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Morton Bay Geothermal LLC
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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 Responses to The LV Equity Technical Advisory Group Comments on Preliminary Determination of Compliance for the Morton Bay Geothermal Plant**

Dear Mr. Ramirez:

Morton Bay Geothermal LLC (the Applicant) appreciates the Imperial County Air Pollution Control District's (ICAPCD) efforts in producing a comprehensive Preliminary Determination of Compliance (PDOC) for the Morton Bay Geothermal Project (MBGP or Morton Bay).

The Applicant welcomes this opportunity to submit selected responses to certain comments submitted by the Lithium Valley Equity Technical Advisory Group (LVETAG) on the PDOC for Morton Bay. LVETAG's comments on the PDOC were docketed with the California Energy Commission (CEC) on March 11, 2024.[1] The following responses are provided for your consideration. The Applicant remains available to provide additional information in furtherance of issuance of the Final Determination of Compliance (FDOC) for the Morton Bay Project.

I. Cumulative Impacts

1. *This analysis should carefully consider not only direct and induced, but also cumulative impacts on the entire Imperial County Air Pollution Control District, which is already severely degraded. Reduced inflow of water to the Salton Sea due to increased apportionment of water for this proposed project would indirectly impact air quality by exposing more lakebed and releasing toxic dust into the air.[1] Any worsening air quality would significantly impact public health and likely exceed legal thresholds, which must be analyzed and mitigated. Air flow models should include those that measure pollutant transport to other areas of Imperial County, air basins, and air districts.*

Response: Inflows to the Salton Sea are predominantly from agricultural return flows augmented with inflows from Mexico and other sources. Imperial Irrigation District (IID) is actively working with federal and state agencies to preserve the lake.[2] Since geothermal power plants like the MBGP are not a source of inflow, their operation will not prevent the IID from continuing its preservation efforts. IID requested the Applicant prepare an assessment of the MBGP's potential impact to the flows into the Salton Sea. A draft of this assessment is being prepared for submittal to IID and will be publicly available once finalized. Based on preliminary results, the MBGP will

[1] The LVETAG PDOC comments for the project - https://efiling.energy.ca.gov/GetDocument.aspx?tn=254965&DocumentContentId=90652.
[2] https://www.iid.com/water/salton-sea

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not have a significant impact on drain flows into the Salton Sea.

With regards to air flow models, ICAPCD Rule 207.F.1.a requires the use of U.S. Environmental Protection Agency (EPA)-recommended models when conducting an air quality impact analysis as part of a permit application. Consistent with this requirement and the modeling protocol approved both by ICAPCD and CEC Staff,[3] the Applicant's air quality impact analysis was conducted using the American Meteorological Society/EPA Regulatory Model (AERMOD). AERMOD is one of three models preferred by the EPA, as described in Appendix A to Appendix W of 40 Code of Federal Regulations (CFR) Part 51, *Guideline on Air Quality Models*. AERMOD is, however, the only preferred model considered suitable for the project, based on the following:

- The Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS) is appropriate for applications with only elevated point sources, whereas AERMOD is appropriate for applications with point, volume, and area sources. Since the project includes both point and area sources, CTDMPLUS is not appropriate for use.

- The Offshore and Coastal Dispersion (OCD) Model is appropriate for overwater emission sources, of which the project has none.

In addition, both AERMOD and CTDMPLUS are appropriate for transport distances of up to 50 kilometers (km). Nearby Riverside and San Diego counties are located within 50 km of the project site, such that either model is capable of estimating potential impacts in nearby counties, air basins, and air districts. As described in Section 5.1.9.1.2 of Attachment DRR 7-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (Transaction Number [TN] #253082), the Applicant's modeling domain extended 10 km from the project fenceline. Extension of this modeling domain was not considered necessary both because the locations of maximum modeled impacts were nowhere near the edge of the modeling domain and the magnitude of modeled impacts diminishes as one moves farther from the source. Pollutant transport within Imperial County and the surrounding areas is also generally addressed through ICAPCD's development of the State Implementation Plan (SIP).

2. *It is critical to consider the broader impact on air quality caused by the buildout of this project as well as other geothermal plants and energy infrastructure developments throughout Imperial County. The model should include background concentrations from all nearby sources. Emissions from several existing and proposed geothermal facilities, including the other two proposed projects by the same Applicant, have been omitted from the modeling. This must be rectified for accurate analysis of impacts, especially when we consider the ambitious planning process underway for the broader Lithium Valley study area that encompasses this project.*

[3] 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.

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Response: In a cumulative impact analysis, the EPA's guidance requires the evaluation of all sources which could contribute to impacts. However, the guidance only requires modeling of nearby sources that are not adequately represented in the background ambient monitoring data, particularly if those sources could contribute to areas where the project alone has Significant Impact Level (SIL) exceedances.[4] Based on the project's operational emissions exceeding the SIL for both 24-hour and annual particulate matter with aerodynamic diameter less than or equal to 2.5 microns ($PM_{2.5}$),[5] the cumulative impacts analysis was conducted only for $PM_{2.5}$, per the modeling protocol approved by both the ICAPCD and CEC Staff.[6]

Existing, operational facilities were considered to be adequately represented in background monitoring data. In addition, as shown in Table 4-1 and Appendix A of the *Air Dispersion Modeling Report for Black Rock, Elmore North, and Morton Bay Geothermal Projects*, the SIL impact radius for the project's 24-hour and annual $PM_{2.5}$ impacts is small (i.e., 0.3 km or less). At such limited distances, it is unlikely that $PM_{2.5}$ impacts from nearby existing sources would overlap with the project's impact areas. This conclusion is further supported through consideration of the location and orientation of similar existing emission sources in the project vicinity. For example, J.L. Featherstone is an existing, operational facility located northeast of the project and, like the project, emits $PM_{2.5}$ from cooling towers. J.L. Featherstone's cooling towers are similarly located along the eastern edge of the property in a northwest to southeast configuration. Given the proximity of these two facilities and their slightly staggered positioning, $PM_{2.5}$ impacts from both facilities would be expected to occur in the same general direction (i.e., east of both property boundaries) under the same meteorological conditions instead of overlapping in an area requiring different wind directions (i.e., east of the project but south of J.L. Featherstone). Furthermore, in the rare event that $PM_{2.5}$ impacts from both facilities did overlap, they would have to do so persistently for 24-hours or the majority of a year to affect the modeled results, based on the averaging periods of the $PM_{2.5}$ standards. For these reasons, it is unlikely that the project's highest $PM_{2.5}$ impacts would overlap with the highest $PM_{2.5}$ impacts from nearby existing sources; therefore, inclusion of such nearby existing sources in the cumulative impact analysis is not warranted.

With regards to proposed development, contrary to LVETAG's indication,[7] both Black Rock and Elmore North Geothermal Projects were modeled in the cumulative impact analysis for Morton Bay as proposed geothermal facilities.[8] Further, as described in Section 4.3 of the *Air Dispersion Modeling Report for Black Rock, Elmore North, and Morton Bay Geothermal Projects*,[9] renewable energy infrastructure developments were evaluated but excluded because they are not

[4] Refer to Section 8.3.1 of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.
[5] The CEC does not require a cumulative assessment for pollutants in which the facility impact is less than the EPA's applicable SIL.
[6] The *Air Dispersion Modeling Protocol for Morton Bay Geothermal Plant Cumulative Impact Analysis* was docketed on September 28, 2023 (TN #252436). 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.
[7] LVETAG Comments, p. 2.
[8] Refer to Attachment DRR 12-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082).
[9] *Id.*

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expected to emit more than five tons per year of criteria pollutants or hydrogen sulfide (H_2S). As a future geothermal plant, Hell's Kitchen was similarly evaluated but excluded because it is currently in the entitlement process, which occurs before any air emissions-related permitting and licensing is publicly available. As such, it is impossible to predict what its potential emissions may be or if the project will even be built in the future. Furthermore, ICAPCD's future permit evaluation of Hell's Kitchen would be expected to include the MBGP in its cumulative evaluation.

3. *In addition to dust suppression and mitigation, plans should be outlined for pavement of roads, ideally with permeable material to mitigate climate and health risks. Despite the well-known problems related to dust pollution in this area, a dust control plan is only required 10 days prior to construction, and paving roads is not required according to the document (Imperial County Air Pollution Control District, 2024, p. 32; 38). Internal combustion engines proposed by the Applicant may be exempt from emission limits if they are emergency standby engines (Imperial County Air Pollution Control District, 2024, p. 31), but the role of electric vehicles (EVs), including trucks and off-road vehicles, in mitigating air pollution from traffic and goods transportation should be outlined in detail with performance metrics for commute trip reduction, rideshare programs, and heavy-duty charging infrastructure.*

Response: The project'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 *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082), 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.

4. *Meteorological data should be representative of the proposed project site, for example using the Sonny Bono monitoring station and/or Comite Civico del Valle's IVAN air monitoring*

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network. The current analysis relies on distant data from an Airport that is many miles away from the project site, as California Unions for Reliable Energy (CURE) recently pointed out in relation to the proposed Elmore North project.[2]

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 and found that 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.[10] 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.[11]

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 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 AERMOD Meteorological Preprocessor (AERMET).

Lastly, although the Imperial County Airport is located over 28 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,[12] 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.4-1, 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 CEC.

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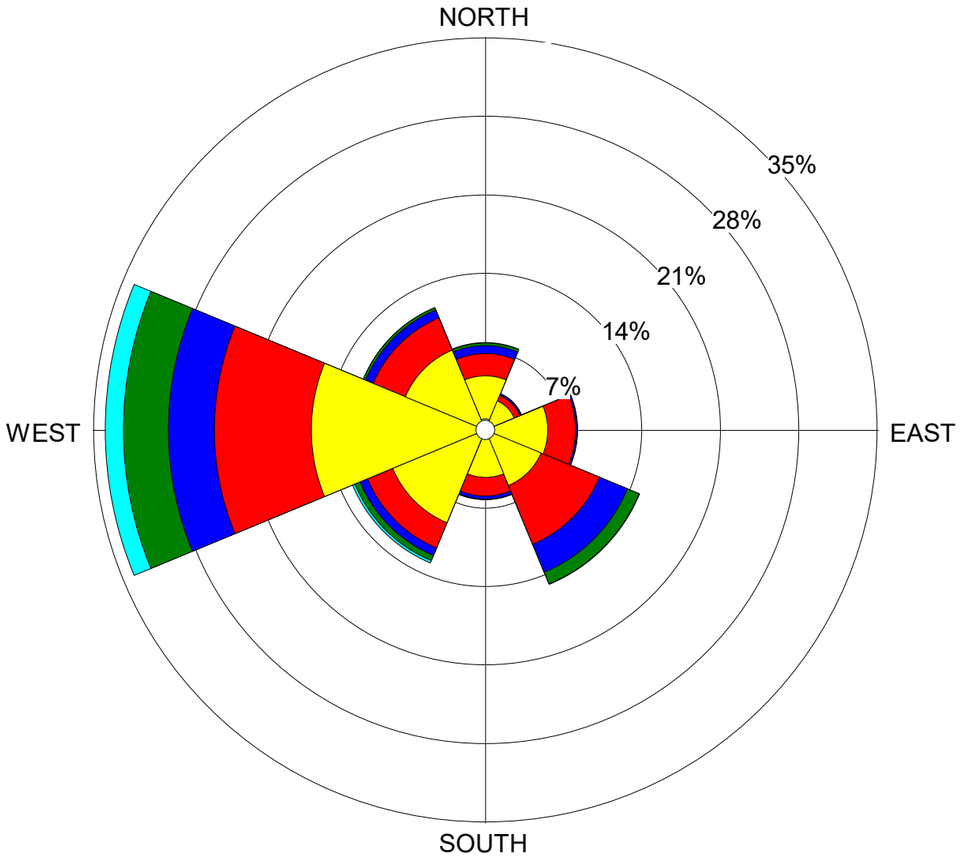
[10] Refer to Section 5.3.2 of EPA's *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (EPA-454/R-99-005), which is available online at https://www.epa.gov/sites/default/files/2020-10/documents/mmgrma_0.pdf.
[11] Refer to Section 8.4.2(e) of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.
[12] Refer to Section 8.4.1(b)(2) of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.

Imperial County Airport (2015 – 2018 and 2021)



Sonny Bono Monitoring Station (2020 – 2022)

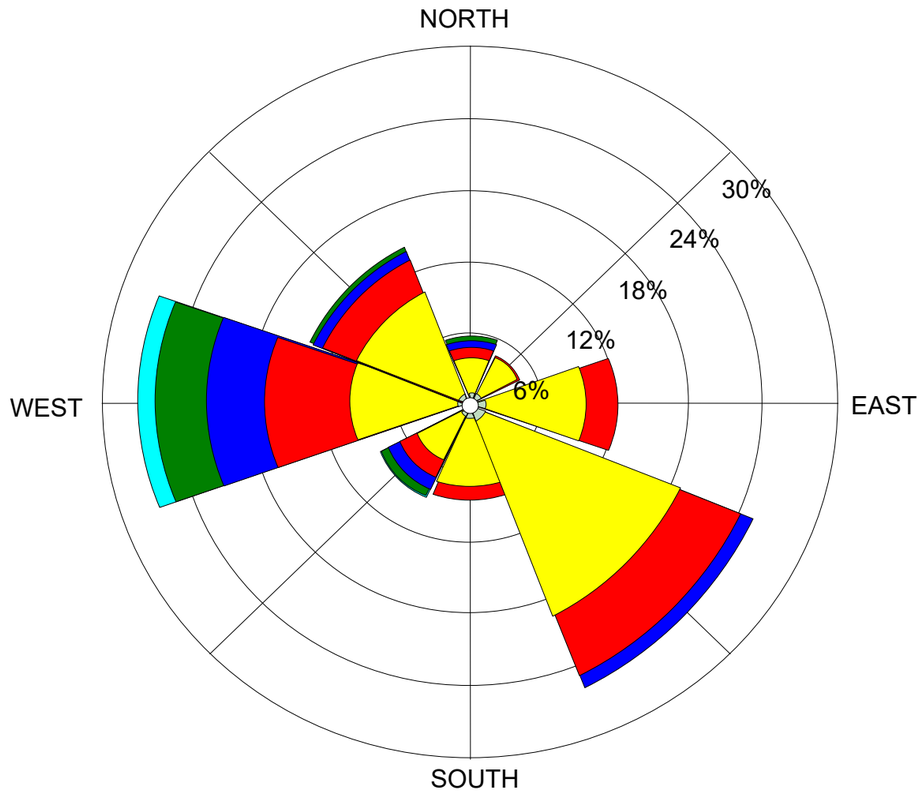


Figure I.4-1
Comparison of Wind Roses
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The Applicant also reviewed the particulate matter with aerodynamic diameter less than or equal to 10 microns (PM_{10}) and $PM_{2.5}$ data collected at the Sonny Bono monitoring station and found only two years 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.[13] 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.

Data collected from the community-level monitors enrolled in the Identifying Violations Affecting Neighborhoods (IVAN) network are also not recommended for use as these data are neither validated nor verified and do not come from regulatory monitors.[14] In turn, the Applicant appropriately used PM_{10} and $PM_{2.5}$ monitoring data collected at the quality assured air quality monitoring stations located in Niland, Brawley, and El Centro, as applicable. These "regional" monitoring stations are located upwind of the project area, have recent quality assured data available, and are impacted by similar or adequately representative sources; therefore, they are considered suitable for use per Section 8.3.2(b) of Appendix W to 40 CFR Part 51, *Guideline on Air Quality Models*.

5. *The project applicant should conduct soil testing to ensure the soil pathogen that causes Valley Fever is not present on site and support the highest standard of occupational safety to avoid exposures recommended by the California Public Health Department. In addition to measures described by the Applicant in responses to data requests, such as PPE and fugitive dust control, mitigation planning should support more robust monitoring for Valley Fever infections in the County. Even if Valley Fever is not considered to be endemic in Imperial Valley, as the Applicant has asserted in response to data requests, disturbing soil has been linked to outbreaks in places where the fungus was not expected to live, according to the CDC.*[3]

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.[15]

In support of these efforts, the project's health and safety programs will include robust measures to protect worker health and safety. These measures include development of a fugitive dust control program, which will include watering unpaved roads during both construction and operation; procedures for using personal protective equipment, as necessary; and training on the recognition of Valley Fever infection, which will be provided upon initial hiring and annually for construction and operational employees. These activities are consistent with CDPH's tips for reducing exposure to Valley Fever[16] and the requirements of Assembly Bill (AB) 203.

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[13] Refer to Table 8-1 of EPA's *Guideline on Data Handling Conventions for 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.

[14] Refer to the disclaimer regarding the use of these data at https://ivan-imperial.org/air/map.

[15] https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciEpiSummary2022.pdf

[16] https://www.cdph.ca.gov/Programs/CID/DCDC/Pages/ValleyFeverPrevention.aspx

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6. *Air quality impacts should include exposure to asbestos, lead, bird waste, and other respiratory irritants, with specific attention made in CalEnviro Screen designated areas.*

Response: The Applicant has analyzed air quality and public health impacts for all pollutants known or expected to be emitted by the project, including lead and other respiratory irritants, consistent with programs and methods approved by regulatory agencies.

II. Best Available Control Technologies (BACT)

1. *According to the determination of compliance, BACT is triggered for PM10 and H2S emissions, and models show these emissions exceeding thresholds (Imperial County Air Pollution Control District, 2024, p. 24; 28; 35). Nonetheless, the Air District's proposed BACT alternatives were rejected. In some cases, tradeoffs regarding water use or other incompatibilities rendered such alternatives technically infeasible. However, in other instances proposed BACT alternatives were rejected because they were considered less cost-effective, for example regenerative thermal oxidizers and bioreactors as potential alternatives to spargers (Imperial County Air Pollution Control District, 2024, p. 25). There needs to be substantial evidence showing that these alternatives are not cost effective. Without such evidence, these alternatives should be reconsidered in relation to the significant tax and financial incentives that the Applicant has been able to access for advancing this development project.*[4]

Response: At the request of the ICAPCD, the Applicant prepared a Best Available Control Technology (BACT) analysis.[17] The analysis specifically considered the following additional control technologies for the project's particulate matter and H_2S emissions: air-cooled condensers (ACC) with evaporative pre-cooling for particulate matter abatement; direct injection of condensate for sour condensate liquid (H_2S) abatement; and liquid redox technologies, including Stretford Process, SulFerox, and LO-CAT, for non-condensable gas (NCG) (H_2S) abatement.

The BACT analysis was performed following the EPA's top-down approach, which includes the following elements:

- Step 1: Identify potential control technologies
- Step 2: Eliminate technically infeasible options
- Step 3: Rank remaining control technologies by control effectiveness
- Step 4: Evaluate most effective controls
- Step 5: Select BACT

Per Step 2 of the above process, technically infeasible options are eligible for elimination from the BACT analysis and do not require further evaluation of control and cost effectiveness. As a result, the BACT analysis focused on technically feasible options that reduce emissions without formation of any associated secondary emissions. For example, although thermal oxidizers would reduce H_2S emissions, they require propane combustion to operate, which would lead to an

[17] Refer to Appendix 5.1E of Attachment DRR 7-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082).

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increase in emissions of combustion contaminants.

ICAPCD Rule 207.B defines BACT as the most effective emission control device which has been achieved in practice or any other alternative emission control device determined to be technologically feasible and cost-effective by the Air Pollution Control Officer (APCO).[18] ICAPCD Rule 207.B further indicates that a cost-effectiveness analysis should be performed in accordance with methodology and criteria specified in the South Coast Air Quality Management District's (SCAQMD) BACT Guidelines.

Consistent with the EPA's top-down approach and the provisions of ICAPCD Rule 207.B, the cost-effectiveness of each technically feasible option was provided to ICAPCD. SCAQMD's BACT Guidelines indicate that a technology is considered to be cost effective if its "cost per ton of emissions reduced is less than the maximum required cost effectiveness."[19] However, no maximum required cost effectiveness is provided for H_2S. Therefore, the Applicant instead relied on a comparison of cost per ton of emissions reduced to determine which technology was the most cost-effective and recommended that technology for the project.

By preparing the BACT analysis, the Applicant adequately considered advancements in technology relevant to the project's emissions and ultimately proposed the technologies that were both technically feasible and cost-effective, consistent with the provisions of ICAPCD Rule 207.B.

2. *Moreover, the Applicant needs to ensure a process for periodic review of BACTs and other emerging best practices that can be employed. This could be achieved through an annual review process linked to the Specific Plan and Programmatic Environmental Impact Report for Lithium Valley, which includes this project in its study area. Whether or not BHE Renewables plans to extract lithium from this facility, it should be subject to a public review and the ability of the public and other public agencies to weigh in on emerging impacts, BACTs, and other issues that may emerge as the industry near the Salton Sea develops. For example, the Applicant should track progress toward better drift eliminators with a greater drift rate that can remove higher concentrations of pollutants.*

Response: As stated in the response to II.1 above, the Applicant 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. Future modification of stationary sources at the MBGP will comply with BACT requirements at the time of modification.

3. *The Applicant should explain how mineralization buildup affects the effectiveness of drift eliminators and pollution control and their plan for maintenance and cleaning to ensure equipment operates to performance specifications.*

[18] https://apcd.imperialcounty.org/wp-content/uploads/2020/01/1RULE207.pdf
[19] https://www.aqmd.gov/docs/default-source/bact/bact-guidelines/bact-guidelines-2024/part-c_policy-and-procedures-for-non-major-polluting-facilities.pdf

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Response: As required under proposed Permit Condition F.5 of the PDOC, the Applicant will inspect the cooling tower drift eliminators annually. This inspection includes conducting an inventory survey of the drift eliminators to ensure the equipment is operating to its performance specifications without degradation and replacing any drift eliminators that are damaged. A report of the inspection results will be submitted to the ICAPCD in accordance with proposed Permit Condition I.2 of the PDOC.

4. *The proposed drift eliminators for the cooling towers are an "end-of-pipe" solution to air pollution emissions. The Applicant should pursue methods to remove contaminants like mercury and H2S from the raw steam before they reach the generators, as upstream abatement or separation before the turbines will result in fewer downstream emissions. This could help reduce pollution and increase the capture of pollution at the cooling tower and help avoid heavy metals and other pollution emissions.*

Response: The BACT analysis described in response to II.1 above looked at all feasible control technologies for emissions at both the cooling tower and the steam turbine, where NCGs are first separated from the steam. The proposed control technologies were those that were determined to be achieved in practice, consistent with the EPA's top-down approach and ICAPCD Rule 207.B.

III. Brine Pond and Storage Alternatives

1. *Brine ponds represent one of the potential sources of hazardous waste and emissions at geothermal facilities (Dobson et al., 2023, p. 136).[5] Based on the description of the Fluid Injection System, the brine pond at this proposed site appears to be used to temporarily store all manner of potentially hazardous waste (Imperial County Air Pollution Control District, 2024, p. 6).[6] It is worth noting that there is a track record of spill-related contamination at most of the geothermal facilities in the Salton Sea Known Geothermal Resource Area (SSKGRA) after inaccurate predictions of low spill risk in previous EIRs, and CalEnergy / BHE Renewables already agreed to pay a $910,000 penalty and conduct soil remediation as part of a 2007 consent agreement. Alternatives to brine ponds should be considered for onsite waste handling and storage, such as: (i) above-ground, sealed storage containers to prevent spills and wind-blown contaminants, and secured to avoid tipping in the event of earthquakes; (ii) effectively covered to minimize emissions; and/or (iii) covered solar to generate further onsite renewable energy that could also serve as an alternative to diesel generation.*

Response: The contents of the brine pond will largely be reinjected and otherwise managed in accordance with the requirements of the Regional Water Quality Control Board and Title 22 California Code of Regulations (CCR) Division 4.5 requirements, outside the jurisdiction of the ICAPCD. Furthermore, there is no potential for emissions from the brine pond as H_2S and other NCGs are removed from the geothermal gas streams before the depleted process stream reaches the brine pond and were included in the modeling analysis as being emitted by the upstream emission sources.

2. *Given the high potential likelihood of hazardous materials, storage containers should not be treated as exempt like the tank storage contents described in the compliance decision. The PDOC mentions that at least one of these tanks may contain 20,000 gallons of hydrochloric*

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acid (Imperial County Air Pollution Control District, 2024, p. 7). However, as CURE has noted, this excludes updated plans for another 800-gallon HCl storage tank and associated scrubber. The throughput limit for HCl appears to significantly underestimate the usage rate, and given the serious health risks of exposure to HCl, the relevant conditions should be revised for consistency and compliance.

Response: ICAPCD has included a 20,000-gallon hydrochloric acid (HCl) storage tank in the PDOC, indicating that appropriate consideration was given to the project's potential emission sources when determining eligibility for exemption.

In addition, although the project's HCl emissions were conservatively attributed to this 20,000-gallon storage tank, the HCl emissions estimate was developed independent of the HCl concentration and size of the storage tank. The project's HCl emissions assumed a maximum filling rate of 100 gallons per minute with the scrubber operating up to 365 days per year. These conservative assumptions are inclusive of scrubber operation for both the 20,000-gallon and 800-gallon HCl storage tanks proposed for the MBGP and represent the project's potential to emit (PTE) HCl. Permit Condition B.9 was developed consistent with the Applicant's PTE estimate and is independent of the anticipated annual HCl throughput expected each year.

3. *It is imperative to develop and implement a comprehensive stormwater management plan that meticulously separates centralized and/or decentralized spill control mitigation facilities from stormwater runoff management infrastructure. This approach is designed to safeguard against adverse impacts during extreme hydrologic events. By delineating distinct zones for spill control and stormwater management, the potential contamination present in spill control facilities can be effectively contained, preventing its dispersion into surrounding areas via stormwater runoff that may have other knock-on effects for air quality in the broader Salton Sea region. This proactive measure not only preserves the integrity of stormwater management systems but also mitigates the environmental risks associated with the spread of contaminants, and consequent costs.*

Response: Spill control and stormwater management activities will be addressed through the appropriate water resources programs and are outside the jurisdiction of the ICAPCD. However, the Applicant expects to contain all onsite stormwater by either evaporation in the stormwater retention basin or discharge to the geothermal resource. Likewise, spills from process equipment will also be managed in a similar manner and will avoid offsite impacts.

IV. PM10 and PM2.5 Emissions

1. *According to the compliance decision, modeling results for this project exceed the CAAQS standards for PM10 (Imperial County Air Pollution Control District, 2024, p. 28). However, this is dismissed because 24-hour and annual background PM10 concentrations already exceed the CAAQS based on data from 2019-2021 from the Niland monitoring site (Imperial County Air Pollution Control District, 2024, p. 29). This failure of compliance not only ignores data from monitoring stations closer to the proposed development site, but it also seems to be allowed based on the logic that Imperial Valley is a "green sacrifice zone."*[7] *While renewable energy development may appear to meet state and federal climate action*

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goals, it must not render the area a green sacrifice zone by perpetuating unresolved environmental problems or creating new ones, especially considering the urgent local need for environmental justice and ecological restoration of the Salton Sea.

Response: As stated in Section 5.1.10.1.1 of Attachment DRR 7-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082), "Although the Project is expected to have maximum impacts that exceed the 24-hour SIL for PM_{10}, its 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 not dismissing the PM_{10} exceedances but rather demonstrating both that there are other methods for demonstrating a project's significance in nonattainment areas and that BACT is being implemented to reduce PM_{10} emissions to the extent feasible. In addition, as stated in the response to I.4 above, background PM_{10} concentrations collected at monitoring stations located closer to the project site are not recommended for use.

2. *As CURE has pointed out regarding the PDOC for Elmore North, the total concentration of PM2.5 exceeds the updated NAAQS limit announced by the EPA of 9.0 µg/m3. That updated level should replace the ambient air quality standard used in the current model (12 µg/m3). Moreover, emissions are expected to increase by comparison due to the number of well pads and hours of operation for the proposed Morton Bay project. The total concentration at Morton Bay exceeds the updated EPA level at 9.08 µg/m3, and it is important to note that this already omits most background emissions from neighboring facilities, as we discussed above regarding cumulative impacts. The proposed project is therefore not in compliance with standards for either PM10 or PM2.5 emissions.*

Response: The EPA only recently released its final rule to lower the annual National Ambient Air Quality Standard (NAAQS) for $PM_{2.5}$ 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[20] 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 $\mu g/m^3$.

In addition, as stated in the response to I.4 above, background $PM_{2.5}$ concentrations collected at

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

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monitoring stations located closer to the project site are not recommended for use. Existing, operational facilities were considered to be adequately represented in the background $PM_{2.5}$ concentrations collected at the regional quality assured monitoring stations, as stated in the response to I.2 above.

Lastly, LVETAG incorrectly indicates that "emissions are expected to increase by comparison due to the number of well pads and hours of operation for the proposed Morton Bay project."[21] Although updates were made to the MBGP design following submittal of the emission estimates utilized in the PDOC,[22] those updates were limited to the location and orientation of the offsite wells and associated well pads. Because the number of offsite wells did not change, the emission estimates, air quality impact analyses, and health risk assessment (HRA) modeling submitted by the Applicant and utilized in the PDOC are considered to be conservative and representative of the updated MBGP design.

V. Health Risk Assessment of Hydrogen Sulfide, Radon and Other Hazardous Non-Condensable Gases (NCGs)

1. *Exposure to hydrogen sulfide emissions from geothermal plants is associated with an increase in hospitalization due to respiratory diseases, as well as nervous system disorders and cardiovascular diseases.[8] The need for a robust hydrogen sulfide reduction system in geothermal energy development is well known.[9] Yet, while the PDOC labels hydrogen sulfide a "nuisance" due in part to its odor, it fails to account for probable CAAQS violations due to the omission of considerable background concentrations resulting from cumulative impacts of nearby geothermal facilities. Missing worker and community exposures to hazardous air pollutants from normal operations should be included in an updated health risk assessment to ensure that there are no "hotspots" for toxic air exposures from the operation of this and other geothermal facilities.*

Response: As stated in Section 5.1.9.6 of Attachment DRR 7-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082), "H_2S in the ambient air near the Salton Sea is subject to episodic events that result in concentrations which temporarily exceed the CAAQS of 0.03 parts per million (ppm). These episodic events of H_2S exceedances are well known and largely due to biogenic sources and activity (SCAQMD 2021). As a result, monitoring data in the region may not be representative for use in a CAAQS modeling analysis and the project's modeled maximum impacts will instead be compared to the CAAQS directly."

To confirm these factual circumstances, the SCAQMD established H_2S monitors along the north side of the Salton Sea to support notification and reporting of odor nuisances. Data collected at these monitors have exceeded the one-hour CAAQS of 0.03 ppm on numerous occasions. Despite these known and reported results, CARB continues to designate the area as attainment for H_2S. This designation supports the use of these monitored H_2S concentrations for odor evaluations only, which are often attributed to episodic events. Furthermore, the Salton Sea itself is a

[21] LVETAG Comments, p. 5.
[22] Notification of the proposed design changes was submitted to ICAPCD on November 14, 2023.

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predominant source of naturally-occurring H_2S within the region; such biogenic sources should not prohibit the development of stationary sources which utilize the resources for renewable energy.

Consistent with the above, the Applicant initially proposed to model H_2S only as an odor nuisance. Following discussion with the ICAPCD and CEC, the Applicant agreed to conduct an H_2S modeling analysis for demonstration of compliance with the one-hour CAAQS despite such an analysis never having been requested for other geothermal power plants in the project vicinity. As shown in Table 5.1-31 of Attachment DRR 7-1 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082), the project's maximum modeled H_2S concentration of 37.5 µg/m^3 is less than the one-hour CAAQS of 42 µg/m^3. This analysis, the methodology of which was agreed to by both the ICAPCD and CEC, demonstrates a good faith effort by the Applicant to comply with requests made by the reviewing agencies and that, during routine operations, the project will not cause or contribute to an exceedance of the one-hour CAAQS for H_2S.

In addition, the project's H_2S emissions were also evaluated in the HRA as a toxic air contaminant (TAC) contributing to the project's potential health risks. H_2S's contribution to the project's potential health risks is addressed in the response to V.4 below.

Based on these evaluations, 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.

2. *In response to data requests, BHER recently disclosed emissions of radon as high as 2515 pCi/L from Non-Condensable Gas Vacuum Discharge at the CalEnergy Elmore Geothermal Power Plant (Jacobs and Black Rock Geothermal LLC, p. 19).[10] Whether this gas enters the atmosphere or remains inside the facility, this is an alarmingly high level of exposure for workers and fenceline communities, considering the significant cancer risks outlined by the EPA for long-term exposures to radon above 4 pCi/L.[11] Exposure to this radioactive gas is the leading cause of death due to lung cancer among non-smokers.[12] High soil radon has been detected across geothermally active areas, and scientists have analyzed radionuclides in geothermal brine via aquifer host rocks beneath the Salton Sea.[13] OSHA offers guidelines for protecting workers in different exposure scenarios.[14] Nonetheless, in the determination of compliance, cancer risks are considered below the SCAQMD significance threshold (Imperial County Air Pollution Control District, 2024, p. 35).*

Response: According to the commentor, the project may have "emissions of radon as high as 2515 pCi/L." The 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. 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

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Occurring Radioactive Materials (NORM) and to occupants in buildings overlying soils high in radium (Ra-226).[23] 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 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.

The 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.[24] Studies conducted by CARB reported a statewide average outdoor air concentration of 0.49 pCi/L.[25, 26]

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 V.2-1, the annual average concentration at the MEIR is 0.0076 pCi/L, which is well within existing (background) levels of radon in air in California. While radon cancer risk may not have been included in the project's HRA, there is sufficient basis to show that radon emissions from the proposed project do not represent an increased health risk. Other hazards associated with radon (for example workplace hazards) are addressed through existing regulatory programs.

Table V.2-1. Radon Concentration at the MEIR

Parameter	Value
Annual Maximum Modeled TAC Impact [a]	20.91 $\mu g/m^3$ per g/s
	2.09E+07 pCi/m^3 per Ci/s
Annual Radon Emissions [b]	11.4 Ci/year
	3.62E-07 Ci/s

[23] 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.
[24] Agency for Toxic Substances and Disease Registry (ATSDR). 2012. *Toxicological Profile for Radon*. May. https://www.atsdr.cdc.gov/ToxProfiles/tp145.pdf.
[25] 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.
[26] 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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Annual Maximum Radon Impact [c]	7.57 pCi/m^3
	7.57E-03 pCi/L

[a] The Annual Maximum Modeled TAC Impact was taken as the maximum annual impact for the cooling towers from 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[27]
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 *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082) 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)

3. *Radon is not mentioned in the Air District determination of compliance until the very end of the document as source tests needed for analysis. It is not included in estimates of emissions that focus primarily on hydrogen sulfide (p. 15-22). Given the disclosure of significant levels of radon at neighboring facilities, it is critical to consider more rigorous mitigation measures comparable to the abatement of hydrogen sulfide described in the document, including: limits on emissions, continuous monitoring, notification and reporting, as well as surveying to further analyze results. These mitigation measures would help to prevent and control cumulative atmospheric emissions of all NCGs, including radon, before this proposed project and other related developments are approved. Occupational radon exposures should also be monitored to ensure that they remain below levels suggested by OHSA for worker health and safety.*[15]

Response: The Applicant did estimate radon emissions associated with the project, as disclosed throughout Attachments DRR 7-1 and DRR 7-2 of the *Morton Bay Geothermal Project Data Request Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 73 to 77)* (TN #253082). Consistent with the response to V.2 above, radon emissions from the project's cooling tower were modeled to estimate an annual average radon concentration at the MEIR of 0.0076 pCi/L, which is well within existing (background) levels of radon in air in California. While radon cancer risk may not have been included in the project's HRA, based on its not being identified as a TAC in California, 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

[27] https://www.ncbi.nlm.nih.gov/books/NBK158787/table/T23/

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from the radon concentration at the MEIR location is estimated to be less than 1 in 1 million, as shown in Table V.3-1. Other hazards associated with radon (for example workplace hazards) are addressed through existing regulatory programs.

Table V.3-1 Lifetime Cancer Risk from Radon Concentration in Air at the MEIR

Parameter	Value
Radon-222 Concentration	0.0076 pCi/L
Working Level (WL) [a]	0.00003
Working Level Month (WLM) [b]	0.001
Lifetime Cancer Risk [c]	0.00000083 or 0.83 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[28]
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:
Exposure Time = 7,000 hours for residential[29]

[c] The Lifetime Cancer Risk was calculated per the following equation, based on calculations presented in NRC training:[30]

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[31]

4. *Other non-condensable gases should receive similar attention, including ammonia, arsenic, mercury, benzene, toluene, and xylene (Imperial County Air Pollution Control District, 2024, p. 46). The air quality health standards for all NCGs ought to be rigorously monitored (Imperial County Air Pollution Control District, 2024, p. 32). Monitoring data should be made available to the public under periodic review, so that community members may have the opportunity to participate in the decision-making process.*

Response: 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 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. H_2S was similarly included in the HRA but also evaluated against the applicable CAAQS.

To determine the relative importance of each of the above pollutants, the per-pollutant

[28] 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.
[29] *Id.*
[30] https://www.nrc.gov/docs/ML1122/ML11227A237.pdf
[31] 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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contribution to the project's modeled health risks were estimated. Table V.4-1 presents the per-pollutant contribution to the project's estimated cancer risk of 0.48 in 1 million at the MEIR. As shown, arsenic is the predominant contributor to the project's cancer risks.

Table V.4-1. Per-pollutant Contribution to Cancer Risk

Pollutant	Cancer Risk (per million) [a]	Contribution (%)
Ammonia	0	0
Arsenic	0.29	61
Mercury	0	0
Benzene	0.12	25
Toluene	0	0
Xylene	0	0
H_2S	0	0

[a] The per-pollutant cancer risk was extracted from the Applicant's HRA modeling file titled 'MB_8760_MEIR_CancerRisk.csv' for Receptor 5698.

Similarly, Attachment V.4-1 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 83 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, arsenic is the only pollutant apart from H_2S that is notably driving the project's modeled potential health risks. Although arsenic is a predominant contributor to the project's estimated cancer and chronic risks, 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 and Maximum Exposed Sensitive Receptor, with risks greater than 1.0 limited to 400-feet of the facility's eastern fenceline. Although technically not within the project property, it is not expected to be a location presenting a potential for long-term or chronic exposure because public access to this land is restricted as it is private property and not open to the public.

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

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.

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General Manager, Geothermal Development

Sincerely,

Jon Trujillo
General Manager, Geothermal Development

Attachment V.4-1
Per-pollutant Contribution to Chronic and Acute Health Risks
Morton Bay Geothermal Project

Chronic Risks at Receptor 5698

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]	0.02	0.02	0.00	0.00	0.00	0.02	**0.03**	0.02	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%	8%	0%	0%	0%	0%	0%	0%	0%
Arsenic	100%	100%	0%	0%	0%	100%	83%	100%	0%	0%	0%	0%	0%	0%
Mercury	0%	0%	0%	96%	0%	0%	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%	62%	0%	0%	0%	0%	0%
Xylene	0%	0%	0%	0%	0%	0%	0%	0%	38%	0%	0%	0%	0%	0%
H_2S	0%	0%	0%	0%	0%	0%	8%	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	2.18E-03	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	2.39E-02	2.39E-02	0.00E+00	0.00E+00	0.00E+00	2.39E-02	2.39E-02	2.39E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Mercury	0.00E+00	2.19E-05	0.00E+00	2.19E-05	0.00E+00	2.19E-05	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	5.79E-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	2.87E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xylene	0.00E+00	1.76E-08	0.00E+00	0.00E+00	0.00E+00	0.00E+00	1.76E-08	0.00E+00	1.76E-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	2.16E-03	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 'MB_8760_Chronic_NCChronicRiskSumByRec.csv' for Receptor 5698.

[b] The per-pollutant chronic risk was extracted from the Applicant's HRA modeling file titled 'MB_8760_Chronic_NCChronicRisk.csv' for Receptor 5698.

Attachment V.4-1
Per-pollutant Contribution to Chronic and Acute Health Risks
Morton Bay Geothermal Project

Acute Risks at Receptor 5695

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	**0.40**	0.05	0.00	0.00	0.05	0.11	0.00	0.11	0.00	0.00	0.05	0.00	0.00
Per-pollutant Contribution to Target Organ														
Ammonia	0%	0%	0%	0%	0%	0%	99%	0%	99%	0%	0%	0%	0%	0%
Arsenic	100%	1%	0%	0%	0%	7%	0%	0%	0%	0%	0%	0%	0%	0%
Mercury	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Benzene	0%	0%	100%	0%	0%	93%	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	1.05E-01	0.00E+00	1.05E-01	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Arsenic	3.97E-03	3.97E-03	0.00E+00	0.00E+00	0.00E+00	3.97E-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	7.55E-05	0.00E+00	0.00E+00	0.00E+00	7.55E-05	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	4.99E-02	0.00E+00	0.00E+00	4.99E-02	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	4.99E-02	0.00E+00	0.00E+00
Toluene	0.00E+00	3.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	3.18E-06	0.00E+00	3.18E-06	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Xylene	0.00E+00	6.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	6.37E-07	0.00E+00	6.37E-07	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
H_2S	0.00E+00	3.93E-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 'MB_8760_Acute_NCAcuteRiskSumByRec.csv' for Receptor 5695.

[b] The per-pollutant acute risk was extracted from the Applicant's HRA modeling file titled 'MB_8760_Acute_NCAcuteRisk.csv' for Receptor 5695.