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Description:	N/A
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Elmore North Geothermal LLC
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Jon Trujillo
General Manager, Geothermal Development

October 4, 2023

Mr. Jesus Ramirez
APC Division Manager
Imperial County Air Pollution Control District
150 South Ninth Street
El Centro, California 92243

RE: Information Request for Permit Application to Construct for the Elmore North Geothermal Project, Imperial County, California

Dear Mr. Ramirez:

Elmore North Geothermal, LLC (the Applicant), an indirect, wholly owned subsidiary of BHE Renewables, LLC, submitted an Imperial County Air Pollution Control District (ICAPCD) Authority to Construct (ATC) Application for the Elmore North Geothermal Project (ENGP) on April 27, 2023. This application was submitted to ICAPCD in conjunction with an Application for Certification (AFC) that was filed with the California Energy Commission (CEC) on April 18, 2023[1].

As part of its review of the ATC Application, ICAPCD issued an information request on September 29, 2023 for the ENGP. The Applicant has provided the matrix below to respond to each of the specific information requests issued by ICAPCD.

Permit Application Topic	Information Request	Applicant Response
Best Available Control Technology (BACT)	Please provide documentation to support the assumed hydrogen sulfide (H_2S) control efficiencies for the proposed bio-oxidation box and sparger with BIOX control systems.	The assumed air sparger control efficiency of 96.5 percent and oxidation box control efficiency of 95 percent were developed based upon 2022 source testing performed at the Elmore Facility. The Elmore Facility source testing included a combined oxidation box and sparger H_2S control efficiency of 99.24 percent, as calculated by the total inlet H_2S to the oxidation box and sparger and the total outlet H_2S at the cooling tower shroud. A copy of this report data is included in Attachment A to this letter. Therefore, the selected control efficiencies are appropriate.
BACT	Please provide an updated BACT analysis that includes a discussion on the technical feasibility and	An extension for this analysis was requested via email on October 3, 2023. This analysis

[1] The CEC's website for the ENGP proceeding is available at https://www.energy.ca.gov/powerplant/steam-turbine/elmore-north-geothermal-project-engp.

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	cost-effectiveness of using air cooled condensers (ACC) with evaporative pre-cooling, in lieu of wet cooling, to meet the Project's cooling needs. Please include details on the anticipated emissions and effect of the control alternative on the Project's net energy generation.	will be provided in a separate letter to ICAPCD no later than November 10, 2023.

BACT	Please provide an updated BACT analysis that includes a discussion on the feasibility and cost-effectiveness of the following options for the control of H_2S emissions:
	• Condensate
	    ○ Direct injection of condensate
	• Non-Condensable Gas
	    ○ Stretford Process
	    ○ SulFerox
	    ○ LO-CAT
		An extension for this analysis was requested via email on October 3, 2023. This analysis will be provided in a separate letter to ICAPCD no later than November 10, 2023.

Emissions Calculations	General: Please provide any underlying analytical and source test reports used in the emissions calculations so that we may verify the appropriateness and accuracy of the selected data.	The following analytical data have been included as attachments to this letter: • Brine Composition Analytical Data (Attachment B, which is being submitted with the request of remaining confidential as it contains proprietary information crucial to the Applicant's operations) • NCG Sampling Results (Attachment C) • Cooling Tower Condensate Analytical Data (Attachment D)
Emissions Calculations	Tabs "2.6: Commissioning NCG Emissions" and "2.8: Warm Startup NCG Emissions" Emissions from these processes are based on the rate of steam flow under different scenarios (e.g., equipment warm up, turbine pre-heat, etc.). Please explain why some scenarios utilize steam flows from all three flashing units (i.e., high pressure [HP], standard	Emissions from each scenario were based on the anticipated steam flow rates during each scenario. For example, steam flow during well warm-up would be approximately 250,000 pounds per hour (lbs/hr) to allow the system to come to temperature prior to receiving the full steam load. Similarly, steam flow during production line and equipment warm-up would be approximately equivalent to the average of the LP, SP, and HP steam flows. The LP flow rate, 674,391 lbs/hr, was used to align with the anticipated average flow rate range (HP, SP,

	pressure [SP], and low pressure [LP] systems), while others utilize only one.	and LP). Steam flows would not be limited during steam blows, which is why emissions from steam blows were based on the sum of HP, SP, and LP flow rates. Note that steam blows are only expected to occur during commissioning, which typically happens just once during the plant's lifetime.
Emissions Calculations	Tabs "2.6: Commissioning NCG Emissions", "2.7 Cold Startup NCG Emissions", and "2.8: Warm Startup NCG Emissions" The sparger emissions tables in these tabs include columns for "Sparger Burner". Was this intended to say "burner"? We did not identify any discussion of sparger burners in the application. Why are all of the sparger burner emissions equal to 0?	The emissions calculation workbook was constructed from a similar facility with a burner. To facilitate preparation of this emissions inventory, the workbook structure was retained. Since there is no burner in the ENGP design, the burner emissions were set to zero rather than eliminated from the workbook entirely.
Emissions Calculations	Tab "2.7 Cold Startup NCG Emissions" Please explain why the cell for "Average Steam Flow Rate to Sparger" during gradual steam delivery to turbine is calculated as the total steam flow rate (HP+SP+LP) divided by 8. How does this equate to an average flow rate over the 6 hour event? A similar question applies to the average steam flow rate calculations in Rows 28 and 29 in tab 2.8C.	The average steam flow rate was calculated as the total steam flow divided by 8. Eight was selected instead of the number of production wells (9) to provide a more conservative estimate. During cold startup, wells would be sequentially opened to the system, thereby gradually increasing steam flow to the system. The length of time between each well opening is not linear and, therefore, the average steam flow is not a duration-related average. Rather, the steam flows would be better represented by well counts than duration of activity. Therefore, it was considered more representative to calculate average steam flow based upon the production well count (9), or in this case, the more conservative number of 8. The average steam flow rate to the sparger unit is accordingly presented in units of pounds per hour per well (lbs/hr/well).
Emissions Calculations	Tab "2.8: Warm Startup NCG Emissions"	To present the most conservative emissions estimate, we assumed all steam delivered to the turbine is HP steam. Although the actual

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	Please explain why the calculation for "Emissions through Sparger during Gradual Steam Delivery to Turbine", in cells C63:C92 uses only the HP steam flow rate in the denominator, as opposed to the sum of the HP, SP, and LP flow rates.	quality of the steam would be a mix of multiple pressure flashes of steam, this is a conservative approach since HP steam has the greatest concentration of non-condensable gases, as compared to SP and LP steam. Assuming a smaller denominator of steam flows also results in higher emissions.
Emissions Calculations	Tabs "2.10: NCG Emissions Sparger" and "2.10a: Sparger Bypass" A ratio of 60% for the H_2S partitioned into the NCG is listed in these tabs. The application states that "H_2S emissions from the NCG stream are assumed to split between the gas phase and the condensate/liquid phase prior to reaching the cooling towers at a ratio of 60 to 40 percent, respectively". Please provide documentation or additional explanation supporting the basis of this assumption and how it is a conservative representation of Project emissions. The concentration of ammonia (ppmw) in the steam differs between tabs 2.10 and 2.10a (Sparger Bypass). Tab 2.10 draws from the Arsenic, Mercury, and Ammonia 2018 and 2022 source tests (Tab 2.2) while Tab 2.10a draws from the Brine Composition 2021 source test (Tab 2.1). Additionally, the assumed ratio for ammonia partitioned into NCG is different between these two tabs. What is the reason for these differences?	The H_2S split between the gas phase and the condensate liquid phase was approximated based on 2022 weekly emissions data for the Elmore Facility, which are submitted to the ICAPCD as part of the facility's monthly emissions report. A copy of these data is included in Attachment A to this letter. Tab 2.10 is intended to present emissions associated with normal operations. Accordingly, ammonia emissions presented on this tab were calculated based upon source testing data of ammonia in the non-condensable gas. These source testing conditions are considered representative of normal operations. Tab 2.10a is intended to present emissions associated with non-routine operations. Accordingly, ammonia emissions presented on this tab were not calculated from source testing data but instead utilized a mass balance of the facility's ammonia. These ammonia emissions were calculated as the total influent ammonia, based upon wellhead brine sample data, minus the amount of ammonia emitted through the cooling towers, based upon the condensate sample data. This mass balance assumes any influent ammonia not emitted through the cooling tower condensate is emitted through non-condensable gas.
Emissions Calculations	Tab "2.15: CT TAC"	The ammonia concentration assigned to the cooling tower circulating water was derived from a mass balance of the hot well water

	The ammonia concentration in the condensate as listed in the table does not appear to align with the values listed in Footnote [d], which states “Ammonia emissions calculated based on an effective concentration, which was derived from a mass balance of ammonia…”. Please explain how the ammonia concentration was calculated and clarify if the correct unit is mg/L or µg/L.	(inlet to the cooling tower circulating stream) and the blowdown (outlet from the cooling tower circulating stream). This mass balance was developed because not all ammonia that reaches the cooling tower circulating water is emitted to the atmosphere. Rather, a portion of the ammonia remains in the liquid phase and is ultimately removed as cooling tower blowdown. The ammonia concentration was calculated to be 55.3 milligrams per Liter (mg/L) as follows: Total Circulating Ammonia Concentration (Cc) x Circulating Rate (Qc) = [Hot Well Concentration (Ch) x Hot Well Flow (Qh)] – [Blowdown Concentration (Cb) x Blowdown Flow (Qb)], where: • Qc = 4,151 gallons per minute (gpm) • Ch = 230 mg/L • Qh = 4,383 gpm • Cb = 1,500 mg/L • Qb = 519 gpm All units for ammonia concentration are correctly presented as mg/L.

Equipment Parameters	Certain Information provided in the Internal Combustion Engine Summary Forms is inconsistent with information provided in the operational emissions calculations workbook. Please confirm the values for the following parameters:
	
	• Fire Pump
	  o Stack Height
	  o Exhaust Flow Rate
	  o Exhaust Temperature
	• Generators 1-5
	  o Stack Diameter
	  o Stack Height
		The Applicant is currently refining the design for the ENGP. As such, the information provided in the ATC Application is subject to change. The latest available design data for the fire pump and each generator is provided below. Please note that the ENGP now includes a total of four diesel engines consisting of one fire pump and only three emergency generators (previously identified as G2, G3, and G4). The unit previously identified as G1 is no longer included in the ENGP. Updated modeling associated with these design updates is being conducted for the CEC and will be available to the ICAPCD once completed.
		
		Fire Pump
		• Stack Diameter – 0.5 feet (ft)

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	○ Exhaust Flow Rate	• Stack Height – 10.92 ft • Exhaust Flow Rate – 1,400 actual cubic feet per minute (acfm) • Exhaust Temperature – 961 degrees Fahrenheit (ºF) G2, G3, and G4 • Stack Diameter – 12.5 inches • Stack Height – 23.5 ft • Exhaust Flow Rate – 23,701 acfm • Exhaust Temperature – 887 ºF
Chemical Storage	Please provide a list of materials and their concentrations (if diluted) for all materials stored in the Norms Inhibitor Tank (as listed in the Applicant's June 2023 ICAPCD Completeness Determination Response Letter for Elmore North).	The Norms Inhibitor Tank will store NALCO GEO901 or a similar product.
Chemical Storage	Please provide the Safety Data Sheet for each material stored in the Norms Inhibitor Tank, as well as their concentrations (if diluted).	The Safety Data Sheet for NALCO GEO901 is included as Attachment E to this letter.

The Applicant looks forward to working with the ICAPCD during its ongoing review of the ATC Application for the ENGP. Please contact Anoop Sukumaran at (760) 348-4275 (email address: Anoop.Sukumaran@calenergy.com) or Andrew Dunavent at (707) 372-7810 (email address: Andrew.Dunavent@jacobs.com) if you have any questions or if you need additional information.

Sincerely,

Jon Trujillo
General Manager, Geothermal Development

cc: Anoop Sukumaran/BHE Renewables
Jerry Salamy/Jacobs
Andrew Dunavent/Jacobs

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Attachment A: 2022 Elmore Source Test Sparger and Oxidation Control Efficiencies and Weekly H_2S Partition Ratio Data

TABLE 6-1
CALENERGY ELMORE GEOTHERMAL POWER PLANT
TEST PROGRAM SUMMARY

Constituent	Units	Value
Cooling Tower Emissions		
Shroud Hydrogen Sulfide Emissions		
Cooling Tower Exhaust Flow Rate	dscfm	8,537,800
H2S Concentration	ppmv	0.0008
H2S Emission Rate	lb/hr	0.11
Particulate < 10 micron Emissions		
Emission Rate	lb/hr	0.31
Emission Rate	lb/day	7.41
Non Condensible Gas Vacuum Discharge		
Mercury	ug/dscm	188.03
Arsenic	ug/dscm	425.82
Benzene	ppbv	18,333
Benzene	lb/hr	0.052
Toluene	ppbv	647
Ethylbenezene	ppbv	< 143
Xylene	ppbv	< 143
Hydrogen Sulfide	lb/hr	7.32
Ammonia	ppmv	244
Radon	pCi/L	2515
Process Stream Water Sample Concentrations		
Hot Well Total Metals	ug/L	< 84.3
Blowdown Total Metals	ug/L	< 3853
Hot Well Ammonia	mg/L	240
Blowdown Ammonia	mg/L	960
Hot Well Radon	pCi/L	1.23
Blowdown Radon	pCi/L	1.00
Hot Well Hydrogen Sulfides	mg/L	13.80
Blowdown Hydrogen Sulfides	mg/L	<0.10
Ox Box Inlet A Hydrogen Sulfides	mg/L	<10.6
Ox Box Inlet B Hydrogen Sulfides	mg/L	10.6
Ox Box Outlet Hydrogen Sulfides	mg/L	0.2
Ox Box Inlet A H2S Mass	lb/hr	0.13
Ox Box Inlet B H2S Mass	lb/hr	6.98

2022 Weekly Data for H2S Gas and Liquid Partition Ratio

Minimum or Maxiumum Base Estimate	Date Observed	Unabated Gas (lb/hr)	Unabated Liquid (lb/hr)	Total Unabated Emission (lb/hr)	Ratio of H2S Gas	Ratio of H2S Liquid
		Potential to Emit without Abatement				
H2S Min Gas Base	4/11/2022	3.24	**5.86**	9.10	35.6%	64.40%
H2S Max Gas Base	6/27/2022	12.84	**3.65**	16.49	77.9%	22.13%
H2S Min Liquid Base	8/29/2022	7.60	1.65	9.25	82.2%	17.84%
H2S Min Liquid Base	1/31/2022	7.18	9.13	16.31	44.0%	55.98%
	Average Ratio Approximate =				**59.9%**	**40.1%**
H2S Min	NA	3.24	1.65	4.89	66.3%	33.74%
H2S Max	NA	12.84	9.13	21.97	58.4%	41.56%
H2S Average	NA	7.95	4.49	12.50	63.6%	35.93%
	Average Ratio Approximate =				62.8%	37.1%

Date (Week of)	NCG Sparger Inlet (lb/hr)	Liquid H2S Oxbox Inlet A&B (lb/hr)	Total H2S (Gas and Liquid) Mass to Plant
1/1/2022	12.06	2.62	14.68
1/10/2022	9.59	4.89	14.48
1/17/2022	12.22	5.79	18.01
1/24/2022	11.58	2.67	14.25
1/31/2022	7.18	9.13	16.31
2/7/2022	6.65	5.81	12.46
2/14/2022	8.89	3.21	12.1
2/21/2022	6.09	6.54	12.63
2/28/2022	9.04	4.74	13.78
3/7/2022	6.55	3.02	9.57
3/14/2022	7.37	2.83	10.2
3/21/2022	6.87	4.69	11.56
4/11/2022	3.24	5.86	9.1
4/18/2022	4.64	4.45	9.09
4/25/2022	7.4	5.57	12.97
5/2/2022	11.41	5.65	17.06
5/9/2022	9.23	4.07	13.3
5/16/2022	7.97	6.02	13.99
5/23/2022	7.93	7.18	15.11
5/30/2022	8.77	2.95	11.72
6/6/2022	10.4	5.04	15.44
6/13/2022	9.38	3.53	12.91
6/20/2022	8.55	5.00	13.55
6/27/2022	12.84	3.65	16.49
7/4/2022	9.35	1.77	11.12
7/11/2022	8.45	3.29	11.74
7/18/2022	7.5	4.91	12.41
7/25/2022	8.78	2.37	11.15
8/1/2022	7.08	3.21	10.29
8/8/2022	9.59	2.62	12.21
8/15/2022	11.42	2.18	13.6
8/22/2022	9.8	2.94	12.74
8/29/2022	7.6	1.65	9.25
9/19/2022	8.1	6.12	14.22
9/26/2022	10.6	3.83	14.43
10/3/2022	7.84	6.23	14.07
10/10/2022	6.04	7.63	13.67
10/17/2022	7.56	2.95	10.51
10/24/2022	4.2	4.57	8.77
10/31/2022	5.08	4.39	9.47
11/7/2022	6.25	4.4	10.65
11/14/2022	5.22	4.7	9.92
11/21/2022	5.45	7.49	12.94
11/28/2022	5.88	9.00	14.88
12/5/2022	5.61	1.86	7.47
12/12/2022	5.39	4.14	9.53
12/19/2022	7.63	5.56	13.19
12/26/2022	5.42	2.88	8.3

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Attachment B: Brine Composition Analytical Data

This attachment has been provided under a request for confidential designation.

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Attachment C: NCG Sampling Results

TABLE 6-3
CALENERGY REGION 3 ELMORE
NON CONDENSIBLE GASES VACUUM DISCHARGE

Parameter	Run 1	Run 2	Run 3	Average
Vacuum Gas Flow Rate (lb/hr)	1514	1577	1526	1539
Vacuum Gas O_2 (%)	3.20	3.00	3.00	3.07
Vacuum Gas CO_2 (%)	80	85	81	82
Non Condensible Gases Vacuum Discharge Results				
Mercury				
Concentration (ug/dscm)	148.17	194.03	221.90	188.03
Mass Rate (lb/hr)	1.25E-04	1.71E-04	1.92E-04	1.63E-04
Arsenic				
Concentration (ug/dscm)	459.43	414.36	403.67	425.82
Mass Rate (lb/hr)	3.88E-04	3.65E-04	3.49E-04	3.68E-04
Benzene				
Concentration (ppbv)	18,000	19,000	18,000	18,333
Mass Rate (lb/hr)	0.050	0.055	0.051	0.052
Toluene				
Concentration (ppbv)	640	690	610	647
Mass Rate (lb/hr)	0.002	0.002	0.002	0.002
Ethylbenezene				
Concentration (ppbv)	< 130	< 160	< 140	< 143
Mass Rate (lb/hr)	< 0.00049	< 0.00063	< 0.00054	< 0.00056
Xylene				
Concentration (ppbv)	< 130	< 160	< 140	< 143
Mass Rate (lb/hr)	< 0.00049	< 0.00063	< 0.00054	< 0.00056
Ammonia				
Concentration (ppmv)	16.9	219.7	495.9	244.2
Mass Rate (lb/hr)	0.010	0.134	0.282	0.142
Hydrogen Sulfide				
Concentration (ppmv)	6064	5563	6070	5899
Mass Rate (lb/hr)	7.37	7.05	7.55	7.32
Radon				
Concentration (pCi/Liter)	2591	2454	2501	2515

TABLE 6-1
CALENERGY LEATHER GEOTHERMAL POWER GENERATING UNIT
TEST PROGRAM RESULTS SUMMARY

Constituent	Units	Combined [1]
Cooling Tower Emissions		
Shroud Hydrogen Sulfide Emissions		
Cooling Tower Exhaust Flow Rate	dscfm	7,789,429
H2S Concentration	ppmv	0.0013
H2S Emission Rate	lb/hr	0.08
Particulate < 10 micron Emissions		
Emission Rate	lb/hr	4.53
Emission Rate	lb/day	108.61
NCG Vent Gas Emissions		
Mercury	lb/hr	1.70E-03
Arsenic	lb/hr	7.73E-04
Ammonia	lb/hr	2.57
Benzene	ppbv	33,667
Benzene	lb/hr	0.395
Toluene	lb/hr	< 0.00278
Ethylbenezene	lb/hr	< 0.00339
Xylene	lb/hr	< 0.00339
Hydrogen Sulfide	lb/hr	15.57
Radon	pCi/L	1041
Process Stream Water Sample Concentrations		
Hot Well Total Metals	ug/L	< 3.4
Blowdown Total Metals	ug/L	< 5262
Hot Well Ammonia	mg/L	160
Blowdown Ammonia	mg/L	980
Hot Well Radon	pCi/L	0.53
Blowdown Radon	pCi/L	980.00
Hot Well Hydrogen Sulfides	mg/L	0.19
Blowdown Hydrogen Sulfides	mg/L	0.11
Ox Box Inlet Hydrogen Sulfides	mg/L	6.375
Ox Box Outlet Hydrogen Sulfides	mg/L	0.11
Cyanuric Acid	mg/L	11.8
pH	dimensionless	6.1

[1] Combined values are the sum for concentrations and total for flow/emission rates

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Attachment D: Cooling Tower Condensate Analytical Data

TABLE 4-3
AQEOUS SAMPLE MULTIPLE METALS RESULTS
CALENERGY – ELMORE
AUGUST 21, 2019

Parameter	Hotwell	CT Blowdown
Sample Time	09:45	10:00
Arsenic (µg/l)	10.0	380
Berilium (µg/l)	2.0	2.0
Cadmium (µg/l)	2.0	2.0
Chromium (µg/l)	5.0	5.0
Copper (µg/l)	10.0	10.0
Lead (µg/l)	5.0	55.0
Manganese (µg/l)	5.0	5700
Nickel (µg/l)	5.0	13.0
Selenium (µg/l)	30.0	30.0
Zinc (µg/l)	50.0	1400

TABLE 4-4
AQUEOUS SAMPLE RADON, MERCURY AND AMMONIA RESULTS
CALENERGY – ELMORE
AUGUST 21, 2019

Parameter	Hotwell	CT Blowdown
Sample Time	09:45	10:00
Radon (pCi/l)	0.13	0.27
Mercury (µg/l)	0.081	2.3
Ammonia (mg/l)	230	1500

TABLE 6-5
CALENERGY HOCH GEOTHERMAL POWER PLANT
COOLING TOWER PROCESS STREAM CONCENTRATIONS

Parameter	Units	Hotwell	Blow Down	Ox Box Inlet A	Ox Box Inlet B	Ox Box Outlet
Antimony	ug/L	< 2.0	<20	N/A	N/A	N/A
Arsenic	ug/L	5.9	61	N/A	N/A	N/A
Barium	ug/L	17	120	N/A	N/A	N/A
Beryllium	ug/L	< 1.0	<10	N/A	N/A	N/A
Cadmium	ug/L	< 1.0	<10	N/A	N/A	N/A
Chromium	ug/L	< 5.0	<50	N/A	N/A	N/A
Cobalt	ug/L	< 1.0	<10	N/A	N/A	N/A
Copper	ug/L	< 3.0	<30	N/A	N/A	N/A
Lead	ug/L	< 5.0	21	N/A	N/A	N/A
Manganese	ug/L	< 10.0	2900	N/A	N/A	N/A
Mercury	ug/L	< 0.4	0.53	N/A	N/A	N/A
Molybdenum	ug/L	< 5.0	<50	N/A	N/A	N/A
Nickel	ug/L	< 5.0	<50	N/A	N/A	N/A
Selenium	ug/L	< 2.0	<20	N/A	N/A	N/A
Silver	ug/L	< 5.0	<50	N/A	N/A	N/A
Thallium	ug/L	< 1.0	<10	N/A	N/A	N/A
Vanadium	ug/L	< 5.0	<50	N/A	N/A	N/A
Zinc	ug/L	< 10	750	N/A	N/A	N/A
Total Metals	ug/L	< 84	< 3853	N/A	N/A	N/A
Hydrogen Sulfide	mg/L	13.8	<0.10	<10.6	10.6	0.2
Ammonia	mg/L	240	960	N/A	N/A	N/A
Radon	pCi/L	1.23	1.00	N/A	N/A	N/A

TABLE 6-5
CALENERGY LEATHERS GEOTHERMAL POWER GENERATING UNIT
COOLING TOWER PROCESS STREAM CONCENTRATIONS

Parameter	Units	Hotwell	Blow Down	CT Basin	Ox Box Inlet	Ox Box Outlet
Antimony	ug/L	<2.0	7.5	N/A	N/A	N/A
Arsenic	ug/L	3.4	880	N/A	N/A	N/A
Barium	ug/L	<5.0	360	N/A	N/A	N/A
Beryllium	ug/L	<1.0	<5.0	N/A	N/A	N/A
Cadmium	ug/L	<1.0	1.5	N/A	N/A	N/A
Chromium	ug/L	<5.0	<25	N/A	N/A	N/A
Cobalt	ug/L	<1.0	<1.0	N/A	N/A	N/A
Copper	ug/L	<3.0	24	N/A	N/A	N/A
Lead	ug/L	<5.0	50	N/A	N/A	N/A
Manganese	ug/L	<10	1700	N/A	N/A	N/A
Mercury	ug/L	<0.40	53	N/A	N/A	N/A
Molybdenum	ug/L	<5.0	<25	N/A	N/A	N/A
Nickel	ug/L	<5.0	6.1	N/A	N/A	N/A
Selenium	ug/L	<2.0	79	N/A	N/A	N/A
Silver	ug/L	<5.0	<5.0	N/A	N/A	N/A
Thallium	ug/L	<1.0	1.1	N/A	N/A	N/A
Vanadium	ug/L	<5.0	<25	N/A	N/A	N/A
Zinc	ug/L	<10	2100	N/A	N/A	N/A
Total Metals	ug/L	< 3	< 5262	N/A	N/A	N/A
Hydrogen Sulfide	mg/L	0.19	< 0.11	N/A	6.4	< 0.11
Ammonia	mg/L	160	980	N/A	N/A	N/A
Radon	pCi/L	0.53	1.08	N/A	N/A	N/A
Cyanuric Acid	mg/L	N/A	N/A	11.8	N/A	N/A
pH	dimensionless	NA	NA	6.1	N/A	N/A

Elmore North Geothermal LLC
4124 NW Urbandale Drive
Urbandale, IA 50322

Jon Trujillo
General Manager, Geothermal Development

Attachment E: NALCO GEO901 Safety Data Sheet

Section: 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	NALCO® GEO901
Other means of identification	:	Not applicable.
Restrictions on use	:	Refer to available product literature or ask your local Sales Representative for restrictions on use and dose limits.
Company	:	Nalco Company 1601 W. Diehl Road Naperville, Illinois 60563-1198 USA TEL: (630)305-1000
Emergency telephone number	:	(800) 424-9300 (24 Hours) CHEMTREC
Issuing date	:	09/03/2014

Section: 2. HAZARDS IDENTIFICATION

GHS Classification

Serious eye damage/eye irritation : Category 1

GHS Label element

Hazard pictograms :

Signal Word : Danger

Hazard Statements : Causes serious eye damage.

Precautionary Statements : **Prevention:**
Wear eye protection/face protection.
Response:
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.

Other hazards : None known.

Section: 3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS-No.	Concentration: (%)
Amine Triphosphate	Proprietary	30 - 60
Sodium Phosphate, Tribasic	7601-54-9	10 - 30
Ethylene Glycol	107-21-1	1 - 5

Section: 4. FIRST AID MEASURES

In case of eye contact	:	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention immediately.
In case of skin contact	:	Wash off with soap and plenty of water. Get medical attention if symptoms occur.
If swallowed	:	Rinse mouth. Get medical attention if symptoms occur.
If inhaled	:	Remove to fresh air. Treat symptomatically. Get medical attention if symptoms occur.
Protection of first-aiders	:	In event of emergency assess the danger before taking action. Do not put yourself at risk of injury. If in doubt, contact emergency responders.Use personal protective equipment as required.
Notes to physician	:	Treat symptomatically.

See toxicological information (Section 11)

Section: 5. FIREFIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	None known.
Specific hazards during firefighting	:	Not flammable or combustible.
Hazardous combustion products	:	Carbon oxides
Special protective equipment for firefighters	:	Use personal protective equipment.
Specific extinguishing methods	:	Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.

Section: 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Ensure adequate ventilation. Keep people away from and upwind of spill/leak. Avoid inhalation, ingestion and contact with skin and eyes. When workers are facing concentrations above the exposure limit they must use appropriate certified respirators. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental precautions	:	Do not allow contact with soil, surface or ground water.
Methods and materials for containment and cleaning up	:	Stop leak if safe to do so. Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Flush away traces with water. For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway.

Section: 7. HANDLING AND STORAGE

Advice on safe handling : Do not breathe dust/fume/gas/mist/vapours/spray. Do not get in eyes, on skin, or on clothing. Wash hands thoroughly after handling. Use only with adequate ventilation.

Conditions for safe storage : Keep out of reach of children. Keep container tightly closed. Store in suitable labeled containers.

Suitable material : The following compatibility data is suggested based on similar product data and/or industry experience: Stainless Steel 304, Stainless Steel 316L, EPDM, HDPE (high density polyethylene), Neoprene, Nitrile, Perfluoroelastomer, PTFE, MDPE, Fluoroelastomer
The following compatibility data is suggested based on similar product data and/or industry experience: Shipping and long term storage compatibility with construction materials can vary; we therefore recommend that compatibility is tested prior to use.

Unsuitable material : The following compatibility data is suggested based on similar product data and/or industry experience: Carbon steelThe following compatibility data is suggested based on similar product data and/or industry experience:

Section: 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Form of exposure	Permissible concentration	Basis
Sodium Phosphate, Tribasic	7601-54-9	STEL	5 mg/m3	WEEL
Ethylene Glycol	107-21-1	Ceiling (Aerosol only)	100 mg/m3	ACGIH

Engineering measures : Effective exhaust ventilation system Maintain air concentrations below occupational exposure standards.

Personal protective equipment

Eye protection : Safety goggles
Face-shield

Hand protection : Wear protective gloves.
Gloves should be discarded and replaced if there is any indication of degradation or chemical breakthrough.

Skin protection : Wear suitable protective clothing.

Respiratory protection : No personal respiratory protective equipment normally required.

Hygiene measures : Handle in accordance with good industrial hygiene and safety practice. Remove and wash contaminated clothing before re-use. Wash face, hands and any exposed skin thoroughly after handling. Provide suitable facilities for quick drenching or flushing of the eyes and body in case of contact or splash hazard.

Section: 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Liquid
Colour	:	colourless
Odour	:	Mild
Flash point	:	105 °C Method: ASTM D 3278, Tag closed cup
pH	:	3.5 - 5.5, 10 % (25 °C)
Odour Threshold	:	no data available
Melting point/freezing point	:	no data available
Initial boiling point and boiling range	:	no data available
Evaporation rate	:	no data available
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapour pressure	:	24 mm Hg (25 °C)
Relative vapour density	:	no data available
Relative density	:	1.42 (20 °C)
Density	:	1.4 g/cm3 11.7 lb/gal
Water solubility	:	completely soluble
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Auto-ignition temperature	:	no data available
Thermal decomposition	:	Carbon oxides
Viscosity, dynamic	:	no data available
Viscosity, kinematic	:	250 mm2/s (20 °C)
VOC	:	3 %

Section: 10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	None known.
Hazardous decomposition products	:	Oxides of nitrogen Oxides of phosphorus Oxides of carbon

Section: 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation, Eye contact, Skin contact

Potential Health Effects

Eyes	:	Causes serious eye damage.
Skin	:	Health injuries are not known or expected under normal use.
Ingestion	:	Health injuries are not known or expected under normal use.
Inhalation	:	Health injuries are not known or expected under normal use.
Chronic Exposure	:	Health injuries are not known or expected under normal use.

Experience with human exposure

Eye contact	:	Redness, Pain, Corrosion
Skin contact	:	No symptoms known or expected.
Ingestion	:	No symptoms known or expected.
Inhalation	:	No symptoms known or expected.

Toxicity

Product

Acute oral toxicity	:	Acute toxicity estimate > 5,000 mg/kg
Acute inhalation toxicity	:	no data available
Acute dermal toxicity	:	no data available
Skin corrosion/irritation	:	no data available
Serious eye damage/eye irritation	:	no data available
Respiratory or skin sensitization	:	no data available
Carcinogenicity	:	no data available
Reproductive effects	:	no data available
Germ cell mutagenicity	:	no data available
Teratogenicity	:	Ethylene glycol has been shown to produce dose-related teratogenic effects in rats and mice when given by gavage or in drinking water at high concentrations. A mouse inhalation study of 1000 mg/m3 and 2500 mg/m3 showed malformations

in the offspring.

STOT - single exposure : no data available

STOT - repeated exposure : no data available

Aspiration toxicity : no data available

Components

Acute inhalation toxicity : Sodium Phosphate, Tribasic
LC50 rat: >= 0.54 mg/l
Exposure time: 4 h

Components

Acute dermal toxicity : Sodium Phosphate, Tribasic
LD50 rabbit: > 2,000 mg/kg

Ethylene Glycol
LD50 rabbit: 10,600 mg/kg

Section: 12. ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects : This product has no known ecotoxicological effects.

Product

Toxicity to fish : LC50 Bluegill Sunfish: > 1,000 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Rainbow Trout: > 1,800 mg/l
Exposure time: 96 hrs
Test substance: Product

LC50 Turbot: > 1,831 mg/l
Exposure time: 96 h
Test substance: Product

Toxicity to daphnia and other aquatic invertebrates : LC50 Daphnia magna: > 2,000 mg/l
Exposure time: 48 hrs
Test substance: Product

LC50 Acartia tonsa: 426 mg/l
Exposure time: 48 h
Test substance: Product

Toxicity to algae : no data available

Components

Toxicity to algae : Amine Triphosphate
EC50 : 550 mg/l
Exposure time: 72 h

Ethylene Glycol
EC50 : 6,500 mg/l
Exposure time: 96 h

Components

Toxicity to bacteria	:	Ethylene Glycol > 1,995 mg/l

Components

Toxicity to fish (Chronic toxicity)	:	Ethylene Glycol NOEC: 15,380 mg/l Exposure time: 7 d

Components

Toxicity to daphnia and other aquatic invertebrates (Chronic toxicity)	:	Ethylene Glycol NOEC: 8,590 mg/l Exposure time: 7 d

Persistence and degradability

The organic portion of this preparation is expected to be inherently 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	:	<5%
Water	:	30 - 50%
Soil	:	50 - 70%

The portion in water is expected to be soluble or dispersible.

Bioaccumulative potential

This preparation or material is not expected to bioaccumulate.

Other information

no data available

Section: 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.

Disposal methods	:	Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility. Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an

approved waste disposal facility.

Disposal considerations : Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.
Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.

Section: 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport (DOT)

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.

Proper shipping name : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
Technical name(s) : SODIUM PHOSPHATE, TRIBASIC
UN/ID No. : UN 3082
Transport hazard class(es) : 9
Packing group : III
Reportable Quantity (per package) : 31,250 lbs
RQ Component : SODIUM PHOSPHATE, TRIBASIC

Air transport (IATA)

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.

Proper shipping name : ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S.
Technical name(s) : SODIUM PHOSPHATE, TRIBASIC
UN/ID No. : UN 3082
Transport hazard class(es) : 9
Packing group : III
Reportable Quantity (per package) : 31,250 lbs
RQ Component : SODIUM PHOSPHATE, TRIBASIC

Sea transport (IMDG/IMO)

Proper shipping name : PRODUCT IS NOT REGULATED DURING TRANSPORTATION

Section: 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know Act

CERCLA Reportable Quantity

Components	CAS-No.	Component RQ (lbs)	Calculated product RQ (lbs)

Ethylene Glycol	107-21-1	5000	109794

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards : Acute Health Hazard

SARA 302 : No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 : The following components are subject to reporting levels established by SARA Title III, Section 313:

Ethylene Glycol	107-21-1	4.554 %

California Prop 65

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

INTERNATIONAL CHEMICAL CONTROL LAWS :

TOXIC SUBSTANCES CONTROL ACT (TSCA)

The substances in this preparation are included on or exempted from the TSCA 8(b) Inventory (40 CFR 710)

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA)

The substance(s) in this preparation are included in or exempted from the Domestic Substance List (DSL).

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 Provisions on the Environmental Administration of New Chemical Substances and are listed on or exempt from the Inventory of Existing Chemical Substances China (IECSC).

EUROPE

The substance(s) in this preparation are included in or exempted from 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 Existing and New Chemical Substances list (ENCS).

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

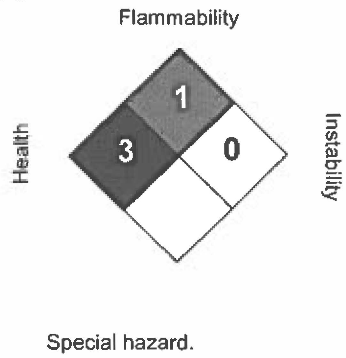
All substances in this product comply with the Hazardous Substances and New Organisms (HSNO) Act 1996,and are listed on or are exempt from the New Zealand Inventory of Chemicals.

PHILIPPINES

All substances in this product comply with the Republic Act 6969 (RA 6969) and are listed on the Philippines Inventory of Chemicals & Chemical Substances (PICCS).

Section: 16. OTHER INFORMATION

NFPA:



HMIS III:

HEALTH	3
FLAMMABILITY	1
PHYSICAL HAZARD	0

0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Revision Date	:	09/03/2014
Version Number	:	1.0
Prepared By	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.
For additional copies of an MSDS visit www.nalco.com and request access.

150 SOUTH NINTH STREET
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September 29, 2023

AIR POLLUTION CONTROL DISTRICT

Elmore North Geothermal, LLC
7030 Gentry Rd.
Calipatria, CA 92233

Subject: Information Request for Permit Application to Construct for the Elmore North Geothermal Project, Imperial County, California

Dear Jon Trujillo:

The Imperial County Air Pollution Control District (ICAPCD) received a permit application to construct from Elmore North Geothermal, LLC ("Applicant") for the Elmore North Geothermal Project (ENGP) on April 27, 2023. In response to a request from the ICAPCD, the Applicant provided spreadsheet versions of the emissions calculations on June 12, 2023. At this time, the ICAPCD requests additional information from the Applicant in order to complete our technical analysis of the ENGP application. Please provide the following information:

Best Available Control Technology (BACT)

- Please provide documentation to support the assumed hydrogen sulfide (H_2S) control efficiencies for the proposed bio-oxidation box and sparger with BIOX control systems.
- Please provide an updated BACT analysis that includes a discussion on the technical feasibility and cost-effectiveness of using air cooled condensers (ACC) with evaporative pre-cooling, in lieu of wet cooling, to meet the project's cooling needs. Please include details on the anticipated emissions and effect of the control alternative on the project's net energy generation.
- Please provide an updated BACT analysis that includes a discussion on the feasibility and cost-effectiveness of the following options for the control of H_2S emissions.
    - Condensate
        - Direct injection of condensate
    - Non-Condensable Gas
        - Stretford Process
        - SulFerox
        - LO-CAT

Emissions Calculations

Regarding the operational emissions calculations workbook ("Appendix 5.1A ENGP_OperationEmissions_MCR_20230609.xlsx"), please provide responses to the following:

- General: Please provide any underlying analytical and source test reports used in the emissions calculations so that we may verify the appropriateness and accuracy of the selected data.
- Tabs "2.6: Commissioning NCG Emissions" and "2.8: Warm Startup NCG Emissions"
    - Emissions from these processes are based on the rate of steam flow under different scenarios (e.g., equipment warm up, turbine pre-heat, etc.).
    - Please explain why some scenarios utilize steam flows from all three flashing units (i.e., high pressure [HP], standard pressure [SP], and low pressure [LP] systems), while others utilize only one?
- Tabs "2.6: Commissioning NCG Emissions", "2.7: Cold Startup NCG Emissions", and "2.8 Warm Startup NCG Emissions"
    - The sparger emissions tables in these tabs include columns for "Sparger Burner". Was this intended to say "burner"? We did not identify any discussion of sparger burners in the application.
    - Why are all of the sparger burner emissions equal to 0?
- Tab "2.7: Cold Startup NCG Emissions"
    - Please explain why the cell for "Average Steam Flow Rate to Sparger" during gradual steam delivery to turbine is calculated as the total steam flow rate (HP+SP+LP) divided by 8? How does this equate to an average flow rate over the 6 hour event? A

similar question applies to the average steam flow rate calculations in Rows 28 and 29 in tab 2.8.C.

- Tab "2.8: Warm Startup NCG Emissions"
  - Please explain why the calculation for "Emissions through Sparger during Gradual Steam Delivery to Turbine", in cells C63:C92 uses only the HP steam flow rate in the denominator, as opposed to the sum of the HP, SP, and LP flow rates?
- Tabs "2.10: NCG Emissions Sparger" and "2.10a: Sparger Bypass"
  - A ratio of 60% for the H2S partitioned into NCG is listed in these tabs. The application states that "H2S emissions from the NCG stream are assumed to split between the gas phase and the condensate/liquid phase prior to reaching the cooling towers at a ratio of 60 to 40 percent, respectively". Please provide documentation or additional explanation supporting the basis of this assumption and how it is a conservative representation of project emissions.
  - The concentration of ammonia (ppmw) in the steam differs between tabs 2.10 and 2.10a (Sparger Bypass). Tab 2.10 draws from the Arsenic, Mercury, and Ammonia 2018 and 2022 source tests (Tab 2.2) while Tab 2.10a draws from the Brine Composition 2021 source test (Tab 2.1). Additionally, the assumed ratio for ammonia partitioned into NCG is different between these two tabs. What is the reason for these differences?
- Tab "2.15: CT TAC"
  - The ammonia concentration in the condensate as listed in the table does not appear to align with the values listed in Footnote [d], which states "Ammonia emissions calculated based on an effective concentration, which was derived from a mass balance of ammonia…". Please explain how the ammonia concentration was calculated and clarify if the correct unit is mg/L or µg/L.

Equipment Parameters

Certain information provided in the Internal Combustion Engine Summary Forms is inconsistent with information provided in the operational emissions calculations workbook. Please confirm the values for the following parameters:

- Fire Pump
  - Stack Height
  - Exhaust flow rate
  - Exhaust temperature
- Generators 1-5
  - Stack Diameter
  - Stack Height
  - Exhaust flow rate

Chemical Storage

- Please provide a list of materials and their concentrations (if diluted) for all materials stored in the Norms Inhibitor Tank (as listed in the Applicant's June 2023 ICAPCD Completeness Determination Response letter for Elmore North)
- Please provide the Safety Data Sheet for each material stored in the Norms Inhibitor Tank, as well as their concentrations (if diluted)

Please provide a response to the above questions no later than **Wednesday, October 4**. Your cooperation is key to the timely review of the applications. If you have any questions regarding your permit applications, please contact me at 442-265-1800.

Sincerely,

Jesus A. Ramirez
APC Division Manager
ICAPCD