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March 4, 2024

Via E-Mail, U.S. Mail, and Docket No. 23-AFC-02

Jesus Ramirez
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Re: **California Unions for Reliable Energy Comments on the Preliminary Decision to Grant a Preliminary Determination of Compliance for the Elmore North Geothermal Power Generation Plant**

Dear Mr. Ramriez:

We write on behalf of California Unions for Reliable Energy ("CURE") regarding the Imperial County Air Pollution Control District's ("Air District") preliminary decision to grant a preliminary determination of compliance ("PDOC") to Elmore North Geothermal, LLC ("Applicant"), an indirect, wholly owned subsidiary of BHE Renewables, LLC ("BHER") for the Elmore North Geothermal Power Generation Project ("Elmore North" or "Project").[1]

For the reasons discussed below, the Air District must inform the California Energy Commission ("Commission") that a PDOC cannot be issued because the proposed Project would cause or contribute an exceedance of ambient air quality standards ("AAQS") and result in significant, unmitigated health risks due to toxic air contaminant ("TAC") emissions. If the Air District makes significant changes to the PDOC in response to public comments, the revised PDOC must be re-noticed, and the public must have a full and fair opportunity to comment on the revisions.

[1] TN 254004, Preliminary Determination of Compliance (PDOC) Elmore North (Jan. 19, 2024) (hereinafter "PDOC"), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=254004&DocumentContentId=89308.

I. INTRODUCTION

The Applicant submitted an Application for Certification ("AFC") to the Commission seeking approval to construct and operate a geothermal power plant and associated interconnection transmission lines in an unincorporated area of Imperial County, California, near the southeastern edge of the Salton Sea.[2] When an AFC has been accepted by the Commission, the Air District must conduct a determination of compliance review, which is identical to what would be performed for an Authority to Construct ("ATC") application.[3] Accordingly, the Air District reviews the proposed Project to ensure that operation of the stationary source does not interfere with the attainment or maintenance of AAQS. The Air District must also evaluate the Project's health risks associated with emission of TACs as required by Assembly Bill ("AB") 2588.

The Applicant has identified the following emissions equipment/sources for the proposed Project: the power plant, an emergency fire pump, 3 emergency generator sets, a biological oxidizer box (Ox-Box), a sprager abatement system, a hydrochloric (HCl) scrubber, the cooling tower equipped with high efficiency drift eliminators (0.0005%), a 20-000-gallon HCl storage tank and dosing system, 9 production wells, 8 injection wells (brine), 2 injection wells (condensate), and 1 injection well (aerated).[4] Based on the results of an air quality impact analysis and health risk assessment ("HRA") for the proposed Project, the Air District has issued a preliminary decision to grant a PDOC.[5]

We reviewed the PDOC, air quality permit application and amendments, and available supporting documents with the assistance of our technical expert, James J. Clark, Ph.D., whose comments and qualifications are attached as Exhibit A.[6] Based on our review, we conclude the proposed Project fails to comply with all

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[2] TN 249737, Elmore North Geothermal Project Application for Certification Volume 1 (Apr. 18, 2023), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=249737&DocumentContentId=84377.
[3] Imperial County Air Pollution Control District, Rule 207 New and Modified Stationary Source Review (last revised Sept. 11, 2018) (hereinafter "Rule 207"), *available at* https://apcd.imperialcounty.org/wp-content/uploads/2020/01/1RULE207.pdf.
[4] PDOC at p. 49.
[5] TN 254370, Notice of Decision by the Imperial County Air Pollution Control District to Issue a Determination of Compliance to Elmore North Geothermal, LLC for the Construction of a New Geothermal Power Plant (Feb. 7, 2024), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=254370&DocumentContentId=89740.
[6] **Exhibit A**, Letter to Andrew J. Graf, Adams Broadwell Joseph & Cardozo from James J. Clark, Clark & Associates re: Comment Letter Elmore North Geothermal Preliminary Determination of Compliance (Feb. 29, 2024) (hereinafter "Clark Comments").

applicable Rules and Regulations of the Air District ("Rules"), including Rule 207 governing review of new stationary sources.

As discussed in greater detail below, the PDOC suffers from fatal defects because it (1) shows that the Project would cause or contribute to the exceedance of National and California AAQS, (2) contains erroneous conditions, (3) fails evaluate whether the proposed Project and the nearby geothermal facility constitute a single source, and (4) demonstrates that the hazard risks from TACs expected to be emitted by the Project are significant and unmitigated.

Given these deficiencies, the Air District must inform the Commission that a PDOC cannot be issued unless it significantly revises the air quality modeling, emissions limits, and controls to ensure compliance with all applicable Air District Rules and requirements.

II. STATEMENT OF INTEREST

CURE is a party to the Project's AFC proceeding before the Commission.[7] CURE is a coalition of unions whose members' environmental and economic interests are affected by the Project. Union members live in communities that suffer the impacts of projects that are detrimental to human health and the environment. Unions have a corresponding interest in acting to minimize the impacts of projects that would degrade the environment, and in enforcing environmental laws to protect their members.

The Project also affects the union members' longer term economic and environmental interests. CURE's coalition members construct, maintain and operate conventional and renewable power plants, energy storage facilities, and other industrial facilities in California where the coalition members live, work, and recreate. CURE is equally committed to building both a strong economy and a healthy environment. Environmental degradation jeopardizes future jobs by causing construction moratoriums, depleting limited air pollutant emissions offsets, consuming limited freshwater resources, and imposing other stresses on the environmental carrying capacity of the state. This in turn reduces future employment opportunities. In contrast, well designed projects that reduce environmental impacts improve long-term economic prospects.

[7] TN 251917, Order Granting CURE's Petition to Intervene (Aug. 25, 2023), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=251917&DocumentContentId=86917.

III. LEGAL STANDARD

Section D.4 of Rule 207 governs review of power plants proposed to be constructed within Imperial County and for which an AFC has been accepted by the Commission. The Air District must consider the AFC to be the equivalent of an application for an ATC during the determination of compliance review and must apply all provisions of Rule 207 which apply to ATC applications. Within 180 days of accepting an AFC as complete, the Air District must make a preliminary decision on:

- Whether the proposed power plant meets the requirements of this Rule and all other applicable District regulations; and
- In the event of compliance, what permit conditions will be required including the specific BACT requirements and a description of required mitigation measures.

The preliminary written decision is treated as a preliminary decision under Rule 206 and must be finalized by the Air District only after being subject to the public notice and comment requirements of Rule 206. The Air District shall not issue a preliminary determination of compliance unless all requirements of Rule 207 are met.

Within 240 days of accepting an AFC as complete, the Air District must issue and submit to the Commission a PDOC or inform the Commission that a PDOC cannot be issued. A determination of compliance confers the same rights and privileges as an ATC only when and if the Commission approves the application for certification, and the certificate includes all conditions of the final determination of compliance.

As discussed in detail below, the Air District's own analysis demonstrates that the Project fails to comply with all applicable District Rules and regulations. As a result, the Air District must inform the Commission that it cannot issue a PDOC unless the air quality modeling, emissions limits, and any additional controls demonstrates that the Project would not cause or contribute to any exceedances of AAQS and would not result in significant, unmitigated health risks. If significant changes are made to the PDOC, the Air District must re-circulate the revised PDOC for public review and comment.

IV. THE PROJECT WILL CAUSE OR CONTRIBUTE TO A VIOLATION OF AMBIENT AIR QUALITY STANDARDS

Rule 207 establishes the preconstruction review requirements for new stationary sources to ensure that the operation of such sources does not interfere with the attainment or maintenance of AAQS. Section C.5.b of Rule 207 prohibits emissions from a new emission unit from causing or worsening a violation of an AAQS. Section F.1 similarly states that "[i]n case shall emissions from a new emissions unit cause or make worse the violation of an AAQS.[8] The Applicant cannot demonstrate compliance with this requirement because the air quality modeling suffers from critical defects. In addition, the Air District fails to account for the more stringent NAAQS for $PM_{2.5}$ which were recently adopted and will be effective before the permitting process concludes.

A. The Air Quality Model Is Not Consistent with EPA Guidelines

Section F.1.a. of Rule 207 requires that any air quality models used to estimate the effects of a new emissions unit be consistent with the requirements contained in the most recent edition of EPA's "Guidelines on Air Quality Models, 40 CFR 51 Appendix W" ("*Guidelines*").[9] The *Guidelines* provide a common basis for estimating the air quality concentrations of criteria pollutants used in assessing control strategies and developing emissions limits.[10]

The air quality model relied upon by the Air District to determine the Project's compliance with AAQS suffers from two critical defects. First, the model fails to use representative meteorological data. Second, the model fails to include nearby sources in the background concentrations as part of the cumulative impact analysis.

1. The Model Fails to Use Representative Meteorological Data

The *Guidelines* recommend that meteorological data be selected based on spatial and climatological (temporal) representativeness as well as the ability of individual of parameters selected to characterize the transport and dispersion conditions in the area of concern.[11] The representativeness of the measured data is dependent on numerous factors including but not limited to: (1) the proximity of the meteorological monitoring site to the area under consideration, (2) the complexity of

[8] Rule 207.F.1.
[9] 40 C.F.R Pt. 51, App. W; *see also* 82 Fed. Reg. 5182-235 (Jan. 17, 2017).
[10] 40 C.F.R Pt. 51, App. W, Preface.
[11] 40 C.F.R Pt. 51, App. W § 8.4.1.b; Clark Comments at p. 11.

the terrain, (3) the exposure of the meteorological monitoring site, and (4) the period of time during which data are collected.[12] Meteorological data collected by public agencies may be used if the data: (1) is equivalent in accuracy and detail (e.g., siting criteria, frequency of observations, data completeness, etc.) to National Weather Service data, (2) are judged to be adequately representative for the particular application, and (3) have undergone quality assurance checks.

The dispersion modeling utilized 5 years (2015-2018, 2021) of AERMET-processed meteorological data collected at the Imperial County Airport.[13] The years 2019 and 2020 were not included in the data set because they were likely determined to be incomplete by the California Air Resources Board.[14] The Applicant claims the data set was selected based on completeness, similar surrounding land use as the plant site and proximity to the facility.[15]

Meteorological data from the Airport is not representative of the Project site. A critical element of any air dispersion model is accurate, representative surface and upper air data.[16] The Airport is over 28 miles away from the Project site.[17] Dr. Clark recommends that meteorological data from the nearby IID-operated Sonny Bono monitoring station be used because it is the best representation of the conditions that will exist during Project operation.[18] This monitoring station is less than 2 miles from the Project site.[19] Nine years (2015-2023) of hourly meteorological data and PM data collected from the station is publicly available online.[20]

The primary purpose of this station is to support the Salton Sea Air Quality Mitigation Program designed to address air quality mitigation requirements around the Salton Sea.[21] The station is equipped with a Themo Fisher Scientific TEOM

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[12] *Ibid.*
[13] PDOC at p. 26.
[14] TN 250005-2, Elmore North Geothermal Project Air Quality Permit Application Part 1 (May 4, 2023) p. 5.1-31 (hereinafter "AQP Application"), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=250005-2&DocumentContentId=84738.
[15] *Ibid.*
[16] Clark Comments at p. 11.
[17] *Ibid.*
[18] *Ibid.*
[19] *Ibid.*
[20] *Ibid*; Imperial Irrigation District, Salton Sea Air Quality Monitoring Program, Documents and Data (last accessed Mar. 4, 2024), *available at* https://www.dropbox.com/sh/xevsp0836vygiyj/AABQmBVzD95fUrrgjoIlTp50a?dl=0.
[21] Imperial Irrigation District, Salton Sea Air Quality Mitigation Program (July 2016) p. 41, *available at* https://saltonseaprogram.com/aqm/docs/Salton_Sea_Air_Quality_Mitigation_Program.pdf.

1405-D to take real-time measurements of PM_{10}.[22] The TEOM has a co-located 10-meter-tall meteorological tower equipped with instruments needed to support standard regulatory air dispersion models, including AERMOD.[23] The meteorological instruments are subject to site check and audits, data processing and quality assurance/quality control procedures, and calibration and audit procedures.[24]

To comply with EPA Guidelines and ensure accurate modeling, the Air District should have required that the Applicant utilize representative meteorological data for use in the air quality modeling. Compliance with AAQS should not have been determined based on data from distant monitoring station when essentially site-specific data is available from a reliable source.

2. The Model Fails to Include Nearby Sources

Background concentrations are essential in constructing the air quality concentration for a cumulative impact analysis.[25] The Guidelines recommend that individual sources located in the vicinity of the source(s) under consideration for emissions limits that are not adequately represented by ambient monitoring data be accounted for by explicitly modeling their emissions.[26] Typically, sources that cause a significant concentration gradient in the vicinity of the source(s) under consideration for emissions limits are not adequately represented by background ambient monitoring.[27] For multi-source areas, such as the case here, the *Guidelines* recommend determining the appropriate background concentration by (1) identifying and characterizing contributions from nearby sources through explicit modeling, and (2) characterization of contributions from other sources through adequately representative ambient monitoring data.[28]

The Applicant's air quality model did not explicitly include any nearby sources because emissions from existing sources are assumed to be accounted for with the ambient air background concentrations.[29] However, there are clearly sources that will likely have a significant concentration gradient in the vicinity of the proposed Project that must be included in the modeling.

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[22] *Id*. at p. 43.
[23] *Id*. at p. 43.
[24] *Id*. appen. C at p. C-18; *see also id*., appen. D-2.
[25] 40 C.F.R Pt. 51, App. W § 8.3.1.
[26] *Id*. §§ 8.3.1.i., 8.3.1.3.
[27] *Id*. §§ 8.3.1.i., 8.3.1.3.
[28] *Id*. § 8.3.1.3.a.
[29] AQP Application at p. 5.1-43, fn. 7.

At the bare minimum, the air quality model should have included emission from the JJ Elmore geothermal power plant. As discussed in Section VI, JJ Elmore shares common boundaries with Project. The omission of this nearby source is inexcusable given its proximity to the Project site and the fact that it emits substantial quantities of the same criteria pollutants as the proposed Project.

The *Guidelines* state that in most cases the nearby sources will be located within the first 10 to 20 kilometers (6.2 to 12.4 miles) from the source(s) under consideration.[30] Therefore, the modeling must also consider other existing and proposed facilities within 6 miles of the Project site including: JM Leathers, Vulcan, Hudson Ranch Power, Salton Sea Units 1-5, Morton Bay, Black Rock, and Hell's Kitchen.[31] As with JJ Elmore, all these geothermal facilities emit the same criteria pollutants of concern as Elmore North.

The Air District cannot adequately assess whether Elmore North will cause or contribute to a violation of the AAQS based on the analysis provided in the application or PDOC alone. The Air District must require the Applicant to conduct a complete cumulative impact analysis that is expanded to include all the above sources.

B. The Project Would Cause or Contribute to a Violation of Newly Revised NAAQS for Annual $PM_{2.5}$

Section C.5.b.1 of Rule 207 prohibits emission from new sources from causing or worsening a violation of AAQS. On February 7, 2024, the EPA announced a final rule to strengthen the NAAQS for $PM_{2.5}$.[32] EPA is revising the level of primary (health-based) annual PM2.5 from 12.0 $\mu g/m^3$ to 9.0 $\mu g/m^3$, based on scientific evidence that shows the current standard does not protect public health with an adequate margin of safety, as required by the Clean Air Act.[33] Based on 2020-2022 data, Imperial County does not meet the revised annual primary PM2.5 standard of 9.0 $\mu g/m^3$.[34]

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[30] 40 C.F.R Pt. 51, App. W § 8.3.3.b.iii.
[31] Clark Comments at pp. 7-8.
[32] U.S. Environmental Protection Agency, EPA Finalizes Stronger Standards for Harmful Soot Pollution, Significantly Increasing Health and Clean Air Protections for Families, Workers, and Communities (Feb. 7, 2024), *available at* https://www.epa.gov/newsreleases/epa-finalizes-stronger-standards-harmful-soot-pollution-significantly-increasing.
[33] U.S. Environmental Protection Agency, Pre-Publication Notice (Feb. 5, 2024), *available at* https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-final-frn-pre-publication.pdf.
[34] U.S. Environmental Protection Agency, Fine Particle Concentrations for Counties with Monitors Based on Air Quality Data from 2020-2022 (Feb. 2022) p. 1, *available at*

Generally, applications received by the Air District are only subject to the new source review requirements in effect at the time the application is deemed completed. However, Rule 207 contains an exception. Section A.2.b. requires that more stringent federal requirements not yet incorporated into Rule 207 apply to the new or modified stationary source.

The effective date for the new NAAQS for annual $PM_{2.5}$ is 60 days following publication of the notice of final rulemaking in the Federal Register. While the new rule has not yet been published in the Federal Register, it will undoubtedly become effective before the proposed Project is certified by the Commission. Therefore, the Air District must determine whether the proposed Project will cause or contribute to an exceedance of the new standard.

Notwithstanding the errors and omissions discussed in Section IV.A., the current modeling already demonstrates that the Project's new emissions would cause or contribute to a violation of the revised standards. Specifically, the PDOC shows that the Project's maximum concentration of PM2.5 is 0.36 $\mu g/m^3$ and the background concentration is 8.67 $\mu g/m^3$, for a total concentration of 9.03 $\mu g/m^3$.[35] The Air District cannot issue a PDOC until the Applicant demonstrates that the Project complies with the revised annual PM2.5 standard.

C. The Project Would Cause or Contribute to a Violation of CAAQS for Hydrogen Sulfide

Section C.5.b.1 of Rule 207 prohibits emission from new sources from causing or worsening a violation of AAQS. The current CAAQS standard for hydrogen sulfide ("H_2S") is 0.03 parts per million (42 $\mu g/m^3$).

The proposed Project is a significant source of H_2S emissions. The PDOC analyzes H_2S based on the worst-case subsequent year of operation.[36] The proposed Project exceeds the emission threshold of 100 pounds per day for H_2S.[37] The proposed Project also exceeds the BACT threshold of potential to emit equal to or greater than 55 pounds per day.[38] With implementation of BACT, the Project is estimated to emit a maximum concentration of 36.7 $\mu g/m^3$.[39]

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https://www.epa.gov/system/files/documents/2024-02/table_annual-pm25-county-design-values-2020-2022-for-web.pdf.

[35] PDOC at p. 28.
[36] *Id.* at p. 14.
[37] *Id.* at p. 24.
[38] *Ibid.*
[39] *Id.* at p. 28.

While the PDOC determined background concentrations for all other criteria pollutants (albeit inconsistent with the *Guidelines* as discussed in Section IV.A.2.), the Air District did not identify any background concentration for H_2S.[40] This is a significant omission given the number of nearby sources that also emit large quantities of H_2S, in addition high concentrations of H_2S naturally occurring in the area.[41] While monitoring data for this pollutant is not readily available, that does not excuse the Air District from determining whether the proposed Project would cause or contribute to an exceedance of the CAAQS standard.

In 2010, the Air District utilized a background concentration of 36.7 $\mu g/m^3$ based on an average hourly concentration that was captured by the Niland monitoring station from 1993-1994.[42] Dr. Clark concludes that if background concentrations for H_2S were considered as part of the cumulative impact analysis, the Project would likely cause or contribute to an CAAQS violation because the Project's emissions alone are only slightly below standard.[43] The Air District cannot issue a PDOC until the Applicant demonstrates that the Project complies with the CAAQS for H_2S when background concentrations are included.

D. The Air District Fails to Use Representative Ambient Air Quality Data for PM_{10}

For the cumulative impact analysis, the PDOC relies on data from two monitoring stations (Niland-English Road and Brawly-220 Main Street) to determine compliance with annual and hourly PM_{10} AAQS.[44] In doing so, the Air District ignores monitoring data from several sources closer to the Project site, including the Sonny Bono monitoring station, which tracks PM_{10} as part of the Salton Sea Mitigation Monitoring Program.[45] The EPA *Guidelines* recommend that background concentrations be temporally and/or spatially representative of the area around the new source for purposes of regulatory assessment.[46] The Air District should utilize PM_{10} data from the Sonny Bono monitoring station given its proximity (less than 2 miles) to the Project site.[47]

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[40] Clark Comments at p. 10.
[41] *Ibid*.
[42] *Ibid*; *see also* TN 58474, Revised Air Pollution Control District Determination of Compliance (Sept. 15, 2010) p. 20, *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=58474&DocumentContentId=50349.
[43] Clark Comments at p. 10.
[44] *Ibid*.
[45] *Ibid*.
[46] 40 C.F.R Pt. 51, App. W § 8.3.3.a.
[47] Clark Comments at pp. 8-10.

V. CONDITION B.9 IS CLEARLY ERRONEOUS

The PDOC includes a condition which establishes a facility-wide emissions and throughput limit for HCl scrubber and tank operation.[48] The throughput limit is set at 52,560,000 gallons per year.[49] This throughput far exceeds the anticipated annual quantities for HCl. As stated in the revised project description, the Project is estimated to use approximately 789,000 gallons per year of HCl <37%.[50] Therefore, the throughput limit is nearly 67 times greater than estimated usage rates.

The throughput also far exceeds the anticipated annual quantity of HCl 2.5%. As stated in the revised project description, the Project is estimated to use approximately 10,400,000 gallons of diluted HCl.[51] Therefore, the throughput limit is 5 times greater than estimated usage rate for diluted HCl. Condition B.9 must be revised to accurately set a throughput limit consistent with anticipated operations, which considers all HCl tanks.

VI. ELMORE NORTH AND JJ ELMORE MUST BE PERMITTED AS A SINGLE STATIONARY SOURCE

Rule 207 establishes preconstruction review requirements for new and modified stationary sources to ensure that the operation does not interfere with the attainment of AAQS. Section B of Rule 207 defines "stationary source" as "any building, structure, facility, equipment, or emissions unit which emits or may emit any affected pollutant directly or as a fugitive emission. Building, structure, or facility includes all pollutant emitting activities, including emissions unit which: (1) are located on one or more contiguous or adjacent properties, and (2) are under the same or common ownership or operation, or which are owned or operated by entities which are under common control, and (3) belong to the same industrial grouping either by virtue of falling in the same two-digit standard industrial classification code or by virtue of being part of a common production process, industrial process, manufacturing process, or connected process involving a common raw material."[52]

The PDOC evaluates only sources from Elmore North. In doing so, the PDOC erroneously emits emissions from sources at the JJ Elmore facility which, as

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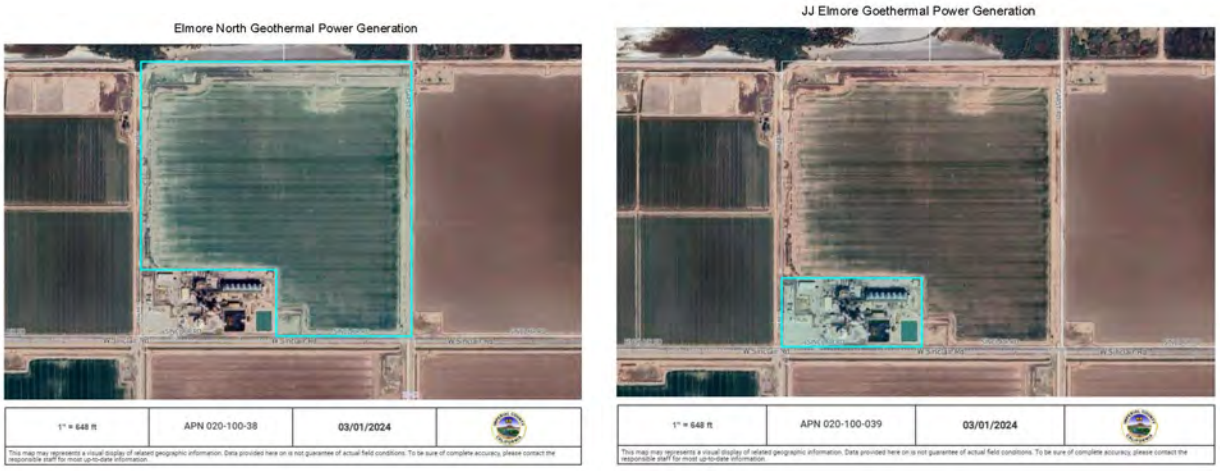
[48] PDOC at p. 40.
[49] *Ibid.*
[50] TN 253187, Revised General Arrangement Refinement (Nov. 17, 2023) p. 20 (hereinafter "Revised Project Description"), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=253187&DocumentContentId=88396.
[51] *Ibid.*
[52] Rule 207.B.

discussed below, is located on a contiguous property, under common control, and belongs to the same industrial grouping as the Elmore North facility. The Air District cannot issue a final determination of compliance until it conducts a revised air quality analysis that combines the emissions from Elmore North and JJ Elmore to determine whether (1) the stationary source qualifies as a major stationary source and (2) the stationary source interferes with attainment of AAQS.

A. Elmore North and JJ Elmore Are on Contiguous Properties

Under the first factor, the Air District must determine whether all pollutant emitting activities are located on one or more continuous or adjacent properties. Section B of Rule 207 defines "contiguous property" as "two or more parcels of land with a common boundary separated solely by a public or private roadway or other public right-of-way." There can be no reasonable dispute that the facilities are located on contiguous properties.



JJ Elmore is located at APN 020-100-039 and Elmore North is at APN 020-100-038. The two parcels share a common boundary. They are not separated by any public or private roadway, nor are they separated by any other public right-of-way. The Air District must conclude that the facilities satisfy the first factor.

B. Elmore North and JJ Elmore Are Under Common Control by BHE Renewables, LLC

Under the second factor, the Air District must determine whether the facilities are under common control. Determinations of common control are fact-

specific and should be made by permitting authorities on a case-by-case basis.[53] In interpreting a similar definition of stationary source for the PSD permitting program, the EPA has stated that the determination of "control" focuses on the power or authority of one entity to dictate decisions of the other that could affect the applicability of, or compliance with, relevant air pollution regulatory requirements.[54]

While the Applicant does not intend to connect Elmore North to any existing geothermal plants,[55] Rule 207 does not require that the two facilities be physically connected to qualify as a single stationary source. For example, the EPA determined that two independent facilities (power plant and coal mine) can be considered part of the same source when they are located on adjacent properties and are under common control.[56] Although the PSD regulations have been amended since the 1980 source determination to add the requirement that the pollutant emission activities belong to the same industrial grouping, the analysis remains the same. That is, the key inquiry is whether the independent facilities are under common control.

With respect to the power or authority to dictate decisions, the EPA explained in the April 2018 *Meadowbrook* letter:

> Control exists when one entity has the power or authority to restrict another entity's choices and effectively dictate a specific outcome, such that the controlled entity lacks autonomy to choose a different course of action. This power and authority could be exercised through various mechanisms, including common ownership or managerial authority (the chain of command within a corporate structure, including parent/subsidiary relationships), contractual obligations (e.g., where a contract gives one entity the authority to direct specific activities of another entity), and other forms of control where, although not specifically delineated by corporate structure or contract, one

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[53] Letter to Hon. Patrick McDonnell, Secretary, Pennsylvania Department of Environmental Protection from William L. Wehrum, Assistant Administrator, Office of Air and Radiation, U.S. Environmental Protection Agency re: Meadowbrook Energy (Apr. 30, 2018) (hereinafter "Meadowbrook Letter"), *available at* https://www.epa.gov/sites/default/files/2018-05/documents/meadowbrook_2018.pdf.

[54] *Id*. at p. 6.

[55] TN 253376, CURE Data Response Set 1 (Responses to Data Requests 1 to 96) (Nov. 28, 2023) p. 2, *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=253376&DocumentContentId=88595.

[56] Memorandum to Director, Division of Stationary Source Enforcement from Allyn David, Director, Air Hazardous Materials Division re: PSD Applicability Determination (Apr. 24, 1980), *available at* https://www.epa.gov/sites/default/files/2015-07/documents/19800424.pdf.

> entity nonetheless has the ability to effectively direct the specific actions of another entity.. Thus, control can be established: (1) when one entity has the power to command the actions of another entity (e.g., Entity A expressly directs Entity B to "do X"); or (2) when one entity's actions effectively dictate the actions of another entity (e.g., Entity A's actions force Entity B to do X, and Entity B cannot do anything other than X). … Ultimately, the focus is not on *how* control is established (through ownership, contract, or otherwise), but on *whether* control is established – that is, whether one entity can expressly or effectively force another entity to take a specific course of action, which the other entity cannot avoid through its own independent decision-making.[57]

Elmore North is owned by Elmore North Geothermal, LLC, an indirect, wholly owned subsidiary of BHER.[58] JJ Elmore is owned by BHER.[59] "Operating as CalEnergy, the company owns 10 geothermal facilities in California's Imperial Valley with a total net capacity of 345 megawatts."[60] BHE Renewables, LLC is a wholly owned subsidiary of Berkshire Hathaway Energy Company.[61] BHER and Berkshire Hathaway Energy Company are subsidiaries of Berkshire Hathaway, Inc.[62]

The permit record does not adequately demonstrate the ownership and management structures of these two facilities. Elmore North and JJ Elmore are undoubtedly owned by BHER and presumably will be operated by the same operating entity, CalEnergy, as is the case for all other BHER owned geothermal

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[57] Meadowbrook Letter at pp. 6-7.
[58] TN 249737, Letter from Steven C. Rowley, Vice President, Elmore North Geothermal, LLC to Drew Bohan, Executive Director, California Energy Commission re: Application for Certification for the Elmore North Geothermal Project (Apr. 13, 2023), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=249737&DocumentContentId=84377.
[59] Lawrence Berkeley National Laboratory, Characterizing the Geothermal Lithium Resource at the Salton Sea: A Project Report to the U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy, Geothermal Technologies Office (Nov. 22, 2023) p. 7, *available at* https://eta-publications.lbl.gov/sites/default/files/escholarship_uc_item_4x8868mf.pdf.
[60] BHE Renewables, Just the Facts (Apr. 2023) p. 2, *available at* https://www.brkenergy.com/content/published/api/v1.1/assets/CONT753EAC8FF076422DAC98F4A5F3341FEF/native?cb=_cache_a478&channelToken=43656b04884643bc9fe334ad550d375f&download=true.
[61] TN 23-ERDD-01, Response from BHE Renewables to Request for Information (Sept. 15, 2023) p. 1, *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=252279&DocumentContentId=87287.
[62] Berkshire Hathaway, Inc., Form 10-K (Dec. 31, 2023) Ex. 21, *available at* https://www.sec.gov/Archives/edgar/data/0001067983/000095017024019719/brka-ex21.htm; see also Berkshire Hathaway Energy, 2019 EEI Financial Conference (Nov. 2019) p. 5, *available at* https://www.sec.gov/Archives/edgar/data/1098296/000108131619000019/eei2019.htm.

power plants in the area. The Air District must assess whether there is common control over these facilities, requiring them to be permitted as a single source.

C. Elmore North and JJ Elmore Belong to the Same Industrial Grouping

Under the third factor, the Air District must determine whether the facilities belong to the same industrial group. There can be no reasonable dispute that the two facilities belong to the same industrial group because they share the same two digit SIC code – Major Group 49: Electric, Gas, and Sanitary Services.[63] "This major group includes establishments engaged in the generation, transmission, and/or distribution of electricity or gas or steam."[64]

The two facilities also share the same NAICS code: 221116. NAICS stands for the North American Industry Classification System.[65] It is an industry classification system that groups establishments into industries based on the similarity of their production processes.[66] NAICS replaced the SIC system in 1997.[67]

NAICS 221116 "comprises establishments primarily engaged in operating geothermal electric power generation facilities. These facilities use heat derived from Earth to produce electric energy. The electricity produced in these establishments is provided to electric power transmission systems or to electric power distribution systems."[68]

Both Elmore North and JJ Elmore are geothermal electric power generation facilities that provide electricity to the electric transmission and distribution systems. The Air District must conclude that the facilities satisfy the third factor.

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[63] U.S. Department of Labor, Occupational Safety and Health Administration, SIC Manual, Major Group 49: Electric, Gas, and Sanitary Services, https://www.osha.gov/data/sic-manual/major-group-49 (last visited Mar. 4, 2024).
[64] *Ibid.*
[65] Office of Management and Budget, North American Industry Classification System (2022) p. 3, *available at* https://www.census.gov/naics/reference_files_tools/2022_NAICS_Manual.pdf.
[66] *Id.* at p. 14.
[67] *Id.* at p. 13.
[68] *Id.* at p. 114.

VII. THE AIR DISTRICT MUST INFORM THE COMMISSION THAT A PRELIMINARY DETERMINATION OF COMPLIANCE CANNOT BE ISSUED BECAUSE EMISSIONS FROM THE PROJECT EXCEED RISK THRESHOLDS

AB 2588 requires facilities that are ranked as a high priority to submit a HRA to the Air District.[69] The HRA includes a comprehensive analysis of the dispersion of hazardous substances into the environment, the potential for human exposure, and a quantitative assessment of both individual and population-wide health risks associated with those levels of exposure.[70] The HRA must be consistent with the Risk Management Guidance for Stationary Sources of Air Toxics.[71]

The Applicant prepared an HRA following the Office of Environmental Health Hazard Assessment Risk Assessment Guidelines.[72] The HRA estimated risks of cancer, non-cancer chronic exposure, and non-cancer acute exposure based on AERMOD and HARP2 modeling.[73] As discussed below, the Applicant's own modeling demonstrate that the proposed Project's non-cancer chronic and acute health risks exceed the selected thresholds despite likely underestimate the risks due to the use of nonrepresentative metrological data.

A. The Project's TAC Emissions Exceed the Air District's Informal Non-Cancer Hazard Index Thresholds and SCAQMD Rule 1401 Thresholds

Th Air District has not formally established health risk thresholds. However, based on the Air District's response to CARB and the California Air Pollution Control Officers Association ("CAPCOA"), the District identified the following permitting levels:[74]

- Best Available Control Technology for Toxics ("T-BACT") is triggered when the maximum individual cancer risk is greater than one in one million at any receptor location.

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[69] Health & Safety Code § 44340.
[70] California Air Resources Board, "Hot Spots" Risk Assessment, https://ww2.arb.ca.gov/our-work/programs/ab-2588-air-toxics-hot-spots/hot-spots-risk-assessment (last visited Mar. 4, 2024).
[71] Health & Safety Code § 44340(a).
[72] AQP Application at p. 5.9-1 to 5.9-24; PDOC at p. 34.
[73] PDOC at p. 34.
[74] California Air Resources Board and California Air Pollution Control Officers Association, Risk Management Guidance for Stationary Sources of Air Toxics (July 23, 2015) p. 45 ("TAC Stationary Source Guidance"), *available at* https://ww2.arb.ca.gov/sites/default/files/classic/toxics/rma/rmgssat.pdf.

- The Air District will approve the permit only if all the following conditions are met:
    - The maximum individual cancer risk is less than one in one million at any receptor location if the permit unit is constructed without T-BACT *or* the maximum individual cancer risk is less than 10 in one million if the permit unit is constructed with T-BACT.
    - The total chronic hazard index is less than 1.0.
    - The total acute hazard index is less than 1.0.
    - The cancer burden is less than 0.5.

If any of one of these conditions is not met, the permit is denied.[75]

Because the Air District has not formally adopted thresholds, the Applicant analyzed health risks based on those established by South Coast Air Quality Management District ("SCAQMD").[76] SCAQMD has adopted the same thresholds as those communicated by the Air District to CARB and CAPCOA.[77] Under SCAQMD Rule 1401(d), the executive officer must deny the permit to construct a new, related or modified permit unit if emissions of any TACs occur, unless the applicant has substantiated all of the following:[78]

- The cumulative increase in MICR will not result in any of the following:[79]
    - An increased MICR greater than one in one million at any receptor location, if the permit unit is constructed without T-BACT;[80]
    - An increased MICR greater than ten in one million at any receptor location, if the permit is constructed with T-BACT;[81]
    - A cancer burden greater than 0.5.[82]
- The cumulative increase in total chronic HI for any target organ system due to total emission from the new, relocated or modified permit unit owned and operated by the applicant will not exceed 1.0 at any receptor.[83]

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[75] *Ibid.*
[76] AQP Application at p. 5.9-3; *see also* PDOC at p. 35.
[77] TAC Stationary Source Guidance at p. 47; *see also* South Coast Air Quality Management District, Rule 1401. New Source Review of Toxi Air Contaminants (Sept. 1, 2017) (hereinafter "SCAQMD Rule 1401"), *available at* https://www.aqmd.gov/docs/default-source/rule-book/reg-xiv/rule-1401.pdf.
[78] SCAQMD Rule 1401(d).
[79] SCAQMD Rule 1401(d)(1).
[80] SCAQMD Rule 1401(d)(1)(A).
[81] SCAQMD Rule 1401(d)(1)(B).
[82] SCAQMD Rule 1401(d)(1)(C).
[83] SCAQMD Rule 1401(d)(2).

- The cumulative increase in total acute HI for any target organ system due to total emission from the new, relocated or modified permit unit owned and operated by the applicant will not exceed 1.0 at any receptor.[84]

Here, the PDOC acknowledges that the proposed Project exceeds the thresholds for both chronic and acute HI during routine operation of the cooling tower without startups and shutdowns, emergency generators, fir pump and HCl scrubber. Specifically, the PDOC shows that the chronic and acute HI for the maximally exposed individual worker ("MEIW") is 1.29 and 2.41, respectively.[85] The PDOC also acknowledges that the proposed Project exceeds the threshold for acute HI for the MEIW due to the mobile testing unit alone. Specifically, the PDOC shows that the acute HI is 3.70.[86] Because the hazard risks exceed the Air District's informal thresholds and SCAMD adopted thresholds, the Air District must inform the Commission that a PDOC cannot be issued.

B. The HRA Is Flawed and Fails to Account for Radon Impacts

Dr. Clark reviewed the AERMOD and HARP modeling files for the HRA.[87] He found that excel cells and sheets were locked or hidden which would identify how emissions and health risks were summarized and their underlying sources of data.[88] When reviewing the underlying data, Dr. Clark found that the cumulative health risks show that the maximally exposed individual worker had a potential cancer risk of 21.54 in one million.[89] However, the PDOC identifies the cancer risk as 0.82 in one million.[90] The PDOC fails to explain this discrepancy.[91]

Moreover, the underlying data revealed that the health risk does not expressly quantify the risk from exposure to radon.[92] As Dr. Clark notes, and the Applicant's air quality permit application confirms,[93] radon will be emitted from the proposed Project.[94] These omissions are critical flaws that must be corrected before a PDOC can be issued.

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[84] SCAQMD Rule 1401(d)(3).
[85] PDOC at p. 36.
[86] PDOC at p. 37.
[87] Clark Comments at p. 11.
[88] *Ibid*.
[89] *Id*. at p. 12-13.
[90] PDOC at p. 36.
[91] Clark Comments at p. 13.
[92] *Ibid*.
[93] AQP Application at p. 5.1-17.
[94] Clark Comments at p. 13.

C. The HRA Modeling Fails to Use Representative Meteorological Data

Even though the Project's non-cancer hazard risks exceed applicable thresholds, the Project's health risks are likely significantly underestimated because of unrepresentative meteorological data. The Applicant used the same AERMOD model to estimate ambient air concentrations for the HRA as it did to determine compliance with AAQS.[95] As discussed in Section IV.A.1., the Airport meteorological data utilized to model is not representative of the Project site despite the availability of data form the IID meteorological station less than a mile away.

D. The HRA Fails to Include Emissions Estimates for All Hydrochloric Acid Tanks

The HRA must include emission estimates for all substances that are required to be quantified in the facility's emissions inventory report.[96] After submission of its initial air quality permit application to the Air District, the Applicant made a number of significant modifications to the project description, including a substantial increase in the amount of concentrated hydrochloric acid ("HCl") that would be used by the Project.[97] Specifically, the amount of HCl stored on site changed from one 1,250-gallon tank of 37% HCl to one 20,000-gallon tank of HCl (<37%) and one 800-gallon tank of dilute HCl (2.5%).[98] The Project anticipates using approximately 789,000 gallons of the <37% HCl and approximately 10,400,000 gallons of the 2.5% HCl.[99] Both tanks include a HCl scrubbing system.[100]

The PDOC analyzes the 20,000-gallon HCl storage tank and establishes emissions limit of 0.11 pounds per hour and 2.75 pounds per day.[101] However, neither the Applicant, nor the Air District address the 800-gallon HCl storage tank and associated scrubber.[102] The Air District's failure to analyze TAC emissions from the smaller tank and establish an emission limitation for that source must be rectified before the Air District can issue a final PDOC.

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[95] AQP Application at p. 5.1-31; PDOC at p. 34.
[96] Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program: Risk Assessment Guidelines (Feb. 2015) p. 4-6, *available at* https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf.
[97] Revised Project Description at p. 1.
[98] *Ibid.*
[99] *Id.* at p. 20.
[100] *Id.* at p. 1.
[101] PDOC at p. 13.
[102] Clark Comments at p. 6.

VIII. CONCLUSION

For the reasons stated above, the Air District should inform the California Energy Commission that it cannot issue a PDOC or revise the analysis to correct the numerous errors and omissions and recirculate a revised PDOC for public review and comment.

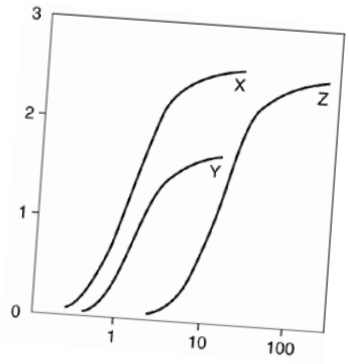
Thank you for your consideration of these comments.

Sincerely,

Andrew J. Graf

Attachment
AJG:acp

EXHIBIT A



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March 4, 2024

Adams Broadwell Joseph & Cardozo
601 Gateway Boulevard, Suite 1000
South San Francisco, CA 94080

Attn: Mr. Andrew Graf

Subject: Comment Letter Elmore North Geothermal Project Preliminary Determination of Compliance (PDOC).

Dear Mr. Graf:

At the request of Adams Broadwell Joseph & Cardozo (ABJC), Clark and Associates (Clark) has reviewed materials related to the above referenced project.

Clark's review of the materials in no way constitutes a validation of the conclusions or materials contained within the documentations reviewed. If I do not comment on a specific item, this does not constitute acceptance of the item.

Project Description:

According to the Air Quality Permit Application submitted to the Imperial County Air Pollution Control District (ICAPCD)[1], docketed at California Energy Commission Docket No. 23-AFC 02, the Applicant proposes to site and construct the Elmore North Geothermal Project (ENGP or Project) within the Salton Sea Known Geothermal Resource Area (KGRA) located near Calipatria, Imperial County, California. The ENGP includes geothermal production wells, pipelines, fluid and steam handling facilities, a solids handling system, Class II surface impoundment, service water pond, a retention basin, process fluid injection pumps, power distribution

[1] Jacobs. 2023. Elmore North Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-02. Dated May 4, 2023. Pg. 1-1

center, borrow pits, and injection wells. The proposed project would have a gross output of 157 megawatt (MW), with a net output of 140 MW. The Project will be located on approximately 63 acres of a 160-acre parcel within the unincorporated area of Imperial County, California and is bounded by an unnamed dirt road to the north, Cox Road to the west, Garst Road to the east, and West Sinclair Road to the south.

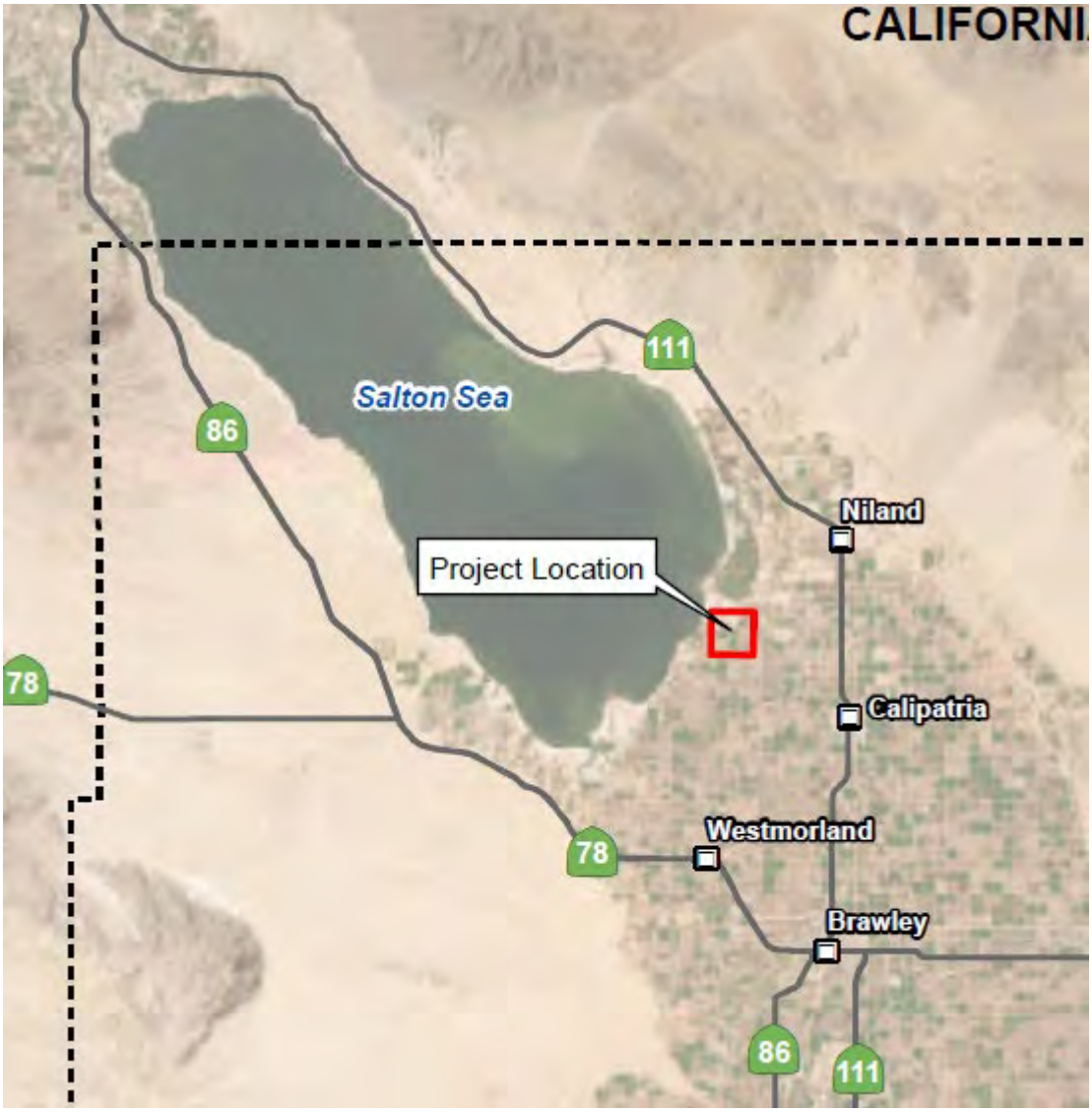


Figure 1: Project Location

The Project is in an area designated by the U.S. Environmental Protection Agency as nonattainment for ozone and by the California Air Resources Board as nonattainment for ozone and

particulate matter with a diameter less than 10 microns (PM_{10}). According to the application[2], the Project's potential air quality impacts will be mitigated by the installation and operation of best available control technology (BACT) for hydrogen sulfide (H_2S) emission from geothermal processes and for particulate matter emissions from cooling tower operations. The application concludes that after mitigation the Project would have *less than significant impacts for air quality and public health impacts*.

The Project is described by the applicant as consisting of

- One steam turbine generator system consisting of a condensing turbine generator set with three steam entry pressures (high pressure, standard pressure, and low pressure).
- A non-condensable gas (NCG) removal system.
- A sparger abatement system and condensate biological oxidation abatement system in the cooling tower system.
- A heat rejection system.
- A generator step-up transformer (GSU).
- The system includes a 230 kilovolt (kV) substation and power distribution center.
- Four standby diesel-fueled engines (3 generators and one fire water pump).[3]
- Geothermal fluid processing systems, including steam separation vessels, pipelines and tanks, including one, 800-gallon tank of dilute hydrochloric acid (HCl) (2.5%), one, 20-000 gallon tank of concentrated HCl (<37%), with HCl scrubbing systems on both HCl tanks, and a 10,000 gallon tank of liquid lime (42-47% calcium hydroxide).[4]
- A single cooling tower consisting of fourteen cells, equipped with high-efficiency drift eliminators (0.0005%).[5]
- 20 wells and 13 associated well pads, including:

[2] Jacobs. 2023. Elmore North Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-02. Dated May 4, 2023. Pg. 1-7

[3] Jacobs. 2023. Elmore North Geothermal Project Revised General Arrangement Refinement. Docket Number 23-AFC-02. Dated Nov. 17, 2023. Pg.1.

[4] *Id.*

[5] *Id.*

- Nine production wells on five new well pads adjacent and to the north of the plant. Production pipelines will connect the production wells to the plant site. One additional production well pad is identified for resource support.
- 11 injection wells on five well pads south of the plant. Injection pipelines will connect the injection wells to the plant site. One additional injection well pad is identified for resource support.[6]

Figure 2: Project Layout

- Interconnection to the proposed Imperial Irrigation District (IID) switching station via a 0.5-mile-long aboveground generation tie line that runs south from the ENGP to the switching station.
- Class II surface impoundment (brine pond) sized to receive aerated process fluid, geothermal fluid from unplanned overflow events, geothermal fluid from the partial draining of clarifiers during maintenance events. Aerated fluid from the brine pond will be directed to a dedicated aerated fluid injection well for disposal.

[6] *Id*. at Figure DA4.0-1bR: Injection Wells.

- Process water supply from IID canal water with a delivery point at the IID canal Vail 3, Gate 321B as the primary connection. A secondary water supply connection is via a pipeline from the Project site east along Estelle Road, to Vail Lateral 2A, Gate 271, which is located adjacent to Hatfield Road. Potable water will be supplied through a reverse osmosis system or an equivalent system, and/or delivered through a commercial water service.

Site Location and Existing Air Quality Concerns

The facility would be located near the southern end of the Salton Sea, near the town of Calipatria in Imperial County. Land uses in the surrounding area include existing geothermal power facilities, agriculture, and the Sonny Bono Salton Sea National Wildlife Refuge. In addition to the Imperial Valley Air District being in in non-attainment for ozone concentrations based on the 8-hour Federal standard, non-attainment for ozone based on the 1-hour and 8-hour California standards, non-attainment for PM_{10} based on the California standard; the immediate vicinity of the Project Site has been identified as a disadvantaged community under Senate Bill 535. This designation requires that the State invest in improving public health, quality of life and economic opportunity in California's most burdened communities, and at the same time, reducing pollution that causes climate change. The investments are authorized by the California Global Warming Solutions Act of 2006 (Assembly Bill 32, Nunez, 2016). Adding additional air pollutants to already impacted community will disproportionally affect the residents.

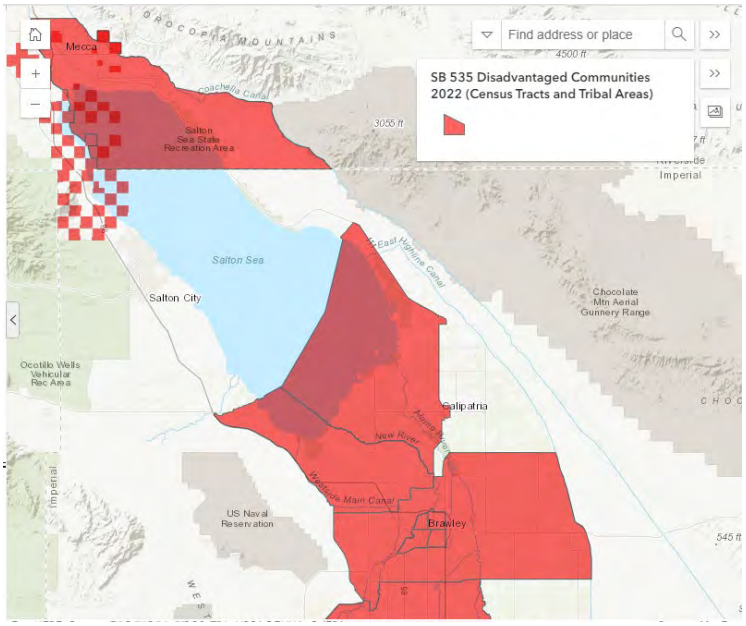


Figure 3: SB 535 Designated Communities

The PDOC fails to comply with the ICAPCD rules and regulations, specifically Rule 207 governing new and modified stationary sources since it fails to assess cumulative impacts from the emissions of the Project with other proposed projects, does not include a complete analysis of the health risks from radon being released into the community and does not asses the emissions from the storage of hydrogen chloride and the hydrogen chloride scrubbing system.

Specific Comments:

1. The PDOC Does Not Analyze All Sources with Potential to Emit

The PDOC fails to analyze all of the sources of pollutants onsite. Among the list of sources not evaluated in the PDOC are the 800-gallon tank of 2.5 % hydrogen chloride (HCl) and the emissions from the hydrogen chloride scrubbing system. HCl released into the atmosphere from a system upset or through the scrubbers will represent a significant source of respiratory irritants. At room temperature, HCl is a colorless to slightly yellow, corrosive, nonflammable gas that is heavier than air and has a strong irritating odor. On exposure to air, HCl forms dense white corrosive vapors. Upon contact with water, it forms hydrochloric acid. Both HCl and hydrochloric acid are corrosive.

HCl is irritating and corrosive to any tissue it contacts. Brief exposure to low levels causes throat irritation. Exposure to higher levels can result in rapid breathing, narrowing of the bronchioles, blue coloring of the skin, accumulation of fluid in the lungs, and even death. Exposure to even higher levels can cause swelling and spasm of the throat and suffocation. Some people may develop an inflammatory reaction to hydrogen chloride. This condition is called reactive airways dysfunction syndrome (RADS), a type of asthma caused by some irritating or corrosive substances. Depending on the concentration, hydrogen chloride can produce from mild irritation to severe burns of the eyes and skin. Long-term exposure to low levels can cause respiratory problems, eye and skin irritation, and discoloration of the teeth. Swallowing concentrated hydrochloric acid will cause severe corrosive injury to the lips, mouth, throat, esophagus, and stomach.

Given the potential harm to the environment and to human health, the releases of the HCl from the Project Site must be evaluated fully before a PDOC can be completed.

2. The Air Quality Analysis Does Not Model Emissions From Nearby Geothermal Facilities

The PDOC ignores the emissions from the currently constructed geothermal plants in the vicinity of the ENGP. The geothermal plants include the CalEnergy Salton Sea Units 1 & 2/3&4/5

Facilities to the southwest of the ENGP, the CalEnergy JM Leathers Facility, the CalEnergy Central Services facility, the CalEnergy Vulcan/Del Ranch facilities and the existing CalEnergy JJ Elmore Facility.

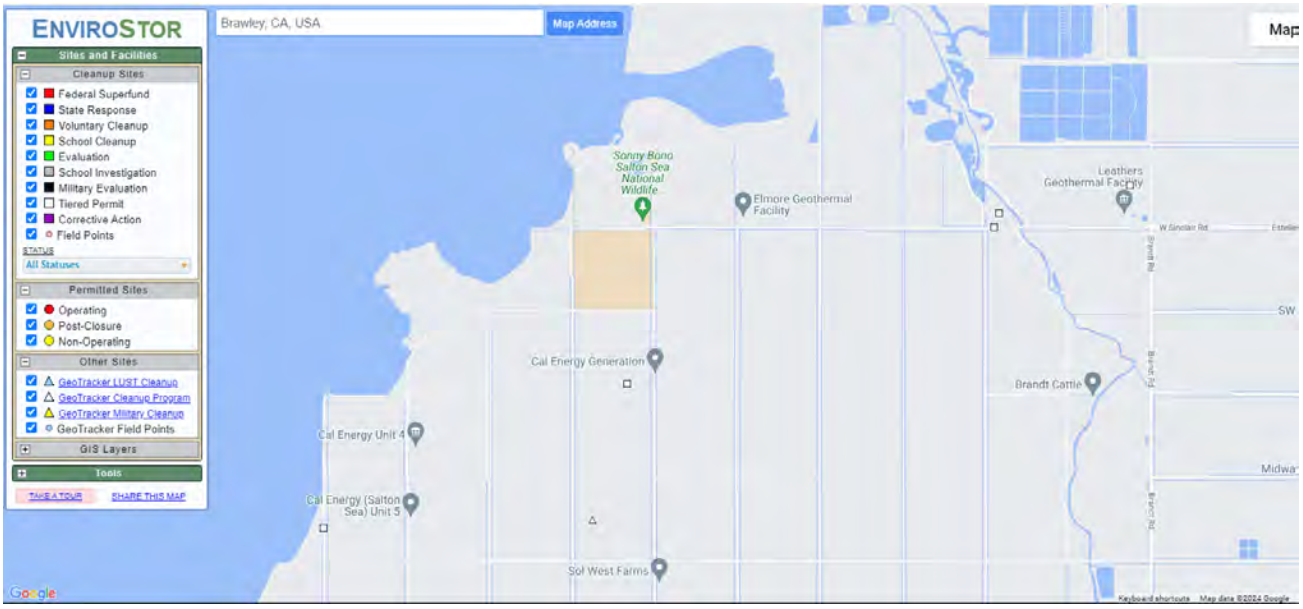


Figure 4: Existing Geothermal Sites Near ENGP

The cumulative emissions of criteria pollutants (NOx, SOx, PM, CO, and lead) and air toxins (VOCs including benzene, toluene, diesel particulate matter, etc..) were not included in the Project evaluation. Give the designation of the area as a Disadvantaged Community under SB 535 and the non-attainment status of the Imperial Valley Airshed it is clear that there is a clear concentration gradient caused by the existing emissions into the community. Monitoring of particulate matter in the area shows higher concentrations PM10 downwind of the Sonny Bono Salton Sea National Wildlife Reserve (in Calipatria) than at the Reserve. The primary difference in the PM results appears to be at least partly the emissions from the existing facilities.

Adding additional geothermal plants with additional particulate matter sources is only going to exacerbate the existing pollutant gradient.

3. The Cumulative Impact Analysis Does Not Include Emissions from Operation of the Other Two Proposed Geothermal Facilities

Two other geothermal projects, the Black Rock Geothermal Project, and Morton Bay Geothermal Project are proposed near the ENGP site. Emissions from the three projects were quantified separately and have not been combined to determine the cumulative impacts on the

surrounding community. As with the ENGP project, the emissions quantifications for the Black Rock Geothermal and Morton Bay Geothermal fail to account for the cumulative impact of criteria pollutants and air toxins in the community with existing projects and do not quantify the health risk from exposure to radon from the project sites. The failure to perform these analyses concurrently is a major flaw in the PDOC.

4. The PDOC Is Relying On Monitoring Data From Stations Miles Away From The Project Site. Additional Monitoring Sites Closer To The Project Site Are Currently In Place And Reporting PM_{10} Measurements.

The air quality analysis was conducted to demonstrate that impacts from nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than 10 micrometers (PM_{10}), particulate matter with an aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), and H_2S will comply with the California and National Ambient Air Quality Standards (CAAQS and NAAQS, respectively) for the applicable averaging periods. As was noted previously, the Imperial County is in non-attainment for ozone concentrations based on the 8-hour Federal standard, non-attainment for ozone based on the 1-hour and 8-hour California standards, and, non-attainment for PM_{10} based on the California standard. The Application describes the closest and most representative monitoring data near the Project Site as:

- Niland-English Road (AQS ID: 60254004) [7.6 miles from Project]: 24-hour PM10 concentrations (2019-2021) and ozone concentrations (2019)
- Brawley-220 Main Street (AQS ID: 60250007) [13.8 miles from Project]: 24-hour PM2.5 concentrations (2019-2021), and annual PM2.5 concentrations (2019-2020)
- El Centro-9th Street (AQS ID: 60251003) [26.1 miles from Project]: annual PM2.5 concentrations (2021), ozone concentrations (2020-2021), 1-hour NO2 concentrations (2019-2021), and annual NO2 concentrations (2020-2021)
- Calexico-Ethel Street (AQS ID: 60250005) [34.6 miles from Project]: annual NO2 concentrations (2019), 1-hour SO2 concentrations (2019-2021), 24-hour SO2 concentrations (2019-2021), 1-hour CO concentrations (2019-2021), and 8-hour CO concentrations (2019-2021).

Figure 5: Monitoring Stations Identified In Application

The application fails to identify 40 additional monitoring stations currently being operated in Imperial County. According to the Identifying Violations Affecting Neighborhoods (IVAN) website, IVAN Air Monitoring is a network of 40 air monitors located throughout Imperial County. As of September 2016, all but 7 of these monitors have been installed. The 13 closest IVAN stations to the Project Site are shown below in Figure 5.

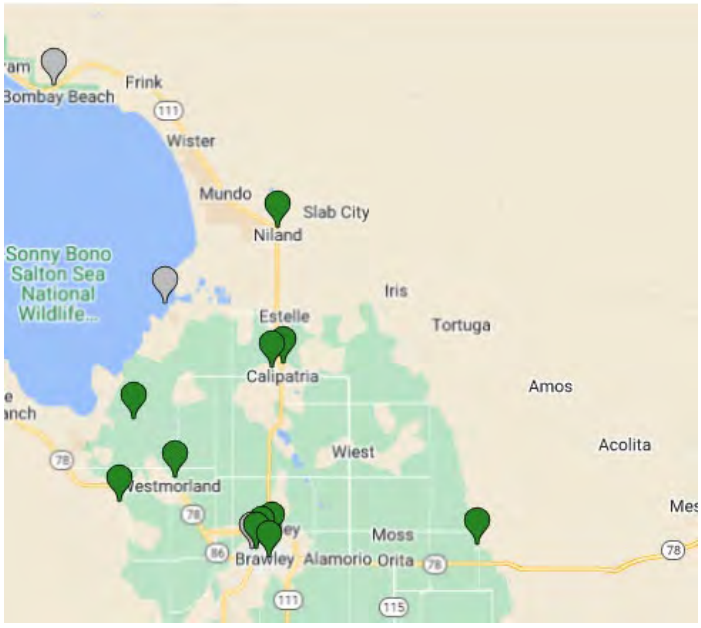


Figure 6: IVAN Monitoring Stations Near Project Site

The applicant should include all relevant monitoring sites in the background analysis of air quality to ensure that background concentrations are accurately reported for the region.

5. The PDOC Fails to Disclose and Analyze Background Concentrations for Hydrogen Sulfide

Nowhere in the application does the applicant disclose the concentrations of hydrogen sulfide measured in the community. And the ICAPCD did not include a background concentration as part of its cumulative impact analysis in the PDOC.

According to the Black Rock 1, 2, and 3 Geothermal Power Project – Major Amendment Staff Assessment (SA),[7] hydrogen sulfide is emitted as part of natural geologic and biologic processes, and is emitted from manmade sources such as oil production and refining, wastewater treatment, geothermal power plants, etc. The SA states that the Niland monitoring station was originally established to monitor ambient levels of H_2S in the geothermal area; however, because of extensive operating and quality control issues with the H_2S monitor, H_2S monitoring was discontinued. At the time the SA was prepared in 2010, the ICAPCD recommended a background concentration of 24.6 microgams per cubic meter (ug/m^3) based on an average hourly concentration that was monitored during 1993-1994, before the geothermal facilities at that time (Salton Sea Units 1, 2 and 3, Vulcan and Hoch) were retrofitted with H_2S controls, and also before Salton Sea Units 4 and 5, and CE Turbo started operation. The background concentration was 59% of the State standard of 42 ug/m^3.

Clearly the PDOC fails to disclose background concentrations for H_2S, thereby underestimating the cumulative impacts of the proposed projects on ambient H_2S concentrations in the area. If all of the sources are added to together it is clear that the Project would likely cause or contribute to an exceedance given that PDOC estimates that the maximum concentration of H_2S emissions from the Project is only 5.3 ug/m^3 below the CAAQS for H_2S.

6. The Dispersion Modeling Of Emissions From The Project Site Utilizes A Station 28 Miles Away From The Site.

The AERMOD analysis of the emissions from the Project Site utilized the meteorological data

[7] Black Rock 1, 2, and 3 Geothermal Project – Major Amendment, Staff Assessment, Dec. 3, 2010, p. 4.1-6 to 4.1-7, 4.1-11. Accessed at https://efiling.energy.ca.gov/GetDocument.aspx?tn=59129&DocumentContentId=50350.

from the Imperial County Airport (KIPL). This monitoring station is located 28 miles south of the Project Site. U.S. EPA guidance on the use of meteorological data requires that the data be spatially and climatologically (temporal) representativeness of the area. The representativeness of the measured data is dependent on numerous factors, including but not limited to: (1) the proximity of the meteorological monitoring station site to the area under consideration, (2) the complexity of the terrain, (3) the exposure of the meteorological site, and (4) the period of time during which the data are collected. Given this guidance, I recommend that the data from the Sonny Bono monitoring station (less than 2 miles from the Project Site) would be the best representation of the conditions that will exist during the construction and operational phase of the Project. Utilizing a meteorological station 28 miles south of the Project would not be the most representative modeling input.

A critical element in any air dispersion model is accurate, representative surface and upper air meteorological data. Given the long distance from the meteorological station at KIPL to the Project Site, collection of data from a closer meteorological station should be performed. Hourly meteorological and PM_{10} data from the IID's Sonny Bono monitoring station, operated as part of the Salton Sea Air Quality Mitigation Program, is available for the time period from 2015 through 2023.[8] This local, up to date information would provide a representative source for the dispersion modeling inputs.

7. The HRA For The Operational Phase Flawed And Fails To Account For The Risk From Radon Emissions

A review of the excel files for the HRA (Table 6 – Health Risk Results) shows that critical columns/cells in the spreadsheets are locked or hidden. The cells include the results of the HRA that would include the risk from each of the emitted pollutants associated with the Project. In the PDOC risk the Maximum Exposed Individual Worker (MEIW) is listed as 0.82 in 1,000,000. The Applicant should include unlocked files to allow for the validation of the tables within the HRA portion of the PDOC.

[8] Accessed at: https://www.dropbox.com/sh/xevsp0836vygiyj/AABQmBVzD95fUrrgjoIlTp50a?e=1&dl=0.

Table 10. Operational HRA Summary						
Receptor Type	**Receptor No.**	**UTM E (m)**	**UTM N (m)**	**Cancer Risk (per million)**	**Chronic HI**	**Acute HI**
PMI	50 [a] 75 [b]	630,714.83 [a] 630,254.29 [b]	3,672,138.02 [a] 3,671,995.77 [b]	18.7	1.29	2.41
MEIR	5,729 [a] 5,724 [b]	638,180.33 [a] 629,090.70 [b]	3,672,664.25 [a] 3,671,844.15 [b]	0.46	0.03	0.96
MEIW	50 [a] 75 [b]	630,714.83 [a] 630,254.29 [b]	3,672,138.02 [a] 3,671,995.77 [b]	0.82	1.29	2.41
Maximally Exposed Sensitive Receptor	5,729 [a] 5,724 [b]	638,180.33 [a] 629,090.70 [b]	3,672,664.25 [a] 3,671,844.15 [b]	0.46	0.03	0.96
Notes: [a] Receptor number and coordinates associated with cancer and chronic analyses. [b] Receptor number and coordinates associated with acute analyses. E = Easting m = meters N = Northing UTM = Universal Transverse Mercator						

As a check to the value reported in the application, an analysis of the comma separated file provided by the Applicant in the Elmore North Geothermal Project file for the cancer risk (BR_8760_Burden_CancerRisk.csv) was performed. In the csv files the results from the HRA performed using the HARP software is compiled in a format that that allows the risk from each of the pollutants of concern to be isolated. The cumulative result shows that the MEIW (Receptor 50) has a risk of 21.54 in 1,000,000. This discrepancy is not explained in the PDOC.

REC	GRP	X	Y	CONC	POLID	POLABBREV	RISK_SUM
50	ALL	630714.8	3672138	3.41E-06	7439921	Lead	3.65E-09
50	ALL	630714.8	3672138	0.080404	71432	Benzene	6.16E-06
50	ALL	630714.8	3672138	0.000445	100414	Ethyl Benzene	2.97E-09
50	ALL	630714.8	3672138	4.80E-08	7440417	Beryllium	3.09E-10
50	ALL	630714.8	3672138	1.44E-07	7440439	Cadmium	1.65E-09
50	ALL	630714.8	3672138	5.86E-07	7440020	Nickel	4.08E-10
50	ALL	630714.8	3672138	0.000892	9901	DieselExhPM	7.52E-07

REC	GRP	X	Y	CONC	POLID	POLABBREV	RISK_SUM
50	ALL	630714.8	3672138	5.85E-06	50000	Formaldehyde	9.41E-11
50	ALL	630714.8	3672138	2.59E-06	91203	Naphthalene	2.38E-10
50	ALL	630714.8	3672138	3.35E-06	75070	Acetaldehyde	2.56E-11
50	ALL	630714.8	3672138	1.72E-08	56553	B[a]anthracene	8.98E-10
50	ALL	630714.8	3672138	2.81E-08	218019	Chrysene	1.56E-10
50	ALL	630714.8	3672138	1.98E-08	205992	B[b]fluoranthen	1.10E-09
50	ALL	630714.8	3672138	4.40E-09	207089	B[k]fluoranthen	2.40E-10
50	ALL	630714.8	3672138	5.20E-09	50328	B[a]P	2.84E-09
50	ALL	630714.8	3672138	8.66E-09	193395	In[1,2,3-cd]pyr	4.69E-10
50	ALL	630714.8	3672138	8.26E-09	53703	D[a,h]anthracen	1.51E-09
50	ALL	630714.8	3672138	4.52E-05	7440382	Arsenic	1.46E-05
50	ALL	630714.8	3672138	1.48E-07	106990	1,3-Butadiene	6.81E-11
50	ALL	630714.8	3672138	4.80E-08	7440484	Cobalt	9.93E-10
						Risk From All Compounds	21.54 In 1,000,000

In addition, the health risk does not expressly quantify the risk from exposure to radon, a known human carcinogen, despite radon emissions from the Project's cooling tower. Radon is the number one cause of lung cancer among non-smokers, according to U.S. EPA estimates.[9] Overall, radon is the second leading cause of lung cancer. Radon is responsible for about 21,000 lung cancer deaths every year. About 2,900 of these deaths occur among people who have never smoked. On January 13, 2005, Dr. Richard H. Carmona, the U.S. Surgeon General, issued a national health advisory on radon.[10]

[9] U.S.EPA. 2024. Health Risk Of Radon. Accessed February 29, 2024. https://www.epa.gov/radon/health-risk-radon.

[10] HSS Press Office. 2005. Surgeon General Releases National Health Advisory On Radon . Thursday, January 13, 2005

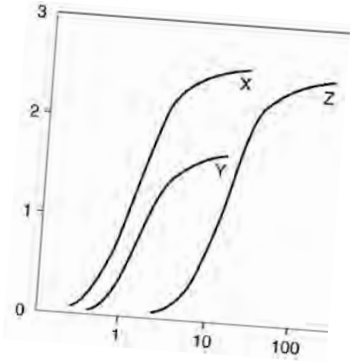
Conclusion

The facts identified and referenced in this comment letter lead me to reasonably conclude that the Project could result in significant impacts if allowed to proceed.

Sincerely,

Exhibit A:

Curriculum Vitae



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James J. J. Clark, Ph.D.

Principal Toxicologist

Toxicology/Exposure Assessment Modeling

Risk Assessment/Analysis/Dispersion Modeling

Education:

Ph.D., Environmental Health Science, University of California, 1995

M.S., Environmental Health Science, University of California, 1993

B.S., Biophysical and Biochemical Sciences, University of Houston, 1987

Professional Experience:

Dr. Clark is a well-recognized toxicologist, air modeler, and health scientist. He has 30 years of experience in researching the effects of environmental contaminants on human health including environmental fate and transport modeling (SCREEN3, AEROMOD, ISCST3, Johnson-Ettinger Vapor Intrusion Modeling, RESRAD, GENII); exposure assessment modeling (partitioning of contaminants in the environment as well as PBPK modeling); conducting and managing human health risk assessments for regulatory compliance and risk-based clean-up levels; and toxicological and medical literature research.

SELECTED AIR MODELING RESEARCH/PROJECTS

Client(s) - Confidential

Dr. Clark performed a historical dose reconstruction for community members from an active 700 acre petroleum refinery in Los Angeles. The analysis included a multi-year dispersion model was performed in general accordance with the methods outlined by the U.S. EPA and the SCAQMD for assessing the health impacts in Torrance, California. The results of the analysis are being used as the basis for injunctive relief for the communities surrounding the refinery.

Client(s) – Multiple

Indoor Air Evaluations, California: Performed multiple indoor air screening evaluations and risk characterizations consistent with California Environmental Protection Agency's (Cal/EPA) Department of Toxic Substances Control (DTSC) and Regional Water Quality Control Board (RWQCB) methodologies. Characterizations included the use of DTSC's

modified Johnson & Ettinger Model and USEPA models, as well as the attenuation factor model currently advocated by Cal/EPA's Office of Environmental Health and Hazard Assessment (OEHHA).

Client – Adams, Broadwell, Joseph Cardozo, P.C.

Dr. Clark has performed numerous air quality analyses and risk assessments of criteria pollutants, air toxins, and particulate matter emissions for sites undergoing evaluation via the California Environmental Quality Act (CEQA) process. The analyses include the evaluation of Initial Study (IS) and Environmental Impacts Reports (EIR) for each project to determine the significance of air quality, green house gas (GHG), and hazardous waste components of the projects. The analyses were compiled as comment letters for submittal to oversight agencies.

Client – Confidential

Dr. Clark performed a comprehensive evaluation of criteria pollutants, air toxins, and particulate matter emissions from a carbon black production facility to determine the impacts on the surrounding communities. The results of the dispersion model were used to estimate acute and chronic exposure concentrations to multiple contaminants and were be incorporated into a comprehensive risk evaluation.

Client – Confidential

Dr. Clark performed a comprehensive evaluation of air toxins and particulate matter emissions from a railroad tie manufacturing facility to determine the impacts on the surrounding communities. The results of the dispersion model have been used to estimate acute and chronic exposure concentrations to multiple contaminants and have been incorporated into a comprehensive risk evaluation.

PUBLIC HEALTH/TOXICOLOGY

Client: Confidential

Dr. Clark performed a historical dose reconstruction for community members from radiologically impacted material (RIM) releases from an adjacent landfill. The analysis was performed in general accordance with the methods outlined by the Agency for Toxic Substances Control (ATSDR) for assessing radiation doses from historical source areas in North St. Louis County, Missouri.

Client: City of Santa Clarita, Santa Clarita, California

Dr. Clark managed the oversight of the characterization, remediation and development activities of a former 1,000 acre munitions manufacturing facility for the City of Santa

Clarita. The site is impacted with a number of contaminants including perchlorate, unexploded ordinance, and volatile organic compounds (VOCs). The site is currently under a number of regulatory consent orders, including an Immanent and Substantial Endangerment Order. Dr. Clark assisted the impacted municipality with the development of remediation strategies, interaction with the responsible parties and stakeholders, as well as interfacing with the regulatory agency responsible for oversight of the site cleanup.

Client: Confidential

Dr. Clark performed a historical dose reconstruction for community members exposed to radioactive waste released into the environment from legacy storage facilities. The releases resulted in impacts to soils, sediments, surface waters, and groundwater in the vicinity of the sites. The analysis was performed in general accordance with the methods outlined by the Agency for Toxic Substances Control (ATSDR) for assessing radiation doses from historical source areas in the community.

Client: Confidential

Dr. Clark performed a dose assessment of an individual occupationally exposed to metals and silica from fly ash who later developed cancer. A review of the individual's medical and occupational history was performed to prepare opinions regarding his exposure and later development of cancer.

Client: Brayton Purcell, Novato, California

Dr. Clark performed a toxicological assessment of residents exposed to methyl-tertiary butyl ether (MTBE) from leaking underground storage tanks (LUSTs) adjacent to the subject property. The symptomology of residents and guests of the subject property were evaluated against the known outcomes in published literature to exposure to MTBE. The study found that residents had been exposed to MTBE in their drinking water; that concentrations of MTBE detected at the site were above regulatory guidelines; and, that the symptoms and outcomes expressed by residents and guests were consistent with symptoms and outcomes documented in published literature.

Client: Confidential

Dr. Clark performed a toxicological assessment of an individual occupationally exposed to hexavalent chromium who later developed cancer. A review of the individual's medical and occupational history was performed to prepare opinions regarding her exposure and later development of cancer.

Client: Covanta Energy, Westwood, California

Evaluated health risk from metals in biosolids applied as soil amendment on agricultural lands. The biosolids were created at a forest waste cogeneration facility using 96% whole tree wood chips and 4 percent green waste. Mass loading calculations were used to estimate Cr(VI) concentrations in agricultural soils based on a maximum loading rate of 40 tons of biomass per acre of agricultural soil. The results of the study were used by the Regulatory agency to determine that the application of biosolids did not constitute a health risk to workers applying the biosolids or to residences near the agricultural lands.

Client: Kaiser Venture Incorporated, Fontana, California

Prepared PBPK assessment of lead risk of receptors at a 1,100-acre former steel mill. This evaluation was used as the basis for granting closure of the site by lead regulatory agency.

RISK ASSESSMENTS/REMEDIAL INVESTIGATIONS

Kaiser Ventures Incorporated, Fontana, California

Prepared health risk assessment of semi-volatile organic chemicals and metals for a fifty-year old wastewater treatment facility used at a 1,100-acre former steel mill. This evaluation was used as the basis for granting closure of the site by lead regulatory agency.

ANR Freight - Los Angeles, California

Prepared a comprehensive Preliminary Endangerment Assessment (PEA) of petroleum hydrocarbon and metal contamination of a former freight depot. This evaluation was as the basis for reaching closure of the site with lead regulatory agency.

Kaiser Ventures Incorporated, Fontana, California

Prepared comprehensive health risk assessment of semi-volatile organic chemicals and metals for 23-acre parcel of a 1,100-acre former steel mill. The health risk assessment was used to determine clean up goals and as the basis for granting closure of the site by lead regulatory agency. Air dispersion modeling using ISCST3 was performed to determine downwind exposure point concentrations at sensitive receptors within a 1 kilometer radius of the site. The results of the health risk assessment were presented at a public meeting sponsored by the Department of Toxic Substances Control (DTSC) in the community potentially affected by the site.

Unocal Corporation - Los Angeles, California

Prepared comprehensive assessment of petroleum hydrocarbons and metals for a former petroleum service station located next to sensitive population center (elementary school). The assessment used a probabilistic approach to estimate risks to the community and was used as the basis for granting closure of the site by lead regulatory agency.

Client: Confidential, Los Angeles, California

Managed oversight of remedial investigation most contaminated heavy metal site in California. Lead concentrations in soil excess of 68,000,000 parts per billion (ppb) have been measured at the site. This State Superfund Site was a former hard chrome plating operation that operated for approximately 40-years.

Client: Confidential, San Francisco, California

Coordinator of regional monitoring program to determine background concentrations of metals in air. Acted as liaison with SCAQMD and CARB to perform co-location sampling and comparison of accepted regulatory method with ASTM methodology.

Client: Confidential, San Francisco, California

Analyzed historical air monitoring data for South Coast Air Basin in Southern California and potential health risks related to ambient concentrations of carcinogenic metals and volatile organic compounds. Identified and reviewed the available literature and calculated risks from toxins in South Coast Air Basin.

IT Corporation, North Carolina

Prepared comprehensive evaluation of potential exposure of workers to air-borne VOCs at hazardous waste storage facility under SUPERFUND cleanup decree. Assessment used in developing health based clean-up levels.

Professional Associations

American Public Health Association (APHA)
Association for Environmental Health and Sciences (AEHS)
American Chemical Society (ACS)
International Society of Environmental Forensics (ISEF)
Society of Environmental Toxicology and Chemistry (SETAC)

Publications and Presentations:

Books and Book Chapters

Sullivan, P., **J.J. J. Clark,** F.J. Agardy, and P.E. Rosenfeld. (2007). *Synthetic Toxins In The Food, Water and Air of American Cities*. Elsevier, Inc. Burlington, MA.

Sullivan, P. and **J.J. J. Clark**. 2006. *Choosing Safer Foods, A Guide To Minimizing Synthetic Chemicals In Your Diet*. Elsevier, Inc. Burlington, MA.

Sullivan, P., Agardy, F.J., and **J.J.J. Clark**. 2005. *The Environmental Science of Drinking Water*. Elsevier, Inc. Burlington, MA.

Sullivan, P.J., Agardy, F.J., **Clark, J.J.J.** 2002. *America's Threatened Drinking Water: Hazards and Solutions*. Trafford Publishing, Victoria B.C.

Clark, J.J.J. 2001. "TBA: Chemical Properties, Production & Use, Fate and Transport, Toxicology, Detection in Groundwater, and Regulatory Standards" in *Oxygenates in the Environment.* Art Diaz, Ed.. Oxford University Press: New York.

Clark, J.J.J. 2000. "Toxicology of Perchlorate" in *Perchlorate in the Environment.* Edward Urbansky, Ed. Kluwer/Plenum: New York.

Clark, J.J.J. 1995. Probabilistic Forecasting of Volatile Organic Compound Concentrations At The Soil Surface From Contaminated Groundwater. UMI.

Baker, J.; **Clark, J.J.J.**; Stanford, J.T. 1994. Ex Situ Remediation of Diesel Contaminated Railroad Sand by Soil Washing. Principles and Practices for Diesel Contaminated Soils, Volume III. P.T. Kostecki, E.J. Calabrese, and C.P.L. Barkan, eds. Amherst Scientific Publishers, Amherst, MA. pp 89-96.

Journal and Proceeding Articles

Tam L. K.., Wu C. D., Clark J. J. and **Rosenfeld, P.E.** (2008) A Statistical Analysis Of Attic Dust And Blood Lipid Concentrations Of Tetrachloro-p-Dibenzodioxin (TCDD) Toxicity Equialency Quotients (TEQ) In Two Populations Near Wood Treatment Facilities. Organohalogen Compounds, Volume 70 (2008) page 002254.

Tam L. K.., Wu C. D., Clark J. J. and **Rosenfeld, P.E.** (2008) Methods For Collect Samples For Assessing Dioxins And Other Environmental Contaminants In Attic Dust: A Review. Organohalogen Compounds, Volume 70 (2008) page 000527

Hensley A.R., Scott, A., Rosenfeld P.E., **Clark, J.J.J.** (2007). "Attic Dust And Human Blood Samples Collected Near A Former Wood Treatment Facility." *Environmental Research.* 105:194-199.

Rosenfeld, P.E., **Clark, J. J.,** Hensley, A.R., and Suffet, I.H. 2007. "The Use Of An Odor Wheel Classification For The Evaluation of Human Health Risk Criteria For Compost Facilities" Water Science & Technology. 55(5): 345-357.

Hensley A.R., Scott, A., Rosenfeld P.E., **Clark, J.J.J.** 2006. "Dioxin Containing Attic Dust And Human Blood Samples Collected Near A Former Wood Treatment Facility." The 26th International Symposium on Halogenated Persistent Organic Pollutants –

DIOXIN2006, August 21 – 25, 2006. Radisson SAS Scandinavia Hotel in Oslo Norway.

Rosenfeld, P.E., **Clark, J. J.** and Suffet, I.H. 2005. "The Value Of An Odor Quality Classification Scheme For Compost Facility Evaluations" The U.S. Composting Council's 13th Annual Conference January 23 - 26, 2005, Crowne Plaza Riverwalk, San Antonio, TX.

Rosenfeld, P.E., **Clark, J. J.** and Suffet, I.H. 2004. "The Value Of An Odor Quality Classification Scheme For Urban Odor" WEFTEC 2004. 77th Annual Technical Exhibition & Conference October 2 - 6, 2004, Ernest N. Morial Convention Center, New Orleans, Louisiana.

Clark, J.J.J. 2003. "Manufacturing, Use, Regulation, and Occurrence of a Known Endocrine Disrupting Chemical (EDC), 2,4-Dichlorophnoxyacetic Acid (2,4-D) in California Drinking Water Supplies." National Groundwater Association Southwest Focus Conference: Water Supply and Emerging Contaminants. Minneapolis, MN. March 20, 2003.

Rosenfeld, P. and **J.J.J. Clark**. 2003. "Understanding Historical Use, Chemical Properties, Toxicity, and Regulatory Guidance" National Groundwater Association Southwest Focus Conference: Water Supply and Emerging Contaminants. Phoenix, AZ. February 21, 2003.

Clark, J.J.J., Brown A. 1999. Perchlorate Contamination: Fate in the Environment and Treatment Options. In Situ and On-Site Bioremediation, Fifth International Symposium. San Diego, CA, April, 1999.

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Browne, T., **Clark, J.J.J.** 1998. Treatment Options For Perchlorate In Drinking Water. Proceedings From the Groundwater Resource Association Seventh Annual Meeting, Walnut Creek, CA, October 23, 1998.

Clark, J.J.J., Brown, A., Rodriguez, R. 1998. The Public Health Implications of MtBE and Perchlorate in Water: Risk Management Decisions for Water Purveyors. Proceedings of the National Ground Water Association, Anaheim, CA, June 3-4, 1998.

Clark J.J.J., Brown, A., Ulrey, A. 1997. Impacts of Perchlorate On Drinking Water In The Western United States. U.S. EPA Symposium on Biological and Chemical Reduction of Chlorate and Perchlorate, Cincinnati, OH, December 5, 1997.

Clark, J.J.J.; Corbett, G.E.; Kerger, B.D.; Finley, B.L.; Paustenbach, D.J. 1996. Dermal Uptake of Hexavalent Chromium In Human Volunteers: Measures of Systemic Uptake From Immersion in Water At 22 PPM. Toxicologist. 30(1):14.

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Harber, P.H.; Gong, H., Jr.; Lachenbruch, A.; **Clark, J.**; Hsu, P. (1992). Respiratory Pattern Effect of Acute Sulfur Dioxide Exposure in Asthmatics. American Review of Respiratory Disease. 145(4):A88.

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Tierney, D.F. and **J.J.J. Clark.** (1990). Lung Polyamine Content Can Be Increased By Spermidine Infusions Into Hyperoxic Rats. American Review of Respiratory Disease. 139(4):A41.