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| **TN #:** | 257276 |
| **Document Title:** | Black Rock Geothermal LLC Responses to Jobs to Move America Comments on the ICAPCD PDOC |
| **Description:** | N/A |
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Jon Trujillo
General Manager, Geothermal Development

June 21, 2024

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

RE: **Selected Reponses to the Jobs to Move America's Public Comments on Black Rock Geothermal Facility Preliminary Determination of Compliance (PDOC)**

Dear Mr. Ramirez:

Black Rock Geothermal LLC (the Applicant) appreciates the work of the Imperial County Air Pollution Control District (ICAPCD) to produce a comprehensive Preliminary Determination of Compliance (PDOC) for the Black Rock Geothermal Project (BRGP or Black Rock). The Applicant welcomes this opportunity to submit selected responses to certain comments submitted by the Jobs to Move America (JMA) on the PDOC for Black Rock. JMA's comments on the PDOC were submitted to the ICAPCD on March 25, 2024. The Applicant remains available to provide additional information in furtherance of issuance of the Final Determination of Compliance (FDOC) for the Black Rock Project.

## I. Noncompliance with State and Federal Ambient Air Quality Standards

***1.*** *Particulate matter emissions are a major contributor to the degradation of public health in Imperial County. Page 28 of the PDOC for Black Rock lists operational air quality impacts of various pollutants including PM10 and PM2.5. The Applicant is currently not in compliance with the EPA NAAQS limit of 9.0 µg/m3 for PM2.5.[2] ICAPCD must ensure the Applicant first complies with state and federal ambient air quality standards before this project moves forward.*

**Response:** The U.S. Environmental Protection Agency (EPA) only recently released its final rule to lower the annual National Ambient Air Quality Standard (NAAQS) for particulate matter with aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$) to 9.0 micrograms per cubic meter ($\mu g/m^3$). In conjunction with the release of the revised $PM_{2.5}$ NAAQS, the EPA also released an implementation guide[1] to help affected parties understand the timeline under which changes to permitting, area designations, etc. would be made. According to this guidance, all applicants for permits to construct a new major source or major modification of an existing stationary source after the effective date of the final rule (60 days after publication in the Federal Register or May 6, 2024) will need to conduct an air quality analysis that considers the revised $PM_{2.5}$ NAAQS. Because this project's permit application and Application for Certification were deemed complete on June 22, 2023 and July 26, 2023, respectively, which are well before the effective date of the final rule, and because the project is neither a major source nor a Prevention of Significant Deterioration (PSD) source of $PM_{2.5}$ emissions, an air quality analysis considering the revised $PM_{2.5}$ NAAQS is not required. Table 7 of the PDOC did demonstrate compliance with the current annual $PM_{2.5}$ NAAQS of 12.0 $\mu g/m^3$.

[1] https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-implementation-fact-sheet.pdf

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As stated in Section 5.1.10.1.1 of Attachment DRR 7-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (Transaction Number [TN] #253080), "As noted above, the facility is already projected to have maximum impacts less than the SILs for both 24-hour and annual $PM_{10}$ (the only pollutant with background concentrations above the ambient air quality standard). In addition, the Project's emissions are expected to be less than the ICAPCD Rule 207 offset thresholds and CEQA significance thresholds for $PM_{10}$, as presented in Tables 5.1-1 and 5.1-17, respectively. Furthermore, the Project will implement BACT to reduce particulate matter emissions from the cooling towers and to minimize emissions from diesel combustion by using a Tier 3-certified fire pump and Tier 4-certified emergency generators." With this language, the Applicant is demonstrating both that a project's significance in nonattainment areas is not strictly determined by a comparison to Significant Impact Levels (SILs) and that best available control technology (BACT) is being implemented to reduce emissions of particulate matter with aerodynamic diameter of 10 microns or less ($PM_{10}$) to the extent feasible.

***2.*** *The PDOC should also rely on data from monitoring stations closer to the project development site to develop its air quality analysis. Page 27 of the PDOC states that "the dispersion modeling utilized 5 years of hourly meteorological data collected at the Imperial County Airport." The airport is approximately 25 miles away from the project site. Data from the Sonny Bono monitoring station should be used since it is approximately 5 miles away from the project site. This data will more accurately model impacts on workers and community members closer to the facility. The ICAPCD should re-model its air quality analysis using data from the Sonny Bono monitoring stations before this project moves forward.*

**Response:** The dispersion model utilized the most representative, accurate, and reliable meteorological data available, consistent with EPA Guidelines. In particular, the Applicant reviewed the meteorological data collected at the Sonny Bono monitoring station, which is the monitoring station that JMA recommended the Air District analyze within its comments.[2] Only two years of recent data (2020 and 2022) from that station meet the EPA requirements of 90 percent minimum completeness before substitution on a quarterly basis.[3] To ensure the worst-case meteorological conditions are adequately represented in the model results, the EPA requires the use of five years of adequately representative National Weather Service (NWS) meteorological data, at least one year of site-specific data, or at least three years of prognostic meteorological data.[4]

In addition, the Sonny Bono monitoring station is not an Automated Surface Observing Systems (ASOS) station, unlike the Imperial County Airport NWS station. ASOS stations are those monitoring stations which collect sub-hourly 1 to 5-minute wind speed and wind direction

[2] JMA PDOC Comments, p. 2.
[3] Refer to Section 5.3.2 of EPA's *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA-454/R-99-005), which is available online at https://www.epa.gov/sites/default/files/2020-10/documents/mmgrma_0.pdf.
[4] Refer to Section 8.4.2(e) of Appendix W to 40 Code of Federal Regulations (CFR) Part 51, *Guideline on Air Quality Models*.

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readings. To reduce the number of calms and missing winds in the surface data, archived 1-minute winds for the ASOS stations can be used to calculate hourly average wind speeds and wind directions, which are used to supplement the standard archive of hourly observed winds processed in the American Meteorological Society/EPA Regulatory Model (AERMOD) Meteorological Preprocessor (AERMET).

Lastly, although the Imperial County Airport is located over 25 miles from the project site, there are no significant geographic features between the two locations, and both are located south/southeast of the Salton Sea. The lack of significant geographic features between the two locations is itself an indicator of representativeness of the Imperial County Airport meteorological data,[5] but also leads to the expectation that wind speeds and wind directions in the project vicinity are similar to those incurred at the Imperial County Airport. This expected similarity is verified by comparing the wind rose for the Imperial County Airport (for years 2015 to 2018 and 2021) to the wind rose for the Sonny Bono monitoring station (for years 2020 to 2022). As shown in Figure I.2-1, attached hereto, both wind roses share the predominant wind directions from the west and southeast.

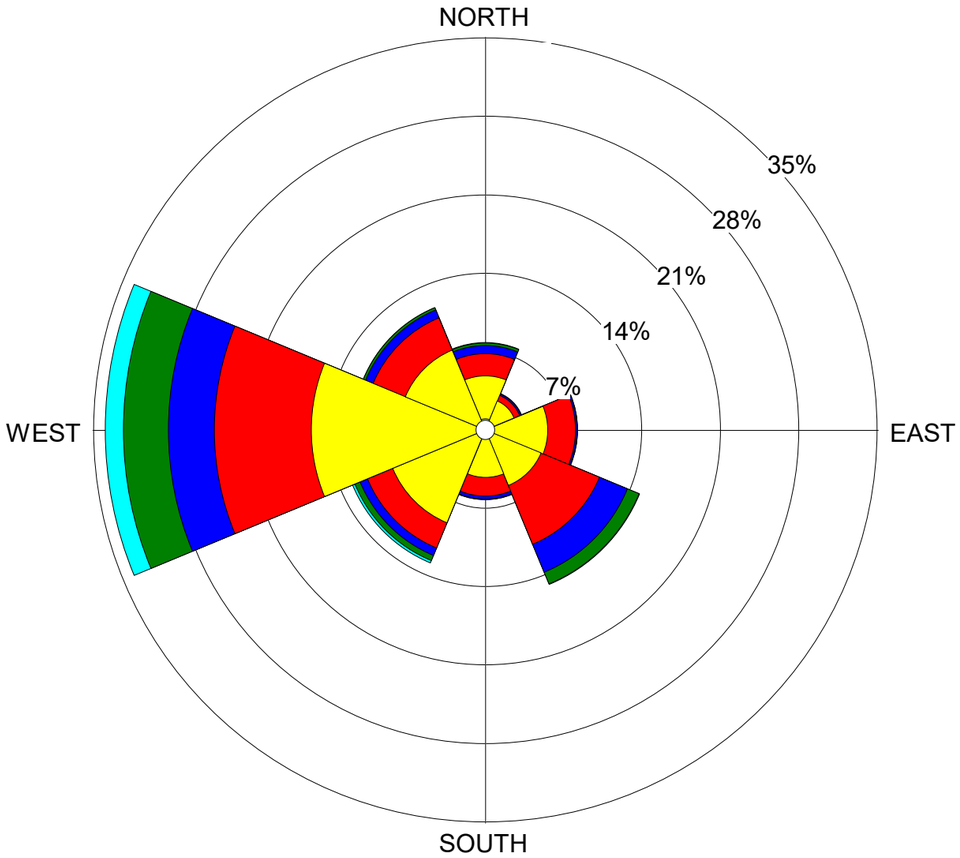
Based on the above, the meteorological data collected at the Sonny Bono monitoring station is not more suitable for modeling as the data does not meet the minimum requirements for completeness and would not be any more representative of the project site than the Imperial County Airport data based on a comparison of wind roses. Furthermore, as an ASOS station, the Imperial County Airport NWS station may provide fewer missing hours of wind speeds and wind directions. For these reasons, the Applicant supports the continued use of the Imperial County Airport NWS station meteorological data, as previously approved both by the ICAPCD and California Energy Commission (CEC).[6]

## II. Cumulative Impacts on Air Quality

***1.*** *The PDOC must study the direct and cumulative impact on air quality from the construction and operation of the proposed geothermal development. This development will be one of many future renewable energy projects in the Salton Sea region, and increased construction activities can potentially resuspend dust and particulate matter from unpaved roads. Additionally, decreased water flow into the Salton Sea would indirectly affect air quality, as the drying lakebed will release harmful dust into the atmosphere. Imperial County continues to experience high levels of air pollution and continued degradation will likely exceed legal thresholds, negatively impacting public health and resulting in more respiratory and heart diseases, among other worsened health outcomes.[3] Consider mitigation measures for air pollution, such as the use of electric vehicles for the construction and operations phases of projects. Also, consider Salton Sea restoration as a mitigation measure to reduce the negative air quality impacts from exposed dry bed playa. Paved roads are also recognized by the U.S. Department of Transportation Federal Highway Administration as a sustainability measure to improve air quality, thus it should be considered as a mitigation measure.[4]*

[5] Refer to Section 8.4.1(b)(2) of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.
[6] CEC Staff provided informal approval via electronic mail to the Applicant on December 14, 2022 and did not have any subsequent data requests associated with the modeling protocol. ICAPCD similarly did not have any comments regarding the modeling protocol during its completeness review of the permit application.

**Imperial County Airport (2015 – 2018 and 2021)**





**Sonny Bono Monitoring Station (2020 – 2022)**

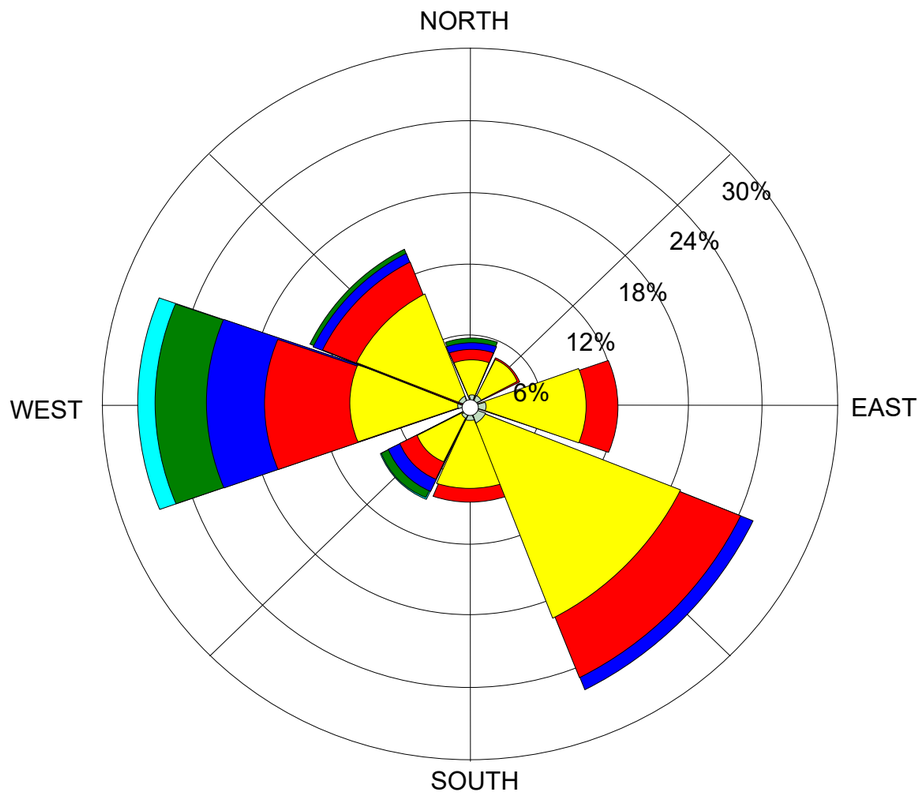



**Figure I.2-1**
**Comparison of Wind Roses**
**Black Rock Geothermal Project**
Imperial County, California

Jacobs

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**Response:** BRGP's dust, stationary sources, and vehicle exhaust emissions will be minimized to the extent feasible during both construction and operation through a number of means, including the following:

- As presented in Section 5.1.7.2.2 of Attachment DRR 7-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (TN #253080), the Applicant will implement control measures during project construction to minimize fugitive dust and equipment and vehicle exhaust emissions.

- The project's construction-related emission estimates already assume the majority of construction equipment will meet Tier 4 final emission standards.

- The Applicant will comply with applicable provisions of the California Air Resources Board's (CARB) Airborne Toxic Control Measures for diesel-fueled on- and offroad vehicles, which strive to minimize equipment and vehicle exhaust emissions.

- Although the project's internal combustion engines are exempt from emission limits as standby emergency units, they will use state-of-the-art emissions controls to minimize stationary combustion emissions.

- The vehicle fleet used to support project operations will be subject to CARB's Advanced Clean Fleet Regulation, which requires a transition to electric and other zero-emission vehicles over time and will reduce vehicle exhaust emissions.

In addition, the project's construction emissions will be temporary and finite, ceasing with completion of construction activities after approximately 29 months. Potential air quality impacts associated with these finite construction emissions will be localized to the project site[7] based on the low modeled emission rates and release heights presented in Section 5.1.9.2.2 and Appendix 5.1D of Attachment DRR 7-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (TN #253080).

***2.*** *Mitigation planning should also include continued monitoring of Valley Fever, asthma, and other respiratory and heart diseases with reportable data accessible to the public. Reporting on air quality should also include other respiratory irritants, including asbestos.*

**Response:** Imperial County comprises less than 1 percent of the State's total Valley Fever cases according to the California Department of Public Health's (CDPH) year-end surveillance report on suspect, probable, and confirmed Valley Fever cases in 2022.[8] Therefore, the potential exposure of construction workers and sensitive receptors to Valley Fever is expected to be very

[7] Section 5.1.10.2 of Attachment DRR 7-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (TN #253080) states that "all modeled maximum facility impacts occurred well inside the fine gridded receptors with 25-m spacing," which extends only 500 meters from the facility center.
[8] https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciEpiSummary2022.pdf

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low. Furthermore, the implementation of the construction worker health and safety plans, which will include procedures for using personal protective equipment, as necessary, and training on the recognition of Valley Fever infection, and the air quality fugitive dust control measures proposed by the Applicant will reduce the already low potential impacts even further. These activities are consistent with CDPH's tips for reducing exposure to Valley Fever[9] and the requirements of Assembly Bill (AB) 203 and are expected to similarly reduce exposure to other respiratory irritants that may lead to asthma, other respiratory diseases, and heart diseases.

***3.*** *Consider monitoring data from stations closer to the proposed development. With the potential for the buildout of more geothermal developments and other renewable energy facilities, consideration should also be given to the cumulative impact of PM10 and PM2.5 pollutants. As mentioned before, the Applicant is currently not in compliance with the EPA NAAQS limit of 9.0 µg/m3 for PM2.5. Additional build-out of more renewable energy development will increase the potential for concentrations (or "hotspots") of PM10, PM2.5, and other air pollutants. Mitigation planning should include strategies to identify existing and emerging concentrations of PM10 and PM2.5 pollutants.*

**Response:** As described in the response to Comment I.1 above, the project demonstrates compliance with the EPA's current NAAQS limit of 12.0 µg/m$^3$ for $PM_{2.5}$ and is not required to demonstrate compliance with the EPA's new, lower NAAQS limit of 9.0 µg/m$^3$.

With regards to monitoring data, the Applicant reviewed $PM_{10}$ and $PM_{2.5}$ data collected at the Sonny Bono monitoring station and found only two years of recent $PM_{10}$ data (2018 and 2019) and none of the recent $PM_{2.5}$ data to meet the EPA's minimum requirements of 75 percent completeness of the scheduled sampling days on a quarterly basis.[10] Based on this evaluation, the Sonny Bono monitoring station does not provide a complete three-year dataset to compute a design value for $PM_{10}$ or $PM_{2.5}$ for the air dispersion modeling analysis and is not recommended for use. Instead, the Applicant appropriately used $PM_{10}$ monitoring data collected at the quality assured air quality monitoring station located in Niland. This "regional" monitoring station is located upwind of the project area, has recent quality assured data available, and is impacted by similar or adequately representative sources; therefore, it is considered suitable for use per Section 8.3.2(b) of Appendix W to 40 Code of Federal Regulations (CFR) Part 51, *Guideline on Air Quality Models*.

$PM_{2.5}$ monitoring data is not collected at the air quality monitoring station located in Niland. Therefore, the Applicant instead used $PM_{2.5}$ monitoring data collected at the air quality monitoring stations located in Brawley and El Centro. These stations are the closest stations to the project with quality assured data and are, therefore, appropriate for use. In addition, these monitors are located in urban areas which provide a potentially higher localized $PM_{2.5}$ background concentration[11] than what is expected to be emitted by existing geothermal power

[9] https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/ValleyFeverPrevention.aspx
[10] Refer to Table 8-1 of EPA's *Guideline on Data Handling Conventions for the PM NAAQS* (EPA-454/R-99-009), which is available online at https://www3.epa.gov/ttn/naaqs/aqmguide/collection/cp2/19990401_oaqps_epa-454_r-99-009_guideline_data_handling_pm_naaqs.pdf.
[11] Refer to Section 4.3 of EPA's *Draft Guidance on Developing Background Concentrations for Use in Modeling Demonstrations* (EPA-454/P-23-001), which is available online at

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plants in the project's rural vicinity, the incorporation of which provides a more conservative assessment of $PM_{2.5}$ impacts.

With regards to cumulative impacts, a cumulative impacts analysis was conducted for $PM_{2.5}$ per the modeling protocol approved by both the ICAPCD and CEC,[12] based on the project's operational emissions exceeding the SIL for both 24-hour and annual $PM_{2.5}$. This analysis appropriately considered all existing and proposed facilities, consistent with EPA guidance,[13] and resulted in modeled cumulative impacts below the applicable standards, even with inclusion of contributions from the proposed Elmore North and Morton Bay Geothermal Projects.[14]

Because $PM_{10}$ background concentrations already exceed the California Ambient Air Quality Standards (CAAQS), a cumulative impacts analysis for $PM_{10}$ would not provide any additional value and was not conducted. However, the project is expected to have a less-than-significant impact for $PM_{10}$ for the reasons noted in the response to Comment I.1 above.

Future modifications to the project's proposed $PM_{10}$ and $PM_{2.5}$ emission sources or new emission sources will be evaluated and permitted, if required, consistent with ICAPCD regulations.

## III. Potential Hazardous Waste Storage Impacts on Air Quality

***1.*** *Proper hazardous and non-hazardous waste and material handling, storage, and disposal must be analyzed thoroughly to prevent atmospheric pollutants and unnecessary emissions. It's important to highlight that in 2007, CalEnergy / BHE Renewables, the parent company of Black Rock Geothermal, LLC, agreed to pay penalties worth $910,000 to settle allegations that it violated hazardous waste regulations.[5] This action was taken by the California Environmental Protection Agency's Department of Toxic Substances Control. On page 6 of the Black Rock PDOC, "the brine pond will be used to temporarily store the spent geothermal fluid, solids that have precipitated out of the fluid during power generation, as well as fluids generated from emergency situations, maintenance, hydro blasting, safety showers, eye wash stations, vehicle wash stations, plant conveyor systems, and reject water from reverse osmosis." Due to the chemical composition within brine ponds, it can potentially be hazardous.[6] Consider mitigation measures and alternatives, such as the use of above-ground waste management containment systems that are effectively sealed and secured to prevent spillage. Also, consider the implementation of stormwater management plans to prevent the risk of overflow and control spillage of hazardous wastes. The cumulative risks of hazardous waste will increase if future renewable energy developments do not consider effective mitigation measures and alternatives.*

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https://www.epa.gov/system/files/documents/2023-10/draft-guidance-on-developing-background-concentrations-for-use-in-modeling-demonstrations.pdf.

[12] The *Air Dispersion Modeling Protocol for Black Rock Geothermal Plant Cumulative Impact Analysis* was docketed on September 28, 2023 (TN #252438). CEC Staff did not have any subsequent data requests associated with this submittal. ICAPCD similarly did not have any comments regarding this modeling protocol during its completeness review of the permit application.

[13] Refer to Section 8.3.3 of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.

[14] Refer to Table 6-1 of Attachment DRR 12-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (TN #253080).

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**Response:** The contents of the brine pond will largely be reinjected into the geothermal reservoir. Furthermore, the brine pond is being permitted through the Regional Water Quality Control Board (RWQCB) via the CEC's Application for Certification process. The brine pond will be managed in accordance with waste discharge requirements issued by the RWQCB and incorporated into the CEC license for the facility, which the Applicant anticipates will include measures to validate the brine pond integrity, testing, and reporting.

## IV. Non-Condensable Gasses in the Atmosphere

***1.*** *In the Black Rock Geothermal Project Response to ICAPCD Data Request #1, the plant may emit 2515 pCi/L of radon. Radon is a naturally occurring gas and prolonged exposure can cause lung cancer.[7] Furthermore, it can be transferred to the surface onto the soil via geothermal fluid movement.[8] Plant workers and nearby communities risk exposure. According to OSHA, the limit that a worker can be exposed to in 40 hours in a consecutive 7 day period is 100 pCi/L.[9] The CDC also recommends taking action if a home is between 2 pCi/L through to 4 pCi/L.[10] Mitigation must consider OSHA, Center for Disease Control, or higher standards to limit exposure. Additionally, the cumulative total of radon emissions will increase as more geothermal sites are developed. The PDOC must more thoroughly center its analysis on radon.*

**Response:** According to the commentor, "the plant may emit 2515 pCi/L of radon." This statement is incorrect. The estimated value of 2,515 picocuries per liter (pCi/L) is not a measure of the project's radon emissions, but the concentration of radon within the inlet stream to the sparger, as measured by source testing at other nearby geothermal facilities. This concentration was incorporated into the Applicant's estimates of radon emissions from the geothermal processes, based on the project- and process-specific steam flowrates. Potential worker exposure to the project's radon emissions is discussed below.

Radon (Rn-222) primarily is a hazard in occupations where workers may be exposed to Naturally Occurring Radioactive Materials (NORM) and to occupants in buildings overlying soils high in radium (Ra-226).[15] Radon workplace hazards are addressed as part of a facility occupational health and safety program; risks to the general public from radon exposure are addressed by programs administered by state and county health departments, which primarily involve education about indoor air testing and building mitigation. Selected sources of radon are managed under federal standards, including U.S. Nuclear Regulatory Commission (NRC) regulations and EPA's National Emissions Standards for Hazardous Air Pollutants (NESHAPs). For example, NRC regulations for uranium mill tailings include requirements to control the release of radon. The NESHAP for emissions of radon from U.S. Department of Energy facilities establishes a surface emission standard of 20 picocuries per square meter per second ($pCi/m^2$-s) from impoundments or disposal facilities. Because radon is managed as a radiation health hazard under other programs, it has not been identified as a toxic air contaminant (TAC) in California. An outcome of not being a TAC is that there are no risk assessment methods in Office of Environmental Health Hazard Assessment (OEHHA) guidelines for assessing radon emissions to ambient air.

[15] International Commission on Radiological Protection (ICRP). 1993. *Protection Against Radon-222 at Home and at Work*. ICRP Publication 65. https://journals.sagepub.com/doi/pdf/10.1177/ANIB_23_2.

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The study cited by the commentor[16] measured static ground surface fluxes of radon emissions in geothermally active and background locations in western Turkey. The highest radon surface flux reported was 484 becquerals per square meter per hour (Bq/m$^2$-hr) or 3.6 pCi/m$^2$-s, in a sample from a geothermally active location. This highest flux estimate was lower than the guideline value for radon surface flux of 20 pCi/m$^2$-s, which was developed in a risk assessment conducted by the EPA.[17] The results from this comparison suggest that radon surface fluxes to outdoors do not pose an increased human health risk. The closest human habitation, approximately 0.6 miles (1.0 kilometers) from the project site, would be unaffected by radon surface fluxes related to site geothermal activity; therefore, there are no indoor air risks from the project's radon emissions.

The potential risk from the project's radon emissions can be assessed based on comparison with background levels in ambient air. An authoritative estimate of a typical concentration of radon in ambient (outdoor) air is 0.4 pCi/L.[18] Studies conducted by CARB reported a statewide average outdoor air concentration of 0.49 pCi/L.[19, 20]

Radon emissions from the project's cooling tower were modeled to estimate the annual average radon concentration for the Maximum Exposed Individual Resident (MEIR). As shown in Table IV.1-1, the annual average concentration at the MEIR is 0.0033 pCi/L, which is well within existing (background) levels of radon in air in California.

**Table IV.1-1.** Radon Concentration at the MEIR

| Parameter | Value |
|---|---|
| Annual Maximum Modeled TAC Impact [a] | 12.89 µg/m$^3$ per g/s |
| | 1.29E+07 pCi/m$^3$ per Ci/s |
| Annual Radon Emissions [b] | 8.07 Ci/year |
| | 2.56E-07 Ci/s |
| Annual Maximum Radon Impact [c] | 3.30 pCi/m$^3$ |
| | 3.30E-03 pCi/L |

[a] The Annual Maximum Modeled TAC Impact was taken as the maximum annual impact for the cooling towers from

[16] Aydar, E. and C. Dikar. 2021. Carcinogen soil radon enrichment in a geothermal area: case of Guzelcamli-Davutlar district of Aydin city, western Turkey. *Ecotoxicology and Environmental Safety*. 208:111466. https://www.sciencedirect.com/science/article/pii/S0147651320313038.

[17] U.S. Environmental Protection Agency (EPA). 1982. *Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), Volume 1*. EPA 520-4-82-013-1. https://semspub.epa.gov/work/05/145482.pdf.

[18] Agency for Toxic Substances and Disease Registry (ATSDR). 2012. *Toxicological Profile for Radon*. May. https://www.atsdr.cdc.gov/ToxProfiles/tp145.pdf.

[19] Liu, K-S et al. 1990. *Survey of Residential Indoor and Outdoor Radon Concentrations in California*. https://ww2.arb.ca.gov/sites/default/files/classic/research/apr/past/a6-194-53.pdf.

[20] Liu, K-S et al. 1991. *Annual Average Radon Concentrations in California Residences*. Journal of Air and Waste Management Association. 41(9):1207-1212. https://www.tandfonline.com/doi/abs/10.1080/10473289.1991.10466917.

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the 1 g/s TAC AERMOD run and converted to units of pCi/m$^3$ per Ci/s using the following conversion factors:

1 µg = 1.00E-06 g
1 g = 1.50E+05 Ci[21]
1 Ci = 1.00E+12 pCi

[b] Annual Radon Emissions were taken from Appendix 5.1A, Table 1 of Attachment DRR 7-1 of the *Black Rock Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 63 to 66)* (TN #253080) and converted to units of Ci/s using the following conversion factor:

1 year = 3.15E+07 s

[c] The Annual Maximum Radon Impact was calculated by scaling the Annual Maximum Modeled TAC Impact by the Annual Radon Emissions and converted to units of pCi/L using the following conversion factor:

1 m$^3$ = 1,000 L

Notes:
µg = microgram(s)
Ci = curie(s)
Ci/s = curie(s) per second
g = gram(s)
g/s = gram(s) per second
L = liter(s)
m$^3$ = cubic meter(s)
pCi = picocurie(s)
pCi/m$^3$ = picocurie(s) per cubic meter
s = second(s)

While radon cancer risk may not have been included in the project's health risk assessment (HRA), there is sufficient basis to show that radon emissions from the proposed project do not represent an increased health risk. Specifically, the lifetime cancer risk from the radon concentration at the MEIR location is estimated to be less than 1 in 1 million, as shown in Table IV.1-2. Other hazards associated with radon (for example workplace hazards) are addressed through existing regulatory programs.

**Table IV.1-2** Lifetime Cancer Risk from Radon Concentration in Air at the MEIR

| Parameter | Value |
|---|---|
| Radon-222 Concentration | 0.0033 pCi/L |
| Working Level (WL) [a] | 0.00001 |
| Working Level Month (WLM) [b] | 0.001 |
| Lifetime Cancer Risk [c] | 0.00000036 or 0.36 in 1 million |

[a] The WL represents the energy of radon daughters (i.e., isotopes from rapidly decaying radon) and is calculated per the following equation:

WL = Radon-222 Concentration (pCi/L) x Equilibrium Factor x Fraction of Time Exposed to Radon Concentration in Air / 100, where:
Equilibrium Factor = 0.4 for residences[22]
Fraction of Time Exposed to Radon Concentration in Air = 1 (default)

[b] The WLM is calculated per the following equation:

WLM = WL x Exposure Time (hours) / 170 hours per month, where:

[21] https://www.ncbi.nlm.nih.gov/books/NBK158787/table/T23/
[22] ICRP. 1993. *Protection Against Radon-222 at Home and at Work*. ICRP Publication 65. https://journals.sagepub.com/doi/pdf/10.1177/ANIB_23_2.

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Exposure Time = 7,000 hours for residential[23]

[c] The Lifetime Cancer Risk was calculated per the following equation, based on calculations presented in NRC training:[24]

Lifetime Cancer Risk = WLM x Risk Factor per WLM, where:
Risk Factor per WLM = 0.00066, based on the mid-point of the estimated range[25]

2. *Other non-condensable gasses (i.e. hydrogen sulfide, ammonia, arsenic, mercury, benzene, toluene, and xylene) pose a risk and should be monitored and mitigated to protect geothermal workers and surrounding communities before issuing a decision for this project. Workers and nearby communities may be more exposed to hazardous non-condensable gasses during normal operations of the facility. Mitigation should also include regular health risk assessment to ensure there are no concentrations of hazardous air pollutants in the region.*

**Response:** The project's hydrogen sulfide ($H_2S$) emissions were evaluated for comparison to the 1-hour CAAQS and as a TAC contributing to the project's potential health risks. Based on this evaluation, many of the conditions included in the PDOC aim to limit the project's $H_2S$ emissions, thereby limiting exposure to workers and nearby communities. The Applicant will also implement BACT for $H_2S$.

Ammonia, arsenic, mercury, benzene, toluene, and xylene are all identified TACs in California, were included in the Applicant's HRA per OEHHA guidance, and contribute to the project's modeled potential health risks. Because there are no established state or federal ambient air quality standards for these TACs, there is no need to address them outside of the HRA.

To determine the relative importance of each of the above pollutants, the per-pollutant contribution to the project's modeled health risks were estimated. Table IV.2-1 presents the per-pollutant contribution to the project's estimated cancer risk of 0.25 in 1 million at the MEIR. As shown, benzene is the predominant contributor to the project's cancer risks.

**Table IV.2-1.** Per-pollutant Contribution to Cancer Risk

| Pollutant | Cancer Risk (per million) [a] | Contribution (%) |
|---|---|---|
| Ammonia | 0 | 0 |
| Arsenic | 0.05 | 20 |
| Mercury | 0 | 0 |
| Benzene | 0.13 | 52 |
| Toluene | 0 | 0 |
| Xylene | 0 | 0 |
| $H_2S$ | 0 | 0 |

[23] *Id.*
[24] https://www.nrc.gov/docs/ML1122/ML11227A237.pdf
[25] EPA. 2003. *EPA Assessment of Risks from Radon in Homes*. EPA 402-R-03-003. Available online at https://www.epa.gov/sites/default/files/2015-05/documents/402-r-03-003.pdf.

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[a] The per-pollutant cancer risk was extracted from the Applicant's HRA modeling file titled 'BR_MEIR_CancerRisk.csv' for Receptor 5548.

Similarly, Attachment IV.2-1 presents the per-pollutant contributions to the project's estimated chronic and acute health risks at the MEIR. As shown, the respiratory system has the highest chronic health risk, with arsenic contributing up to 46 percent of the estimated risk. The central nervous system has the highest acute health risk, with $H_2S$ contributing up to 99 percent of the estimated risk.

Based on the above analysis, benzene and arsenic are the only pollutants apart from $H_2S$ that are notably driving the project's modeled potential health risks. Although benzene and arsenic are predominant contributors to the project's estimated cancer and chronic risks, respectively, those risks are considered to be less than significant for the following reasons:

- Cancer risk is less than 1 in 1 million at the MEIR, Maximum Exposed Individual Worker (MEIW), and Maximum Exposed Sensitive Receptor.
- Chronic risk is less than 1.0 at the MEIR, MEIW, and Maximum Exposed Sensitive Receptor.

Because the benzene- and arsenic-driven risks are considered to have a less-than-significant impact on public health, additional scrutiny of the project's benzene and arsenic emissions is not warranted.

## V. Continued Monitoring of Cumulative Impacts

***1.*** *BHER, the Imperial County Air Pollution Control District, and other agencies and developers must implement monitoring of the cumulative impacts as more geothermal, lithium, and renewable energy developers seek to build projects by the Salton Sea. Regular reviews of the best available control technology (BACT) and other best practices should be employed. Monitoring should be thorough, and data should be readily available, accessible, and reportable to the public. Periodic review of monitoring should also include mitigation measures and recommended alternatives.*

**Response:** As stated in the response to Comment II.3 above, the Applicant prepared a cumulative impacts analysis per the modeling protocol approved by both the ICAPCD and CEC. This analysis appropriately considered all existing and proposed facilities at the time of permitting, consistent with EPA guidance.[26] Any new geothermal, lithium, or renewable energy projects subject to environmental analysis under the California Environmental Quality Act will be similarly subject to a cumulative impacts analysis.

The Applicant also prepared a BACT analysis consistent with the EPA's top-down approach. This analysis was appropriate for the project's new emission sources as BACT applies to new and modified stationary sources.

[26] Refer to Section 8.3.3 of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.

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**The Applicant Remains Available to Support the Issuance of the FDOC**

Thank you for the opportunity to address some of the selected comments of JMA. The Applicant looks forward to working with the ICAPCD during the finalization of the Determination of Compliance. Please contact Anoop Sukumaran at (760) 348-4275 (email address: Anoop.Sukumaran@calenergy.com) or Jerry Salamy at (916) 769-8919 (email address: Jerry.Salamy@jacobs.com) if you have any questions or if you need additional information.

Sincerely,

Jon Trujillo
General Manager, Geothermal Development

**Attachment IV.2-1**

Per-pollutant Contribution to Chronic and Acute Health Risks

*Black Rock Geothermal Project*

**Chronic Risks at Receptor 5548**

| Target Organ | Cardiovascular System | Central Nervous System | Immune System | Kidney | Gastrointestinal Tract and Liver or Alimentary Tract | Reproductive and Development System | Respiratory System | Skin | Eye | Bone and Teeth | Endocrine System | Blood | Odor | General |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk by Target Organ [a] | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | **0.01** | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| *Per-pollutant Contribution to Target Organ* | | | | | | | | | | | | | | |
| Ammonia | 0% | 0% | 0% | 0% | 0% | 0% | 28% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Arsenic | 100% | 92% | 0% | 0% | 0% | 92% | 46% | 100% | 0% | 0% | 0% | 0% | 0% | 0% |
| Mercury | 0% | 8% | 0% | 100% | 0% | 8% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Benzene | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% |
| Toluene | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 90% | 0% | 0% | 0% | 0% | 0% |
| Xylene | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 10% | 0% | 0% | 0% | 0% | 0% |
| $H_2S$ | 0% | 0% | 0% | 0% | 0% | 0% | 9% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| *Per-pollutant Risk by Target Organ* [b] | | | | | | | | | | | | | | |
| Ammonia | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.42E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Arsenic | 4.01E-03 | 4.01E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 4.01E-03 | 4.01E-03 | 4.01E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Mercury | 0.00E+00 | 3.38E-04 | 0.00E+00 | 3.38E-04 | 0.00E+00 | 3.38E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Benzene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 6.39E-04 | 0.00E+00 | 0.00E+00 |
| Toluene | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.61E-07 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Xylene | 0.00E+00 | 2.94E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.94E-08 | 0.00E+00 | 2.94E-08 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| $H_2S$ | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 8.25E-04 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Maximum Risk**

[a] The total chronic risk was extracted from the Applicant's HRA modeling file titled 'BR_Chronic_NCChronicRiskSumByRec.csv' for Receptor 5548.

[b] The per-pollutant chronic risk was extracted from the Applicant's HRA modeling file titled 'BR_Chronic_NCChronicRisk.csv' for Receptor 5548.

**Attachment IV.2-1**
Per-pollutant Contribution to Chronic and Acute Health Risks
*Black Rock Geothermal Project*

**Acute Risks at Receptor 5548**

| Target Organ | Cardiovascular System | Central Nervous System | Immune System | Kidney | Gastrointestinal Tract and Liver or Alimentary Tract | Reproductive and Development System | Respiratory System | Skin | Eye | Bone and Teeth | Endocrine System | Blood | Odor | General |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Risk by Target Organ [a] | 0.00 | **0.35** | 0.12 | 0.00 | 0.00 | 0.13 | 0.27 | 0.00 | 0.27 | 0.00 | 0.00 | 0.12 | 0.00 | 0.00 |
| *Per-pollutant Contribution to Target Organ* | | | | | | | | | | | | | | |
| Ammonia | 0% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 100% | 0% | 0% | 0% | 0% | 0% |
| Arsenic | 100% | 0% | 0% | 0% | 0% | 1% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Mercury | 0% | 1% | 0% | 0% | 0% | 2% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Benzene | 0% | 0% | 100% | 0% | 0% | 97% | 0% | 0% | 0% | 0% | 0% | 100% | 0% | 0% |
| Toluene | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Xylene | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| $H_2S$ | 0% | 99% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| *Per-pollutant Risk by Target Organ* [b] | | | | | | | | | | | | | | |
| Ammonia | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.64E-01 | 0.00E+00 | 2.64E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Arsenic | 1.53E-03 | 1.53E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.53E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Mercury | 0.00E+00 | 2.66E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 2.66E-03 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Benzene | 0.00E+00 | 0.00E+00 | 1.24E-01 | 0.00E+00 | 0.00E+00 | 1.24E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.24E-01 | 0.00E+00 | 0.00E+00 |
| Toluene | 0.00E+00 | 3.81E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 3.81E-05 | 0.00E+00 | 3.81E-05 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| Xylene | 0.00E+00 | 1.60E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 1.60E-06 | 0.00E+00 | 1.60E-06 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |
| $H_2S$ | 0.00E+00 | 3.43E-01 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 | 0.00E+00 |

**Maximum Risk**

[a] The total acute risk was extracted from the Applicant's HRA modeling file titled 'BR_Acute_NCAcuteRiskSumByRec.csv' for Receptor 5548.

[b] The per-pollutant acute risk was extracted from the Applicant's HRA modeling file titled 'BR_Acute_NCAcuteRisk.csv' for Receptor 5548.