 13. DISPOSAL CONSIDERATIONS

If this product becomes a waste, it is not a hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA) 40 CFR 261, since it does not have the characteristics of Subpart C, nor is it listed under Subpart D.

As a non-hazardous waste, it is not subject to federal regulation. Consult state or local regulation for any additional handling, treatment or disposal requirements. For disposal, contact a properly licensed waste treatment, storage, disposal or recycling facility.

## 14. TRANSPORT INFORMATION

The information in this section is for reference only and should not take the place of a shipping paper (bill of lading) specific to an order. Please note that the proper Shipping Name / Hazard Class may vary by packaging, properties, and mode of transportation. Typical Proper Shipping Names for this product are as follows.



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## LAND TRANSPORT :

Proper Shipping Name : BISULPHITES, AQUEOUS SOLUTION, N.O.S.  
Technical Name(s) : SODIUM BISULPHITE  
UN/ID No : UN 2693  
Hazard Class - Primary : 8  
Packing Group : III  
  
Flash Point : None  
  
DOT Reportable Quantity (per package) : 12,500 lbs  
DOT RQ Component : SODIUM BISULFITE

## AIR TRANSPORT (ICAO/IATA) :

Proper Shipping Name : BISULPHITES, AQUEOUS SOLUTION, N.O.S.  
Technical Name(s) : SODIUM BISULPHITE  
UN/ID No : UN 2693  
Hazard Class - Primary : 8  
Packing Group : III  
IATA Cargo Packing Instructions : 820  
IATA Cargo Aircraft Limit : 60 L (Max net quantity per package)

## MARINE TRANSPORT (IMDG/IMO) :

Proper Shipping Name : BISULPHITES, AQUEOUS SOLUTION, N.O.S.  
Technical Name(s) : SODIUM BISULPHITE  
UN/ID No : UN 2693  
Hazard Class - Primary : 8  
Packing Group : III

## 15. REGULATORY INFORMATION

### NATIONAL REGULATIONS, USA :

OSHA HAZARD COMMUNICATION RULE, 29 CFR 1910.1200 :

Based on our hazard evaluation, the following substance(s) in this product is/are hazardous and the reason(s) is/are shown below.

Sodium Bisulfite : Respiratory irritant

CERCLA/SUPERFUND, 40 CFR 117, 302 :

This product contains the following Reportable Quantity (RQ) Substance. Also listed is the RQ for the product.

<u>RQ Substance</u>	<u>RQ</u>
Sodium Bisulfite	12,000 lbs





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SARA/SUPERFUND AMENDMENTS AND REAUTHORIZATION ACT OF 1986 (TITLE III) - SECTIONS 302, 311, 312, AND 313 :

SECTION 302 - EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355) :

This product does not contain substances listed in Appendix A and B as an Extremely Hazardous Substance.

SECTIONS 311 AND 312 - MATERIAL SAFETY DATA SHEET REQUIREMENTS (40 CFR 370) :

Our hazard evaluation has found this product to be hazardous. The product should be reported under the following indicated EPA hazard categories:

- X Immediate (Acute) Health Hazard
- Delayed (Chronic) Health Hazard
- Fire Hazard
- Sudden Release of Pressure Hazard
- Reactive Hazard

Under SARA 311 and 312, the EPA has established threshold quantities for the reporting of hazardous chemicals. The current thresholds are: 500 pounds or the threshold planning quantity (TPQ), whichever is lower, for extremely hazardous substances and 10,000 pounds for all other hazardous chemicals.

SECTION 313 - LIST OF TOXIC CHEMICALS (40 CFR 372) :

This product does not contain substances on the List of Toxic Chemicals.

TOXIC SUBSTANCES CONTROL ACT (TSCA) :

The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

FOOD AND DRUG ADMINISTRATION (FDA) Federal Food, Drug and Cosmetic Act :

When use situations necessitate compliance with FDA regulations, this product is acceptable under : 21 CFR 173.310 Boiler Water Additives, 21 CFR 176.170 Components of paper and paperboard in contact with aqueous and fatty foods and 21 CFR 176.180 Components of paper and paperboard in contact with dry foods.

Limitations: no more than required to produce intended technical effect.

This product has been certified as KOSHER/PAREVE for year-round use INCLUDING THE PASSOVER SEASON by the CHICAGO RABBINICAL COUNCIL.

FEDERAL WATER POLLUTION CONTROL ACT, CLEAN WATER ACT, 40 CFR 401.15 / formerly Sec. 307, 40 CFR 116.4 / formerly Sec. 311 :

This product contains the following substances listed in the regulation:

Substance(s)	Citations
• Sodium Bisulfite	Sec. 311

CLEAN AIR ACT, Sec. 112 (40 CFR 61, Hazardous Air Pollutants), Sec. 602 (40 CFR 82, Class I and II Ozone Depleting Substances) :

None of the substances are specifically listed in the regulation.



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### CALIFORNIA PROPOSITION 65 :

This product does not contain substances which require warning under California Proposition 65.

### MICHIGAN CRITICAL MATERIALS :

None of the substances are specifically listed in the regulation.

### STATE RIGHT TO KNOW LAWS :

The following substances are disclosed for compliance with State Right to Know Laws:

Sodium Bisulfite	7631-90-5
Water	7732-18-5

### NATIONAL REGULATIONS, CANADA :

#### WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS) :

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

#### WHMIS CLASSIFICATION :

E - Corrosive Material

#### CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) :

The substances in this preparation are listed on the Domestic Substances List (DSL), are exempt, or have been reported in accordance with the New Substances Notification Regulations.

#### INTERNATIONAL CHEMICAL CONTROL LAWS

##### AUSTRALIA

All substances in this product comply with the National Industrial Chemicals Notification & Assessment Scheme (NICNAS).

##### CHINA

All substances in this product comply with the Chemical Control Law and are listed on the Inventory of Existing Chemical Substances China (IECSC).

##### EUROPE

The substances in this preparation have been reviewed for compliance with the EINECS or ELINCS inventories.

##### JAPAN

All substances in this product comply with the Law Regulating the Manufacture and Importation Of Chemical Substances and are listed on the Ministry of International Trade & Industry List (MITI).

##### KOREA

All substances in this product comply with the Toxic Chemical Control Law (TCCL) and are listed on the Existing Chemicals List (ECL)

##### NEW ZEALAND

This product complies with Parts XI - XV of the HSNO Act (1996).

**Nalco Company** 1601 W. Diehl Road • Naperville, Illinois 60563-1198 • (630)305-1000

For additional copies of an MSDS visit [www.nalco.com](http://www.nalco.com) and request access



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### THE PHILIPPINES

All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippine Inventory of Chemicals & Chemical Substances (PICCS).

### 16. OTHER INFORMATION

Due to our commitment to Product Stewardship, we have evaluated the human and environmental hazards and exposures of this product. Based on our recommended use of this product, we have characterized the product's general risk. This information should provide assistance for your own risk management practices. We have evaluated our product's risk as follows:

\* The human risk is: Low

\* The environmental risk is: Low

Any use inconsistent with our recommendations may affect the risk characterization. Our sales representative will assist you to determine if your product application is consistent with our recommendations. Together we can implement an appropriate risk management process.

This product material safety data sheet provides health and safety information. The product is to be used in applications consistent with our product literature. Individuals handling this product should be informed of the recommended safety precautions and should have access to this information. For any other uses, exposures should be evaluated so that appropriate handling practices and training programs can be established to insure safe workplace operations. Please consult your local sales representative for any further information.

### REFERENCES

Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists, OH., (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Hazardous Substances Data Bank, National Library of Medicine, Bethesda, Maryland (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

IARC Monographs on the Evaluation of the Carcinogenic Risk of Chemicals to Man, Geneva: World Health Organization, International Agency for Research on Cancer.

Integrated Risk Information System, U.S. Environmental Protection Agency, Washington, D.C. (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

Annual Report on Carcinogens, National Toxicology Program, U.S. Department of Health and Human Services, Public Health Service.

Title 29 Code of Federal Regulations, Part 1910, Subpart Z, Toxic and Hazardous Substances, Occupational Safety and Health Administration (OSHA), (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

Registry of Toxic Effects of Chemical Substances, National Institute for Occupational Safety and Health, Cincinnati, OH, (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.



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Ariel Insight# (An integrated guide to industrial chemicals covered under major regulatory and advisory programs), North American Module, Western European Module, Chemical Inventories Module and the Generics Module (Ariel Insight# CD-ROM Version), Ariel Research Corp., Bethesda, MD.

The Teratogen Information System, University of Washington, Seattle, WA (TOMES CPS# CD-ROM Version), Micromedex, Inc., Englewood, CO.

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