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March 11, 2024

Via E-Mail, U.S. Mail, and Docket No. 23-AFC-01

Jesus Ramirez
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Re: **California Unions for Reliable Energy's Comments on Preliminary Determination of Compliance for the Morton Bay Geothermal Power Generation Plant**

Dear Mr. Ramirez:

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 Morton Bay Geothermal, LLC ("Applicant"), an indirect, wholly owned subsidiary of BHE Renewables, LLC ("BHER") for the Morton Bay Geothermal Power Project ("Morton Bay" or "Project").

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 then be re-noticed, and the public must have a full and fair opportunity to comment on the revisions.

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.[1] 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.[2] 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 Sparger Abatement System, a hydrochloric acid ("HCl") scrubber, the cooling tower consisting of fourteen cells 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 fluid).[3] 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.[4]

We reviewed the PDOC, air quality permit application and amendments, and available supporting documents with the assistance of our technical expert, Komal Shukla, Ph.D., M.Sc., B.Sc., whose comments and qualifications are attached as Exhibit A.[5] Based on our review, we conclude the proposed Project fails to comply with all applicable Rules and Regulations of the Air District ("Rules"), including

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[1] TN 249723, Morton Bay Geothermal Project Application for Certification Volume 1 (Apr. 18, 2023), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=249723&DocumentContentId=84361.
[2] 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.
[3] 254307, Preliminary Determination of Compliance (PDOC) Morton Bay (Feb. 2, 2024), p. 49 (hereinafter "PDOC"), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=254307&DocumentContentId=89667.
[4] *Id.* at 49.
[5] **Exhibit A**, Letter to Kelilah Federman, Adams Broadwell Joseph & Cardozo from Komal Shukla, Group Delta re: Comment Letter Morton Bay Geothermal Preliminary Determination of Compliance (Mar. 8, 2024) (hereinafter "Shukla Comments").

Rule 207. As discussed in greater detail below, the PDOC suffers from fatal defects because it (1) fails to evaluate all emission sources, (2) shows that the Project would cause or contribute to the exceedance of Federal and State AAQS, (3) contains erroneous conditions, (4) fails evaluate whether the proposed Project and the nearby geothermal facility constitute a single sources, and (5) demonstrates that the non-cancer hazards are significant and unmitigated. In addition, the Air District failed to follow all required procedures when it released the PDOC.

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.[6] 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.

III. LEGAL STANDARD

The Imperial County Air Pollution Control District issued the PDOC for the Project pursuant to ICAPCD's Rule 207 for power plants. Rule 207 D.4.b requires

[6] TN 251919, Order Granting CURE's Petition to Intervene (Aug. 25, 2023), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=251919&DocumentContentId=86919.

the Air Pollution Control Officer to conduct a determination of compliance review, which "shall consist of a review identical to that which would be performed if an application for an Authority to Construct had been received for the power plant," and "shall apply all provisions of this Rule [Rule 207] which apply to applications for an Authority to Construct."[7] Under Rule 207 D.4.b, the PDOC itself must consist of a review identical to that which would be performed if an application for an authority to construct had been received for the power plant and shall apply all provisions of Rule 207. 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.[8]

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.[9] The Air District shall not issue a preliminary determination of compliance unless all requirements of Rule 207 are met.[10]

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.[11] 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.[12]

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

[7] Rule 207 D.4.b-c.
[8] Rule 207 D.4.e.1.
[9] Rule 207 D.4.e.3.
[10] *Id.*
[11] Rule 207 D.4.f.
[12] Rule 207 D.4.f.

changes are made to the PDOC, the Air District must re-circulate the revised PDOC for public review and comment.

IV. THE AIR DISTRICT DID NOT PERFORM THE COMPLIANCE REVIEW REQUIRED BY DISTRICT RULE 207 AND MUST ISSUE A NEW PDOC THAT COMPLIES WITH ITS RULES

The PDOC does not ensure that the operation of the Project will not interfere with the attainment or maintenance of ambient air quality standards, nor does it ensure no net increase in emissions from new sources which emit 137 pounds per day or more of nonattainment pollutants or their precursors.[13] The PDOC fails to rely on accurate or representative data for modeling. Thus, the PDOC does not meet the legal requirements of the District's own rules or the other applicable requirements for new source review under local, state and federal law. The District must issue a revised PDOC for public comment that complies with the law.

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*").[14] The *Guidelines* provide a common basis for estimating the air quality concentrations of criteria pollutants used in assessing control strategies and developing emissions limits.[15]

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.[16] The representativeness of the measured data is

[13] Rule 207 A.1.b.
[14] 40 C.F.R Pt. 51, App. W; *see also* 82 Fed. Reg. 5182-235 (Jan. 17, 2017).
[15] 40 C.F.R Pt. 51, App. W, Preface.
[16] 40 C.F.R Pt. 51, App. W § 8.4.1.b.

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 the terrain, (3) the exposure of the meteorological monitoring site, and (4) the period of time during which data are collected.[17] 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.[18] 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.[19] The Applicant claims the data set was selected based on completeness, similar surrounding land use as the plant site and proximity to the facility.[20]

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. The Airport is over 28 miles away from the Project site.[21] The choice to utilize data from so far contradicts the requirement to ensure spatial and climatological representativeness of the data under consideration.[22]

Dr. Shukla 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.[23] This monitoring station is less than 2 miles from the Project site.[24] Nine years (2015-2023) of hourly meteorological data and PM data collected from the station is publicly available online.[25]

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[17] *Ibid*.
[18] PDOC at p. 27.
[19] TN 250006-2, Morton Bay 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=250006-2&DocumentContentId=84742.
[20] *Ibid*.
[21] *Ibid*.
[22] Shukla Comments, p. 23.
[23] *Ibid*.
[24] *Ibid*.
[25] *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.

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.[26] The station is equipped with a Themo Fisher Scientific TEOM 1405-D to take real-time measurements of PM_{10}.[27] The TEOM has a co-located 10-meter-tall meteorological tower equipped with instruments needed to support standard regulatory air dispersion models, including AERMOD.[28] The meteorological instruments are subject to site check and audits, data processing and quality assurance/quality control procedures, and calibration and audit procedures.[29]

Despite Imperial County's existing non-attainment status for ozone and PM_{10}, the analysis fails to incorporate data from the nearby Sonny Bono monitoring station, situated within 2 miles of the project site, which holds pertinent air quality information for 2019 and 2020.[30] This oversight undermines the completeness and accuracy of the Air District's review. The Air Quality Permit Application relies on monitoring stations for PM_{10} and $PM_{2.5}$ background concentrations, such as Niland-English Road and Brawley-220 Main Street which are 7.6 miles and 13.8 miles away from the Project site, respectively. A more accurate approach would utilize background concentration values from the Sonny Bono station, which not only is in closer proximity but also covers the more recent years of 2021 and 2022, thereby providing a more accurate depiction of current background pollution levels.[31]

The PDOC fails to include background concentration data from the 40 additional monitoring stations currently active in Imperial County.[32] Identifying Violations Affecting Neighborhoods ("IVAN") Air Monitoring network consists of 40 air monitors strategically placed throughout Imperial County.[33] 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.

To comply with EPA Guidelines and ensure accurate modeling, the Air District should have required that the Applicant utilize representative

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[26] 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.
[27] *Id*. at p. 43.
[28] *Id*. at p. 43.
[29] *Id*. appen. C at p. C-18; *see also id*., appen. D-2.
[30] Shukla Comments, p. 15.
[31] *Id.* at 22.
[32] *Id.*
[33] Shukla Comments, p. 22.

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[34]

Background concentrations are essential in constructing the air quality concentration for a cumulative impact analysis.[35] 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.[36] 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.[37] 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.[38]

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.[39] 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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[34] In addition to analyzing cumulative impacts, the Air District may also be required to analyze this project in conjunction with the Applicant's other concurrently proposed nearby geothermal facilities, including Elmore North and J.J. Elmore, as a single stationary source pursuant to Rule 207 and other applicable provisions of the federal Clean Air Act. 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." Rule 207.B. The PDOC lacks discussion of the factors described in Rule 207., and lacks any supporting evidence to conclude that the facilities are not a single source required to undergo a joint analysis pursuant to Rule 207.B.
[35] 40 C.F.R Pt. 51, App. W § 8.3.1.
[36] *Id*. §§ 8.3.1.i., 8.3.1.3.
[37] *Id*. §§ 8.3.1.i., 8.3.1.3.
[38] 40 C.F.R Pt. 51, App. W § 8.3.1.3.a.
[39] AQP Application at p. 5.1-43, fn. 7.

Dr. Shukla concludes that the PDOC falls short in its air quality analysis by omitting a crucial consideration—the emissions from operational geothermal facilities near the Project.[40] Notably absent from the cumulative emission evaluation are emissions from the CalEnergy Salton Sea Units 1 & 2/3&4/5 facilities, CalEnergy JM Leathers Facility, CalEnergy Central Services facility, CalEnergy Vulcan/Del Ranch facilities, and the existing CalEnergy JJ Elmore Facility (Figure 5 and Table 2).[41] The oversight extends to the exclusion of criteria pollutants (NOx, SOx, PM, CO, lead) and air toxins (VOCs, including benzene, toluene, diesel particulate matter, etc.) from the comprehensive assessment.[42]

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.[43] Therefore, the modeling must also consider other existing and proposed facilities within 6 miles of the Project site including: CalEnergy Salton Sea Units 1 & 2/3&4/5 facilities, CalEnergy JM Leathers Facility, CalEnergy Central Services facility, CalEnergy Vulcan/Del Ranch facilities, and CalEnergy JJ Elmore Facility.[44] All these geothermal facilities emit the same criteria pollutants of concern as Morton Bay.

Further, Dr. Shukla found that localized monitoring of particulate matter reveals a distinct concentration gradient, with higher PM10 concentrations observed downwind of the Sonny Bono Salton Sea National Wildlife Reserve.[45] This observed gradient strongly implies a potential influence from existing facilities.[46] The failure to incorporate these emissions into the analysis raises substantial doubts about the overall accuracy and completeness of the Project's air quality impact assessment.[47] The Project results in a potentially significant exacerbation of cumulative pollutant gradients with the introduction of additional geothermal plants in the Project vicinity.[48]

Dr. Shukla concludes that "[t]he potential cumulative effects on air quality, emissions, and overall environmental health necessitate a comprehensive analysis that encompasses the combined influence of all geothermal activities in the region. Addressing this oversight in a revised PDOC is paramount to ensuring a thorough

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[40] Shukla Comments, p. 11.
[41] *Id.*
[42] *Id.*
[43] 40 C.F.R Pt. 51, App. W § 8.3.3.b.iii.
[44] Shukla Comments, p. 11.
[45] *Id.*
[46] *Id.*
[47] Shukla Comments, p. 11.
[48] *Id.*

understanding of the cumulative environmental impact of geothermal projects in the area."[49] This data is necessary to provide an accurate calculation of emissions.

The Air District cannot adequately assess whether Morton Bay will cause or contribute to a violation of the AAQS based on the analysis provided in the application or PDOC alone, nor are the PDOC's findings regarding the severity of exceedances supported by substantial evidence if relevant data is missing from the Air District's analysis. The Air District must require the Applicant to conduct a complete cumulative impact analysis that is expanded to include all the above sources, report the results of that analysis in a revised PDOC, and identify any additional BACT measures necessary to reduce cumulative exceedances.

V. 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.[50] 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 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 March 6, 2024, the EPA published a final rule to strengthen the NAAQS for $PM_{2.5}$.[51] EPA revised 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.[52] Based on 2020-2022

[49] *Id.* at 13.
[50] Rule 207.F.1.
[51] 89 Fed. Reg. 16202-406 (Mar. 6, 2024), *available at* https://www.govinfo.gov/content/pkg/FR-2024-03-06/pdf/2024-02637.pdf.
[52] 89 Fed. Reg. 16204-05.

data, Imperial County does not meet the revised annual primary $PM_{2.5}$ standard of 9.0 $\mu g/m^3$.[53]

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. Since the EPA published the new rule on March 6, 2024, the more stringent federal requirements become effective on May 6, 2024. 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 Applicant's 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 $PM_{2.5}$ is 0.41 $\mu g/m^3$ and the background concentration is 8.67 $\mu g/m^3$, for a total concentration of 9.08 $\mu g/m^3$.[54] The Air District cannot issue a PDOC until the Applicant demonstrates that the Project complies with the revised annual $PM_{2.5}$ standard.

B. The Project May 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.[55] The proposed Project exceeds the emission threshold of 100 pounds per day for H_2S.[56] The proposed Project also exceeds the BACT threshold of potential to emit equal to or

[53] 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* https://www.epa.gov/system/files/documents/2024-02/table_annual-pm25-county-design-values-2020-2022-for-web.pdf.
[54] PDOC at p. 28.
[55] PDOC at p. 14.
[56] *Id*. at p. 24.

greater than 55 pounds per day.[57] With implementation of BACT, the Project is estimated to emit a maximum concentration of 37.5 µg/m^3.[58] **Dr. Shukla calculated that "when added to the background H_2S, the total concentration reaches 67.5 µg/m^3, significantly surpassing the standard."[59]**

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.[60] 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.[61] 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 µg/m^3 based on an average hourly concentration that was captured by the Niland monitoring station from 1993-1994.[62] Dr. Shukla 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.[63] 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.

C. The Measures Proposed to Reduce Hydrogen Sulfide Emissions Not Meet the BACT Requirement for This Project

The PDOC provides that control measures will be required for filter cake handling, but the PDOC lacks evidence that the specific technologies or procedures will be sufficiently effective at reducing H2S emissions. Dr. Shukla determined that additional information on these controls is necessary to determine their efficacy.[64]

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[57] *Ibid.*
[58] *Id.* at p. 28.
[59] *Id.* at 22.
[60] *Id.* at 10.
[61] *Ibid.*
[62] *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.
[63] Shukla Comments at p. 10.
[64] Shukla Comments at p. 8.

Moreover, Dr. Shukla finds that a "thorough analysis of the proposed sparger system and biological oxidation box should be conducted, considering their effectiveness, reliability, and potential limitations" before the PDOC can be issued. Dr. Shukla determined that additional feasible BACT measures are available to further reduce H2S emissions. The Air District should consider additional feasible BACT measures to reduce H2S emissions before the PDOC can be issued.

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

AB 2588 requires facilities that are ranked as a high priority to submit a HRA to the Air District.[65] 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.[66] The HRA must be consistent with the Risk Management Guidance for Stationary Sources of Air Toxics.[67]

The Applicant prepared an HRA following the Office of Environmental Health Hazard Assessment Risk Assessment Guidelines.[68] The HRA estimated risks of cancer, non-cancer chronic exposure, and non-cancer acute exposure based on AERMOD and HARP2 modeling.[69] 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

The Air District has not formally established health risk thresholds. However, based on the Air District's response to CARB and the California Air

[65] Health & Safety Code § 44340.
[66] 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).
[67] Health & Safety Code § 44340(a).
[68] AQP Application Appendix 5.9A; PDOC at p. 34.
[69] PDOC at p. 34.

Pollution Control Officers Association ("CAPCOA"), the District identified the following permitting levels:[70]

- 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.
- 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.[71]

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").[72] SCAQMD has adopted the same thresholds as those communicated by the Air District to CARB and CAPCOA.[73] 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:[74]

- The cumulative increase in MICR will not result in any of the following:[75]
    - An increased MICR greater than one in one million at any receptor location, if the permit unit is constructed without T-BACT;[76]

[70] 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.
[71] *Ibid.*
[72] AQP Application at p. 5.9-3; *see also* PDOC at p. 35.
[73] 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.
[74] SCAQMD Rule 1401(d).
[75] SCAQMD Rule 1401(d)(1).
[76] SCAQMD Rule 1401(d)(1)(A).

  - An increased MICR greater than ten in one million at any receptor location, if the permit is constructed with T-BACT;[77]
  - A cancer burden greater than 0.5.[78]
- 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.[79]
- The cumulative increase in total acute HI for any target organ system due to total emissions from the new, relocated or modified permit unit owned and operated by the applicant will not exceed 1.0 at any receptor.[80]

Here, the PDOC acknowledges that the proposed Project exceeds the thresholds for the maximally exposed individual worker and points of maximum impact for both chronic and acute HI during routine operation of the cooling tower without startups and shutdowns, emergency generators, fir pump and HCl scrubber.[81] Specifically, the PDOC shows that the chronic and acute HI for the maximally exposed individual worker ("MEIW") is 1.41 and 2.46, respectively.[82] 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. Shukla reviewed the AERMOD and HARP modeling files for the HRA and found that excel cells and sheets were locked or hidden[83] which would identify how emissions and health risks were summarized and their underlying sources of

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[77] SCAQMD Rule 1401(d)(1)(B).
[78] SCAQMD Rule 1401(d)(1)(C).
[79] SCAQMD Rule 1401(d)(2).
[80] SCAQMD Rule 1401(d)(3).
[81] PDOC at p. 34.
[82] *Id.* at 36.
[83] The Air District may not rely on locked or hidden files that are not disclosed to the public to support its emissions calculations and conclusions in the PDOC. State law, including the California Public Records Act and the California Clean Air Act, provide that emissions data and calculations used to support or related significance determination are subject to public disclosure. "[A]ll information, analyses, plans, or specifications that disclose the nature, extent, ***quantity or degree of air contaminants*** or other pollution which any article, machine, equipment or other contrivance will produce, which any . . . air pollution management district [. . .] requires any applicant to provide before the applicant [. . .] operates, sells, rents or uses the article, machine, equipment, or other contrivance, ***are public records***." Gov. Code § 7924.510(a). "Nothwithstanding any other provision of law, all ***air pollution emission data***, including those emission data which constitute trade secrets as defined in subdivision (d), ***are public records***." Gov. Code § 7924.510(d); Health and Safety Code § 44346(h).

data.[84] The underlying data revealed that the health risk does not expressly quantify the risk from exposure to radon.[85] As Dr. Shukla notes, and the Applicant's air quality permit application confirms,[86] radon will be emitted from the proposed Project.[87]

Radon is a human carcinogen emitted from the cooling tower during normal operation, warm-up, and shutdown.[88] Radon, a colorless and odorless radioactive gas, poses significant health risks when inhaled. As it undergoes radioactive decay, radon releases solid particles that, when trapped in the lungs, emit alpha particles, increasing the risk of lung cancer), identified as the primary cause of lung cancer among non-smokers, contributes to approximately 21,000 lung cancer deaths annually, with a notable 2,900 cases occurring in non-smokers[89]. Despite the gravity of this issue, the PDOC lacks a thorough analysis of the specific health risks posed by radon emissions, including its potential carcinogenic impacts on human health.

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.[90] The Airport meteorological data utilized to model is not representative of the Project site despite the availability of data from the Sonny Bono monitoring station just two miles away. The Air District's failure to accurately model the Project's health risks must be rectified before the Air District can issue a final PDOC.

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[84] *Ibid.*
[85] *Ibid.*
[86] AQP Application at p. 5.1-17.
[87] Shukla Comments at p. 28.
[88] *Id.*
[89] U.S. Environmental Protection Agency, Health Risk of Radon (last updated Feb. 27, 2024), *available at* https://www.epa.gov/radon/health-risk-radon.
[90] AQP Application at p. 5.9-4; PDOC at p. 34.

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.[91] 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.[92] 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%).[93] The Project anticipates using approximately 789,000 gallons of the <37% HCl and approximately 10,400,000 gallons of the 2.5% HCl.[94] Both tanks include a HCl scrubbing system.[95]

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.[96] However, neither the Applicant, nor the Air District address the 800-gallon HCl storage tank and associated scrubber.[97] 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.

VII. THE PROPOSED CONDITIONS ARE NOT ADEQUATE

A. 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.[98] The throughput limit is set at 52,560,000 gallons per year.[99] This throughput far exceeds the anticipated annual quantities for HCl. As stated in the revised project description, the Project

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[91] 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.
[92] TN 253188, Revised General Arrangement Refinement (Nov. 17, 2023) p. 1 (hereinafter "Revised Project Description"), *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=253188&DocumentContentId=88397.
[93] *Ibid.*
[94] *Id.* at p. 36.
[95] *Id.* at p. 1.
[96] PDOC at p. 13.
[97] Shukla Comments at p. 9.
[98] PDOC at p. 39.
[99] *Ibid.*

is estimated to use approximately 789,000 gallons per year of HCl <37%.[100] 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.[101] 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.

VIII. CONCLUSION

For the reasons stated above, the Air District should inform the California Energy Commission that it cannot issue a PDOC and must 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
Kelilah D. Federman

KDF:acp

[100] Revised Project Description at p. 36.
[101] *Ibid.*

EXHIBIT A

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March 8, 2024

Adams Broadwell Joseph & Cardozo
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Attn: Ms. Kelilah Federman

Subject: Comment Letter Morton Bay Geothermal Project Preliminary Determination of Compliance (PDOC)

Dear Ms. Federman:

In compliance with the request from Adams Broadwell Joseph & Cardozo (ABJC), Dr. Komal Shukla (Shukla) has undertaken a comprehensive review of the materials associated with the referenced project.

It is important to note that Dr. Shukla's review of the materials is not indicative of an endorsement for the conclusions or content contained within the documentation. The lack of specific comments on a particular item should not be

construed as acceptance of that item.

Project Description:

According to the Air Quality Permit Application lodged with the Imperial County Air Pollution Control District (ICAPCD) and docketed at California Energy Commission Docket No. 23-AFC 01, the proposed Morton Bay Geothermal Project (MBGP)[1] seeks approval for construction within the Salton Sea Known Geothermal Resource Area (KGRA) in Calipatria, Imperial County, California (Figure 1). Spanning approximately 63 acres of an unincorporated area, the MBGP envisions geothermal production wells, pipelines, fluid and steam handling facilities, a solid handling system, Class II surface impoundment, service water pond, retention basin, process fluid injection pumps, power distribution center, borrow pits, and injection wells. The MBGP targets a gross output of 157 megawatts (MW), with a net output of 140 MW. The project site is situated east of the Salton Sea and is bordered 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.

In the Salton Sea Known Geothermal Resource Area, geothermal brine, exceeding 500 degrees Fahrenheit, is extracted from nine production wells around the power plant and transported via aboveground pipelines to the nearby steam handling system. The process involves producing high-pressure steam and flashing the remaining geothermal fluids at lower pressures to create standard and low-pressure steam for the turbine. Dilution water is added for precipitation control. An atmospheric flash tank ensures pressure removal before entering clarifiers that remove suspended solids. Solids precipitation is crucial for transforming the geothermal fluid to chemical equilibrium. Different injection wells handle spent geothermal fluid, aerated geothermal fluid, and condensate. Mixing fluids risks scaling and excess precipitation, threatening sustainable injection. The steam is sent to a triple condensing steam turbine, and condensed steam serves as cooling tower makeup water. Noncondensable gas (NCG) is extracted for hydrogen sulfide (H_2S) abatement using an oxidizing biocide process (BIOX). Finally, electricity generated is transmitted to an onsite substation, delivering energy to a new Imperial Irrigation District (IID) switching station via a short interconnection transmission (gentie) line.

Project Components:

- Geothermal Resource Production Facility (RPF)
- Geothermal-Powered Power Generation Facility (PGF)
- Associated Facilities

[1] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. (TN250006-2) Dated May 4, 2023.

RPF Features:

- Geothermal Production Wells: Extraction points for geothermal brine.
- Pipelines: Aboveground conduits for fluid transportation.
- Geothermal Fluid and Steam Handling Facilities: Facilities managing the extracted geothermal fluid and steam.
- Solid Handling System: System for managing solid byproducts.
- Class II Surface Impoundment: Containment for managing surface fluids.
- Service Water Pond: Reservoir for service water.
- Retention Basin: Basin for retaining fluid.
- Process Injection Pumps: Pumps for injecting fluid into the process.
- Power Distribution Center: Hub for distributing power.
- Geothermal Injection Wells: Wells for injecting geothermal fluid back into the reservoir.
- Steam-Polishing Equipment: Equipment ensuring turbine-quality steam.

PGF Components:

- Triple Pressure Condensing Turbine/Generator Set: Turbine/generator system for power generation.
- Surface Condensers: Devices for condensing steam back into water.
- Non-Condensable Gas (NCG) Removal System: System for removing non-condensable gases.
- NCG Sparger Abatement System: System for abating hydrogen sulfide (H_2S) in NCG.
- Condensate Bio-Oxidation Abatement Systems: Systems for abating condensate through bio-oxidation in the cooling tower.
- Heat Rejection System: System for rejecting heat from the process.
- Generator Step-Up Transformer (GSU): Transformer for increasing generator voltage.
- 230 kV Substation: Substation for managing 230 kV power.
- Power Distribution Centers: Hubs for distributing power.
- Emergency Standby Diesel Fueled Engines: Backup generators and fire water pump for emergencies.

Shared Facilities:

- Control Building: Facility housing control systems.
- Service Water Pond: Reservoir for service water.
- Other Ancillary Facilities: Additional supporting facilities.

Cooling Tower:

- Mechanical Draft Counterflow Wet Cooling Tower: Cooling tower using mechanical draft counterflow wet method.

Steam Turbine Details:

- Maximum Continuous Rating (MCR): 157 MW.
- Generator Rated Capacity: Approximately 174,000 kVA at a 0.85 power factor.

Facility Description and Location:

The Project site is bounded by McDonald Road to the north, Davis Road to the east, and Schrimpf Road to the south. The town of Niland is approximately 4 miles northeast of the plant site, and the town of Calipatria is approximately 7 miles southeast of the plant site. The Red Hill Marina County Park is approximately 1.6 miles east of the PGF. The Sonny Bono Wildlife Refuge Headquarters is approximately 2 miles northeast of the PGF. The Alamo River is approximately 0.7 mile southwest of the plant site, and the New River is approximately 5 miles southwest of the plant site.

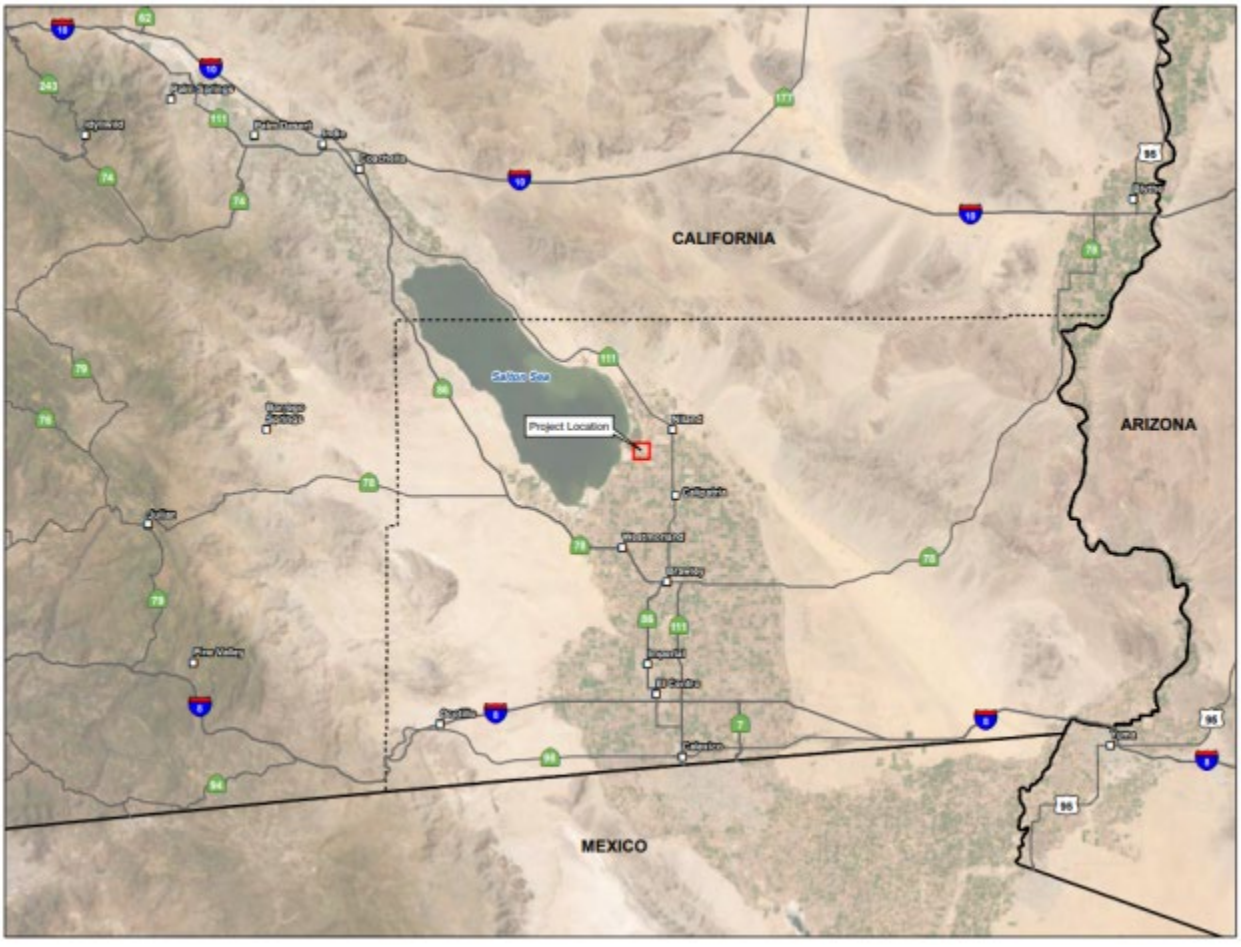

Figure 1: Project Vicinity Morton Bay Geothermal Project Imperial County, California

The RPF includes geothermal production wells, pipelines, geothermal fluid and steam handling facilities, a solid handling system, a Class II surface impoundment, a service water pond, a water retention basin, process injection pumps, one power distribution center, and injection wells (Figure 2 and Figure 3).

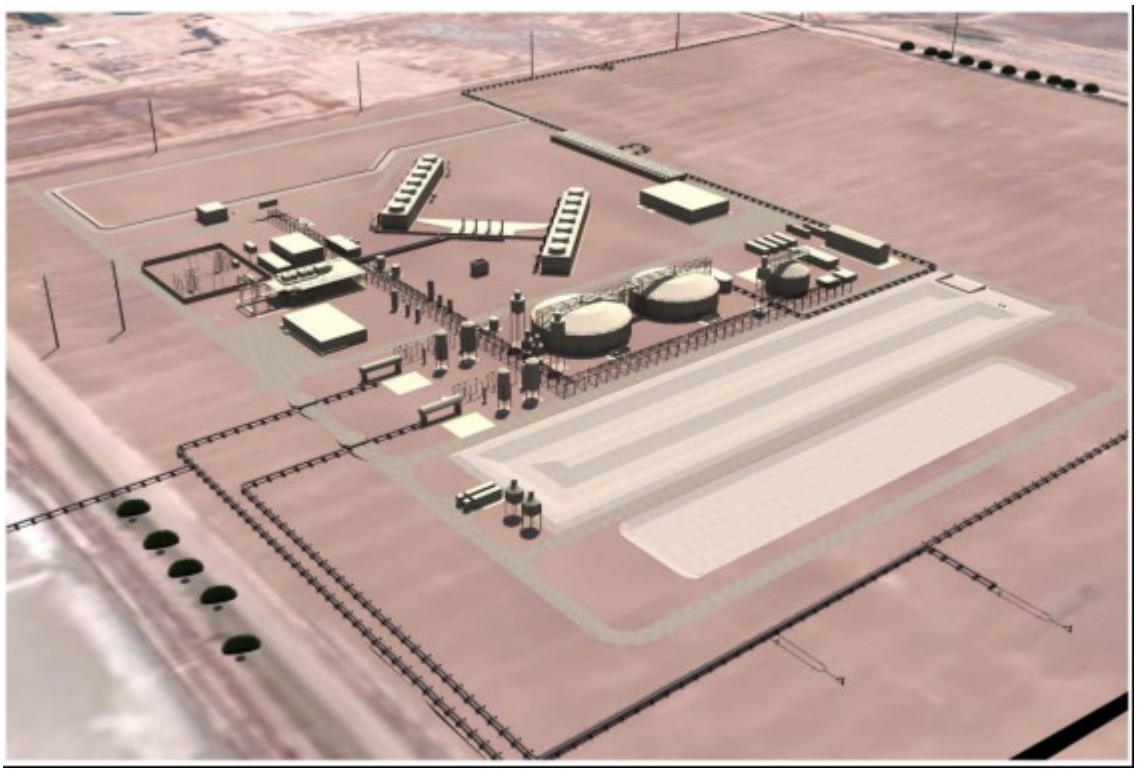

Figure 2: Architectural Rendering, Morton Bay Geothermal Project Imperial County, California

Project Site Location and Current Air Quality Considerations

The proposed Morton Bay Geothermal Project (MBGP) is situated near the southern end of the Salton Sea, close to Calipatria in Imperial County (Figure 3). Surrounding land uses encompass existing geothermal power facilities, agricultural areas, and the Sonny Bono Salton Sea National Wildlife Refuge. Noteworthy is the fact that the Imperial Valley Air District 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.

Additionally, the immediate vicinity of the Project Site has been identified as

a disadvantaged community[2] under Senate Bill 535 (Figure 4). This designation necessitates State investments to enhance public health, improve the quality of life, and boost economic opportunities in California's most burdened communities. Simultaneously, it aims to reduce pollution contributing to climate change. These investments are authorized by the California Global Warming Solutions Act of 2006 (Assembly Bill 32, Nunez, 2016). Introducing additional air pollutants to an already impacted community will disproportionately affect the residents, warranting thorough consideration and careful planning for the MBGP.

Figure 3: Project Location Morton Bay Geothermal Project Imperial County, California

[2] https://calepa.ca.gov/envjustice/ghginvest/

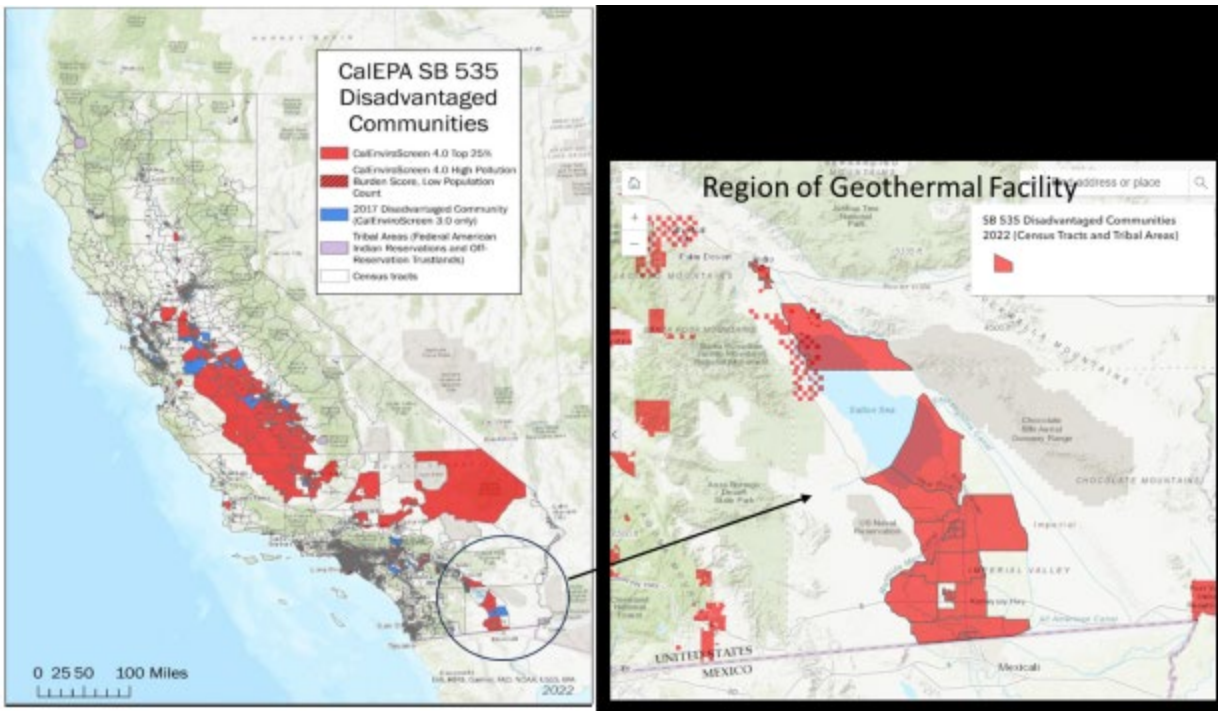

Figure 4: Disadvantaged Communities in California: A Geospatial Representation of Locations in Proximity to Geothermal Power Plants

The PDOC[3] lacks adherence to ICAPCD rules, particularly Rule 207 concerning new and modified stationary sources. This deficiency is evident in its omission of a comprehensive assessment of cumulative impacts resulting from Project emissions in conjunction with other proposed projects. Furthermore, the document inadequately analyzes the health risks associated with the release of radon into the community and neglects to evaluate emissions stemming from the storage of hydrogen chloride and the hydrogen chloride scrubbing system.

Air Quality Concerns

The Project is situated within 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}). The application asserts that potential air quality impacts of the Project will be effectively mitigated through the implementation of best available control technology (BACT) specifically designed for managing hydrogen sulfide (H_2S) emissions arising from geothermal processes and addressing particulate matter emissions stemming from cooling tower operations. According to the application's analysis, post-mitigation measures would result in the Project exhibiting less than

[3] TN254307, Preliminary Determination of Compliance (PDOC) Morton Bay (hereinafter "PDOC"), *available at (February 2 2024)* https://efiling.energy.ca.gov/GetDocument.aspx?tn=254004&DocumentContentId=89308.

significant impacts on air quality and public health.

In this context, provided information outlined in air quality permit application[4] states that "*Particulate emissions from the filter cake handling equipment will be controlled by minimizing handling and keeping the filter cakes covered*"[5] and that "*Low concentrations of H_2S are present in non-condensable gas and condensate in the main condenser*."[6]

- The document briefly addresses control measures for filter cake handling equipment but lacks details on the specific technologies or procedures in place. Additional information on these controls is necessary to determine their efficacy.

- The document describes the removal of non-condensable gases (NCGs) containing H_2S through the GRS and subsequent abatement in the cooling tower. However, it lacks specific details on the efficiency of this process and potential variations under different operational conditions.

- The mention of a compliance limit for H_2S emissions is made, but the document does not specify the actual numerical limit or reference the applicable regulations or standards. This information is crucial for a comprehensive assessment.

- The document does not elaborate on the frequency and methodology of monitoring for both particulate and H_2S emissions. A robust monitoring plan is essential for ensuring ongoing compliance and addressing potential variations over time.

- To enhance transparency and accountability, it is advisable to include specific references to relevant environmental regulations or standards governing particulate and H_2S emissions. This would allow for a clear understanding of the regulatory framework guiding the project.

According to the applicant's statement, project operations will not lead to emissions surpassing the ICAPCD Rule 207(B) "major stationary source" thresholds. Additionally, the facility is expected to stay within the limits defined by Rule 207(C)(2)(a) offset threshold values. The applicant asserts their commitment to implementing Best Available Control Technology (BACT) specifically targeting particulate matter and hydrogen sulfide (H_2S). But, the PDOC's proposed BACT may

[4] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. Dated May 4, 2023
[5] *Ibid*
[6] *Ibid*

be insufficient to reduce H2S emissions.

Inadequate BACT Analysis and Ambiguous Technology Claims for H2S Control

The application states that "*ICAPCD approved a BACT analysis for a similar facility in 2017. This approved BACT analysis utilized a sparger system for H2S removal from the gas stream and a biological oxidation box to oxidize the liquid phase H2S into...*"[7]

Relying on a BACT analysis from 2017 for a different facility does not fully account for the specific BACT needs of this facility or advancements in emission control technologies since that time. The PDOC's reliance on a 2017 BACT analysis does not demonstrate that the most effective and current BACT measures will be applied to this facility. It is essential to conduct an updated analysis considering the latest available technologies and the specific characteristics of the proposed project.

The application quotes *"The proposed Project would use up-to-date technologies and the H2S control system is typical in geothermal power plant designs that have been permitted in other air districts and in other states.*"[8] The statement that the proposed Project would use up-to-date technologies lacks requisite specificity. The Air District must provide a detailed description of the technologies and their alignment with the latest industry standards to validate this claim. In particular, a thorough analysis of the proposed sparger system and biological oxidation box should be conducted, considering their effectiveness, reliability, and potential limitations. Additionally, alternative technologies or control measures must be explored and compared to the currently proposed BACT measures to ensure the selected system represents the best available control technology options.

Identified Gaps and Insufficient Aspects in Proposed Construction Mitigation Measures

The proposed mitigation measures for construction-related air quality impacts outlined in Section 5.1.7.2.2 are a comprehensive set aimed at addressing fugitive dust emissions during project development. While they align with ICAPCD Regulation VIII and CEQA Guidelines, a critical evaluation reveals potential gaps and suggests more stringent measures:

- **Opacity Limit of 20%:** The specified 20% opacity limit may not suffice to prevent significant dust emissions, especially in regions sensitive to air quality.

[7] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. Dated May 4, 2023
[8] *Ibid*

Recommending a more stringent limit, such as 10%, would better align with stricter air quality standards and safeguard against potential adverse impacts.

- **Unpaved Road Stabilization:** While the stabilization of unpaved roads is addressed, considering a complete prohibition of unpaved roads within urban areas, regardless of population density, would be a more robust approach. This would prevent dust emissions in densely populated regions.

- **Track-Out Cleaning:** The requirement to clean track-out daily is commendable, but extending this measure to all areas, irrespective of urban status, would ensure consistent protection against dust dispersion onto paved roads.

- **Alternative Fueled Equipment:** The recommendation to use alternative-fueled equipment is positive. However, specifying a percentage of equipment that must be alternative fueled could enhance the enforceability and impact of this measure, ensuring a meaningful shift toward cleaner technologies.

- **Limiting Heavy-Duty Equipment Operation:** The suggestion to limit operation hours is somewhat vague. A more effective approach would be to establish specific operational restrictions, perhaps during periods of higher air quality sensitivity, to better control emissions.

- **Idling Time Reduction:** While limiting idling time to 5 minutes is suggested, providing clear penalties for non-compliance would strengthen the measure. Establishing fines for exceeding idling time limits would incentivize stricter adherence.

- **Electric Equipment Replacement:** The recommendation to replace fossil-fueled equipment with electric equivalents is positive. However, specifying a phased plan or target percentage for such replacements would enhance the enforceability and impact of this measure.

- **Enhanced Mitigation Measures:** Acknowledging that additional mitigation measures are available as discretionary measures is vague. Defining specific circumstances or criteria triggering the application of enhanced measures would eliminate ambiguity and strengthen overall mitigation efforts.

Deficiencies in PDOC Analysis in Assessing Potential TAC Emissions from HCl Source

The MBGP incorporates a 20,000-gallon hydrochloric acid (HCl) storage tank and dosing system, along with an additional HCl storage tank accompanied by a

scrubber on-site. The scrubber operates during tank loading operations to manage vapor displacement during filling, anticipated for 8,760 hours annually. The PDOC focuses on the analysis of the 20,000-gallon HCl storage tank, setting emissions limits at 0.11 pounds per hour and 2.75 pounds per day. It is being quantified under O&M emissions in the Table 1 consists of emissions from HCl scrubber (operation annual emissions).[9] The Revised General Arrangement Refinement provides that the Project Description is modified to "change amount of hydrochloric acid (HCL) stored on site from 1,250 gallons of 37% HCL to one, 800-gallon tank of dilute HCL (2.5%) and one, 20,000-gallon tank of concentrated HCL (<37%). Included a HCL scrubbing system on both HCL tanks."[10]

Neither the Applicant nor the Air District address TAC emissions from the smaller HCl storage tank and its associated scrubber. The absence of TAC emissions analysis and an established emission limitation for the smaller tank result in unsupported compliance findings and require additional analysis from both the Applicant and the Air District before the issuance of a final DOC.

	First Year Annual Emissions (tpy) [c]				Subsequent Year Annual Emissions with Startups, Shutdowns, & Emission Control Downtime (tpy)				Subsequent Year Annual Emissions without Startups, Shutdowns, & Emission Control Downtime (tpy)			
Pollutant	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]
NO_x	--	0.04	0.36	1.60	--	0.04	0.36	1.60	--	0.04	0.36	1.60
CO	--	0.01	1.88	6.45	--	0.01	1.88	6.45	--	0.01	1.88	6.45
VOC	1.07	<0.01	0.10	0.18	1.87	<0.01	0.10	0.18	2.00	<0.01	0.10	0.18
PM_{10}	3.60	<0.01	0.02	0.11	13.4	<0.01	0.02	0.11	15.7	<0.01	0.02	0.11
$PM_{2.5}$	2.16	<0.01	0.02	0.06	8.05	<0.01	0.02	0.06	9.42	<0.01	0.02	0.06
SO_x	--	<0.01	<0.01	0.02	--	<0.01	<0.01	0.02	--	<0.01	<0.01	0.02
H_2S	183	--	--	--	65.6	--	--	--	8.92	--	--	--
HAPs	1.07	<0.01	0.02	0.57*	1.87	<0.01	0.02	0.57*	2.00	<0.01	0.02	0.57*
Ammonia	179	--	0.03	--	476	--	0.03	--	493	--	0.03	--
CO_2e [f]	37,981	3.27	371	1,620	66,352	3.27	371	1,620	70,982	3.27	371	1,620

Notes:
[a] Steam system emissions are emitted from the PTU, RM, or cooling towers.
[b] Emissions include those from three 3.25 MW generators.
[c] First year annual emissions include commissioning activities with the remaining year routine operations.
[d] Emissions include those associated with gas-insulated equipment, the HCl scrubber, and O&M equipment and vehicles.

Table 1: Annual Emission Estimates During Project Operations

Hydrochloric acid (HCl) presents potential health risks, primarily through inhalation, skin contact, and ingestion, with symptoms including respiratory and gastrointestinal irritation, eye and skin problems. While HCl itself is not typically considered a carcinogen, prolonged exposure to its corrosive nature and potential interaction with other hazardous substances may contribute to overall health risks,

[9] PDOC Table 6 Summary – Project Operational Annual Emissions, p. 22.
[10] TN 253188, Revised General Arrangement Refinement (Nov. 17, 2023) p. 1, *available at* https://efiling.energy.ca.gov/GetDocument.aspx?tn=253188&DocumentContentId=88397.

including the potential for cancer. Workers in industrial settings may face increased occupational exposure risks. Proper safety measures, including the use of protective equipment and adherence to regulations, are crucial in mitigating these risks. A thorough risk assessment, considering concentration, duration, and specific work conditions, is recommended to address potential health impacts comprehensively.

Critical Gap in Air Quality Analysis: Excluding Emissions from Nearby Geothermal Facilities

The PDOC falls short in its air quality analysis by omitting a crucial consideration—the emissions from operational geothermal facilities near the Morton Bay Geothermal Project (MBGP). Notably absent from the cumulative emission evaluation are emissions from the CalEnergy Salton Sea Units 1 & 2/3&4/5 facilities, CalEnergy JM Leathers Facility, CalEnergy Central Services facility, CalEnergy Vulcan/Del Ranch facilities, and the existing CalEnergy JJ Elmore Facility[11] (Figure 5 and Table 2). The oversight extends to the exclusion of criteria pollutants (NOx, SOx, PM, CO, lead) and air toxins (VOCs, including benzene, toluene, diesel particulate matter, etc.) from the comprehensive assessment.

This omission is particularly concerning given the MBGP's location within a designated Disadvantaged Community under SB 535 and the non-attainment status of the Imperial Valley Airshed. Moreover, localized monitoring of particulate matter reveals a distinct concentration gradient, with higher PM10 concentrations observed downwind of the Sonny Bono Salton Sea National Wildlife Reserve. This observed gradient strongly implies a potential influence from existing facilities. The failure to incorporate these emissions into the analysis raises substantial doubts about the overall accuracy and completeness of the Project's air quality impact assessment. Furthermore, it raises serious concerns about the potential exacerbation of pollutant gradients with the introduction of additional geothermal plants, underscoring the urgency of addressing this critical gap in the evaluation process.

[11] https://www.icpds.com/assets/planning/energy-maps/imperial-county-geothermal-09-15-2017.pdf

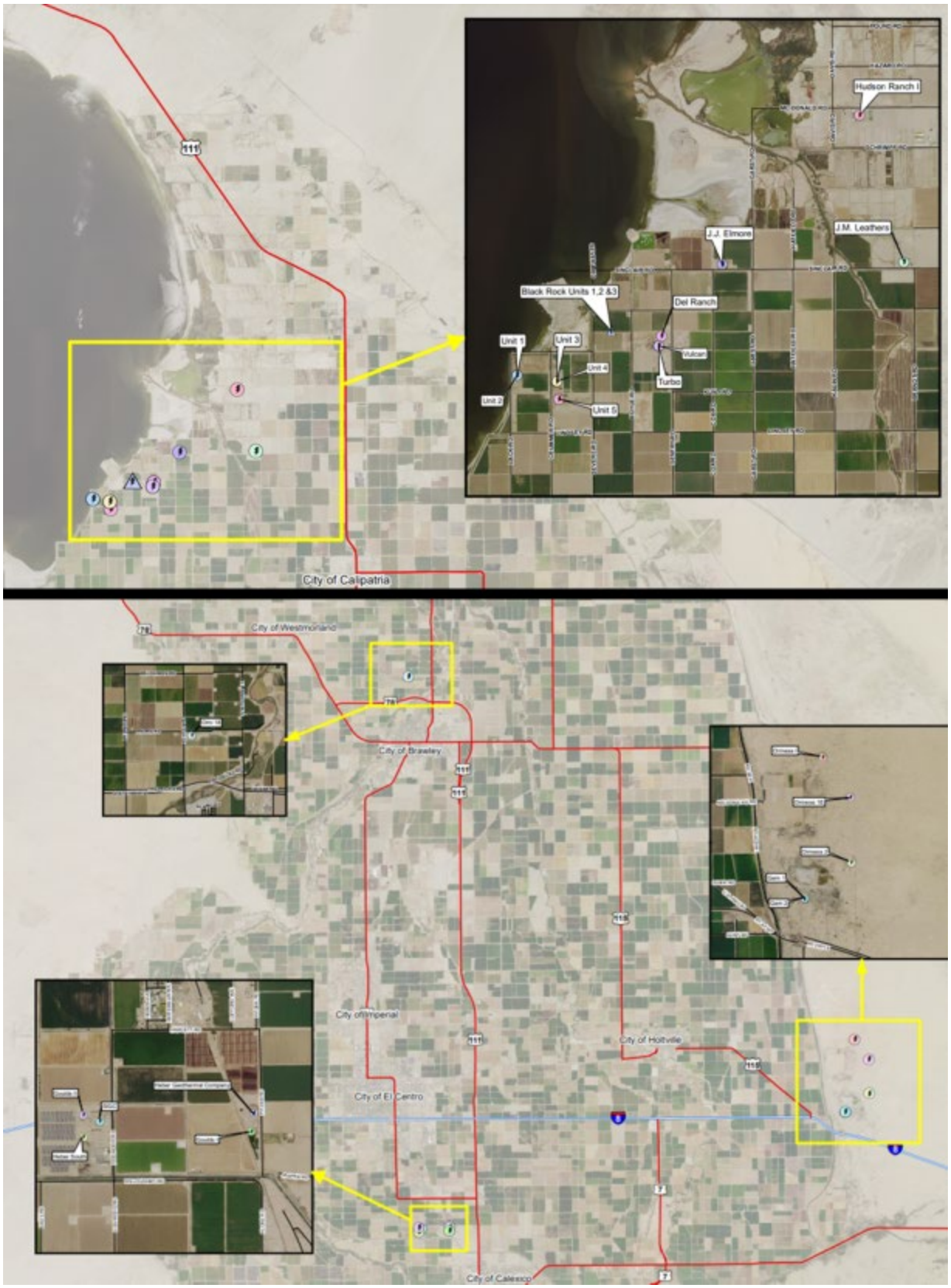

Figure 5: Geothermal Projects in Imperial County

Project Name/Location	Net Capacity (MW)	Commercial Operation Date
Elmore Backpressure Turbine	7	2019
Elmore	42	1989
Leathers	42	1990
Vulcan	38	1986
Del Ranch	42	1989
CE Turbo (backpressure turbine)	10	2000
Salton Sea 1	10	1982
Salton Sea 2	16	1990
Salton Sea 3	50	1989
Salton Sea 4	42	1996
Salton Sea 5	46	2000
Hudson Ranch Power 1	50	2012
Total Existing	**395**	

Table 2: Geothermal Power Plants Operating in the Salton Sea Area

Omission of Cumulative Impact Analysis: The PDOC Neglects Emissions from Two Other Proposed Geothermal Facilities

The PDOC fails to account for the cumulative impact arising from both existing geothermal projects and other proposed ventures by the Applicant in the immediate vicinity of the Morton Bay Geothermal Project (MBGP). Notably, the operational geothermal projects and the Applicant's additional proposed developments, namely the Elmore North Geothermal Project and the Black Rock Geothermal Project, are situated near the MBGP (Figure 6). The absence of an integrated evaluation considering these coexisting projects raises significant concerns about the overall completeness and accuracy of the environmental impact assessment. Emissions from the three projects were quantified separately and have not been combined to determine the cumulative impacts on the surrounding community. The potential cumulative effects on air quality, emissions, and overall environmental health may be significant and necessitate a comprehensive analysis that encompasses the combined influence of all geothermal activities in the region. Addressing this oversight in a revised PDOC is paramount to ensuring a thorough understanding of the cumulative environmental impact of geothermal projects in the area.

Figure 6: Spatial Overview of the Applicant's Three Geothermal Projects - Elmore North Geothermal Project (ENGP), Black Rock Geothermal Project (BRGP), and Morton Bay Geothermal Project (MBGP)

Reliance on Distant Monitoring Stations for PM_{10} Measurements: Overlooking Proximity of Existing Monitoring Sites to the Project Site

The Air Quality Permit Application relies on ambient criteria pollutant background concentrations from the following monitoring sites:

- Niland-English Road (AQS ID: 60254004) [7.6 miles from Project]: 24-hour PM_{10} concentrations (2019-2021) and ozone concentrations (2019)

- Brawley-220 Main Street (AQS ID: 60250007) [13.8 miles from Project]: 24-hour $PM_{2.5}$ concentrations (2019-2021), and annual $PM_{2.5}$ concentrations (2019-2020)

- El Centro-9th Street (AQS ID: 60251003) [26.1 miles from Project]: annual $PM_{2.5}$ concentrations (2021), ozone concentrations (2020-2021), 1-hour NO_2 concentrations (2019-2021), and annual NO_2 concentrations (2020-2021)

- Calexico-Ethel Street (AQS ID: 60250005) [34.6 miles from Project]: annual NO_2 concentrations (2019), 1-hour SO_2 concentrations (2019-2021), 24-hour SO_2 concentrations (2019-2021), 1-hour CO concentrations (2019-2021), and 8-hour CO concentrations (2019-2021).

The air quality assessment ostensibly aimed to showcase compliance with California and National Ambient Air Quality Standards (CAAQS and NAAQS) for various pollutants, including NOx, CO, SO_2, PM_{10}, $PM_{2.5}$, and H_2S. However, it falls significantly short in its methodological rigor.

Despite Imperial County's existing non-attainment status for ozone and PM_{10}, the analysis inexplicably neglects data from the nearby Sonny Bono monitoring station, situated within 2 miles of the project site, which holds pertinent air quality information for 2019 and 2020. This oversight undermines the completeness and accuracy of the PDOC's assessment.

Furthermore, the selection of monitoring stations for PM_{10} and $PM_{2.5}$ concentrations, such as Niland-English Road and Brawley-220 Main Street, respectively, raises serious concerns about the representativeness of the chosen locations (Figure 7 and Figure 8)[12]. A more comprehensive and critical approach would utilize background concentration values from the Sonny Bono station, which not only is in closer proximity but also covers the more recent years of 2021 and 2022, thereby providing a more accurate depiction of current background pollution levels.

The application also neglects to acknowledge the existence of 40 additional monitoring stations currently active in Imperial County. Information available on the Identifying Violations Affecting Neighborhoods (IVAN) website reveals that the IVAN Air Monitoring network consists of 40 air monitors strategically placed throughout Imperial County. As of September 2016, all but 7 of these monitors have been successfully installed. Figure 5 illustrates the locations of the 13 closest IVAN stations to the 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.

[12] **hg https://ivan-imperial.org/air/map**

Figure 7: Monitoring Stations Identified In Application

In essence, the methodology employed in this analysis lacks the necessary depth and inclusivity, resulting in an underestimation of the true environmental impact of the proposed project. The glaring omissions and questionable choices in data selection undermine the overall validity of the findings, necessitating a reevaluation of the air quality assessment. The air quality permit application suggests that:

"*The Project's maximum modeled concentrations are conservatively compared to the CAAQS and NAAQS, regardless of the SIL results, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS except for the PM10 CAAQS. The modeled exceedances of the PM_{10} CAAQS are due to high background concentrations, which already exceed the CAAQS (the area is already designated as a nonattainment area for the PM_{10} CAAQS).*"[13]

[13] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. Dated May 4, 2023

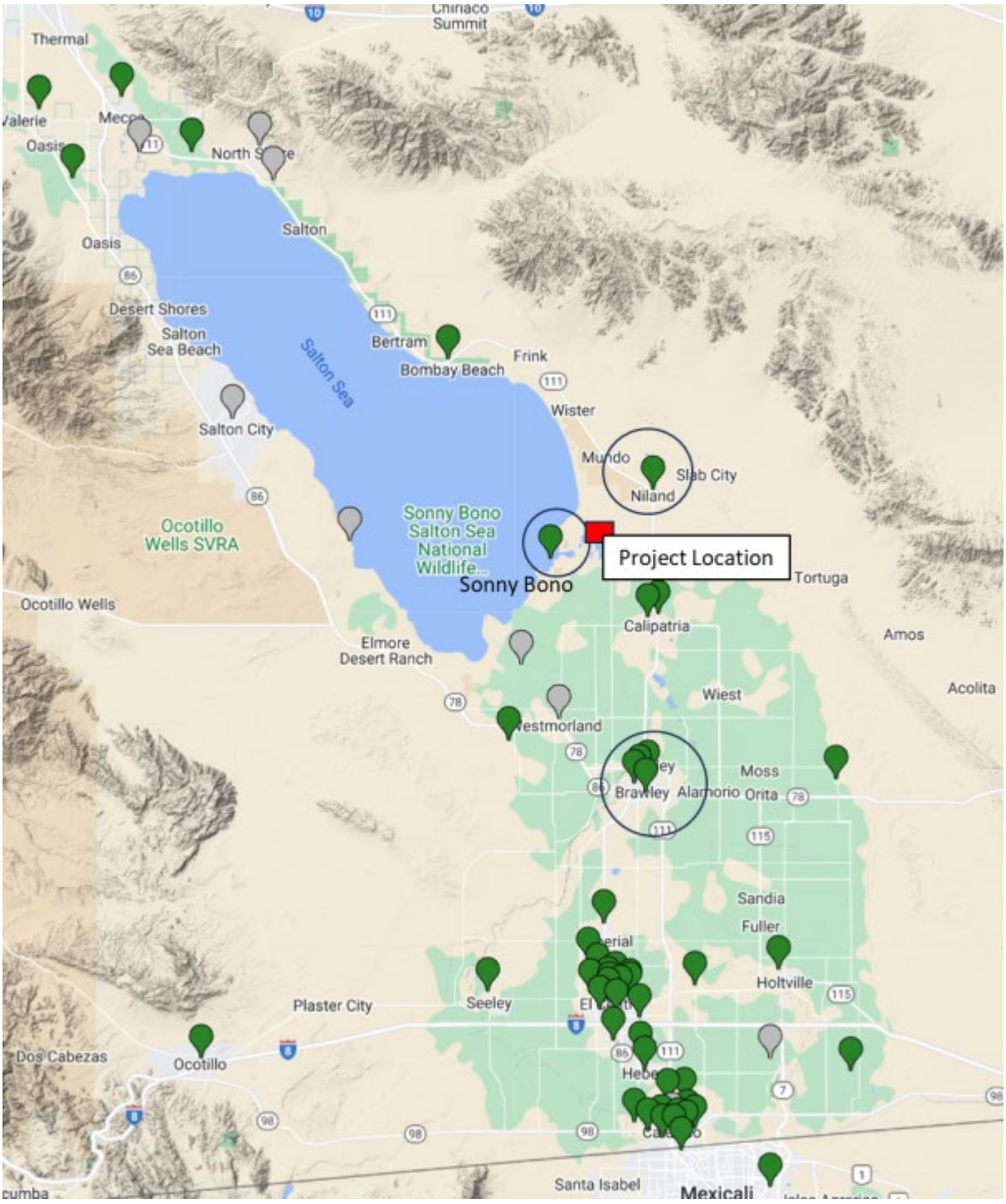

Figure 8: Map Illustrating Project Location with Sonny Bono, Niland, and Brawley Monitoring Stations in Proximity

The air quality permit application asserts the conservative comparison of the

Project's maximum modeled concentrations with the CAAQS and NAAQS. Despite this claim, the combined impacts (modeled plus background) are purportedly below all the CAAQS and NAAQS, except for the PM_{10} CAAQS. The PM10 CAAQS exceedances in the modeling results are attributed to elevated background concentrations, already surpassing the standards in an area designated as nonattainment for PM_{10} CAAQS.

Pollutant	Averaging Period	Maximum Conc. (µg/m³)	Background Conc. (µg/m³)	Total Conc. (µg/m³)	CAAQS (µg/m³)	NAAQS (µg/m³)	Exceeds Standard?
CO	1-hour maximum (CAAQS and NAAQS)	1,668	5,266	6,934	23,000	40,000	No
	8-hour maximum (CAAQS and NAAQS)	131	3,549	3,680	10,000	10,000	No
SO_2	1-hour maximum (CAAQS and NAAQS)	<0.01	22.5	22.5	655	196	No
	3-hour maximum (NAAQS)	<0.01	22.5	22.5	--	1,300 [a]	No
	24-hour maximum (CAAQS and NAAQS)	<0.01	7.10	7.10	105	365	No
	Annual maximum (NAAQS)	<0.01	1.10	1.10	--	80	No
PM_{10}	24-hour maximum (CAAQS) [b]	4.74	241.3	246	50	--	Yes
	24-hour average high-sixth-high (NAAQS)	3.80	142	146	--	150	No
	Annual maximum (CAAQS) [b]	0.55	39.8	40.4	20	--	Yes
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentiles (NAAQS)	1.74	21.0	22.7	--	35	No
	Annual maximum (CAAQS)	0.33	9.40	9.73	12	--	No
	5-year average of annual concentrations (NAAQS)	0.32	8.67	8.99	--	12.0	No

Table 3: Operation Air Quality Impact Results Compared to Ambient Air Quality

Standards

However, two significant discrepancies cast doubt on the application's assertions. Firstly, the initial use of an annual average $PM_{2.5}$ concentration of 12 $\mu g/m^3$, later revised to 9 $\mu g/m^3$ according to USEPA Feb 2024, suggests a more severe pollution scenario than initially presented. This revision accentuates the potential environmental impact.

Secondly, the reliance on Niland and Brawley monitoring stations for $PM_{2.5}$ concentrations, as opposed to the more representative Sonny Bono station, raises concerns. The annual and hourly $PM_{2.5}$ concentrations at Sonny Bono consistently surpass those at Niland and Brawley during various episodes, significantly contributing to the background pollution load. When utilizing the correct representative monitoring station (Sonny Bono), the 24-hour average $PM_{2.5}$ concentration from operational activities (Table 3) is calculated at 146 $\mu g/m^3$, closely approaching the 150 $\mu g/m^3$ NAAQS standard. This brings into question the application's claim that the combined impacts remain below the set standards (Table 3).

Furthermore, if the Sonny Bono background concentration and meteorology (calm wind pattern – 3.5 m/s) from the recent year (2022 – 49.65 $\mu g/m^3$) is considered, the calculated concentration of PM_{10} would exceed 150 $\mu g/m^3$, surpassing **the NAAQS** standard as well. Currently PDOC relies on Niland station and has taken 35.9 $\mu g/m^3$ as the annual average PM10 concentration for 2020 and 39.8 $\mu g/m^3$, for 2021 (As shown in Table 5.1-4 in Air quality permit application). Additionally, the PDOC hasn't taken 2022 observations for Niland station which is also high (47.9 $\mu g/m^3$). This underscores the importance of considering the most up-to-date and representative data for a comprehensive and accurate assessment of the Project's environmental impact.

In essence, the discrepancies in the choice of background concentrations and monitoring stations (Table 3), particularly the neglect of the more pertinent Sonny Bono data, see 2023 particulate matter concentrations in the figure below (Figure 9), introduce uncertainties into the accuracy and reliability of the air quality permit application. A meticulous review and reconsideration of these factors are imperative for a more robust and defensible assessment of the Project's environmental impact.

The assertion that the facility's projected maximum impacts for 24-hour and annual PM_{10} concentrations would be below the Significant Impact Levels (SILs) and would not significantly contribute to current exceedances of the PM_{10} CAAQS is not supported by the evidence provided with the PDOC and warrants critical scrutiny. Contrary to this claim, the emissions from the plant, and potentially from two nearby facilities operated by the same applicant, could substantially add to PM_{10} levels in the atmosphere, exacerbating existing exceedances.

Pollutant and Averaging Time	Background Value (µg/m³) [a]
Ozone – 1-hour Maximum CAAQS	128
Ozone – 8-hour Maximum CAAQS/NAAQS	108
PM_{10} – 24-hour Maximum CAAQS	241.3
PM_{10} – 24-hour High, 2nd High NAAQS [b]	142
PM_{10} – Annual Maximum CAAQS	39.8
$PM_{2.5}$ – 3-Year Average of Annual 24-hour 98th Percentiles NAAQS	21.0
$PM_{2.5}$ – Annual Maximum CAAQS	9.40
$PM_{2.5}$ – 3-Year Average of Annual Values NAAQS	8.67
CO – 1-hour Maximum CAAQS/NAAQS	5,266
CO – 8-hour Maximum CAAQS/NAAQS	3,549
NO_2 – 1-hour Maximum CAAQS	105
NO_2 – 3-Year Average of Max Daily Annual 1-hour 98th Percentiles NAAQS	65.2
NO_2 – Annual Maximum CAAQS/NAAQS	17.4
SO_2 – 1-hour Maximum CAAQS/NAAQS	22.5
SO_2 – 3-hour Maximum NAAQS [c]	22.5
SO_2 – 24-hour Maximum CAAQS/NAAQS	7.10
SO_2 – Annual Maximum NAAQS	1.10

[a] Where applicable, monitored concentrations were converted from ppm/ppb to µg/m³ using the standard molar volume of air at normal temperature and pressure conditions (NTP) of 24.45 liters per mole.

[b] 24-hour PM_{10} background value assumes one exceedance may occur per year on average. Over the 3-year period, two of the maximum three concentrations occur in 2021. Therefore, the design value is the high, 2nd high for 2020.

[c] The 3-hour SO_2 background value conservatively uses the 1-hour SO_2 background value.

Table 4 : Background air quality concentrations

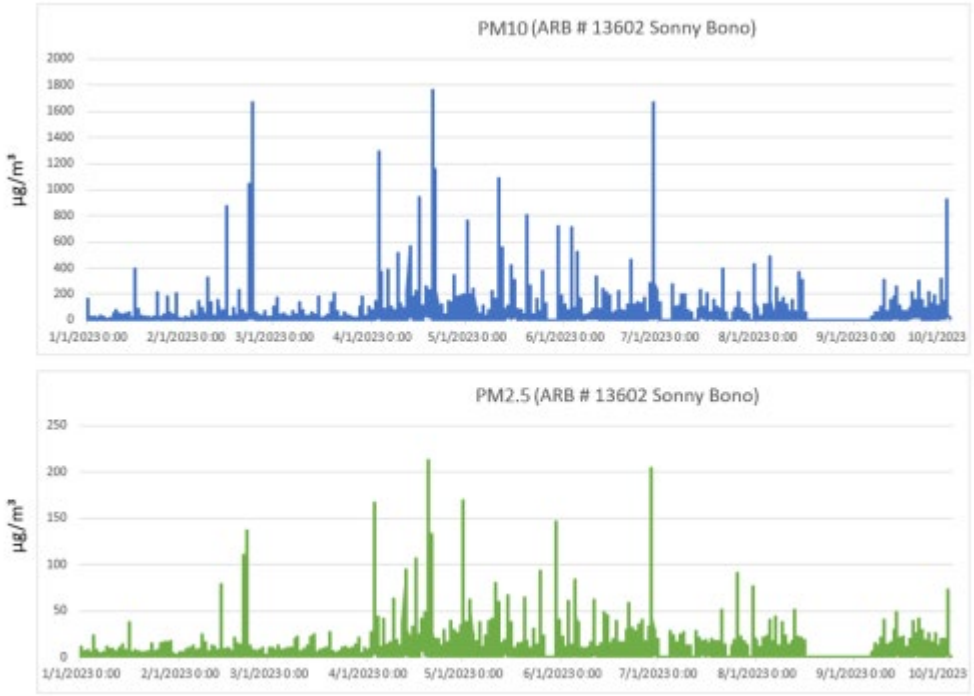

Figure 9: 2023 Air Quality Concentrations of $PM_{2.5}$ and PM_{10} at Sonny Bono

Monitoring Station

The PDOC's failure to assess potential cumulative impacts from multiple sources within proximity of the project is a significant omission which raises concerns about the accuracy of the Air District's assessment. Given that the facility operates in an area already designated as nonattainment for PM_{10} CAAQS, dismissing the contribution of the project to current exceedances appears to be an oversimplification. Moreover, the omission of consideration for $PM_{2.5}$ emissions is notable, as it is a critical component in evaluating overall air quality. Ignoring the potential collective impact of PM_{10} and $PM_{2.5}$ emissions from the facility and neighboring sources undermines the integrity of the claim that the project would not significantly contribute to existing PM_{10} NAAQS exceedances. Further, the assertion regarding construction emissions and reliance on control measures lacks supporting evidence demonstrating their efficacy. The specified threshold for PM_{10} emissions during construction may inadequately account for cumulative impacts in a nonattainment area.

In essence, the PDOC downplays the significance of the potential environmental impacts of the facility by solely focusing on SILs for PM_{10} and overlooking the broader context of cumulative emissions.

Critical Oversight: Concealed Hydrogen Sulfide Background Concentrations in the PDOC

The MBGP application raises serious concerns by omitting vital information regarding hydrogen sulfide (H_2S) concentrations in the community. Equally troubling is the Imperial County Air Pollution Control District's (ICAPCD) failure to incorporate a background concentration into the cumulative impact analysis within the Project Description and Operations Plan (PDOC).

Referring to the Black Rock 1, 2, and 3 Geothermal Power Project[14] – Major Amendment Staff Assessment, the application acknowledges that H2S emissions stem from both natural and anthropogenic sources, such as geologic processes, oil production, refining, wastewater treatment, and geothermal power plants. However, the discontinuation of monitoring at the Niland station, initially established to monitor ambient H_2S levels in the geothermal area, due to operational issues with the H_2S monitor is a significant gap.

The Staff Assessment from 2010 proposes a background concentration of 24.6 micrograms per cubic meter ($\mu g/m^3$), calculated from an average hourly concentration during 1993-1994. Importantly, this background concentration constituted 59% of the State standard of 42 $\mu g/m^3$, indicating that 30 $\mu g/m^3$ is naturally present in the

[14] 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

background.

The PDOC analyzes H_2S based on the worst-case subsequent year of operation. The proposed Project exceeds the emission threshold of 100 pounds per day for H_2S[15]. The proposed Project also exceeds the BACT threshold of potential to emit equal to or greater than 55 pounds per day[16].

The PDOC's failure to disclose H_2S background concentrations results in underestimation of cumulative impacts. When considering all sources, it becomes apparent that the Project may contribute to an exceedance. This is particularly concerning as the PDOC estimates the maximum concentration of H_2S emissions to be 37.5 $\mu g/m^3$[17]. When added to the background H_2S (30 $\mu g/m^3$ background concentration added to 37.5 $\mu g/m^3$ maximum concentration of H_2S from this project), the total concentration reaches 67.5 $\mu g/m^3$, significantly surpassing the standard. This lack of disclosure and potential underestimation underscores the pressing need for a more thorough and transparent assessment of the Project's impact on ambient H_2S concentrations in the area.

Flawed Dispersion Modeling: Inadequate Use of Distant Meteorological Data

The AERMOD analysis for emissions from the Project Site alarmingly relied on meteorological data from the Imperial County Airport (KIPL), situated a staggering 28 miles south of the Project Site. This choice blatantly contradicts U.S. EPA guidance, which mandates spatial and climatological representativeness of the area under consideration.

The selection of KIPL raises significant concerns, as it neglects crucial factors determining representativeness, including the proximity of the monitoring station to the area, the intricacy of terrain, exposure of the site, and the timeframe for data collection. A more suitable alternative is readily available—the Sonny Bono monitoring station, located within 2 miles of the Project Site, possesses superior representativeness of local conditions during both the construction and operational phases.

Accurate meteorological data, both surface and upper air, is fundamental for any air dispersion model. The imprudent reliance on data from a station 28 miles away introduces a glaring deficiency in the modeling process (Figure 10). To rectify this, an immediate and thorough collection of hourly meteorological and PM10 data from the IID's Sonny Bono monitoring station is imperative. This local and up-to-date information stands as the most representative and reliable source for dispersion modeling inputs, ensuring a more accurate assessment of the Project's impact on air

[15] PDOC at p. 22.
[16] *Ibid*.
[17] PDOC at p. 29.

quality.

Figure 10: Topographical Map of Morton Bay Geothermal Project's Proximity to the Imperial County Airport and Sonny Bono

The examination of wind speed, elucidated through wind rose plots for both KIPL and Sonny Bono stations (Figure 11 and Figure 12), is pivotal for understanding the atmospheric dispersion patterns. Notably, KIPL registers an average wind speed of 3.4 m/s, marginally lower than Sonny Bono's 3.51 m/s. However, the key differentiator lies in the prominent wind directions at these locations, with Imperial exhibiting notably calmer conditions.

The reliance on a segmented approach with AERMOD[18], as described in the publication by Pandey and Sharan 2019[19], underscores the significance of considering rapid changes in wind patterns. The assumption that a 2-minute mean wind direction estimates the plume is integral to this approach. Scientifically published insights suggest that under low wind speeds such as 3.5 m/s, the plume does not travel significant distances (velocity = distance/time). In low and variable winds, no single plume centerline is obvious, and the observed concentration distribution is multi-peaked and non-Gaussian (Sagendorf and Dickson, 1974)[20] especially in stable conditions. This critical observation challenges the rationale behind selecting a

[18] Cimorelli, A.J., Perry, S.G., Venkatram, A., Weil, J.C., Paine, R.J., Wilson, R.B., Lee, R.F., Peters, W.D., Brode, R.W., 2005. AERMOD: a dispersion model for industrial source applications. Part I: general model formulation and boundary layer characterization. J. Appl. Meteorol. 44, 682–693.
[19] https://www.sciencedirect.com/science/article/abs/pii/S1352231019300391?via%3Dihub
[20] Sagendorf, J.D., Dickson, C.R., 1974. Diffusion under Low-Wind Speed, Inversion Conditions. NOAA Technical Memorandum. ERL ARL-52.

meteorological station, KIPL, situated at a considerable distance from the facility.

The application acknowledges the site's flat topography with an average elevation of 230 feet below average mean sea level, emphasizing a lack of complex terrain. Despite this, the modeling analysis employs default settings for complex terrain, including temperature gradients, wind profile exponents, and elevated receptor heights. This discrepancy introduces a counterintuitive element, as flat terrain should be modeled without complex terrain adjustments. The use of these settings designed for mountainous terrain can lead to underestimated pollutant concentrations, potentially misrepresenting the actual dispersion characteristics. A more accurate modeling approach should align with the site's flat nature, avoiding unnecessary complexities that may compromise the reliability of the dispersion modeling outcomes.

"The site topography is flat with an average elevation of 230 feet below average mean sea level. The nearest complex terrain (terrain exceeding Project stack heights) is a string of mountainous terrain running from the southwest to the northwest approximately 17 miles northeast of the Project." [21]

And then the fact that *"Default model options for temperature gradients, wind profile exponents, and calm processing, which includes final plume rise, stack-tip downwash, and elevated receptor (complex terrain) heights option were used in this modeling analysis."*[22] It is counterintuitive and highlights modeling flaw. The terrain is flat in nature, thus complex terrain settings should not be used. As they would give lower concentration and can be deceptive.

Receptor Grid Selection and Coverage: Grid Resolution Near Fence Line: The use of discrete receptors every 25 meters around the ambient air boundary (fence line) is a common practice. However, the abrupt transition from 25-meter spacing to 100-meter spacing at 500 meters from the grid origin may introduce potential gaps in capturing localized impacts near the facility. A more gradual transition or additional receptors in critical areas may enhance the accuracy of the assessment.

Calculation Exclusion within Fence Line: The decision not to calculate concentrations within the facility fence line raises questions about the potential localized impacts and exposure risks to on-site personnel. A clear justification for this exclusion should be provided, and alternative approaches, such as refining the receptor grid near the source, could be considered.

The inherent flaw in this approach is evident in the miscalculation of dispersion, leading to an underestimation of pollutant concentrations on receptors.

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[21] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. Dated May 4, 2023

[22] Jacobs. 2023. Morton Bay Geothermal Project Air Quality Permit Application. Docket Number 23-AFC-01. Dated May 4, 2023

By computing dispersion based on a distant met station under low wind speeds, the model fails to accurately represent the actual atmospheric behavior, thereby compromising the reliability of the entire analysis.

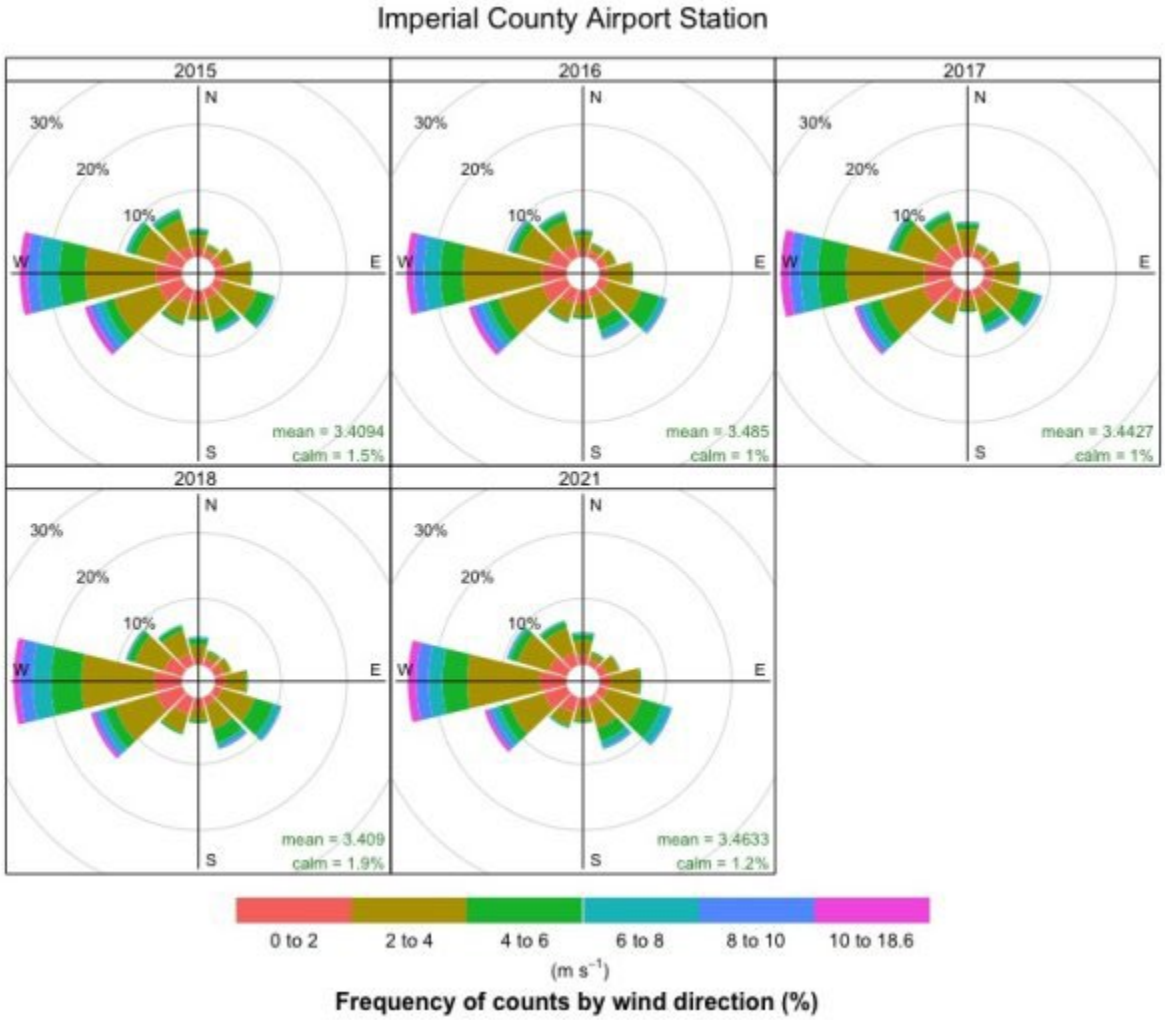

Figure 11: Wind Rose Plot Illustrating Wind Conditions at Imperial County Airport Monitoring Station

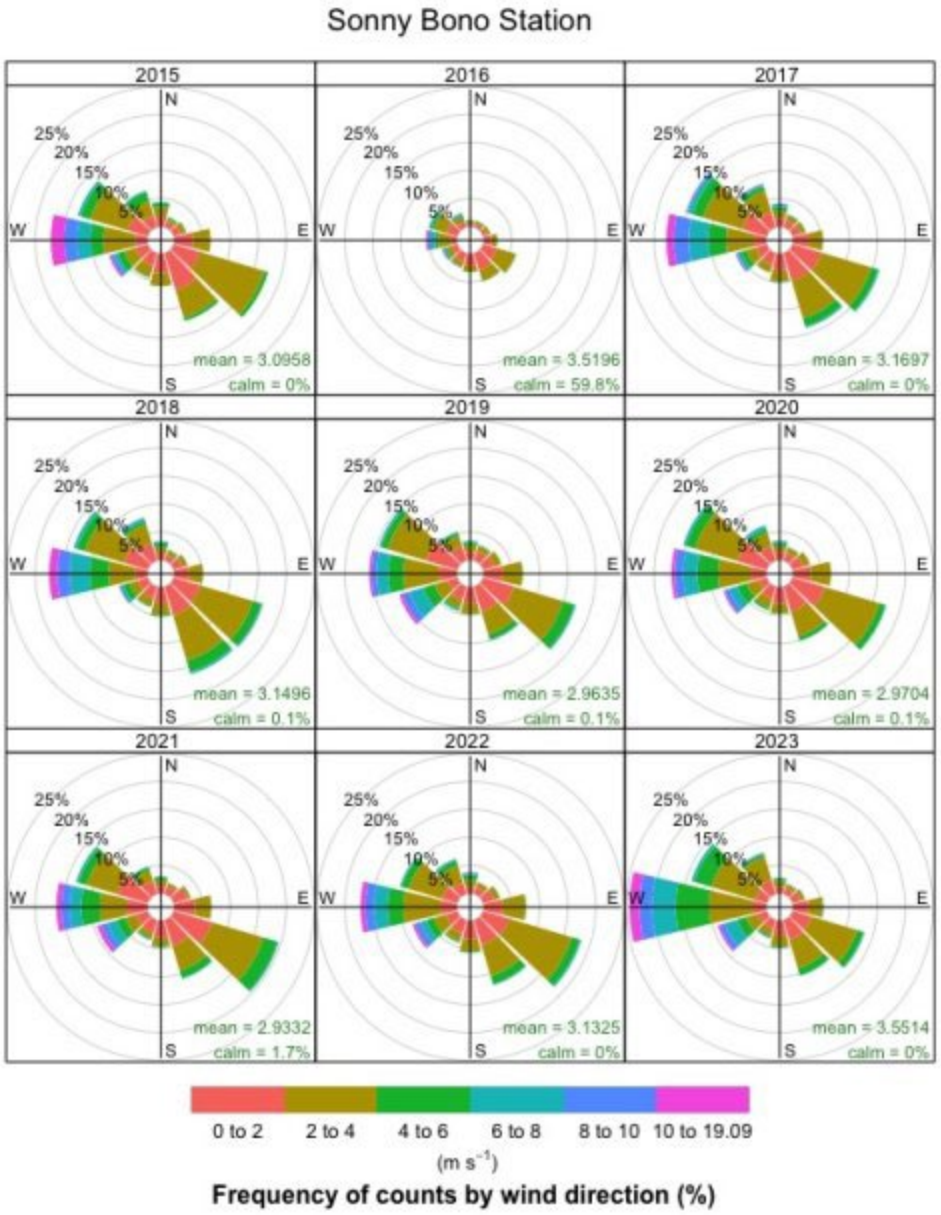

Figure 12: Wind Rose Plot Illustrating Wind Conditions at Sonny Bono Monitoring Station

Additionally, the plume concentration is intricately linked to meteorological factors such as wind speed, relative humidity, and wind direction, governed by the Gaussian plume distribution equation as outlined in the AERMOD manual[23]. Notably, the plume is conveyed with an effective wind speed that remains non-zero, even in the absence of mean wind speed. As the wind speed (u) is utilized to compute the Concentration (Figure 13) Therefore, accurate estimation of concentrations using the Gaussian plume formulation for horizontal spread in AERMOD necessitates the

[23] https://gaftp.epa.gov/Air/aqmg/SCRAM/models/preferred/aermod/aermod_userguide.pdf

incorporation of the appropriate effects of wind meandering, as emphasized by Qian and Venkatram in 2011[24].

$$C_s(x, y, z) = \frac{Q}{\sqrt{2\pi}\sigma_z U_e} F(x, y) \left[\exp\left\{ -\frac{(H_s - z)^2}{2\sigma_z^2} \right\} + \exp\left\{ -\frac{(-H_s - z)^2}{2\sigma_z^2} \right\} \right] \quad (1)$$

where $F(x, y)$ is the weighted horizontal distribution function, U_e is the effective wind speed, H_s is the effective stack height, z is the receptor height, Q is the source strength and σ_z is the vertical dispersion parameter.

Figure 13: Gaussian plume equation in AERMOD

Moreover, the Sonny Bono station provides a comprehensive dataset spanning from 2015 to 2023, affording two additional years of recent meteorological parameters (2022 and 2023) compared to the Imperial County data. Given this, there exists no rationale for the applicant to exclusively rely on Imperial County observations. The utilization of the more extensive and up-to-date Sonny Bono station data is imperative for ensuring the precision and relevance of the meteorological inputs in the assessment.

Neglected Health Risks: Radon Exposure in MBGP Air Quality Permit Application

The health risk assessment in the Morton Bay Geothermal Project's (MBGP) Air Quality Permit Application raises significant concerns by not explicitly quantifying the potential health risks associated with radon exposure, a recognized human carcinogen emitted from the cooling tower during normal operation, warm-up, and shutdown. Radon, a colorless and odorless radioactive gas, poses significant health risks when inhaled. As it undergoes radioactive decay, radon releases solid particles that, when trapped in the lungs, emit alpha particles, increasing the risk of lung cancer), identified as the primary cause of lung cancer among non-smokers, contributes to approximately 21,000 lung cancer deaths annually, with a notable 2,900 cases occurring in non-smokers[25]. Despite the gravity of this issue, the assessment lacks a thorough analysis of the specific health risks posed by radon

[24] Qian, W., Venkatram, A., 2011. Performance of steady-state dispersion models under low wind-speed conditions. Boundary-Layer Meteorol. 138, 478–491.
[25] U.S.EPA. 2024. Health Risk Of Radon. Accessed February 29, 2024.https://www.epa.gov/radon/health-risk-radon.

emissions, including its potential carcinogenic impacts on respiratory health. The provided estimate of 7.42E-02 PTU (curies per year) for radon emissions (as presented in Table 5.9-4. Operational Annual TAC Emissions Estimates – Routine Operating Year), while acknowledged, remains insufficient in addressing the comprehensive health implications. The Surgeon General's 2005 national health advisory on radon underscores its significance, emphasizing the need for a more detailed and critical evaluation of the potential health risks associated with radon exposure in the MBGP, especially focusing on its direct impact on respiratory health and the associated carcinogenic effects[26]. Radon dose is calculated by multiplying radon level by time of exposure. For every 99.9 Bq/m3, or every 2.7 pCI/L increase in long-term radon exposure, lung cancer risk rises 16%. The average concentration of radon in outdoor air is 0.4 pCi/L, while the level around of 4 pCi/L or higher are considered hazardous. The PDOC must include quantification of health risks due to Radon emission exposure.

Conclusion

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

Sincerely,

Dr. Komal Shukla

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

Komal Shukla, Ph.D., M.Sc., B.Sc
Air Quality Scientist

GROUP DELTA

Education
Ph.D. in Photochemical Modeling of Air Pollution (Environmental Engineering), Indian Institute of Technology Delhi-IIT Delhi (Photochemical Modeling of Ground Level Ozone), Delhi, India; Visiting Ph.D. Student, Institute Fellow, Gees, University of Birmingham, UK; MPhil Environment and Sustainable Development, IESD, Banaras Hindu University, Varanasi, India; M.Sc. Environment Management, University School of Environment Management (Sustainable and Low Carbon Energy Plan for Delhi), Delhi, India; B.Sc Chemistry (with honors) in Chemistry, University of Delhi, India

Years of Experience: 7

Years with Group Delta: 1

Dr. Shukla has a Ph.D. in air quality and atmospheric phenomenon modeling, with a strong technical background in tropospheric chemistry, industrial and city level environmental solutions, regulatory and global model applications, trace gases and particulate matter impact on human health and climate, and observations data analytic. Dr. Shukla is an air quality emissions modeler with nearly a decade of technical and research experience. She served as an in-house lead in federal contract scientific projects supporting the EPA's mission. Related experience includes:

Litigation, Compliance, Environmental Justice, On-Road Emissions, Industrial Emissions, California: As Air Quality Modeling Scientist, Ms. Shukla completed two major projects, including: Project I: Source apportionment of ozone and particulate matter pollution using photochemical modeling techniques, and Project II: Transportation and near-road air quality and emissions projection.

Environment and Climate Change Canada (ECCC), Toronto, Canada: As Research Scientist (Air Quality Modeling and Compliance in Alberta), Ms. Shukla completed two significant projects, including: Project I: Developing a photo-chemical transport model to understand oil and sands region emissions in North America and Project II: Modeling applications in delineating chemistry of tropospheric tracers.

University of North Carolina, Institute of Environment, Chapel Hill, North Carolina: As Postdoctoral Research Associate (Air Quality – Nyserda Led Air Quality Model Development, Ms. Shukla worked on critical projects including: Project I: Air quality modeling of various city level sources and health exposure sciences in New York City, - funded by NYSERDA and Project II: TRECH project (https://www.hsph.harvard.edu/c-change/news/trechstudy/) - Transportation, Equity, Climate & Health CMAQ based modeling of vehicular emission and policy assessment on the East Coast.

Indian Institute of Technology Delhi (IIT Delhi), Delhi, India: As Research Associate, Ms. Shukla worked on Project I: Quantification and contribution of paddy stubble burning emissions in Haryana to estimate PM2.5 concentrations in its surrounding cities and Delhi. Role: Modelling meteorology and PM2.5 for north India using WRF-chem and Project II: A Systems Approach to Air Pollution in Delhi (ASAAP) mobility grant funded by GCRF and NERC. Role: Monitored outdoor PM2.5 concentrations at two flyovers in Delhi and assessed pavement dwellers exposure to air pollution of PM2.5 near heavily trafficked roads to see impact on dwellers.

Various Technical Skills
Languages: T and C Shell-script, MATLAB, Fortran, Python, NCL, R, and NETCDF satellite data retrievals and analysis
Models: WRF-Chem, GEM-MACH, CMAQ, GCAM, CTOOLS, AERMOD, CALPUFF, ADMS, MOVES, InMAP and COBRA.

GROUP DELTA

Photochemical pollutant and aerosol/dust modeling and urban air quality. Expertise in tropospheric chemistry, machine learning aided regression models, WRF-Chem/CMAQ (Chemical transport models), dispersion models.

Air Quality: CTOOLS/AERMOD/ADMS/R-LINE and satellite data assessment (OMI-AURA and MODIS). USEPA observation and meteorology handling, anthrapoegenic/energy emission inventory QA and preparation (MOVES), and impacts-benefits.

Select Research Papers:

- Shukla, K., Seppanen, C., Naess, B., Chang, C., Cooley, D., Maier, A., .. &Arunachalam, S. (2022). ZIP Code Level Estimation of Air Quality and Health Risk Due to Particulate Matter Pollution in New York City. Environmental Science & Technology.
- Shukla, K., Kumar, P., Mann, G. S., & Khare, M. (2020). Mapping spatial distribution of particulate matter using Kriging and Inverse Distance Weighting at supersites of megacity Delhi. Sustainable cities and society, 54, 101997.
- Shukla, K., Srivastava, P. K., Banerjee, T., & Aneja, V. P. (2017). Trend and variability of atmospheric ozone over middle lndo-Gangetic Plain: impacts of seasonality and precursor gases. Environmental Science and Pollution Research, 24(1), 164-179.
- Shukla, K., Dadheech, N., Kumar, P., & Khare, M. (2021). Regression-based flexible models for photochemical air pollutants in the national capital territory of megacity Delhi. Chemosphere, 272, 129611.
- Gulia, S., Khanna, 1., Shukla, K., & Khare, M. (2020). Ambient air pollutant monitoring and analysis protocol for low- and middle-income countries: An element of comprehensive urban air quality management framework. Atmospheric Environment, 222, 117120.
- Khare, M., & Shukla, K. (2020). Outdoor and Indoor Air Pollutant Exposure. In Environmental Pollutant Exposures and Public Health (pp. 95-114)
- Kumar, G. S., Sharma, A., Shukla, K., & Nema, A. K. (2020). Dynamic programming-based decision-making model for selecting optimal air pollution control technologies for an urban setting. In Smart Cities-Opportunities and Challenges (pp. 709-729). Springer, Singa pore.

Select Technical Conferences:

- Shukla, K., OJha, N., & Khare, M., (2019) Air Quality Simulations over Delhi Using WRF-Chem in Conference of Indian Aerosol Science and Technology Association 2018 "Aerosol lmpacts:Human Health to Climate Change" 2018 http://cas.iitd.ac.in/iasta20l8/pdf/
- Shukla, K., Xiaoming, C., OJha, N., & Khare, M., (2018), Air Quality Simulations over Delhi Using WRF-Chem: Effects of Lo- cal Pollution and Regional-Scale Transport , A42A-0l presented at 2018 Fall Meeting, AGU, Washington, D.C., 10-14 Dec. http://abstractsearch.agu.org/meetings/2018/FM/A42A-0l. htm1 (Talk)
- Shukla, K., & Khare M., (2019) Behaviour of Ground Level Ozone and Its Association with Precursors and Meteorology in Delhi, India, AS17-A023, Atmospheric Chemistry in Highly Polluted Environments: Emissions, Fates, and Impacts, AS17-A023 presented at 2019 16th Annual meeting AOGS, Singapore, 28th -2nd August (Poster)
- Shukla, K., Kumar, S., & Nema A., (2019) Environmental Characterization of Two Chromium-based Industrial Waste Contaminated Sites of India, accepted as BllH-2219, to be presented in presented at 2019 Fall Meeting, AGU, San Francisco, CA, USA 09-13 Dec. (Poster)
- Shukla, K., & Khare M., (2019), Behavioral Chemistry of ground level ozone formation in heavily polluted environment of Delhi city, accepted as A21G-2645, to be presented in presented at 2019 Fall Meeting, AGU, San Francisco, CA, USA 09-13 Dec.
- (Poster) Kumar. S, Sharma. A., Shukla K., Nema, A.K., (2019). Dynamic programming based decision-making model for selecting optimal air pollution control technologies for an urban setting. Presented at 1st smart cities conference, Delhi, India (Talk).

International Panelist

Air Pollution, Environmental Management and Policy Related Invited Talks:

- Minimizing air pollution in Delhi city, Pure Earth, NY, USA, Boston College, 2019
- Photochemical pollution in heavily polluted environments of India and China" in the Development of Traffic Pollution Dispersion Models based upon Artificial Intelligence Technology, Chang'an University, Xian, 2019, China
- Air Pollution Challenges and Mitigation Opportunities in Delhi, CADTIME, Newcastle University, 2019, UK
- Indoor Air Quality: Problems and Initiatives", 2nd Indian International National Conference on Air Quality Management (IICAQM 2017): Health and Exposure, Indian Institute of Technology Delhi, New Delhi 2017, India
- Tackling the Challenges of Air Pollution in India", Indian Institute of Public Administration, New Delhi, 2019, lndia