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Data Response Set 1 (Revised Responses to Data Requests 3, 4, 7, 10 to 13, and 69 to 73)

Submitted to
California Energy Commission

Prepared by
Elmore North Geothermal LLC

With assistance from
Jacobs

Elmore North Geothermal Project
(23-AFC-02)

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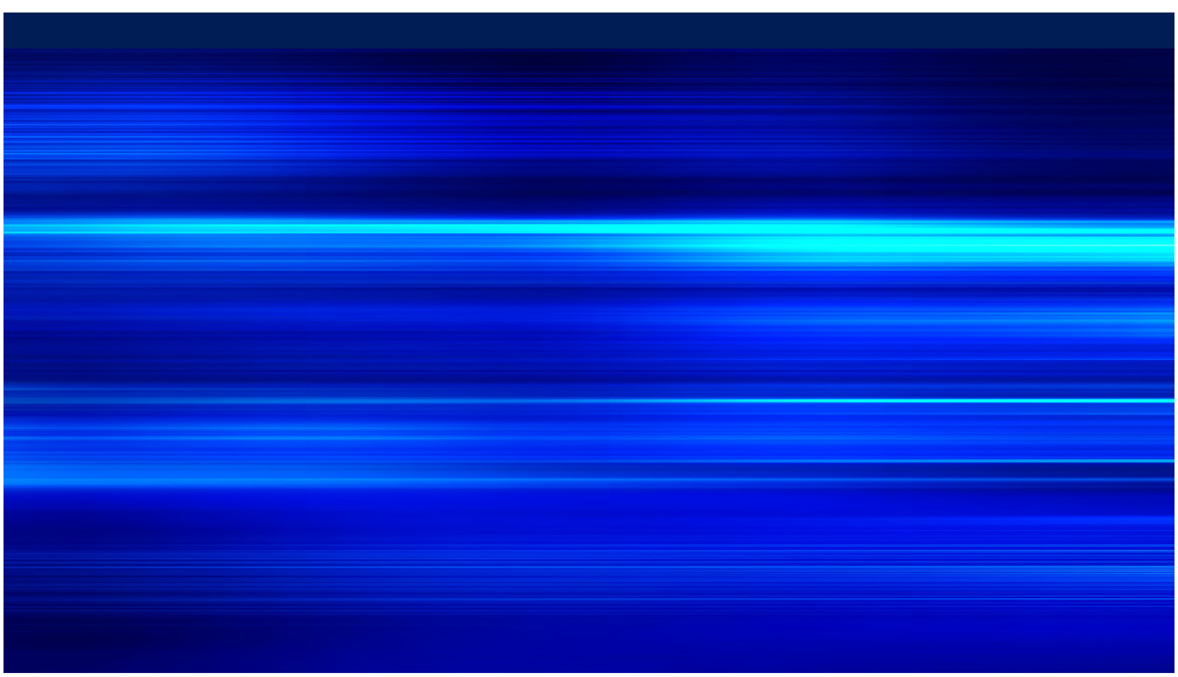

Introduction

Attached are Elmore North Geothermal LLC's[1] (Applicant) revised responses to the California Energy Commission (CEC) Staff's *Data Requests Set 1* regarding the Application for Certification (AFC) for the Elmore North Geothermal Project (ENGP) (23-AFC-02). This submittal includes revised response to Data Requests 3, 4, 7, 10 through 13, and 69 through 73.

The responses are grouped by individual discipline or topic area. Within each discipline area, the responses are presented in the same order as presented in *Data Requests Set 1* and are keyed to the Data Request numbers.

New or revised graphics or tables are numbered in reference to the Data Request number. For example, the first table used in response to Data Request 28 would be numbered Table DRR 28-1. The first figure used in response to Data Request 28 would be Figure DRR 28-1, and so on. Figures, tables, or attachments that have been revised from the responses previously submitted on October 2, 2023 have a "R" following the original number, indicating a revision.

Additional tables, figures, or documents submitted in response to a data request (for example, supporting data, stand-alone documents such as plans, folding graphics, etc.) are found at the end of each discipline-specific section and are not sequentially page numbered consistently with the remainder of the document, though they may have their own internal page numbering system.

Please note that during the development of these revised data responses, a new version of the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) (Version 23132) was released. The analyses presented in this document utilize AERMOD (Version 22112) for consistency with the files originally submitted on April 18, 2023. Future analyses, if any, will utilize AERMOD (Version 23132) or the latest version, as may be required by CEC Staff.

[1] An indirect, wholly owned subsidiary of BHE Renewables, LLC ("BHER").

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Attachments

DRR 3-1R Revised Operational Emissions Inventory Spreadsheets
DRR 3-2R Revised Operational Air Quality Impacts Analysis Spreadsheets
DRR 4-1R Revised Construction Emissions Inventory Spreadsheets
DRR 4-2R Revised Construction Air Quality Impacts Analysis Spreadsheets
DRR 7-1 Revised AFC Section 5.1
DRR 7-2 Revised AFC Section 5.9
DRR 12-1 Cumulative Impacts Analysis Modeling Report
DRR 69R Revised Construction Health Risk Assessment Spreadsheets
DRR 71-1 Revised Operation Health Risk Assessment Spreadsheets

Acronyms and Abbreviations

AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AFC	Application for Certification
BHER	BHE Renewables, LLC
CEC	California Energy Commission
DRR	Data Request Response
ENGP	Elmore North Geothermal Project
H_2S	Hydrogen Sulfide
MTU	Mobile Testing Unit
NO_2	Nitrogen Dioxide
$PM_{2.5}$	Particulate Matter with Aerodynamic Diameter Less than 2.5 Microns

1 Air Quality (DR 3, 4, 7, and 10-13)

1.1 Background: Emission Calculation Spreadsheets (DR 3-4)

Appendices 5.1A, 5.1B, and 5.1D of the Application for Certification (AFC) (TN 249743) contain tables with estimates of the project's operational and construction emissions (Appendices 5.1A and 5.1D) as well as tables showing the model inputs used in the project's air quality impact analysis (Appendix 5.1D). CEC staff requires spreadsheet versions of the tables contained in the appendices, with live, embedded calculations, to complete the analysis.

Data Requests:

3. *Please provide spreadsheet versions of the tables listed in Appendix 5.1A and Appendix 5.1B, with live, embedded calculations.*

Response: Appendices 5.1A and 5.1B have been revised to incorporate refinements to the ENGP design and address other CEC comments previously provided. Spreadsheet versions of Appendices 5.1A and 5.1B are included with this Data Request Response (DRR) as Attachments DRR 3-1R and DRR 3-2R, respectively.

Data Requests:

4. *Please provide spreadsheet versions of the tables listed in Appendix 5.1D, with live, embedded calculations. Please also provide a construction schedule showing the estimated start and end dates of each construction phase, the type of equipment used during each phase, the operating time of each equipment type during each phase, and the number of each equipment type used.*

Response: Appendix 5.1D has been revised to incorporate refinements to the ENGP design and address other CEC comments previously provided. A spreadsheet version of Appendix 5.1D is included with this DRR as Attachments DRR 4-1R and DRR 4-2R.

1.2 Background: Mobile Testing Unit Modeling (DR 7)

Page 5.1-40 of the AFC (TN 249737) states that the mobile testing unit (MTU) was not included in the modeling analysis due to its use at various (i.e., temporary) well locations throughout the project site for only a limited number of hours. The AFC also states that the emissions from MTU operation would be minimal and less than emissions from the production testing units (PTUs) and rock muffler (RM). However, pages 3 and 4 of 174 of Appendix 5.1A (TN 249743) show that the hourly and first year annual emissions of the MTU would be higher than those of the PTUs. In addition, page 3 of Appendix 5.1A shows that the MTU would operate 2,160 hours and 2,880 hours per year for production well testing and injection well testing respectively, which would be 10 times more than the PTU operation. CEC staff needs an impact analysis of the MTU with other emission sources modeled previously to complete the analysis.

Data Requests:

7. *Please provide a revised impact analysis to include the MTU with other emission sources modeled previously. The analysis to be revised would include but not limited to the hydrogen sulfide (H_2S) impact analysis and the nitrogen deposition modeling analysis.*

Response: The criteria air pollutant, health risk assessment (HRA), and nitrogen deposition modeling analyses have been revised to include the Mobile Testing Unit (MTU), as previously requested by CEC Staff.

The results of these analyses are provided in revised versions of Sections 5.1 and 5.9 from the AFC, which are included with this DRR as Attachments DRR 7-1 and DRR 7-2, respectively. To facilitate the CEC's review, revisions to these sections have been left in tracked changes mode.

1.3 Background: Nitrogen Deposition Modeling (DR 10-11)

Page 47 of 174 of HNO_3 5.1A (TN 249743) and the applicant's modeling files indicate that the applicant modeled the HNO3 emissions of 224 grams/second for each of the 14 point sources defined for the cooling tower. That would result in a total HNO_3 emissions of 24,889 (=224×3,600/453.6×14) lbs/hr or 109,013 (=24,889×8,760/2,000) tons per year (tpy). If this were derived from the NH_3 emissions, the equivalent NH_3 emissions would be 6,716 (=24,889×17/63) lbs/hr or 29,416 (=6,716×8,760/2,000) tpy. CEC staff is not able to find such high emission rates in the application. Staff needs to understand how the HNO_3 emissions were derived.

Data Requests:

10. *Please provide spreadsheet versions of the tables showing how the modeled emission rates for nitrogen deposition were derived, with live, embedded calculations.*

Response: The nitrogen deposition calculations have been revised to incorporate refinements to the ENGP design and address other CEC comments previously provided. The revised calculations are included in new Table 25 of Appendix 5.1A, which is included with this DRR as Attachment DRR 3-1R.

11. *Please update the nitrogen deposition modeling if necessary.*

Response: Nitrogen deposition modeling has been updated, based on the revised calculations provided in response to Data Request 10 above. The updated results have been incorporated into the revised Section 5.1 of the AFC, which is included with this DRR as Attachment DRR 7-1.

1.4 Background: Cumulative Modeling (DR 12-13)

Page 5.1-45 of the AFC (TN 249737) states that both 24-hour and annual PM2.5 predicted concentrations during project operation exceed their respective Significant Impact Level (SIL) and will, therefore, require a cumulative modeling analysis. Page 5.1-50 of the AFC states that 1-hour and annual NO_2, 24-hour and annual PM10, and annual PM2.5 predicted concentrations during construction exceed their respective SIL and will, therefore, require a cumulative modeling analysis. In addition, page 5.1-43 of the AFC also mentioned a cumulative impacts analysis to include the project with new or modified sources (individual emission units) that would cause a net increase of 5 tpy or more per modeled criteria pollutant within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process.

Data Requests:

12. *Please provide an update on the cumulative impacts analyses mentioned in the AFC.*

Response: CEC Staff conditionally approved the cumulative impacts analysis modeling protocol on October 24, 2023. Following this protocol and to address the CEC's request to evaluate potential hydrogen sulfide (H_2S) cumulative impacts, a cumulative impacts analysis was conducted for the following pollutants:

- 1-hour H_2S and 24-hour and annual particulate matter with aerodynamic diameter less than 2.5 microns ($PM_{2.5}$) during Project operation
- 1-hour and annual nitrogen dioxide (NO_2) and annual $PM_{2.5}$ during construction

The results of this analysis are included with this DRR as Attachment DRR 12-1.

13. Please provide the modeling files if they are available for review.

Response: Modeling files associated with the cumulative impacts modeling analysis, as well as the revised criteria air pollutant, HRA, and nitrogen deposition modeling analyses, are being submitted concurrent with this response under separate cover.

2 Public Health (DR 69-73)

2.1 Background: Construction Health Risk Assessment (HRA) (DR 69-70)

In the AFC for ENGP (TN 249737), the construction health risk assessment (HRA) estimated the rolling cancer risks for each 29-month period during a 30-year exposure duration (starting with exposure during the third trimester), aligned with the expected construction duration, at the point of maximum impact (PMI), the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), and maximally exposed sensitive receptor. The results of the analysis are contained in Table 5.9-9 and Appendix 5.9B.

The construction HRA indicates that the maximum cancer risk due to exposure to air toxics emitted by a Power Generation Facility (PGF) construction would be approximately 28.3 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million. The applicant stated that 'although this risk level is greater than the SCAQMD's "significant health risk" threshold, its location represents the maximum possible cancer risk outside of the facility boundary. Cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 0.93, 0.65, and 0.93, respectively, which are all less than the significance threshold. Non-cancer chronic and acute effects (i.e., HI values) from Project construction are also well below the SCAQMD significance thresholds of 1.0 at all locations. Additionally, the project construction activities will be finite, and best available emission control techniques would be used throughout the 29-month construction period to control pollutant emissions. Therefore, the potential cumulative health risk impacts from construction are also expected to be less than significant.' (TN 249737, P. 5.9-19)

Staff needs to verify that the health impact during construction is less than significant.

Data Requests:

69. Please provide spreadsheet versions of the tables listed in Appendix 5.9B, including live, embedded calculations.

Response: Appendix 5.9B has been revised to incorporate refinements to the ENGP design and address other CEC comments previously provided. A spreadsheet version of Appendix 5.9B is included with this DRR as Attachment DRR 69R.

70. For residential exposures, please provide a map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million.

Response: A map containing cancer risk isopleths reflective of the revised construction HRA modeling, including isopleths showing the risk values of 1, 5, and 10 in a million, is included as new Figure 5.9-4 of revised Section 5.9 from the AFC, which is included with this DRR as Attachment DRR 7-2.

2.2 Background: Operational Health Risk Assessment (HRA) (DR 71)

In the AFC (TN 249737), the operation HRA estimated cancer risks by using the 30-year continuous exposure duration scenario for residence and by using the 25-year exposure duration (8 hours per day starting at age 16 years old) for worker, at PMI, MEIR, MEIW, and maximally exposed sensitive receptor. The results of the analysis are contained in Table 5.9-8 and Appendix 5.9A.

The operation HRA indicated that the maximum cancer risk due to exposure to air toxics emitted by a Power Generation Facility (PGF) operation would be 16.4 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million.

The applicant stated that 'Although this risk level is greater than the SCAQMD's "significant health risk" threshold, its location represents the maximum possible cancer risk outside of the facility boundary. Cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 0.52, 0.74, and 0.52, respectively, which are all less than the significance threshold, as is the estimated cancer burden rate. Non-cancer chronic and acute effects (i.e., HI values) from Project operations are also below the SCAQMD significance thresholds of one (1) at all receptor locations. Additionally, emission control technologies for key toxic air contaminants (TACs) will also be installed as part of the project, as described in Section 5.9.6, which will reduce TAC emissions to the extent technically feasible. Therefore, the potential cumulative health risk impacts from operation are expected to be less than significant.' (TN 249737, P. 5.9-19)

Staff needs to verify that the health impact during operation is less than significant.

71. *For residential exposures, please provide a map containing health risk isopleths, including an isopleth showing the risk value of 10 in a million.*

Response: A map containing cancer risk isopleths reflective of the revised operational HRA modeling, including isopleths showing the risk values of 1, 5, and 10 in a million, is included as new Figure 5.9-2 of revised Section 5.9 from the AFC, which is included with this DRR as Attachment DRR 7-2. Additionally, Appendix 5.9A has been revised to incorporate refinements to the ENGP design. A spreadsheet version of revised Appendix 5.9A is included with this DRR as Attachment DRR 71-1.

2.3 Background: Hydrogen Sulfide (H2S) HRA (DR 72)

Project operation would result in emissions of hydrogen sulfide (H2S). H2S causes a wide range of health effects, including odor nuisance, nausea, tearing of the eyes, headaches or loss of sleep, airway problems (bronchial constriction) in some asthma patients, possible fatigue, loss of appetite, headache, irritability, poor memory, dizziness, coughing, eye irritation, loss of smell, etc.1 In the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values2, noncancer acute and chronic Reference Exposure Levels (RELs) are listed.

However, it is stated that "the acute risk threshold for H2S in the Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values is equal to the 1-hour CAAQS of 42 micrograms per cubic meter (CARB 2022a), which was adopted for purposes of odor control. As a result of the acute threshold developed by OEHHA and the CAAQS being based upon the same concentration, the CAAQS analysis presented in Section 5.1 is considered sufficient for addressing short-term impacts and associated risks of H2S. this HRA does not analyze H2S in the presented HARP2 modeling and associated health risk results." (TN 249737, P.5.9-16) Staff doesn't agree with this argument.

Data Requests:

72. *Please revise the operation HRA (i.e., noncancer chronic and noncancer acute) including H_2S.*

Response: The operational HRA has been revised to include H_2S emissions, as requested. The methodology and results of this analysis are presented in revised Section 5.9 from the AFC, which is included with this DRR as Attachment DRR 7-2. Updated modeling files are being submitted concurrent with this response under separate cover.

2.4 Background: Mobile Testing Unit Modeling (DR 73)

Page 5.1-40 of the AFC (TN 249737) states that the mobile testing unit (MTU) was not included in the modeling analysis due to its use at various (i.e., temporary) well locations throughout the project site for only a limited number of hours. The AFC also states that the emissions from MTU operation would be minimal and less than emissions from the production testing units (PTUs) and rock muffler (RM). However, pages 3 and 4 of 174 of Appendix 5.1A (TN 249743) show that the hourly and first year annual emissions of the MTU would be higher than those of the PTUs. In addition, page 3 of Appendix 5.1A shows that the MTU would operate 2,160 hours and 2,880 hours per year for production well testing and injection well testing respectively, which would be 10 times more than the PTU operation. CEC staff needs a revised HRA to include the MTU with other emission sources modeled previously to complete the analysis.

Data Requests:

73. Please revise the HRA to include the MTU with other emission sources modeled previously.

Response: The operational HRA has been revised to include operation of the MTU, as applicable. The methodology and results of this analysis are presented in revised Section 5.9 from the AFC, which is included with this DRR as Attachment DRR 7-2. Updated modeling files are being submitted concurrent with this response under separate cover.

Attachment DRR 3-1R
Revised Operational Emissions Inventory Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled "Appendix 5.1A ENGP_OperationEmissions_MCR_20231030_Protect.xls"

Attachment DRR 3-2R
Revised Operational Air Quality Impacts Analysis Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled "Appendix 5.1B ENGP_OpsAQIA_20231103_Protect.xlsx"

Attachment DRR 4-1R
Revised Construction Emissions Inventory Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.1D-1 ENGP_ConstructionEmissions_20230609_Protect.xlsx”

Attachment DRR 4-2R
Revised Construction Air Quality Impacts Analysis Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled "Appendix 5.1D-2 ENGP_ConstructionAQIA_20230403_Protect.xlsx"

Attachment DRR 7-1
Revised AFC Section 5.1

5.1 Air Quality

This section presents the methodology and results of an analysis performed to assess the potential impacts of airborne emissions from the construction and operation of the Elmore North Geothermal Project (ENGP or Project) and the Project's compliance with applicable air quality requirements. Section 5.1.1 presents an overview of the Project as it relates to air quality. Imperial County Air Pollution Control District (ICAPCD or "District") rules applicable to the Project, particularly as related to New Source Review (NSR), are summarized in Section 5.1.2. Section 5.1.3 provides a more detailed description of the Project. Section 5.1.4 presents the existing site conditions including geography, topography, climate, and meteorology. Section 5.1.5 summarizes the air quality standards for criteria pollutants. Section 5.1.6 summarizes the existing air quality at the Project site. Section 5.1.7 presents the Project's criteria pollutant and greenhouse gas (GHG) emissions estimates. Section 5.1.8 presents the best available control technology (BACT) evaluation for the Project. Section 5.1.9 presents the air quality impact analysis methodology; the air quality impact analysis results are presented in Section 5.1.10. Section 5.1.11 presents applicable federal, state, and local laws, ordinances, regulations, and standards (LORS). Section 5.1.12 presents agency contacts. Section 5.1.13 presents permit requirements and schedules. Section 5.1.14 contains references cited or consulted in preparing this section. Appendix 5.1A contains the support data for the operational emissions calculations. Appendix 5.1B presents the operational air quality impact analysis support data. Appendix 5.1C presents the approved dispersion modeling protocol. Appendix 5.1D contains the support data for the construction emissions calculations and accompanying air quality impact analysis. Appendix 5.1E presents the BACT determination support data. Potential public health risks posed by emissions of toxic air contaminants (TACs) are addressed in Section 5.9.

5.1.1 Project Overview as it Relates to Air Quality

The Project consists of a proposed geothermal Resource Production Facility (RPF), a Power Generation Facility (PGF), and associated facilities in Imperial County, California. Figure 1-1 shows the Project regionally, and Figure 1-4 depicts the Project area, including proposed interconnection gen-tie line and pipelines. The Project will be owned by Elmore North Geothermal LLC (Project owner or "Applicant").

The RPF includes geothermal production wells, pipelines, geothermal fluid and steam handling facilities, a solid handling system, a Class II surface impoundment, a service water pond, a stormwater retention basin, process injection pumps, power distribution centers, and injection wells (Figure 1-4). It also includes steam-polishing equipment designed to provide turbine-quality steam to the PGF. The PGF includes a triple-pressure condensing turbine/generator set, one cooling tower, a non-condensable gas (NCG) removal system, a NCG sparger abatement system and condensate bio-oxidation abatement system in the cooling tower system, a heat rejection system, and a generator step-up transformer (GSU). The PGF also includes a 230 kilovolt (kV) substation and power distribution centers, as well as four emergency standby diesel-fueled engines (three generators and one fire water pump). Shared facilities among the RPF and PGF include a control building, a service water pond, and other ancillary facilities. Heat rejection for the steam turbines will be accomplished with a mechanical draft counterflow wet cooling tower. The steam turbine will have a maximum continuous rating (MCR) of 157 megawatts (MW) and the generator will have an approximate rated capacity of 174,000 kilovolt-amperes (kVA) at a 0.85 power factor. Geothermal steam from the RPF will be the only fuel used by the steam turbine generator (STG).

Geothermal fluid will be produced from nine production wells near the PGF (Figure 1-4). The fluid will flow, without pumping, to and through aboveground pipelines to the steam handling system adjacent to the PGF. At the steam handling system, the geothermal fluid will be separated from the steam phase (flashed) at successively lower pressures to produce high pressure (HP), standard pressure (SP), and low pressure (LP) steam for use in the STG. The depressurized fluid will flow into the primary and secondary clarifiers to remove suspended solids that precipitated upstream, by design, in the RPF. Solids precipitation returns geothermal fluid to chemical equilibrium from a state of super saturation, particularly for silica and iron constituents, during reductions in temperature and pressure. Stabilizing the geothermal fluid makes the injection process sustainable. Injection of super saturated silica fluid and/or suspended solids would be an unmanageable process due to scaling and plugging of wells. Geothermal fluid is injected and returned to the geothermal reservoir to maintain pressure and allows for the fluid to be reheated causing the resource to be renewable and sustainable. Three types of injection wells are used to return the geothermal fluids back to the reservoir: wells for spent geothermal fluid, aerated fluid, and condensate. Spent geothermal fluid comes from the process described above. Aerated fluid is oxygenated and near ambient temperature, which comes from the RPF surface impoundment and similar sources. Condensate comes from the cooling tower as an aerated mix of condensed steam and cooling tower make-up water. All production and injection wells will be operated in accordance with California Department of Conservation, Geologic Energy Management Division (CalGEM) and Colorado River Basin Regional Water Quality Control Board regulations.

Steam from the RPF will have impurities removed, after which it will be delivered to a triple-pressure condensing turbine and STG. NCGs will be extracted from the main condensers by the gas removal system and then directed to the cooling tower basin for abatement.

Electricity generated by the Project will be delivered to a substation near the northeast corner of the Project site. This substation will deliver energy through a gen-tie into the Imperial Irrigation District (IID) transmission system at a new switching station near and northwest of the intersection of Garst Road and West Sinclair Road.

The Project will supply capacity and energy to California's electric market. The location and the configuration of the plant have been selected to best match operating needs and the available geothermal resource. A System Impact Study (IID 2022) concluded IID network (transmission) upgrades are required to deliver additional energy to the Southern California Edison Devers substation, including a new gen-tie line with capacity for the Project and future projects. IID's network upgrades will support sustainable operation of IID's system and further power generation projects not affiliated with the Applicant. IID will construct and complete the network updates prior to Project operations.

5.1.2 Regulatory Items Affecting New Source Review

This air quality impact analysis was prepared pursuant to ICAPCD Rule 207(D)(4). The analysis includes discussions of emissions calculations, control technology assessments, regulatory review and modeling analysis, which include impact evaluations for criteria pollutants and TACs.

Project operations are not expected to result in emissions that will exceed ICAPCD Rule 207(B) "major stationary source" thresholds, nor is the facility expected to have emissions which would exceed Rule 207(C)(2)(a) offset threshold values. BACT will be implemented for particulate matter and hydrogen sulfide (H_2S).

The emissions impacts associated with the Project were analyzed pursuant to ICAPCD and California Energy Commission (CEC) modeling requirements. The air quality analysis was conducted to demonstrate that impacts from nitrogen oxides (NO_x), carbon monoxide (CO), sulfur dioxide (SO_2), particulate matter with an aerodynamic diameter less than 10 micrometers (PM_{10}), particulate matter with an aerodynamic diameter less than 2.5 micrometers ($PM_{2.5}$), and H_2S will comply with the California and National Ambient Air Quality Standards (CAAQS and NAAQS, respectively) for the applicable averaging periods. Impacts from nearby sources (cumulative sources located within six miles of the Project site with emissions greater than five tons per year [tpy]) were assessed for criteria pollutants under separate cover in consultation with the ICAPCD and CEC following completion of the CEC's data adequacy review.

Project operations are also not expected to trigger the Prevention of Significant Deterioration (PSD) permitting requirements outlined in Code of Federal Regulations (CFR), Title 40, Section 51.166(b)(1)(i)(b), because facility-wide emissions will not equal or exceed 250 tpy for any criteria pollutant. Worst-case hourly and annual Potential to Emit (PTE) emissions are summarized in Table 5.1-1.

Table 5.1-1. Facility PTE Summary

Pollutant	Facility PTE [a] (tpy)	Facility PTE [a] (lbs/day) [c]	ICAPCD Rule 207 Major Polluting Facility Thresholds (tpy)	ICAPCD Rule 207 Offset Thresholds (lbs/day)	EPA Major PSD Source Thresholds [b] (tpy)
NO_x	0.40	21.0	100	137	250
CO	1.89	101	--	137	250
VOC	2.10	17.8	100	137	250
SO_x	<0.01	<0.01	100	137	250
PM_{10}	14.8	81.7	70	137	250
$PM_{2.5}$	8.87	49.4	100	--	250
CO_2e	70,478	455,847	--	--	75,000

[a] Emissions represent the maximum emissions of either the commissioning year or a subsequent operating year, including operation of the diesel-fueled emergency generators and fire pump, but do not include operations and maintenance activities which are not subject to permitting.

[b] PSD major source review would be triggered for criteria pollutant emissions greater than 250 tpy, from which the major modification thresholds are then used for the remaining pollutants. PSD review is not triggered solely based on greenhouse gas (GHG) emissions. If the Project triggered PSD for any non-GHG pollutant, then PSD would be triggered if the carbon dioxide equivalent (CO_2e) emissions were equal to or greater than 75,000 tpy.

[c] Daily emission estimates assume a maximum of two diesel-fired emergency generators would operate up to two hours per day for maintenance and testing.

Notes:

-- = Not applicable and/or no standard

< = less than

EPA = U.S. Environmental Protection Agency

lbs/day = pound(s) per day

SO_X = sulfur oxides

VOC = volatile organic compound

A regulatory compliance analysis is presented in Sections 5.1.11 and 5.1.13, which will discuss in detail the applicable ICAPCD regulations that directly affect the Project's permitting application and review process. These regulations include the following:

- ICAPCD NSR Rule 207(C)(1) requires that BACT be applied to all proposed new or modified sources which will result in any emissions increase equal to or greater than the following:
  - CO: 550 pounds per day (lbs/day)
  - Lead: 3.3 lbs/day
  - Fluorides: 16 lbs/day
  - Sulfuric Acid Mist: 38 lbs/day
  - H_2S: 55 lbs/day
  - Total Reduced Sulfur Compounds: 55 lbs/day
  - Ozone Precursors
    - NO_X: 25 lbs/day
    - VOC: 25 lbs/day
  - PM_{10}: 25 lbs/day

The Project will implement BACT for PM_{10} and H_2S, as described in Section 5.1.8.

- ICAPCD Rule 207(D)(3)(c) provides that all emission reduction credits proposed for use by the new source must be evaluated and approved prior to the issuance of the ICAPCD Authority to Construct (ATC). The Project is not expected to trigger the offset requirements, as shown in Table 5.1-1.
- ICAPCD Rule 207(F) requires that an air impact analysis be prepared to insure the protection of state and federal ambient air quality standards. This analysis is presented in Sections 5.1.9 and 5.1.10.
- ICAPCD Rule 207(C)(5)(c) requires that, prior to the issuance of the ATC, all major stationary sources owned or operated by the Project applicant, which are subject to emissions limitations, are either in compliance or on a schedule for compliance with all applicable emissions limitations under the Clean Air Act (CAA).
- The Project will not require a PSD permit, per ICAPCD Rule 904 or the federal PSD regulations, as shown in Table 5.1-1.

5.1.3 Project Description

5.1.3.1 Project Site Location

The Project site is located in a region of the Imperial Valley, southeast of the Salton Sea, characterized mostly by agriculture and geothermal power production, with more recent additions of utility scale solar power plants. The area surrounding the plant site is primarily agricultural land. The Imperial Valley is the southwest part of the Colorado Desert that merges northwestward into the Coachella Valley near the northern shore of the Salton Sea.

The PGF will be located on approximately 63 acres (plant site) of a 160-acre parcel (APN 020-100-038) (Township 11 South, Range 13 East, Section 27, SE 1/4) within Imperial County, California. The plant site is located north of the existing Elmore Power Plant.

The Project site is bounded by Sinclair Road to the south, Cox Road to the west, and Garst Road to the east. The town of Niland is approximately 6 miles northeast of the plant site, and the town of Calipatria is approximately 6 miles southeast of the plant site. The Sonny Bono Wildlife Refuge Headquarters is approximately 1 mile west of the PGF. The Alamo River is approximately 1 mile east of the plant site, and the New River is approximately 6 miles southwest of the plant site.

5.1.3.2 Project Equipment Specifications

The layout of the proposed facility is illustrated in Section 2 including site cross sections, a plant site rendering, an isometric view of the facility, and a before and after plant visual rendering.

Approximately 63 acres of land will be required to accommodate the plant facilities (all areas approximate), and is comprised of the following:

- Turbine/generator
- One cooling tower (14 cells)
- Dilution water heater
- Gas removal system
- Switchyard
- Control room and laboratory
- Maintenance building
- Horizontal belt filter
- Thickener clarifier
- Flash/drain atmospheric flash tank (AFT)
- Head tank
- Secondary clarifier
- Primary clarifier

- Rock muffler
- Production AFT
- Purge water system
- HP separator
- HP/SP/LP scrubbers
- SP/LP crystallizers
- HP/SP/LP demisters
- Emergency diesel generators
- Power distribution centers
- Auxiliary transformers (4,160 volts [V])
- Fire water pumps (electric and diesel fired)
- Domestic water pumps
- Service water and stormwater ponds
- Warm up AFT
- Hydro blast pad
- Auxiliary transformers (480 V)
- Aerated fluid injection pumps
- Class II surface impoundment
- Generator circuit breaker
- Gen-tie
- Isolated phase bus duct
- Instrument and service air system
- Naturally Occurring Radioactive Material (NORM) inhibitor chemical storage and injection system
- Polymer storage and injection system
- Cooling tower chemicals storage and feed system
- Steam turbine lube oil system
- Dilution water pumps
- Condensate storage tank
- Excess condensate storage tank
- Potable water system
- Process fluid injection pumps
- Biological oxidation box
- Production/injection well pads and pipelines
- Hydrochloric acid (HCl) storage and dosing system with scrubber control

A complete description of the Project is presented in Section 2.

5.1.4 Existing Site Conditions

The Project site is currently vacant. There are no current air pollution sources on the proposed site, and there are no facilities currently on the site that are permitted by the ICAPCD. Figure 1-2 shows the Project site and immediate vicinity.

5.1.4.1 Geography and Topography

The Project will be located in a flat lot located less than a mile from the Salton Sea coastline near Carcass Beach. The site topography is flat with an average elevation of 230 feet below average mean sea level. The nearest complex terrain (terrain exceeding Project stack heights) in relation to the Project is a string of mountainous terrain running from the southwest to the northwest approximately 17 miles northeast of the Project. Red Island Volcano is located less than two miles from the Project but is not considered to be complex terrain as it is a single piece of terrain less than a quarter-mile wide and gradually sloped no more than 100 feet tall. The nearest Class I area is Joshua Tree National Park located 35 miles to the north of the Project.

5.1.4.2 Climate and Meteorology

Climatic conditions in Imperial County are governed by the large-scale sinking and warming of air in the semi-permanent tropical high-pressure center of the Pacific Ocean. The high-pressure ridge blocks out most mid-latitude storms except in winter when it is weakest and farthest south. The coastal mountains prevent the intrusion of any cool, damp air found in California coastal environs. Because of the barrier and weakened storms, Imperial County experiences clear skies, extremely hot summers, mild winters, and little rainfall. On average, the sun shines more in Imperial County than anywhere else in the United States. (ICAPCD 2018)

Winters are mild and dry with daily average temperatures ranging between 65 and 75 degrees Fahrenheit (ºF) (18-24 degrees Celsius [ºC]). During winter months, it is not uncommon to record maximum temperatures of up to 80ºF. Summers are extremely hot with daily average temperatures ranging between 104 and 115ºF (40-46ºC). It is not uncommon to record maximum temperatures of 120ºF during summer months (ICAPCD 2018).

The flat terrain of the valley and the strong temperature differentials created by intense solar heating produce moderate winds and deep thermal convection. The combination of subsiding air, protective mountains, and distance from the ocean severely limits precipitation. Rainfall is highly variable with precipitation from a single heavy storm able to exceed the entire annual total during a later drought condition. The average annual rainfall is just over three inches (7.5 centimeters) with most of it occurring in late summer or mid-winter (ICAPCD 2018).

Humidity is low throughout the year, ranging from an average of 28 percent in summer to 52 percent in winter. The large daily oscillation of temperature produces a corresponding large variation in the relative humidity. Nocturnal humidity rises to 50 to 60 percent but drops to about 10 percent during the day (ICAPCD 2018).

The wind in Imperial County follows two general patterns. Wind statistics indicate prevailing winds are from the west-northwest through southwest; a secondary flow maximum from the southeast is also evident. The prevailing winds from the west and northwest occur seasonally from fall through spring and are known to be from the Los Angeles area. Occasionally, Imperial County experiences periods of extremely high wind speeds wherein wind speeds can exceed 31 miles per hour (mph). This occurs most frequently during the months of April and May. However, speeds of less than 6.8 mph account for more than one-half of the observed wind measurements (ICAPCD 2018).

5.1.5 Overview of Air Quality Standards

In 1970, the U.S. Congress instructed EPA to establish standards for air pollutants, which were of nationwide concern. This directive resulted from the concern of the potential impacts of air pollutants on the health and welfare of the public. The resulting CAA set forth air quality standards to protect the health and welfare of the public. Two levels of standards were promulgated—primary standards and secondary standards. Primary NAAQS are “those which, in the judgment of the administrator [of EPA], based on air quality criteria and allowing an adequate margin of safety, are requisite to protect the public health (state of general health of community or population).” The secondary NAAQS are “those which, in the judgment of the administrator [of EPA], based on air quality criteria, are requisite to protect the public welfare and ecosystems associated with the presence of air pollutants in the ambient air.” To date, NAAQS have been established for the following seven criteria pollutants: SO_2, CO, ozone, nitrogen dioxide (NO_2), PM_{10}, $PM_{2.5}$, and lead.

Criteria pollutants are those pollutants that have been demonstrated historically to be widespread and have a potential to cause adverse health effects. EPA developed comprehensive documents detailing the basis of, or criteria for, the standards that limit the ambient concentrations of these pollutants. The State of California has also established ambient air quality standards (CAAQS) that further limit the allowable concentrations of certain criteria pollutants. Review of the established air quality standards is undertaken by both EPA and the State of California on a periodic basis. As a result of the periodic reviews, the standards have been updated and amended over the years following adoption.

Each federal or state standard is comprised of two basic elements: a numerical limit expressed as an allowable concentration, and an averaging time that specifies the period over which the concentration value is to be measured. Table 5.1-2 presents the current federal and state ambient air quality standards.

Table 5.1-2. State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS	NAAQS
Ozone	1-hour	0.09 ppm (180 µg/m^3)	--
	8-hour	0.070 ppm (137 µg/m^3)	0.070 ppm (137 µg/m^3) (3-year average of annual 4th-highest daily maximum)
CO	1-hour	20 ppm (23,000 µg/m^3)	35 ppm (40,000 µg/m^3)
	8-hour	9.0 ppm (10,000 µg/m^3)	9 ppm (10,000 µg/m^3)
NO_2	1-hour	0.18 ppm (339 µg/m^3)	0.100 ppm (188 µg/m^3) (3-year average of annual 98th percentile daily maxima)
	Annual average	0.030 ppm (57 µg/m^3)	0.053 ppm (100 µg/m^3)
SO_2	1-hour	0.25 ppm (655 µg/m^3)	0.075 ppm (196 µg/m^3) (3-year average of annual 99th percentile daily maxima)
	3-hour	--	0.5 ppm (1,300 µg/m^3) [a]
	24-hour	0.04 ppm (105 µg/m^3)	0.14 ppm (365 µg/m^3) [b]
	Annual average	--	0.030 ppm (80 µg/m^3) [b]
PM_{10}	24-hour	50 µg/m^3	150 µg/m^3
	Annual arithmetic mean	20 µg/m^3	--
$PM_{2.5}$	24-hour	--	35 µg/m^3 (3-year average of annual 98th percentiles)
	Annual arithmetic mean	12 µg/m^3	12 µg/m^3 (3-year average)
Sulfates	24-hour	25 µg/m^3	--
Visibility Reducing Particles	8-hour	Extinction of 0.23 per kilometer	--
H_2S	1-hour	0.03 ppm (42 µg/m^3)	--
Vinyl Chloride	24-hour	0.01 ppm (26 µg/m^3)	--
Lead	30-day	1.5 µg/m^3	--
	3-month rolling average	--	0.15 µg/m^3

Source: CARB 2016

[a] The 3-hour SO_2 NAAQS is a secondary standard.

[b] The 24-hour and annual 1971 SO_2 NAAQS remain in effect until 1 year after the attainment status is designated by EPA for the 2010 NAAQS (the Project area is still undesignated for the 2010 NAAQS, but presumed to be in attainment).

Notes:

-- = Not applicable and/or no standard

µg/m^3 = microgram(s) per cubic meter

ppm = part(s) per million

Brief descriptions of health effects for the main criteria pollutants are as follows:

- **Ozone—**Ozone is a reactive pollutant that is not emitted directly into the atmosphere, but rather is a secondary air pollutant produced in the atmosphere through a complex series of photochemical reactions involving VOC and NO_x. VOC and NO_x are therefore known as precursor compounds for ozone. Significant ozone production generally requires ozone precursors to be present in a stable atmosphere with strong sunlight for approximately three hours. Ozone is a regional air pollutant because it is not emitted directly by sources, but is formed downwind of sources of VOC and NO_x under the influence of wind and sunlight. Short-term exposure to ozone can irritate the eyes and cause constriction of the airways. In addition to causing shortness of breath, ozone can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema.
- **Carbon Monoxide—**CO is a non-reactive pollutant that is a product of incomplete combustion. Ambient CO concentrations generally follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors such as wind speed and atmospheric mixing. Under inversion conditions, CO concentrations may be distributed more uniformly over an area out to some distance from vehicular sources. When inhaled at high concentrations, CO combines with hemoglobin in the blood and reduces the oxygen-carrying capacity of the blood. This results in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease or anemia, as well as fetuses.
- **Particulate Matter (PM_{10} and $PM_{2.5}$)—**Both PM_{10} and $PM_{2.5}$ represent fractions of particulate matter, which can be inhaled into the air passages and the lungs and can cause adverse health effects. Particulate matter in the atmosphere results from many kinds of dust- and fume-producing industrial and agricultural operations, combustion, and atmospheric photochemical reactions. Some of these operations, such as demolition and construction activities, contribute to increases in local PM_{10} concentrations, while others, such as vehicular traffic, affect regional PM_{10} concentrations.

  Several studies that EPA has relied on have shown an association between exposure to particulate matter, both PM_{10} and $PM_{2.5}$, and respiratory ailments or cardiovascular disease. Other studies have related particulate matter to increases in asthma attacks. In general, these studies have shown that short-term and long-term exposure to particulate matter can cause acute and chronic health effects. $PM_{2.5}$, which can penetrate deep into the lungs, causes more serious respiratory ailments.
- **Nitrogen Dioxide and Sulfur Dioxide—**NO_2 and SO_2 are two gaseous compounds within a larger group of compounds, NO_x and sulfur oxides (SO_x), respectively, which are products of the combustion of fuel. NO_x and SO_x emission sources can elevate local NO_2 and SO_2 concentrations, and both are regional precursor compounds to particulate matter. As described above, NO_x is also an ozone precursor compound and can affect regional visibility. (NO_2 is the "whiskey brown-colored" gas readily visible during periods of heavy air pollution.) Elevated concentrations of these compounds are associated with increased risk of acute and chronic respiratory disease.

  SO_2 and NO_2 emissions can be oxidized in the atmosphere to eventually form sulfates and nitrates, which contribute to acid rain. Large power facilities with high emissions of these substances from the use of coal or oil are subject to emissions reductions under the Phase I Acid Rain Program of Title IV of the 1990 CAA Amendments. Power facilities with individual equipment capacity of 25 MW or greater that use natural gas or other fuels with low sulfur content are subject to the Phase II Acid Rain Program of Title IV. The Phase II program requires facilities to install continuous emissions monitoring systems (CEMS) in accordance with 40 CFR Part 75 and report annual emissions of SO_x and NO_x. The Acid Rain Program provisions do not apply to the Project as it will not use fossil fuels as the energy source for the PGF operations.
- **Lead—**Gasoline-powered automobile engines used to be the major source of airborne lead in urban areas. Excessive exposure to lead concentrations can result in gastrointestinal disturbances, anemia, and kidney disease, and, in severe cases, neuromuscular and neurological dysfunction. The use of lead additives in motor vehicle fuel has been eliminated in California and lead concentrations have declined substantially as a result.

In addition to the above criteria pollutants, greenhouse gas (GHG) emissions are of global concern. Although there are no ambient air quality standards for GHGs, they are regulated by both the California Air Resources Board (CARB) and the EPA.

GHGs include the following pollutants:

- **Carbon Dioxide—**Carbon dioxide (CO_2) is a naturally occurring gas, as well as a by-product of burning fossil fuels and biomass, land-use changes, and other industrial processes. It is the principal anthropogenic GHG that affects the Earth's radiative balance.
- **Methane—**Methane (CH_4) is a GHG with a global warming potential (GWP) most recently estimated at 25 times that of CO_2.[1] CH_4 is produced through anaerobic (without oxygen) decomposition of waste in landfills, animal digestion, decomposition of animal wastes, production and distribution of natural gas and petroleum, coal production, and incomplete fossil fuel combustion.
- **Nitrous Oxide—**Nitrous oxide (N_2O) is a GHG with a GWP most recently estimated at 298 times that of CO_2. Major sources of N_2O include soil cultivation practices, especially the use of commercial and organic fertilizers, fossil fuel combustion, nitric acid production, and biomass burning.
- **Hydrofluorocarbons—**Hydrofluorocarbons (HFCs) are compounds containing only hydrogen, fluorine, chlorine, and carbon. HFCs have been introduced as a replacement for the chlorofluorocarbons identified as ozone-depleting substances.
- **Perfluorocarbons—**Perfluorocarbons (PFCs) are compounds containing only fluorine and carbon. Similar to HFCs, PFCs have been introduced as a replacement for chlorofluorocarbons. PFCs are also used in manufacturing and are emitted as by-products of industrial processes. PFCs are powerful GHGs.
- **Sulfur Hexafluoride—**Sulfur hexafluoride (SF_6) is a colorless gas soluble in alcohol and ether, and is slightly soluble in water. It is a very powerful GHG used primarily in electrical transmission and distribution systems, as well as dielectrics in electronics.

Climate change refers to any significant change in measures of climate, such as average temperature, precipitation, or wind patterns over a period of time. Climate change may result from natural factors, natural processes, and human activities that change the composition of the atmosphere and alter the surface and features of the land. Significant changes in global climate patterns have recently been associated with global warming, an average increase in the temperature of the atmosphere near the Earth's surface, attributed to accumulation of GHG emissions in the atmosphere. GHGs trap heat in the atmosphere, which in turn heats the surface of the Earth.

Some GHGs occur naturally and are emitted to the atmosphere through natural processes, while others are created and emitted solely through human activities. The emission of GHGs through the combustion of fossil fuels (i.e., fuels containing carbon) in conjunction with other human activities, appears to be closely associated with global warming. According to the Intergovernmental Panel on Climate Change's (IPCC) Fifth Assessment, it is extremely likely that more than half of the observed increase in global average surface temperature from 1951 to 2010 was caused by the anthropogenic increase in GHG concentrations.

Emissions of HFCs or PFCs are not expected for the Project. Therefore, the Project impact assessment is focused only on the potential impacts from emissions of CO_2, CH_4, N_2O, and SF_6, reported as carbon dioxide equivalent (CO_2e) emissions.

5.1.6 Existing Air Quality

The NAAQS and CAAQS, as previously described, establish the level for which air pollution is considered detrimental to public health or welfare. If a pollutant concentration in an area is lower than the established

[1] GWP is a measure of how much a given mass of GHG is estimated to contribute to global warming and is a relative scale that compares the mass of one GHG to that same mass of CO_2.

standard, the area is classified as being in "attainment" for that pollutant. If the pollutant concentration meets or exceeds the standard (depending on the specific standard for the individual pollutants), the area is classified as a "nonattainment" area. If there is not enough data available to determine whether the standard is exceeded in an area, the area is designated as "unclassified." Table 5.1-3 presents the ICAPCD attainment/nonattainment status with respect to both the CAAQS and NAAQS.

Table 5.1-3. ICAPCD Attainment Status

Pollutant	Averaging Time	Federal Status	State Status
Ozone	1-hour	Unclassified/Attainment	Nonattainment
	8-hour	Nonattainment (Marginal)	Nonattainment
CO	All	Unclassified/Attainment	Unclassified/Attainment
NO_2	All	Unclassified/Attainment	Unclassified/Attainment
SO_2	All	Unclassified/Attainment	Unclassified/Attainment
PM_{10}	All	Attainment (Maintenance)	Nonattainment
$PM_{2.5}$	All	Unclassified/Attainment	Unclassified/Attainment
Sulfates	24-hour	No NAAQS	Unclassified/Attainment
Lead	All	Unclassified/Attainment	Unclassified/Attainment
H_2S	1-hour	No NAAQS	Unclassified/Attainment
Vinyl Chloride	24-hour	No NAAQS	Unclassified/Attainment
Visibility Reducing Particles	8-hour	No NAAQS	Unclassified/Attainment

Sources: ICAPCD 2023, EPA 2023f, and CARB 2023f

The closest and most representative monitoring data to the Project site are from the following monitoring stations, as shown in Figure 5.1-1:

- Niland-English Road (AQS ID: 60254004) [4.0 miles from the Project]
- Brawley-220 Main Street (AQS ID: 60250007) [14.5 miles from the Project]
- El Centro-9th Street (AQS ID: 60251003) [27.0 miles from the Project]
- Calexico-Ethel Street (AQS ID: 60250005) [35.6 miles from the Project]

Figure 5.1-1
Nearby Ambient Air Monitoring Stations
Elmore North Geothermal Project
Imperial County, California

Jacobs

Table 5.1-4 provides a summary of measured ambient air quality concentrations by year and site for the period 2019-2021. Data from these sites are a reasonable representation of background air quality for the Project area.

Table 5.1-4. Measured Ambient Air Quality Concentrations by Year

Pollutant	Units	Averaging Time	Basis	Site	2019	2020	2021
Ozone	ppm	1-hour	CAAQS-1st High	Niland	0.06	0.054	0.065
		8-hour	CAAQS-1st High	Niland	0.055	0.046	0.055
			NAAQS-4th High	Niland (2019) and Calexico (2020-2021)	0.054	0.078	0.080
NO_2	ppb	1-hour	CAAQS-1st High	El Centro	37	45	56
			NAAQS-98th percentiles	El Centro	30	36	38
		Annual	CAAQS/NAAQS-AAM	El Centro (2020-2021) and Calexico (2019)	9.26	7.93	6.73
CO	ppm	1-hour	CAAQS/NAAQS-2nd High	Calexico	4.30	4.60	3.80
		8-hour	CAAQS/NAAQS-2nd High	Calexico	3.10	2.70	2.90
SO_2	ppb	1-hour	CAAQS/NAAQS-1st High	Calexico	7.5	7.1	8.6
		24-hour	CAAQS/NAAQS-1st High	Calexico	1.6	1.9	2.7
		Annual	CAAQS/NAAQS-AAM	Calexico	0.31	0.4	0.42
PM_{10}	µg/m^3	24-hour	CAAQS-1st High	Niland	156.3	241.3	218.2
			NAAQS-2nd High	Niland	124	142	156
		Annual	CAAQS-AAM	Niland	32.7	35.9	39.8
$PM_{2.5}$	µg/m^3	24-hour	NAAQS-98th percentiles	Brawley	21.0	21.0	21.0
		Annual	CAAQS/NAAQS-AAM	Brawley (2019-2020) and El Centro (2021)	8.30	9.40	8.30

Sources: CARB 2023d and EPA 2023d

Notes:

AAM = annual arithmetic mean

ppb = part(s) per billion

The maximum representative background concentrations for the 3-year evaluation period (2019-2021) are summarized in Table 5.1-5. These background values represent the highest values reported for the most representative air quality monitoring site during any single year of the 3-year evaluation period for the CAAQS assessments. These CAAQS maxima are conservatively used for some of the NAAQS modeling assessments (CO and SO_2). The appropriate values for the NAAQS, according to the format of the standard, are used for the remainder of the NAAQS modeling assessments (NO_2, PM_{10}, and PM_{25}), and also summarized in Table 5.1-5.

Table 5.1-5. Background Air Quality Data

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

[a] Where applicable, monitored concentrations were converted from ppm/ppb to $\mu g/m^3$ using the standard molar volume of air at normal temperature and pressure conditions (NTP) of 24.45 liters per mole.

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

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

5.1.7 Environmental Analysis – Emissions Evaluation

5.1.7.1 Project Operation

Criteria pollutant emissions from the Project are delineated in the following sections, while emissions of TACs are delineated in Section 5.9. Backup data for both the criteria pollutant and TAC operational emission calculations are provided in Appendix 5.1A.

As shown, installation and operation of the Project will not result in emissions greater than the NSR or PSD thresholds for any criteria pollutants and, as such, the Project will be considered a minor NSR source for NO_x, CO, VOC, and PM_{10}/$PM_{2.5}$ under federal and ICAPCD rules. The Project will not trigger the requirements of the federal PSD program since the emissions of one or more criteria pollutants will not exceed the 250 tpy PSD major source applicability thresholds. The applicability determination for PSD is based on the worst-case annual emissions, including commissioning.

5.1.7.1.1 Facility Operational Profile

The emissions calculations presented in this analysis represent the highest potential emissions based on the proposed operational scenarios. The hourly, daily and annual emissions for all criteria pollutants are based upon a series of worst-case assumptions for each pollutant. The intent is to envelop the Project emissions based upon all possible operating profiles provided in Appendix 5.1A and summarized below.

Throughout a typical year, the facility may operate in one of the following PGF-related operating scenarios:

- Commissioning (Only during the first production year)
- Flow Back and Testing Activities
- Cold Startup
- Warm Startup
- Shutdown
- Routine Power Generation Operation (With or without emission control downtime)

The PGF steam-related emissions will be emitted through one or more sources, depending on the operation type of the power generation system. Emission points for this system include a mobile testing unit (MTU) that is temporarily deployed at each well head during commissioning only, two production testing units (PTU) which are located on top of two warm-up AFTs (one PTU per warm-up AFT), a rock muffler (RM), and the cooling tower cells (14 total). Details of where the emissions occur from each operation are provided in Section 5.1.7.1.2.

In addition to the PGF operations, air emissions will occur through the operations of one diesel fire water pump, three 3.25 MW diesel-fired emergency generators, gas-insulated equipment, an HCl scrubber, and operations and maintenance (O&M) equipment and vehicles, which may travel both on and offsite.

A summary of each operating condition and the associated annual hours of operation is included in Table 5.1-6 below.

Table 5.1-6. Facility Operating Hour Summary

Project Operations		First Production Year	Subsequent Production Year with Startups, Shutdowns and Emission Control Downtime	Subsequent Production Year without Startups, Shutdowns and Emission Control Downtime
Production Well Flow Back		216	216	0
Production Well Testing		2,160	0	0
Injection Well Flow Back		288	288	0
Injection Well Testing		2,880	0	0
Commissioning	Well Warm-up	216	0	0
	Production Line and Equipment Warm-up	48	0	0
	Steam Blow	240	0	0
	Turbine Preheat and Auxiliary Loop	48	0	0
	Turbine Load Test	72	0	0
	Turbine Performance Test	48	0	0
Cold Startup	Well Warm-up	120	120	0
	Production Line and Equipment Warm-up	32	32	0
	Turbine Preheat and Auxiliary Loop	24	24	0
	Auxiliary Equipment Startup	12	12	0
	Functional Trip Test	6	6	0
	Gradual Steam Delivery to Turbine	6	6	0

Project Operations		First Production Year	Subsequent Production Year with Startups, Shutdowns and Emission Control Downtime	Subsequent Production Year without Startups, Shutdowns and Emission Control Downtime
Warm Startup	Step 1 (Geothermal Steam sent to RM)	200	200	0
	Step 2 (Gradual Diversion of Steam from RM to Turbine)	200	200	0
Shutdowns		198	198	0
Routine Power Generation Operation	With Controls	1,346	7,058	8,760
	Sparger Bypass/Breakdown [a]	200	200	0
	Biological Oxidation Box Bypass/Breakdown [a]	200	200	0
Total Operating Hours		8,760	8,760	8,760

[a] Sparger and biological oxidation box bypass/breakdown scenarios represent unforeseeable and non-preventable scenarios. These situations would be subject to ICAPCD breakdown requirements. The Applicant has included these conservative emission estimates (i.e., assumptions that tend to overpredict estimated versus actual) for PTE purposes only to determine potential permit applicability. This approach of including unforeseeable emissions in a facility's PTE for permit applicability determinations but not modeling analyses is consistent with the Bay Area Air Quality Management District's 2019 policy titled "Calculating Potential to Emit for Emergency Backup Power Generators" (BAAQMD 2019).

The goal of this air quality analysis is to present a worst-case operating condition for the Project, but there could be other scenarios with different numbers of starts and run-time hours. Thus, the Project proposes that the facility-wide limits be based on total short-term and annual emissions rather than operational hours as the worst-case operating scenario per pollutant can vary based upon the type of plant operations. Operational monitoring along with analytical and periodic source testing requirements will establish a compliance method to allow for monthly tracking, at a minimum, of all emissions at the Project. Specifically, the following operations will be monitored:

- Hours of operation for each operating condition, including:
  - Warm startup
  - Cold startup
  - Shutdown
  - Commissioning
  - Routine operations
  - Biological oxidation box bypass/breakdown
  - Sparger bypass/breakdown
  - Flow back and testing operations
  - Generator and fire pump operation
- Total steam flows through each of the operational systems

Analytical data from testing performed at the facility will be used to speciate the emissions of NCGs and cooling tower discharge to develop emissions from the respective hours of operation from those sources. Engine emissions from the emergency generators and fire pump would be tracked through run logs for compliance with the ICAPCD-issued operating permit(s).

For example, the maximum annual emissions of NO_x at 0.40 tpy would establish the facility's PTE. The Project would propose and accept hourly, daily and annual emission limits for this pollutant, but would propose that the permit not contain any limit on the number of hours of operation as the established emission limits would be monitored monthly. In this way, the facility operational profiles would be solely based on PTE rather than hours which would allow for a flexible response to changing power market conditions. Thus, the short-term and annual emissions limits would establish the facility PTE rather than the individual operational profiles. This type of emissions and compliance strategy is not new and has been implemented on numerous projects to which the CEC has issued Licenses, as well as District permits.

The maximum hourly emissions are based upon the worst-case hourly emissions expected from any source at the facility during any operating profile, considering both controlled and uncontrolled profiles. The maximum daily emissions assume 24 hours of operation of the worst-case hourly emissions scenario with the exception of the fire pump and emergency generators. The fire pump and emergency generators are assumed to operate no more than one and two hours per day, respectively, for maintenance and testing purposes. Additionally, maintenance and testing operations of the emergency generators would be limited to no more than two units per day.

The worst-case annual emissions are presented in Table 5.1-7. With the exception of H_2S, these emissions are based upon the highest emissions for each pollutant as derived from the operating scenarios presented above for both the first year of operation, including commissioning, and subsequent years of operation that do not include commissioning activities. For H_2S, only the worst-case subsequent year of operation was considered.

Table 5.1-7. Significant Emissions Threshold Summary

Pollutant	Project Cumulative Increase (tpy) [a]	Attainment Status		Major Source Thresholds (tpy)			Exceeds Major Source Thresholds?		
		Federal	State	PSD [b]	NSR [b]	Title V [c]	PSD	NSR	Title V
NO_x	0.40	Y	Y	250	100	100	N	N	N
SO_2	<0.01	Y	Y	250	--	100	N	--	N
CO	1.89	Y	Y	250	--	100	N	--	N
PM_{10}	14.8	Y	N	250	--	70	N	--	N
$PM_{2.5}$	8.87	Y	Y	250	100	100	N	N	N
VOC (ozone)	2.10	N	N	250	100	100	N	N	N
H_2S	64.9 [d]	--	Y	--	--	100	--	--	N
HAPs	2.59 [e]	--	--	--	--	25	--	--	N
CO_2	70,478	--	--	75,000	--	--	N	--	--

[a] Unless otherwise noted, emissions represent the maximum emissions of either the commissioning year or a subsequent operating year, including operation of the diesel-fueled emergency generators and fire pump, but do not include O&M activities which are not subject to permitting.

[b] These thresholds are specified both by the EPA and in ICAPCD Rule 207.

[c] These thresholds are specified in ICAPCD Rule 900.

[d] H_2S emissions represent the maximum emissions of a non-commissioning year.

[e] Only combined hazardous air pollutant (HAP) emissions are presented as they are already less than the single HAP Title V major source threshold of 10 tpy.

[f] GHG is an "anyways" pollutant and only triggers the PSD program if the facility is PSD major for another non-GHG pollutant.

Note:

-- = Not applicable and/or no standard

Based on the emissions presented in Table 5.1-7, the Project will be a minor NSR source as defined by ICAPCD Rule 207(D)(4) and will not be subject to ICAPCD requirements for emission offsets for criteria pollutants and toxics. The Project owner has prepared an air quality emissions and impact analysis in Section 5.1.10 for the pollutants shown in Table 5.1-7 to comply with the requirements of the ICAPCD and CEC.

Based on the emissions presented in Table 5.1-7, the Project will not itself trigger Title V permitting requirements. However, if the proposed Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed. Operating air permits for the Project will be applied for and obtained through ICAPCD in accordance with applicable federal, state, and local regulations.

5.1.7.1.2 Emission Estimates

Operation of the proposed process and equipment systems will result in emissions to the atmosphere of criteria pollutants, GHGs, and TACs.[2] Criteria pollutant emissions will consist primarily of NO_x, CO, VOCs, SO_x, PM_{10}, $PM_{2.5}$, and H_2S. GHG emissions may include CO_2, CH_4, N_2O, and SF_6, all presented as CO_2e emissions based on their GWP. TACs will consist of a combination of toxic gases and toxic particulate matter species. Table 5.1-8 lists the pollutants that may potentially be emitted from Project operations.

Table 5.1-8. Potentially Emitted Pollutants

Criteria Pollutants	GHGs	Toxic Air Contaminants [b]		
NO_x CO VOC SO_x $PM_{10/2.5}$ H_2S [a] Lead [a]	CO_2e [a]	Ammonia Arsenic Mercury Aluminum Antimony Barium Beryllium Cadmium Chromium Cobalt Zinc	DPM Radon Copper Manganese Nickel Selenium Silica Silver Vanadium PAHs (excluding naphthalene)	1,3-Butadiene Acetaldehyde Acrolein Benzene Ethylbenzene Formaldehyde Naphthalene Propylene Toluene Xylene HCl

[a] H_2S, lead, and some GHGs are also classified as TACs.

[b] Although the Project is also expected to emit argon, hydrogen, lithium, nitrogen, and strontium, they are not classified as TACs by the Office of Environmental Health Hazard Assessment and CARB and have not been included in this analysis.

Notes:

DPM = diesel particulate matter

PAHs = polynuclear (or polycyclic) aromatic hydrocarbons

The operational emissions estimation methodology for the Project was developed in coordination with the latest available data and engineering design. Details of the specific methodology for each of the operational sources are included below:

- **Steam and NCG-related Processes**: Emissions were estimated based upon analytical data from other geothermal power plants in the area. The analytical data used in the analysis consists of a speciated breakdown of concentrations from a NCG sample, and system inlet and outlet operations from the geothermal system's geothermal steam flows. The Project's geothermal steam flows vary in pressure and are categorized as high, standard, and low pressure, each of which has an assumed NCG concentration. The NCG and system inlet/outlet analytical data are applied to production well estimated steam flows for the Project to determine a total mass of species through the geothermal system. During processing and condensing of the geothermal steam, a portion of the species remain in gas phase and are routed through the sparger installed inside the cooling tower basin; the remaining condensed liquid portion of the species are routed through the biological oxidation box and then overflows to the cooling tower. The mass throughputs of these species are used in coordination with estimated control efficiencies and process-specific correction factors to estimate emissions. The methodology is applied to emissions of criteria pollutants, GHGs, and TACs.
- **Cooling Towers**: Criteria pollutant, GHG, and TAC emissions were estimated based upon two input streams: the NCG condensate/liquid within the cooling towers and the gaseous NCG vented into the cooling towers from the PGF steam. The gaseous NCG stream was characterized using analytical data

[2] Note that the EPA designates a subset of TACs as hazardous air pollutants (HAPs).

from other geothermal power plants in the area. All constituents except mercury, arsenic, and H_2S are assumed to directly pass through in the gas phase as emissions on a mass basis. It is assumed that mercury and arsenic are not emitted through the cooling towers in the gaseous NCG because they are expected to cool into either liquid or solid form and remain in the cooling tower basin, where they are then incorporated into the cooling tower condensate/liquid emissions calculations. H_2S emissions from the NCG stream are assumed to split between the gas phase and the condensate/liquid phase prior to reaching the cooling towers at a ratio of 60 to 40 percent, respectively.

Liquid-based emissions are the result of NCG condensate and make-up water input into the cooling towers for circulation. Particulate matter emissions from the circulating water were estimated using predicted permit limits of total dissolved solids (TDS). A particle size distribution was applied to TDS emissions to determine PM_{10} and $PM_{2.5}$ emissions. As outlined in the CARB California Emissions Inventory Data and Reporting System database, 70 percent of total particulate matter was assumed to be PM_{10} and 42 percent of total particulate matter was assumed to be $PM_{2.5}$ (SCAQMD 2006). With the exception of ammonia, TAC and VOC emissions were calculated using the cooling tower circulating water and make-up water flow rates. Specifically, VOC emissions were developed by applying hot well analytical data from other geothermal power plants in the area to the Project's estimated hot well flow rates. One-hundred percent of the VOC emissions in the hot well condensate are assumed to be emitted through the cooling towers. Non-volatile TAC emissions were developed by applying blowdown analytical data from other geothermal power plants in the area to the Project's cooling tower circulating water flow rates and emitted in the form of drift. Ammonia emissions from the liquid portion of the cooling towers were developed assuming a mass balance between the ammonia entering the cooling towers (in the form of hot well condensate) and leaving the cooling towers (in the form of blowdown). Specifically, hot well and blowdown analytical data from other geothermal power plants in the area were used with Project specific hot well and blowdown flow rates to determine the amount of ammonia remaining in the cooling towers after blowdown, which is assumed to be emitted through the cooling tower shrouds.

- **Diesel Fire Pump:** Criteria pollutant emissions from the diesel fire pump engine were estimated based upon vendor-provided data for a Tier 3-certified unit, with the exception of SO2. SO2 emissions were estimated based upon a mass balance wherein all sulfur in the fuel (assumed as ultra-low sulfur diesel) is assumed to be emitted as SO2. GHG emissions from the engine were calculated consistent with 40 CFR Part 98 methodology. TAC emissions were estimated based upon AP-42 methodology (EPA 1996).
- **Diesel-fired Emergency Generators:** Criteria pollutant emissions from the three diesel-fired emergency generators were estimated based upon vendor-provided data, with the exception of SO2. SO2 emissions were estimated based upon a mass balance wherein all sulfur in the fuel (assumed as ultra-low sulfur diesel) is assumed to be emitted as SO2. GHG emissions from the generators were calculated consistent with 40 CFR Part 98 methodology. TAC emissions were estimated based upon AP-42 methodology (EPA 1996). The vendor-provided data indicate that the engines will be compliant with Tier-4 emission rates through the use of a selective catalytic reduction (SCR) control device, diesel particulate filter, and diesel oxidation catalyst. As such, TAC emissions were assumed to be controlled by up to 80 percent. The SCR is assumed to result in a 5 parts per million (ppm) ammonia slip through the generators' exhaust.
- **Insulating Gas Emissions:** Emissions from the selected insulating gas were estimated based upon California's Regulation for Reducing Greenhouse Gas Emissions from Gas-Insulated Equipment (California Code of Regulations [CCR], Title 17, Section 95353, Tables 4 and 5) for data years through 2034.
- **O&M Equipment:** Emissions were estimated using construction equipment emission factors, horsepower, and load factors from the CalEEMod User's Guide (ICF 2022).
- **O&M Vehicles:** Emissions from vehicle exhaust and idling were calculated using emission factors from EMFAC2021.

- **HCl Scrubber:** Emissions from the HCl scrubber associated with the bulk concentrated HCl storage tank were developed by mass balance using Henry's Law and a conservative estimate that tank loading operations could occur 8,760 hours per year (i.e., assumption of operations around the clock, 24/7/365).
- **Criteria Pollutant Emissions.** Tables 5.1-9 through 5.1-16 present data on the criteria pollutant emissions expected from the facility equipment and systems under worst-case operating scenarios.

For each pollutant, the maximum hourly and annual PTE is presented in Appendix 5.1A and in the tables below. The presented maximum hourly PTE does not occur during the entire duration of the event. Additional details of the hour breakdown for each event are included in Appendix 5.1A.

Table 5.1-9. Maximum Emissions – Well Testing and Commissioning

Pollutant	Production Flow Back Testing [a]		Production Well Testing [b]		Injection Flow Back Testing [c]		Injection Well Testing [b]		Commissioning [d]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--	--	--	--	--
CO	--	--	--	--	--	--	--	--	--	--
VOC	0.03	<0.01	0.14	0.15	0.03	<0.01	0.14	0.20	0.45	0.12
$PM_{10}/PM_{2.5}$	--	--	--	--	--	--	--	--	--	--
SO_x	--	--	--	--	--	--	--	--	--	--
H_2S	9.95	1.07	40.4	43.6	9.95	1.43	40.4	58.2	134	25.4
HAPs	0.03	<0.01	0.14	0.15	0.03	<0.01	0.14	0.20	0.45	0.12
Ammonia	0.10	0.01	0.41	0.44	0.10	0.01	0.41	0.59	126	11.0
CO_2e	1,187	128	4,818	5,204	1,187	171	4,818	6,938	15,990	4,349

[a] Emissions emitted from the MTU during commissioning and the PTU during non-commissioning operations.

[b] Emissions emitted from the MTU.

[c] Emissions emitted from the PTU.

[d] Emissions emitted at varying rates between the PTU, RM, and cooling towers.

Notes:

-- = Pollutant not emitted

Table 5.1-10. Maximum Emissions – Startup and Shutdown

Pollutant	Cold Startup [a]		Warm Startup [b]		Shutdown [c]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--
CO	--	--	--	--	--	--
VOC	0.45	0.02	0.45	0.08	0.51	0.05
$PM_{10}/PM_{2.5}$	--	--	--	--	--	--
SO_x	--	--	--	--	--	--
H_2S	134	6.47	134	20.2	152	15.1
HAPs	0.45	0.02	0.45	0.08	0.52	0.05
Ammonia	126	2.72	126	6.54	1.54	0.15
CO_2e	15,990	851	15,990	2,709	18,148	1,797

[a] Emissions emitted at varying rates between the PTU, RM, and cooling towers.
[b] Emissions emitted at varying rates between the RM and cooling towers.
[c] Emissions emitted from the RM.
Note:
-- = Pollutant not emitted

Table 5.1-11. Maximum Emissions – Power Generation Operation

Pollutant	Routine Operations [a]		Sparger Bypass/Breakdown [b]		Biological Oxidation Box Bypass/Breakdown [b]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	--	--	--	--	--	--
CO	--	--	--	--	--	--
VOC	0.46	2.00	0.46	0.05	0.46	0.05
PM_{10}	3.37	14.7	3.37	0.34	3.37	0.34
$PM_{2.5}$	2.02	8.85	2.02	0.20	2.02	0.20
SO_x	--	--	--	--	--	--
H_2S	2.01	8.81	81.2	8.12	54.8	5.48
HAPs	0.46	2.00	0.46	0.05	0.46	0.05
Ammonia	128	559	564	56.4	128	12.8

Pollutant	Routine Operations [a]		Sparger Bypass/Breakdown [b]		Biological Oxidation Box Bypass/Breakdown [b]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
CO_2e	15,990	70,035	15,990	1,599	15,990	1,599

[a] Annual emissions for routine power generation operations conservatively assume an estimated 8,760 hours of operation without any startups, shutdowns, or emission control downtime. These emissions are emitted from the cooling towers.
[b] Emissions emitted from the cooling towers. Sparger bypass/breakdown emissions include emissions from normal cooling tower operation and biological oxidation box bypass/breakdown emissions include emissions from normal sparger operation, as both the sparger and biological oxidation box systems operate independently and emit through the cooling towers. As stated previously, these emissions represent unforeseeable and non-preventable operations, which would be subject to ICAPCD breakdown requirements.
Note:
-- = Pollutant not emitted

Table 5.1-12. Maximum Emissions – Ancillary Operations

Pollutant	Fire Pump [a]		HCl Scrubber [a]		3.25 MW Emergency Generator [a]		O&M Equipment and Vehicles [b]		Gas-Insulated Equipment [c]	
	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)	(lbs/hr)	(tpy)
NO_x	1.78	0.04	--	--	4.80	0.12	8.26	1.52	--	--
CO	0.42	0.01	--	--	25.1	0.63	23.3	5.25	--	--
VOC	0.05	<0.01	--	--	1.36	0.03	0.79	0.16	--	--
PM_{10}	0.06	<0.01	--	--	0.21	0.01	0.52	0.10	--	--
$PM_{2.5}$	0.06	<0.01	--	--	0.21	0.01	0.28	0.05	--	--
SO_x	<0.01	<0.01	--	--	<0.01	<0.01	0.07	0.01	--	--
H_2S	--	--	--	--	--	--	--	--	--	--
HAPs	0.06	<0.01	0.11	0.50	0.22	0.01	0.39 [d]	0.07 [d]	--	--
Ammonia	--	--	--	--	0.34	0.01	--	--	--	--
CO_2e	131	3.27	--	--	4,949	124	7,289	1,416	15.6	68.4

[a] Emissions emitted from source-specific locations.
[b] Emissions emitted from mobile sources including roadway fugitive dust.
[c] Emissions emitted as fugitives.
[d] HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.
Note:
-- = Pollutant not emitted

Table 5.1-13. Summary – Project Operation Hourly Emissions

Pollutant	Hourly Emissions (lbs/hr)			
	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [c]
NO_x	--	1.78	14.4	8.26
CO	--	0.42	75.2	23.3
VOC	0.51	0.05	4.08	0.79
PM_{10}	3.37	0.06	0.64	0.52
$PM_{2.5}$	2.02	0.06	0.64	0.28
SO_x	--	<0.01	<0.01	0.07
H_2S	152	--	--	--
HAPs	0.52	0.06	0.67	0.51 [d]
Ammonia	128	--	1.01	--
CO_2e	18,148	131	14,848	7,305

[a] Steam system emissions during routine operation (i.e., excluding commissioning) are emitted from the PTU, RM, or cooling towers.

[b] Emissions include those from three 3.25 MW generators.

[c] Emissions include those associated with gas-insulated equipment, the HCl scrubber, and O&M equipment and vehicles.

[d] Combustion-related HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

Table 5.1-14. Summary – Project Operation Annual Emissions

Pollutant	First Year Annual Emissions (tpy) [c]				Subsequent Year Annual Emissions with Startups, Shutdowns and Emission Control Downtime (tpy)				Subsequent Year Annual Emissions without Startups, Shutdowns and Emission Control Downtime (tpy)			
	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]	Steam System [a]	Fire Pump	Emergency Generators [b]	O&M [d]
NO_x	--	0.04	0.36	1.52	--	0.04	0.36	1.52	--	0.04	0.36	1.52
CO	--	0.01	1.88	5.25	--	0.01	1.88	5.25	--	0.01	1.88	5.25
VOC	1.03	<0.01	0.10	0.16	1.86	<0.01	0.10	0.16	2.00	<0.01	0.10	0.16
PM_{10}	2.94	<0.01	0.02	0.10	12.6	<0.01	0.02	0.10	14.8	<0.01	0.02	0.10
$PM_{2.5}$	1.76	<0.01	0.02	0.05	7.53	<0.01	0.02	0.05	8.85	<0.01	0.02	0.05
SO_x	--	<0.01	<0.01	0.01	--	<0.01	<0.01	0.01	--	<0.01	<0.01	0.01
H_2S	186	--	--	--	64.9	--	--	--	8.81	--	--	--
HAPs	1.03	<0.01	0.02	0.57 [e]	1.87	<0.01	0.02	0.57 [e]	2.00	<0.01	0.02	0.57 [e]
Ammonia	176	--	0.03	--	529	--	0.03	--	559	--	0.03	--
CO_2e	36,106	3.27	371	1,484	65,281	3.27	371	1,484	70,035	3.27	371	1,484

[a] Steam system emissions are emitted from the PTU, RM, or cooling towers.

[b] Emissions include those from three 3.25 MW generators.

[c] First year annual emissions include commissioning activities with the remaining year routine operations.

[d] Emissions include those associated with gas-insulated equipment, the HCl scrubber, and O&M equipment and vehicles.

[e] Combustion-related HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

Tables 5.1-15 and 5.1-16 present a summary of the hourly emissions for the worst-case operational scenario for each of the Project's emission sources and a summary of the facility-wide PTE, respectively.

Table 5.1-15. Worst-Case Hourly Emissions by Source or Point of Release

Pollutant	Maximum Hourly Emissions (lbs/hr)						
	PTU	MTU	RM	Cooling Tower & Sparger	Fire Pump	Emergency Generators [a]	O&M [b]
NO_x	--	--	--	--	1.78	14.4	8.26
CO	--	--	--	--	0.42	75.2	23.3
VOC	0.08	0.14	0.51	0.46	0.05	4.08	0.79
SO_x	--	--	--	--	<0.01	<0.01	0.07
PM_{10}	--	--	--	3.37	0.06	0.64	0.52
$PM_{2.5}$	--	--	--	2.02	0.06	0.64	0.28
H_2S	24.8	40.4	152	136	--	--	--
HAPs	0.08	0.14	0.52	0.46	0.06	0.67	0.51 [c]
Ammonia	0.25	0.41	1.54	128	--	1.01	--
CO_2e	2,963	4,818	18,148	15,990	131	14,848	7,305

[a] Emissions include those from three 3.25 MW generators.

[b] Emissions include those associated with gas-insulated equipment, the HCl scrubber, and O&M equipment and vehicles.

[c] Combustion-related HAPs conservatively assumed to be equal to PM_{10} with DPM considered a surrogate for HAPs.

Note:

-- = Pollutant not emitted

Table 5.1-16. Facility-wide Potential to Emit

Pollutant	Hourly Operation (lbs/hr)	First Year of Operation (tpy)	Subsequent Year of Operation with Startups, Shutdowns and Emission Control Downtime (tpy)	Subsequent Year of Operation without Startups, Shutdowns and Emission Control Downtime (tpy)
CO	98.9	7.15	7.15	7.15
NO_x	24.4	1.92	1.92	1.92
VOC	5.44	1.29	2.12	2.26
PM_{10}	4.59	3.06	12.7	14.9
$PM_{2.5}$	3.01	1.83	7.60	8.92
SO_x	0.07	0.01	0.01	0.01
H_2S	152	186	64.9	8.81
HAPs	1.76	1.62	2.45	2.59
Ammonia	129	176	529	559
CO_2e	40,431	37,965	67,140	71,894

The operational profiles presented above include scenarios for the first operating year, including plant commissioning and testing activities; a subsequent operating year without commissioning and testing activities but with all proposed startups, shutdowns, and emission control downtime; and a subsequent operating year assuming 8,760 hours of routine power generation operation (i.e., without any startups, shutdowns, or emission control downtime). The commissioning and testing activities are included in the facility-wide PTE to conservatively capture the Project's worst-case air quality impacts and emissions for permitting purposes.

GHG Emissions. Operational emissions of CO_2e will be primarily from the geothermal fluid in the RPF, onsite diesel combustion from emergency generators and the fire water pump, and insulating gas emissions from the high voltage circuit breaker. The worst-case annual estimate of CO_2e emissions from operation of the Project is 71,894 tpy (64,191 metric tons [MT] per year), with specific source details provided in Tables 5.1-9 through 5.1-16. These estimates were calculated using the emission factors, GWPs, and methodology previously specified. Additional detail is provided in Appendix 5.1A.

TAC Emissions. Operational emissions of TACs will result from multiple Project sources, including geothermal fluid in the RPF, mobile/stationary combustion activities, and the bulk concentrated HCl tank and associated scrubber. Combined HAP emission estimates are summarized in Tables 5.1-9 through 5.1-16, with individual TAC estimates included in Section 5.9. Section 5.9 also provides a detailed discussion and quantification of TAC emissions from Project operation, as well as the results of the health risk assessment (HRA).

5.1.7.1.3 Significance Criteria for Operation

Table 5.1-17 presents the Project emissions for comparison to ICAPCD's regional air quality significance thresholds for operation, as derived from the ICAPCD California Environmental Quality Act (CEQA) guidance (ICAPCD 2017). In the absence of a GHG operational threshold of significance, South Coast Air Quality Management District's (SCAQMD) *Interim CEQA Significance Threshold for Stationary Sources, Rules and Plans* was used for this analysis (SCAQMD 2008).

Table 5.1-17. ICAPCD CEQA Significance Thresholds for Operation

Pollutant	Project Operational Emissions [b]	Operational Thresholds
NO_x	64.2 lbs/day	137 lbs/day
VOC	24.6 lbs/day	137 lbs/day
PM_{10}	83.6 lbs/day	150 lbs/day
$PM_{2.5}$	51.0 lbs/day	550 lbs/day
SO_x	0.15 lbs/day	150 lbs/day
CO	205 lbs/day	550 lbs/day
Odors	--	Project creates an odor nuisance at a distance greater than 1 mile from the facility
CO_2e	64,191 MT/year [a]	10,000 MT/year

Source: ICAPCD 2017 and SCAQMD 2008

[a] Over 98 percent of the Project's total CO_2e emissions result from the processing of geothermal fluid.

[b] Emissions include those associated with gas-insulated equipment and O&M equipment and vehicles.

Note:

-- = Not applicable and/or no standard

As shown, operational emissions from all Project activities are not expected to exceed the daily threshold values of significance for criteria pollutants. Although the Project's operational emissions do exceed the annual significance threshold for GHG emissions, the Project's GHG emissions are the direct result of geothermal steam processing for electricity generation, which is an activity encouraged in the Imperial County Regional Climate Action Plan (Ascent 2021). Additionally, the GHG emissions from the non-geothermal processing activities, including stationary combustion, would be only 1,659 MT CO_2e per year, which is less than the threshold. Therefore, the Project would likely result in less-than-significant impacts with respect to operational emissions.

5.1.7.2 Project Construction

The construction phase of the Project is expected to take approximately 29 months, with a few months on both ends for equipment delivery and demobilization. Construction is anticipated to begin in Second quarter 2024. The overall Project staffing schedule is displayed in Table 2-9. The construction schedule is based on two, 10-hour shifts per day, during which construction equipment may operate up to 10 hours per shift, and a 7 days-per-week work week.[3] Separate contractors working in parallel with the Project's construction and startup schedule will construct offsite utilities.

Several areas in the vicinity of the Project site will be available for equipment and materials laydown, storage, construction equipment parking, small fabrication areas, and office trailers. The proposed construction laydown areas are outlined in Section 2. Layout of access roads and loading areas is important in the development of the laydown yard. Space is required for large turbine parts, structural steel, well piping, spools, electrical components, switchyard apparatus, and building parts. Sufficient space is provided to accommodate equipment preventive and in-storage maintenance activities such as moving, shaft rotation, connecting, lubricating, and heating. Site access will be controlled for personnel and vehicles. A security fence will be installed around the site boundary, including the laydown areas. Security personnel will be onsite.

Construction-related issues and emissions at the Project site are consistent with issues and emissions encountered at any construction site. Compliance with the provisions of the following permits and plans will generally result in minimal site emissions:

- Grading permit
- Construction site provisions of the site's Storm Water Pollution Prevention Plan (SWPPP)
- ICAPCD-issued ATC, which will require compliance with the provisions of all applicable fugitive dust rules that pertain to the Project's construction phase

5.1.7.2.1 Emission Estimates

The construction emissions estimation methodology for the Project was developed in coordination with the latest available data and engineering design. Details of the specific methodology for each of the construction emissions sources are included below:

- **Construction Equipment**: Emissions were estimated using construction equipment emission factors, horsepower, and load factors from the *CalEEMod User's Guide* (ICF 2022). Default CalEEMOD emission factors were assumed for off-highway trucks and small equipment (i.e., equipment with a power rating of less than 25 horsepower); Tier 4 final emission factors were assumed for all other construction equipment.

- **On-Road Vehicles:** Emissions from vehicle exhaust and idling were calculated using emission factors from EMFAC2021.

- **Fugitive Dust Emissions:** Emissions from fugitive dust activities including grading, truck dumping/loading, and travel on paved and unpaved roadways were estimated based upon factors developed using methodology from the *CalEEMod User's Guide* (ICF 2022). As appropriate, fugitive dust emissions will be mitigated up to 74 percent by watering every 2.1 hours, per the *CalEEMod User's Guide* (ICF 2022).[4]

- **Paving Emissions:** Emissions from paving activities were estimated based upon factors developed using methodology from the *CalEEMod User's Guide* (ICF 2022).

Emissions will occur from both onsite and offsite activities during the construction phase of the Project. Onsite emissions will include operations of construction-related equipment, pickup trucks, fugitive dust,

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[3] Although staffing assumes a 7 days-per-week work week, the construction emissions assume a more typical schedule of up to 23 work days per month.

[4] The control efficiency established by the *CalEEMod User's Guide* is based on watering three times per 8-hour shift, or every 2.1 hours (ICF 2022).

and paving. Emissions occurring offsite will include construction equipment for the drilling and construction of offsite wells and well pads, on-road vehicles for worker commutes and material/equipment deliveries, fugitive dust from road dust, and paving emissions associated with the paving of roadways to the Project.

Onsite and offsite Project emissions from construction have been divided into two categories: (1) vehicle and construction equipment exhaust; and (2) fugitive dust from vehicle and construction equipment, including grading and truck loading/dumping during Project construction.

Criteria Pollutant Emissions. The following criteria pollutant emissions have been calculated: NO_X, SO_2, VOC, CO, PM_{10}, and $PM_{2.5}$. It is expected that large stockpiles of earthen materials would not be present during Project construction; therefore, wind-blown fugitive dust emissions from earthen stockpiles were assumed to be negligible.

Daily and annual construction emissions were estimated based on the number and type of construction equipment, the number of heavy-duty trucks, and the workforce projected for each month of construction. It was conservatively assumed that the construction activities would occur 20 hours per day across the two, 10-hour shifts and 23 days per month. The maximum daily emissions occur during month 12 for all pollutants except PM_{10}, which peaks during month 19. The maximum annual construction emissions for all pollutants occur between months 10 and 21, which is calendar year 2025.

The maximum daily and annual criteria pollutant emissions from the combined onsite and offsite construction activities are presented in Table 5.1-18. The detailed emission calculations for construction are provided in Appendix 5.1D.

Table 5.1-18. Project Construction Criteria Pollutant Emissions

Construction Emissions	NO_X	CO	VOC	SO_2	PM_{10}	$PM_{2.5}$
Average Daily Emissions (lbs/day)	120	481	46.1	1.16	23.6	17.3
Maximum Annual Emissions (tpy)	25.2	105	9.64	0.25	4.81	3.62

GHG Emissions. GHG emissions from Project construction were calculated using the same methodology used for criteria pollutants. The maximum daily and annual GHG emissions from the combined onsite and offsite construction activities are presented in Table 5.1-19. The detailed emission calculations for construction are provided in Appendix 5.1D.

Table 5.1-19. Project Construction Greenhouse Gas Emissions

Construction Emissions	CO_2	CH_4	N_2O	CO_2e
Average Daily Emissions (MT/day)	45.1	<0.01	<0.01	45.2
Maximum Annual Emissions (MT/year)	19,259	0.77	0.15	19,323

TAC Emissions. Construction-related emissions of TACs will result from the Project's mobile source combustion activities during the construction phase. See Section 5.9 for a detailed discussion and quantification of TAC emissions from Project construction, as well as the results of the HRA.

5.1.7.2.2 Mitigation Measures for Construction

Construction activities are known to result in impacts due to fugitive dust and other emissions that may result in adverse impacts to air quality. The Project owner will comply with all required fugitive dust mitigation measures consistent with ICAPCD Regulation VIII and the CEQA Guidelines. The required mitigation measures to be implemented by the Project owner during Project construction include the following (ICAPCD 2017):

- All disturbed areas, including bulk material storage which is not being actively utilized, shall be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by using water, chemical stabilizers, dust suppressants, tarps or other suitable material such as vegetative ground cover.
- All onsite and offsite unpaved roads will be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering, except as otherwise provided for by Rule 801.
- All unpaved traffic areas 1 acre or more with 75 or more average vehicle trips per day will be effectively stabilized and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- The transport of bulk materials shall be completely covered unless six inches of freeboard space from the top of the container is maintained with no spillage and loss of bulk material. In addition, the cargo compartment of all haul trucks is to be cleaned and/or washed at delivery site after removal of bulk material.
- All track-out or carry-out will be cleaned at the end of each workday or immediately when mud or dirt extends a cumulative distance of 50 linear feet or more onto a paved road within an urban area.
- Movement of bulk material shall be stabilized prior to handling or at points of transfer with application of sufficient water, chemical stabilizers or by sheltering or enclosing the operation and transfer line.
- The construction of any new unpaved road is prohibited within any area with a population of 500 or more unless the road meets the definition of a temporary unpaved road. Any temporary unpaved road shall be effectively stabilized, and visible emissions shall be limited to no greater than 20 percent opacity for dust emissions by paving, chemical stabilizers, dust suppressants and/or watering.
- Use alternative fueled or catalyst equipped diesel construction equipment, including all off-road and portable diesel-powered equipment to the extent feasible.
- Minimize idling time either by shutting equipment off when not in use or reducing the time of idling to 5 minutes as a maximum.
- Limit, to the extent feasible, the hours of operation of heavy-duty equipment and/or the amount of equipment in use.
- Replace fossil fueled equipment with electrically driven equivalents (provided they are not run via a portable generator set).

Additional mitigation measures are available in ICAPCD's CEQA Guidelines for construction as discretionary or enhanced measures and may be implemented at the request of the CEC or ICAPCD.

5.1.7.2.3 Significance Criteria for Construction

Table 5.1-20 presents the ICAPCD's regional air quality significance thresholds currently being implemented for construction, as derived from the ICAPCD's CEQA Guidelines (ICAPCD 2017), as well as a comparison to the Project's construction emissions. In the absence of a GHG construction threshold of significance, SCAQMD's CEQA threshold of significance was used (SCAQMD 2019).

Table 5.1-20. ICAPCD Construction CEQA Significance Thresholds

Pollutant	Project Construction Emissions	Construction Thresholds
NO_x	120 lbs/day	100 lbs/day
VOC	46.1 lbs/day	75 lbs/day
PM_{10}	23.6 lbs/day	150 lbs/day
$PM_{2.5}$	17.3 lbs/day	--
SO_x	1.16 lbs/day	--
CO	481 lbs/day	550 lbs/day
CO_2e	19,323 MT/year	10,000 MT/year

Source: ICAPCD 2017 and SCAQMD 2019

Note:

-- = Not applicable and/or no standard

As shown, construction emissions from all onsite and offsite Project activities are not expected to exceed the significance thresholds except for NO_2 and GHGs (CO_2e). An exceedance of the significance thresholds does not necessarily indicate the Project would have significant impacts, but does indicate the need for additional analysis. For NO_2, atmospheric dispersion modeling was performed, in accordance with the methodology presented in Section 5.1.9, to demonstrate that Project construction would not exceed either the NAAQS or CAAQS. Based on the results presented in Section 5.1.10.2, the Project would have less-than-significant impacts with respect to criteria pollutants.

For GHGs, one must also consider the Project's conformance with regional climate action plans. Although the Project's construction GHG emissions exceed the significance threshold, those short-term emissions are necessary to support the construction of a new geothermal steam processing facility for electricity generation, which is an activity encouraged in the Imperial County Regional Climate Action Plan (Ascent 2021). Once built, the Project will also support the State's goals of increasing renewable energy resources and reducing GHG emissions. Therefore, the Project is expected to have a potentially less-than-significant impact with respect to GHGs.

5.1.8 Best Available Control Technology Evaluation

ICAPCD does not have BACT guidelines. To evaluate if the Project meets the BACT requirements, BACT guidelines published by other air districts in California, CARB, and the EPA for cooling tower particulate matter emissions and geothermal power plant H_2S emissions were reviewed.

5.1.8.1 BACT for Cooling Tower Particulate Matter Emissions

The San Joaquin Valley Air Pollution Control District's (SVJAPCD) BACT Guideline for cooling towers is to use High Efficiency Cellular Type Drift Eliminators (0.0005 percent drift rate) (SJVAPCD 2018), which is consistent with listings from EPA's Reasonably Available Control Technology (RACT)/ BACT/Lowest Achievable Emission Rate (LAER) Clearinghouse[5]. There are no BACT guidelines or listings from other air districts for cooling towers. The cooling tower of the proposed Project would be designed to have a 0.0005 percent drift eliminator and thus satisfies the BACT requirements. Further BACT analysis was performed regarding dry cooling technologies and determined that these other technologies would not be feasible for this Project. A copy of this analysis is included in Appendix 5.1E.

5.1.8.2 BACT for H_2S Emissions

Currently, there are no applicable BACT listings for H_2S emissions from geothermal power plant operations. However, ICAPCD approved a BACT analysis for a similar facility in 2017. This approved BACT

[5] Available online at https://www.epa.gov/catc/ractbactlaer-clearinghouse-rblc-basic-information.

analysis utilized a sparger system for H_2S removal from the gas stream and a biological oxidation box to oxidize the liquid phase H_2S into elemental sulfur and or sulfates with destruction and removal efficiencies (DRE) of 90 percent and 90 percent (CalEnergy 2017), respectively. An addendum to this BACT analysis was performed as part of this Project to further analyze H_2S control technologies for both the gas and liquid phases. The results of this updated BACT analysis are consistent with the ICAPCD BACT analysis approved in 2017 of an emissions control system consisting of a sparger for the gas phase and biological oxidation box for the liquid phase. A copy of both BACT analyses are included in Appendix 5.1E.

The proposed Project would utilize this same H_2S treatment system consisting of a sparger and a biological oxidation box to remove H_2S from the geothermal stream. The proposed sparger system and biological oxidation box are expected to operate with a combined minimum DRE of 98.5 percent. The proposed Project would use up-to-date technologies and the H_2S control system is typical in geothermal power plant designs that have been permitted in other air districts and in other states.

5.1.8.3 Summary

The particulate matter emissions from the cooling tower and the H_2S emissions from the geothermal stream are subject to BACT requirements. Table 5.1-21 summarizes the proposed BACT for the Project's cooling tower particulate matter emissions and the H_2S emissions from the geothermal stream.

Table 5.1-21. Proposed BACT

Pollutant	Applicable BACT from Guidelines	Project Proposed BACT
$PM_{10}/PM_{2.5}$	High Efficiency Drift Eliminator at 0.0005%	High Efficiency Drift Eliminator at 0.0005%
H_2S	90% DRE with a combination sparger and biological oxidation box	H_2S sparging and biological oxidation box with a combined minimum 98.5% control efficiency.

As shown in Table 5.1-21, the cooling tower meets the BACT requirements for particulate matter because it will be equipped with a high efficiency drift eliminator with 0.0005 percent drift. While there is no published BACT for H_2S from the proposed Project, H_2S emissions will be controlled with a sparger and biological oxidation box system with a combined minimum 98.5 percent control efficiency, consistent with a similar project's BACT analysis within ICAPCD for H_2S abatement. As such, the Project meets the BACT requirements under ICAPCD Rule 207.

5.1.9 Environmental Analysis – Air Quality Impact Analysis Methodology

An ambient air quality impact analysis was conducted to compare ground-level impacts resulting from the Project's operation- and construction-related emissions with established federal and state ambient air quality standards. This section describes the methodology used in developing both the magnitude and spatial extent of the ground-level concentrations resulting from the Project's emissions.

Potential air quality impacts were evaluated consistent with the approved Air Quality Modeling Protocol, as described herein. A copy of the approved Air Quality Modeling Protocol is included in Appendix 5.1C. In addition to what is presented in the approved Air Quality Modeling Protocol, criteria pollutant impacts from the Project's construction phase were also evaluated, as specifically requested by the CEC. All input and output modeling files have been provided to the ICAPCD and CEC under separate cover.

5.1.9.1 Dispersion Model Selection and Options

The American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) (Version 22112) was used for this ambient air quality impact analysis, as recommended in the EPA's Appendix W, *Guideline on Air Quality Models* (EPA 2017a). AERMOD is a steady-state Gaussian plume model that simulates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrain. This model is recommended for short-range (less than 50 kilometers) dispersion from the source.

AERMOD incorporates the plume rise model enhancement (PRIME) algorithm for modeling building downwash and is designed to accept input data prepared by two specific preprocessor programs, AERMOD meteorological data processor (AERMET) and AERMOD terrain processor (AERMAP). AERMOD was run with the following technical options:

- Direction-specific building downwash
- Regulatory default options unless otherwise specified herein
- Rural dispersion characteristics
- Actual receptor elevations and hill height scales obtained from AERMAP (Version 18081)

Default model options for temperature gradients, wind profile exponents, and calm processing, which includes final plume rise, stack-tip downwash, and elevated receptor (complex terrain) heights option were used in this modeling analysis.

The following subsections present details of other inputs required for dispersion modeling with AERMOD.

5.1.9.1.1 Meteorological Data

Five years of AERMET-processed meteorological data were obtained from the CARB Hotspots Analysis and Reporting Program (HARP) AERMOD Meteorological Files webpage[6] for the Imperial County Airport (KIPL, WBAN ID: 03144). The 5 years of data were processed by CARB with AERMET Version 19191 for 2015 through 2018 and 2021. The years 2019 and 2020 were not included in the meteorological data set because they were likely determined to be incomplete by CARB. The data set was selected based on completeness, similar surrounding land use as the plant site and proximity to the facility, as shown in Figure 5.1-2. Wind speeds and directions for this data set are presented in the wind rose in Figure 5.1-3. The average wind speed for the 5-year period was 3.45 meters per second (m/s).

5.1.9.1.2 Receptor Grid Selection and Coverage

The ambient air boundary was defined by the permanent fence line surrounding the facility or the temporary fencing surrounding the offsite well pads. The selection of receptors in AERMOD was as follows:

- Discrete receptors every 25 meters (m) around the facility's ambient air boundary (i.e., fence line)
- 25-m spacing from the fence line to 500 m from grid origin
- 100-m spacing from beyond 500 m to 1,000 m from the fence line
- 250-m spacing from beyond 1,000 m to 5,000 m from the fence line
- 500-m spacing from beyond 5,000 m to 10,000 m from the fence line

For purposes of the offsite well pads, fence line receptors at 25-m spacing were utilized, based on the assumption that these offsite well pads would be located within the larger receptor grid described above.

All receptors and source locations were expressed in the Universal Transverse Mercator North American Datum 1983, Zone 11 coordinate system. U.S. Geological Survey National Elevation Dataset terrain data was used in conjunction with the AERMAP preprocessor (Version 18081) to determine receptor elevations and terrain maxima.

Concentrations within the facility fence line and perimeter of each offsite well pad were not calculated. Figure 5.1-4 displays the receptor grids used in the modeling assessment.

5.1.9.1.3 Ambient Air Boundary

The ambient air boundary is defined by the property line that surrounds the Applicant-owned property within which non-authorized personnel access is precluded. The well pads and associated MTU sources will be located at offsite areas and would only emit during commissioning. For purposes of this analysis, it is assumed that public access would be precluded from the footprint of each well pad during commissioning,

[6] Available online at https://ww2.arb.ca.gov/resources/documents/harp-aermod-meteorological-files.

likely with the use of temporary fencing. The ambient air boundary for the Project facility is represented in Figure 5.1-5.

5.1.9.1.4 Building Downwash

Building influences on the air dispersion of emissions from point source stacks were calculated by incorporating the EPA Building Profile Input Program for use with the PRIME algorithm (BPIP-PRIME). Stack heights, building locations, and building dimensions were obtained from the most currently available architectural plans and onsite measurements. Stacks located on or adjacent to buildings were given base elevations of said buildings. A list of the buildings and their coordinates is included in Appendix 5.1B.

Figure 5.1-2
Meteorological Data Station Location
Elmore North Geothermal Project
Imperial County, California

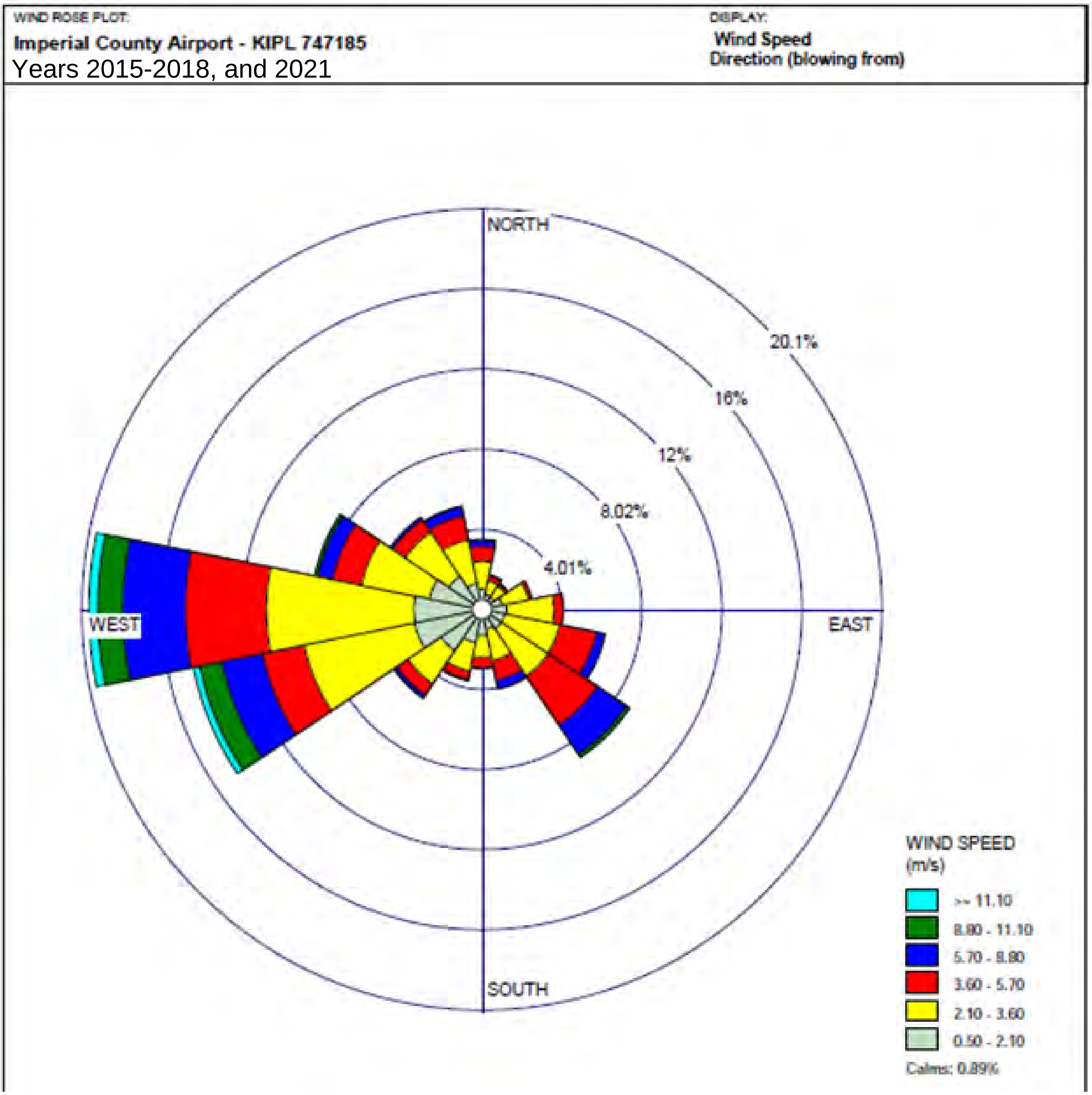


Figure 5.1-3
Meteorological Data Wind Rose
Elmore North Geothermal Project
Imperial County, California

Jacobs

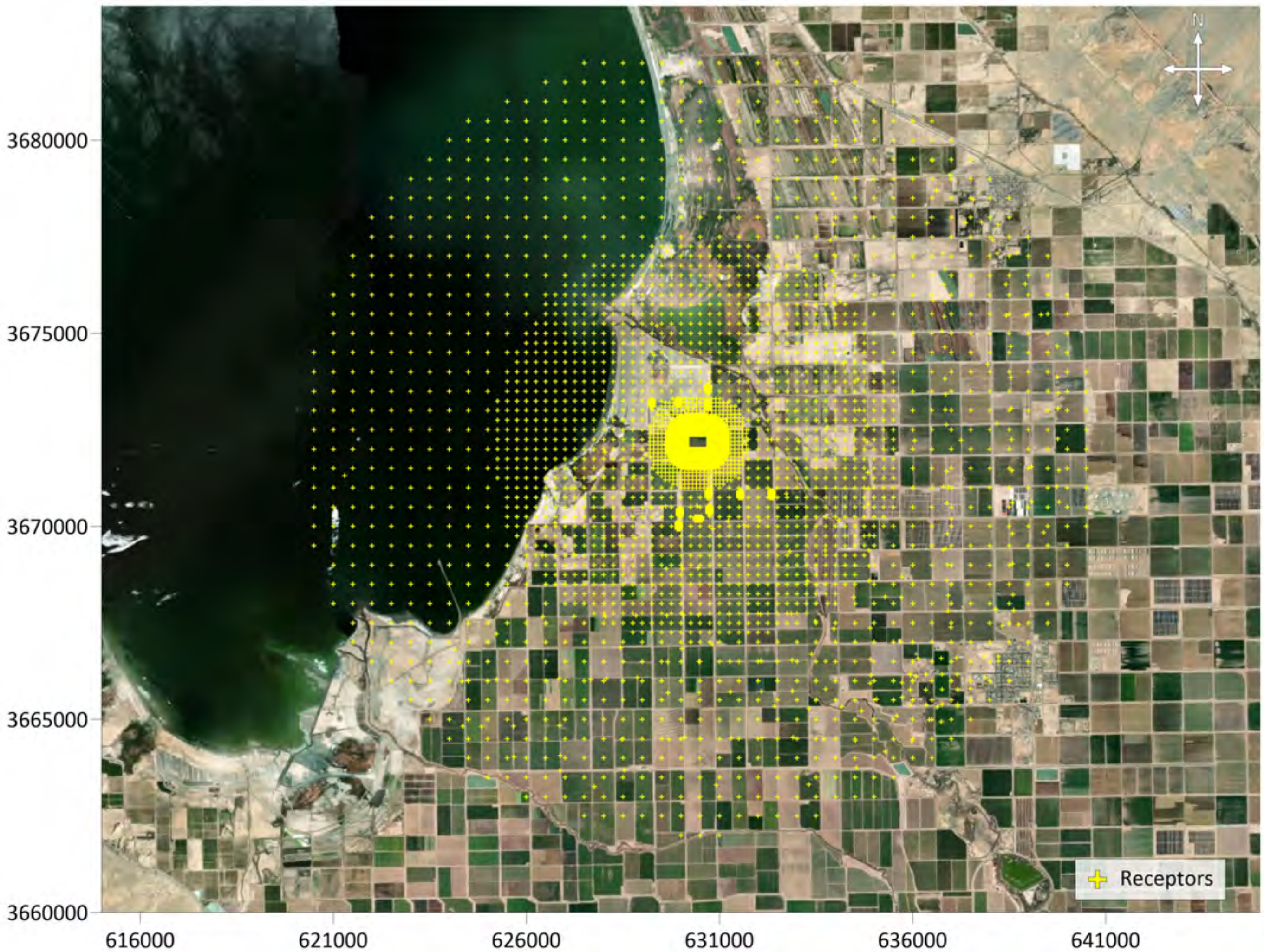


Figure 5.1-4
Dispersion Modeling Receptor Grid
Elmore North Geothermal Project
Imperial County, California

Jacobs

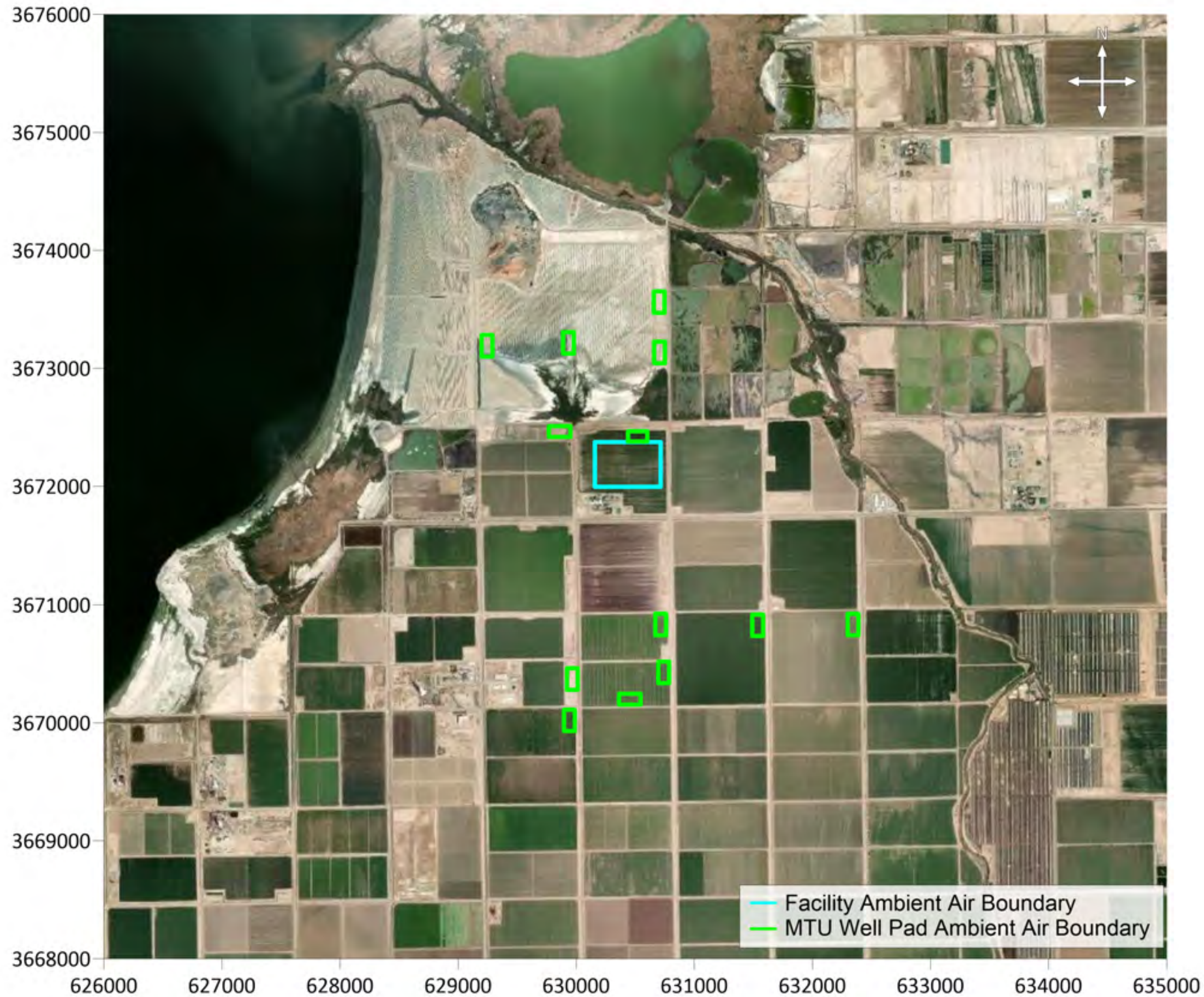


Figure 5.1-5
Facility Ambient Air Boundary
Elmore North Geothermal Project
Imperial County, California

As part of this analysis, a good engineering practice (GEP) stack height screening was performed to determine which stack height should be used in the modeling. The GEP stack height is defined as the height in which the plume dispersion from the stack is not influenced by building downwash. This GEP stack height is calculated as the lesser of the following two criteria:

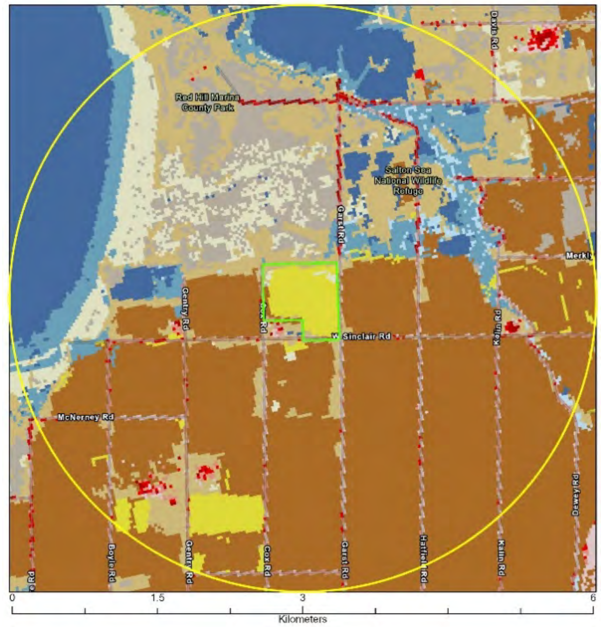
- 65 m
- The sum of the maximum building height for which the stack is in the area of influence plus 1.5 times the lesser of the building height or projected building width

The stack heights used in this dispersion modeling analysis were the actual stack height or the GEP stack height, whichever is less as calculated by AERMOD.

5.1.9.1.5 Rural versus Urban Option

The land use surrounding the facility was evaluated for classification as either urban or rural. A land use analysis was performed following the Auer land use methodology (Auer 1978) using the most recent available land use data. Land use data within a 3-kilometer radius for the site was obtained from the U.S. Geological Survey's 2019 National Land Cover Database (NLCD), as shown below. This data set classified land use for individual 30- by 30-m cells into 15 primary land use categories for the Project site. Of the 15 land use categories in the 2019 NLCD data set, the following two categories are considered urban for dispersion modeling purposes:

- **Developed, Medium Intensity (NLCD Code 23)—**This classification includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50 to 79 percent of the total cover.
- **Developed, High Intensity (NLCD Code 24)—**This classification includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses, and commercial/industrial spaces. Impervious surfaces account for 80 to 100 percent of the total cover.



Land Use Color	Land Use Code ID No.	Land Use Description	Cell Count	% Land Category
	11	Open Water	8,063	16.51%
	21	Developed, Open Space	1,648	3.37%
	22	Developed, Low Intensity	1,321	2.70%
	23	Developed, Medium Intensity	396	0.81%
	24	Developed, High Intensity	100	0.20%
	31	Barren Land	3,381	6.92%
	52	Shrub/Scrub	6,737	13.79%
	71	Herbaceous	2,448	5.01%
	81	Hay/Pasture	1,227	2.51%
	82	Cultivated Crops	20,376	41.72%
	90	Woody Wetlands	289	0.59%
	95	Emergent Herbaceous Wetlands	2,855	5.85%

If more than 50 percent of the area within 3 kilometers is classified as urban land use, the URBAN option may be used for AERMOD modeling of the facility. The analysis showed that less than 1 percent of the land within a 3-kilometer radius of the facility may be classified as urban; therefore, the URBAN option in AERMOD was not used in the dispersion modeling analysis.

5.1.9.2 Source Characterization

The Project's worst-case operation- and construction-related emissions of criteria pollutants, GHGs, and TACs are presented in Section 5.1.7 and, unless otherwise noted, were used for modeling based upon the applicable pollutant and standard. Details of the source specific model inputs are provided in the following subsections.

5.1.9.2.1 Project Operation

The modeled sources for Project operation include the cooling towers, diesel-fired emergency generators, diesel fire water pump, PTU, MTU, RM, and HCl scrubber. Details of the source specific model inputs and modeled emission rates are presented below and included in Appendix 5.1B. The operational source layouts for modeling the onsite sources and the offsite MTUs are included in Figures 5.1-6 and 5.1-7, respectively.

Emissions from O&M equipment and vehicles were not modeled as those operations are infrequent, varied spatially throughout the Project site, and assumed to have a negligible impact on ground-level concentrations relative to the Project's other emission sources.

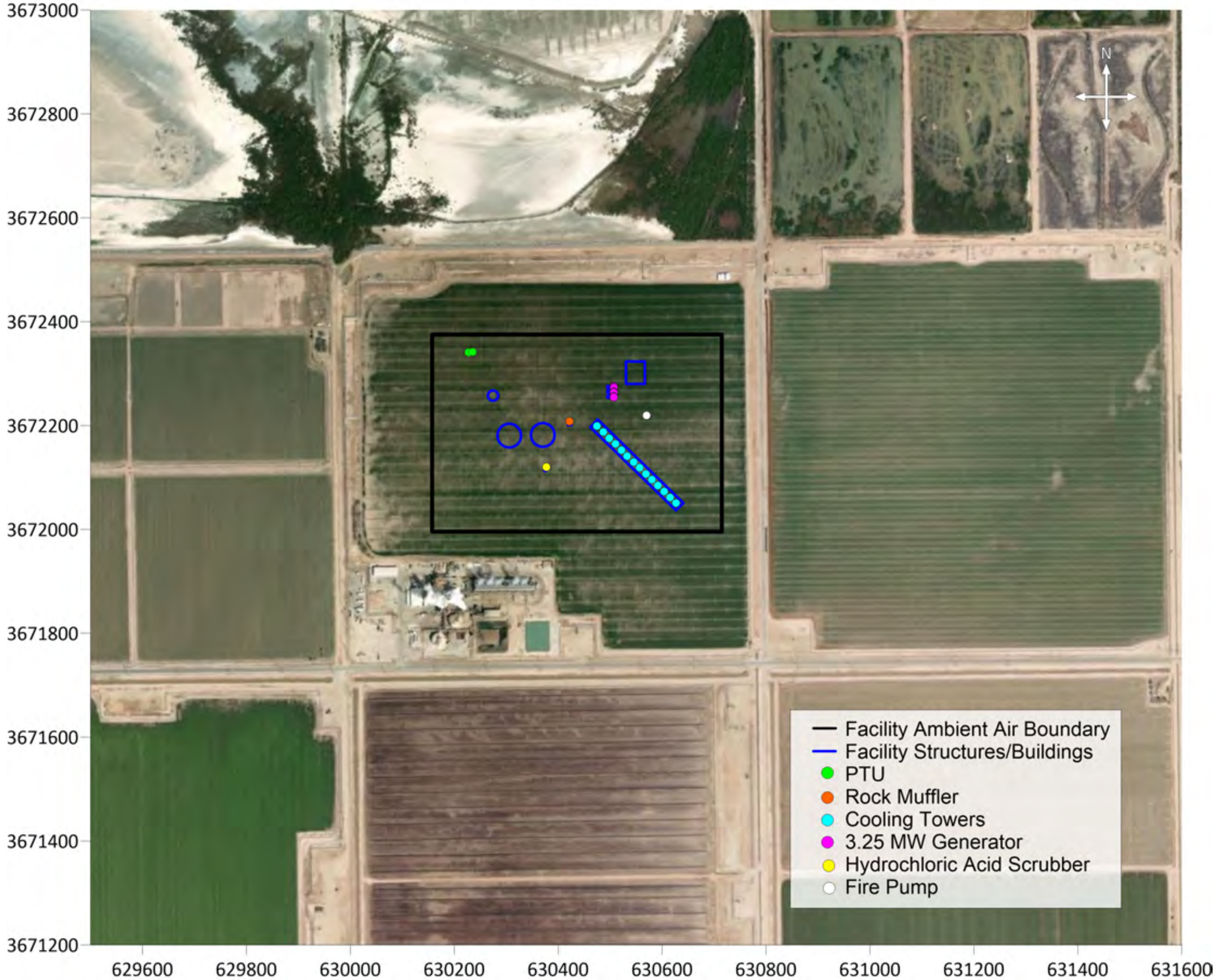


Figure 5.1-6
Facility Source Layout
Elmore North Geothermal Project
Imperial County, California

Jacobs

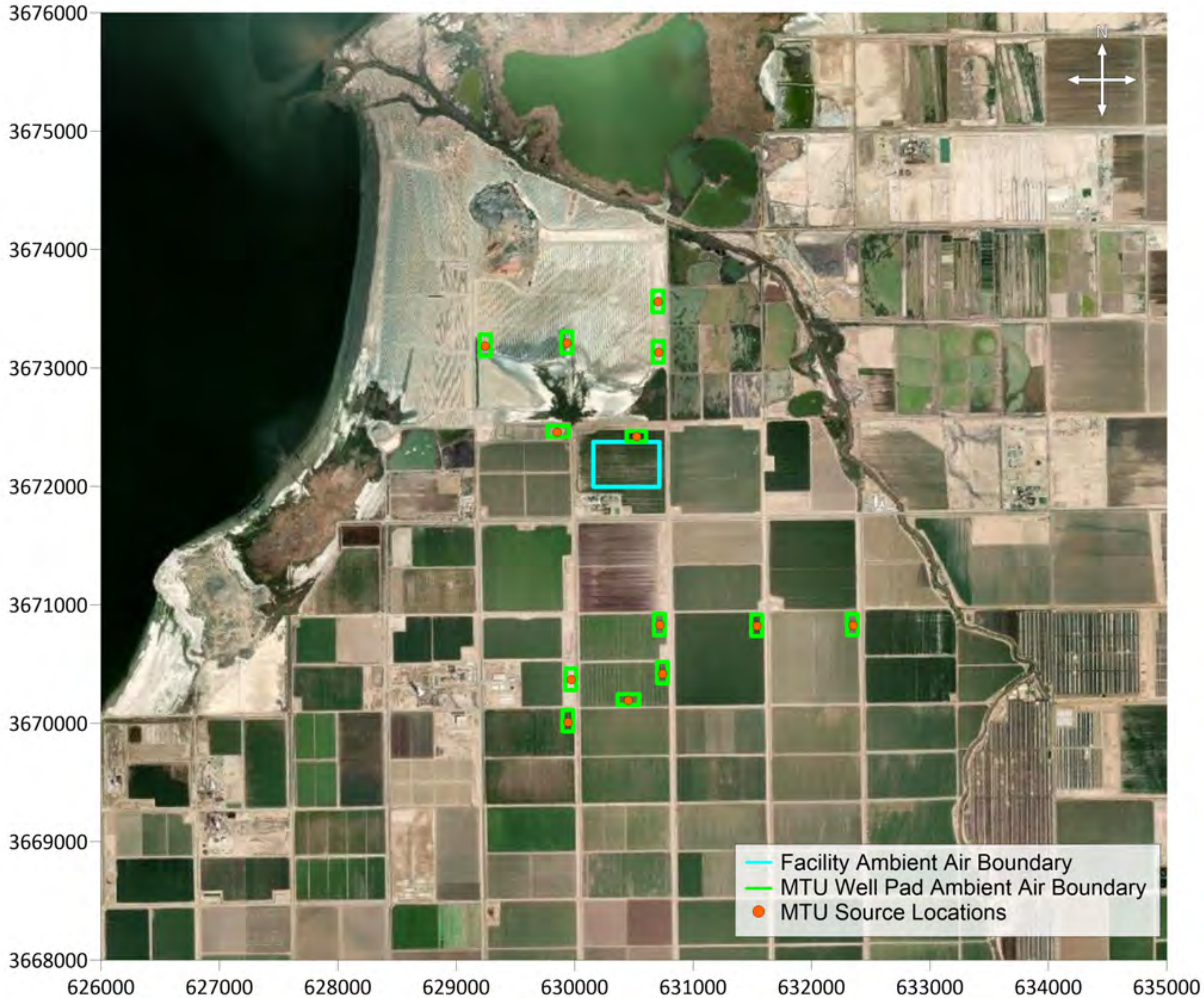


Figure 5.1-7
MTU Source Layout
Elmore North Geothermal Project
Imperial County, California

Jacobs

Cooling Towers. The cooling towers were modeled as a point source in AERMOD with the stack diameter, height, flow rate, temperature, drift eliminator efficiency and location based upon the latest design data. Each of the specific cooling tower stack parameters used in the modeling analysis is presented in Table 5.1-22. As stated in Section 5.1.7, the cooling towers represent emissions from the cooling tower process as well as the sparger. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-22. Modeling Parameters – Cooling Tower [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
CT1	-69.35	12.22	10.00	311.76	9.26
CT2	-69.35	12.22	10.00	311.76	9.26
CT3	-69.35	12.22	10.00	311.76	9.26
CT4	-69.35	12.22	10.00	311.76	9.26
CT5	-69.35	12.22	10.00	311.76	9.26
CT6	-69.35	12.22	10.00	311.76	9.26
CT7	-69.35	12.22	10.00	311.76	9.26
CT8	-69.35	12.22	10.00	311.76	9.26
CT9	-69.35	12.22	10.00	311.76	9.26
CT10	-69.35	12.22	10.00	311.76	9.26
CT11	-69.35	12.22	10.00	311.76	9.26
CT12	-69.35	12.22	10.00	311.76	9.26
CT13	-69.35	12.22	10.00	311.76	9.26
CT14	-69.35	12.22	10.00	311.76	9.26

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.
Note:
K = degrees Kelvin

Diesel-fired Emergency Generators and Diesel Fire Water Pump. The diesel-fired emergency generators and diesel fire water pump were modeled as point sources in AERMOD with the stack diameter, height, flow rate, temperature, and location based on the design data provided by the vendors. Generators 1 through 3 are equipped with Tier 4 emission controls which each vent through three stacks; therefore, each generator is represented by three stacks with emissions and flow evenly distributed between them. Each of the specific stack parameters used in the modeling analysis is presented in Table 5.1-23. For purposes of modeling, the fire pump is assumed to operate one hour per day and the generators are assumed to operate up to 2 hours per day and once per 8-hour period, all of which are conservatively assumed to potentially occur within the same day. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-23. Modeling Parameters – Emergency Diesel Engines [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
FPUMP	-69.16	3.33	0.15	789.26	36.23
G1_1	-69.36	7.17	0.32	748.15	34.97
G1_2	-69.36	7.17	0.32	748.15	34.97
G1_3	-69.36	7.17	0.32	748.15	34.97
G2_1	-69.39	7.17	0.32	748.15	34.97
G2_2	-69.39	7.17	0.32	748.15	34.97
G2_3	-69.39	7.17	0.32	748.15	34.97

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
G3_1	-69.38	7.17	0.32	748.15	34.97
G3_2	-69.38	7.17	0.32	748.15	34.97
G3_3	-69.38	7.17	0.32	748.15	34.97

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

For purposes of the 1-hour NO_2 standard, emergency engines in this analysis were classified as intermittent sources because they have less than 500 hours per year of operation according to EPA (EPA 2011). As a result, the annual average hourly emission rate for each engine was used in the 1-hour averaging period NO_2 modeling analysis, rather than the maximum hourly emission rate, consistent with EPA's *Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS Memorandum* (EPA 2011).

HCl Scrubber. The HCl scrubber operations would be associated with the bulk concentrated HCl storage tank. This source would operate during tank loading operations to control the vapor displacement during filling. These operations were conservatively assumed to occur 8,760 hours per year. This source was modeled as a point source based upon an estimated scrubber size and design data provided by the vendor. Each of the specific stack parameters used in the modeling analysis is presented in Table 5.1-24. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-24. Modeling Parameters – HCl Scrubber [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
HCLS	-69.49	2.32	0.076	0 [b]	1.66

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

[b] A release temperature of 0 K was used in AERMOD to assume all release would be at ambient temperature.**Geothermal Steam Flashing Activities.** Onsite and offsite operations may include the direct release of geothermal steam to the atmosphere through the PTU or the RM and the MTU, respectively. Each of these operations will include the release of hot steam from defined structures and areas within the Project site or within the offsite well pads, respectively. As a result of the heated nature of the steam and defined release point, each source was modeled as a point source in AERMOD. The temperature, mass flow, and stack height/diameter for each PTU, MTU, and RM were obtained from vendor provided data. Steam mass flow data was converted to volumetric flow assuming standard steam density for the temperature of the steam at each source. Because the MTU will operate at each offsite well pad location for only a limited number of hours during commissioning, the maximum hourly emissions were modeled as occurring from each MTU location (well pad) whereas the annual emissions were modeled as being evenly distributed amongst all MTU locations. Each of the specific stack parameters used in the modeling analysis is presented in Table 5.1-25. The modeled emission rates are included in Appendix 5.1B.

Table 5.1-25. Modeling Parameters – Geothermal Steam Flashing Sources [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
RMP (Rock Muffler)	-69.49	7.32	8.97	454.78	2.70
PTU1	-69.92	13.41	2.44	499.82	5.87
PTU2	-69.90	13.41	2.44	499.82	5.87
MTU1	-69.30	15.85	2.74	384.71	8.43
MTU2	-66.62	15.85	2.74	384.71	8.43
MTU3	-65.87	15.85	2.74	384.71	8.43

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
MTU4	-70.06	15.85	2.74	384.71	8.43
MTU5	-69.58	15.85	2.74	384.71	8.43
MTU6	-69.41	15.85	2.74	384.71	8.43
MTU7	-66.42	15.85	2.74	384.71	8.43
MTU8	-70.34	15.85	2.74	384.71	8.43
MTU9	-67.26	15.85	2.74	384.71	8.43
MTU10	-66.62	15.85	2.74	384.71	8.43
MTU11	-67.38	15.85	2.74	384.71	8.43
MTU12	-69.92	15.85	2.74	384.71	8.43
MTU13	-66.57	15.85	2.74	384.71	8.43

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

5.1.9.2.2 Project Construction

The Project's construction-related emissions would include combustion emissions from mobile sources, including diesel construction-type equipment and onsite vehicles, and fugitive dust emissions. The onsite equipment and vehicle exhaust emissions were evenly distributed over the construction area. These combustion-related emissions were modeled as a grid of point sources with a horizontal stack release spaced approximately 25 m apart over the entire construction area. The horizontal release type is an AERMOD option which negates mechanical plume rise. This conservative approach was used because it is unknown whether all construction equipment and vehicles will have vertically oriented exhaust stacks. The exhaust parameters for each point source were estimated based upon data for typical construction equipment.

Fugitive dust emissions from roadways, grading activities, and material loading/unloading were characterized as a single area-poly source within the property, with a 10-m buffer from the nearest property boundary and assuming a ground-level release. This approach is conservative for modeling ground-level fugitive emissions with no initial vertical dimension and assumes grading activities would not continuously occur within 10 m of the proposed facility fence line.

Each of the specific stack parameters used in the modeling analysis for combustion and fugitive dust emission sources are presented in Tables 5.1-26 and 5.1-27, respectively. The modeled emission rates are included in Appendix 5.1D. The construction source layout for the modeling is included in Figure 5.1-8.

Table 5.1-26. Modeling Parameters – Construction Combustion Sources [a]

Source ID	Elevation (m)	Release Height (m)	Stack Diameter (m)	Discharge Temperature (K)	Discharge Velocity (m/s)
Point_1 through Point_408	Varies [b]	4.60	0.13	533	18.0

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

[b] Source-specific elevations were calculated with AERMAP and are included in Appendix 5.1D.

Table 5.1-27. Modeling Parameters – Construction Fugitive Dust Sources [a]

Source ID	Elevation (m)	Release Height (m)	Initial Vertical Dimension (m)
AREA_1	-68.58	0	0

[a] Modeling parameters presented in metric units to mirror what is presented in the modeling input/output files.

5.1.9.3 Additional Model Selection

In addition to AERMOD and its pre-processor AERMAP, several other EPA and CARB models and programs were used to quantify pollutant impacts on the surrounding environment based on the emission sources operating parameters and their locations. The models used were BPIP-PRIME (Version 04274) and the AERSCREEN (Version 15181) dispersion model for fumigation impacts. These models, along with options for their use and how they are used, are discussed below.

The AERSCREEN model was used to evaluate inversion breakup fumigation impacts for all short-term averaging periods (24 hours or less). The methodology outlined in EPA-454/R-92-019 (EPA 1992a) was followed for this analysis. The fumigation concentrations were then compared to the maximum AERSCREEN concentrations under normal dispersion for all meteorological conditions. Because the Project's fumigation impacts were less than the AERSCREEN maxima, as described in Section 5.1.10.1.2, additional analyses were not required.

5.1.9.4 Oxides of Nitrogen Modeling Methodology and Chemistry

The *Guideline on Air Quality Models*, Appendix W to 40 CFR Part 51 (EPA 2017a) recommends a tiered screening approach to characterize the conversion of total NO_X from the Project to NO_2. A Tier 1 approach assumes a 100 percent conversion of total NO_X to NO_2 and is typically overly conservative. The Tier 2 approach allows for the use of the Ambient Ratio Method 2 (ARM2). The Tier 1 and Tier 2 options do not require agency approval.

For this analysis, the Tier 2 approach was selected using the ARM2 model with a default in-stack ratio of 0.5 and a default out-of-stack ratio of 0.9.

Figure 5.1-8
Construction Source Layout
Elmore North Geothermal Project
Imperial County, California

Jacobs

5.1.9.5 Cumulative Source Analysis

Per CEC requirements, a cumulative impacts analysis for the Project's typical operating mode was conducted for pollutants which exceed the Class II Significant Impact Levels (SILs), unless otherwise justified, and submitted under separate cover. Impacts from the Project were combined with other stationary emissions sources within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process (such as the NSR or CEQA permitting process).[7] The stationary emissions sources included in the cumulative impacts assessment were limited to new or modified sources (individual emission units) that would cause a net increase of 5 tpy or more per modeled criteria pollutant. Therefore, VOC sources, equipment shutdowns, permit-exempt equipment registrations, rule compliance, permit renewals, or replacement/upgrading of existing systems were not included in the cumulative impacts analysis. TAC emissions were also excluded from the cumulative impacts analysis. The facilities with cumulative sources identified for inclusion in the air quality impacts analysis are presented in Table 5.1-28.

Table 5.1-28. Cumulative Impacts Assessment – Facility List

CUP-0011	Project Name	Applicant	Area-Location	Phase	Greater than 5 TPY of $PM_{2.5}$ or NO_2 Emissions? [b]	Included in Cumulative Analysis?
13-0031	Wilkinson Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
13-0032	Lindsey Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
17-0014	Midway Solar Farm IV	8 Minute Energy	Calipatria	Pending Construction	No	No
18-0040	Ormat Wister Solar	Omi 22 LLC/Ormat	Niland	Under Construction	No	No
21-0021	Hell's Kitchen Geothermal Exploration Project	Controlled Thermal Resources	Niland	Entitlement Process [a]	N/A	No
20-0008	Energy Source Mineral ALTiS	Energy Source Minerals	Imperial County	Pending Construction	No	No
--	Black Rock Geothermal Project (BRGP)	Black Rock Geothermal, LLC	Imperial County	AFC Under Review	Yes	Yes
--	Morton Bay Geothermal Project (MBGP)	Morton Bay Geothermal, LLC	Imperial County	AFC Under Review	Yes	Yes

[a] Hell's Kitchen Geothermal Exploration Project is in the entitlement process which occurs before any air emissions-related permitting and licensing.

[b] Each facility's $PM_{2.5}$ and NO_2 PTE was considered based on the pollutants which required a cumulative impacts analysis, per the results presented in Section 5.1.10.

Notes:

AFC = Application for Certification

N/A = Not applicable

The cumulative air quality impacts analysis was performed using the same modeling methodology presented in Section 5.1.9.1 and as outlined in the *Air Dispersion Modeling Protocol for Elmore North Geothermal Plant Cumulative Impact Analysis* (TN# 252437), which was conditionally approved by the

[7] Existing sources are not included in the cumulative impacts assessment as their emissions are accounted for with the ambient air background concentrations.

CEC on October 24, 2023. H_2S was included in the cumulative source analysis, as requested as part of the CEC's conditional approval, with the same facilities identified in Table 5.1-28.. The fence lines for the cumulative sources were not included in the modeling analysis as they do not define the ambient air boundary for modeling purposes.

The maximum predicted cumulative impacts represent the impact at the receptor location identified as the maximum receptor for each pollutant required to have a cumulative impacts assessment. The maximum modeled concentrations from the analysis were added to representative background concentrations, and the results compared to the applicable CAAQS and NAAQS for each pollutant included in the cumulative impacts assessment.

5.1.9.6 H_2S Methodology

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.

The Project's non-routine operations, including commissioning, startup, shutdown, and downtime of emission controls, would occur infrequently throughout the year and were not included in the H_2S modeled scenarios. As such, the operations-related H_2S results presented below reflect emissions associated with only routine power generation operations, which are anticipated to occur no less than 80 percent of the year. The non-routine operational conditions would occur for unknown durations randomly during the year and are difficult to predict with any reasonable certainty given their impacts have a strong dependence on meteorological conditions. At similar geothermal power plants operated by the Applicant, these non-routine operations occur for less than 50 percent of the time used to estimate emissions for this Project (in other words, this analysis is conservative with regards to the frequency and duration of non-routine operations). The potential for these infrequent events to occur during meteorological conditions hindering dispersion is expected to be minimal.

At the request of the CEC, emissions from the MTU were analyzed for 1-hour H_2S impacts and separately reported from the 1-hour H_2S impacts associated with the routine operations described above. Although the MTU would operate approximately six times as much as the PTU during the first year of operations, it would only operate during the once-in-a-lifetime commissioning activities occurring in the first year of operations and not in subsequent years. Therefore, results associated with this analysis would be temporary, limited to commissioning of the Project during the first year after construction, and not representative of routine, recurring operational conditions.

5.1.9.7 Model Outputs

Maximum short-term and annual impacts were used for determining compliance with all CAAQS, since these standards are never to be exceeded. The same maximum impacts were also conservatively used for assessing compliance with the following NAAQS: 1-hour and 8-hour CO (high, second-highs allowed); 1-hour SO_2 (5-year average of the 99^{th} annual percentiles of the 1-hour daily maximum allowed); 3-hour and 24-hour SO_2 (high, second-highs allowed); and 24-hour PM_{10} (sixth high over 5-years allowed). These same maximum impacts were also conservatively used for comparison to the NAAQS SILs. For 1-hour NO_2, the 5-year average of the annual 1-hour maxima and 98^{th} annual percentiles of the 1-hour daily maximum were used for assessing compliance with the SIL and NAAQS, respectively. For 24-hour $PM_{2.5}$, the 5-year average of the annual 24-hour maxima and 98^{th} annual percentiles were used for assessing compliance with the SIL and NAAQS, respectively. Finally, for annual $PM_{2.5}$, the 5-year average of the annual impacts was used for assessing compliance with both the SIL and NAAQS.

5.1.10 Environmental Analysis – Air Quality Impact Analysis Results

The following sections present the results of the air quality impact analyses for determining the changes to ambient air quality concentrations in the Project region as a result of Project construction and operation. Cumulative multi-source modeling assessments, which are used to analyze impacts from the Project plus nearby new or modified sources, were performed per the methodology described in Section 5.1.9.5 and submitted under separate cover.

5.1.10.1 Project Operation

5.1.10.1.1 Ambient Air Quality Standards

Based on the Section 5.1.9.7 delineation of modeled results to applicable standards, modeled operational impacts were compared with the SILs, NAAQS, and CAAQS. To determine the magnitude and location of the maximum impacts for each pollutant and averaging period, the AERMOD model was used with all 5 years of meteorological data. All maximum facility impacts occurred well inside the fine gridded receptors with 25-m spacing. Therefore, additional 25-m refined receptor grids were not required.

The secondary formation of $PM_{2.5}$ and ozone from their precursors was also accounted in the Project's operational impacts based upon EPA Maximum Emission Rates of Precursors (MERPS) View Qlik[8] and EPA Methodology. Specifically, secondary impacts were calculated and added to the respective modeled results. The calculated secondary impact results are presented in Table 5.1-29.

Table 5.1-29. Operation Air Quality Impact Results – Secondary Emissions from Precursors

Pollutant	Precursor	Modeled Precursor Emission Rate (tpy)	Modeled Secondary Impact Concentration (µg/m³) [a]	Project Emissions (tpy)	Project Secondary Impact Concentration (µg/m³)
24-Hour $PM_{2.5}$	NO_x	500	0.025	1.92	<0.01
	SO_2	500	0.077	0.01	<0.01
Annual $PM_{2.5}$	NO_x	500	0.001	1.92	<0.01
	SO_2	500	0.002	0.01	<0.01
8-Hour Ozone	NO_x	500	0.84	1.92	<0.01
	VOC	500	0.06	2.26	<0.01

[a] The modeled secondary impacts were obtained from the Los Angeles County hypothetical source with a 10-m stack height.

The Project will not result in any direct emissions of ozone and, as seen in Table 5.1-29, the secondary impacts of ozone from its Project-emitted precursors of NO_x and VOC are less than 0.01 microgram per cubic meter (µg/m³). This secondary ozone impact is well below the SIL of 1 part per billion (ppb) and the Project would not cause or contribute to a violation of the NAAQS. As a result, no further analysis of ozone is presented.

As can be seen in Table 5.1-30, facility impacts are less than the EPA's SILs for all pollutants and averaging periods except $PM_{2.5}$ and PM_{10}. For pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis may be required. 24-hour PM_{10} and 24-hour and annual $PM_{2.5}$ predicted concentrations exceed their respective SIL and may, therefore, require a cumulative modeling analysis unless otherwise stated below. Imperial County and CEC will receive the cumulative analysis under separate cover.

[8] Available online at https://www.epa.gov/scram/merps-view-qlik.

Table 5.1-30. Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maxima (NAAQS)	1.37	7.55	No
	Annual maximum	0.06	1.00	No
Ozone	8-hour maximum	0.01	1.96	No
CO	1-hour maximum	1,421	2,000	No
	8-hour maximum	114	500	No
SO_2	1-hour maximum	<0.01	7.86	No
	3-hour maximum	<0.01	25.0	No
	24-hour maximum	<0.01	5.00	No
	Annual maximum	<0.01	1.00	No
PM_{10}	24-hour maximum	7.11	5.00	Yes
	Annual maximum	0.64	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	3.08	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.36	0.20	Yes

Note:

-- = Not applicable and/or no standard

The Project's maximum modeled concentrations are conservatively compared to the CAAQS and NAAQS, regardless of the SIL results, in Table 5.1-31. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS except for the PM_{10} CAAQS. The modeled exceedances of the PM_{10} CAAQS are due to high background concentrations, which already exceed the CAAQS (the area is already designated as a nonattainment area for the PM_{10} CAAQS, as is most of the State). 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. Thus, the Project would have a less-than-significant impact for PM_{10},.

Table 5.1-31. Operation Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Conc. (µg/m³)	Background Conc. (µg/m³)	Total Conc. (µg/m³)	CAAQS (µg/m³)	NAAQS (µg/m³)	Exceeds Standard?
NO_2	1-hour maximum (CAAQS)	142	105	247	339	--	No
	5-year average of 1-hour yearly 98th percentiles (NAAQS)	1.23	65.2	66.4	--	188	No
	Annual maximum	0.06	17.4	17.5	57	100	No
H_2S	1-hour maximum (CAAQS)	36.7	--	36.7	42	--	No
CO	1-hour maximum (CAAQS and NAAQS)	1,421	5,266	6,687	23,000	40,000	No
	8-hour maximum (CAAQS and NAAQS)	114	3,549	3,663	10,000	10,000	No
SO_2	1-hour maximum (CAAQS and NAAQS)	<0.01	22.5	22.5	655	196	No
	3-hour maximum (NAAQS)	<0.01	22.5	22.5	--	1,300 a	No
	24-hour maximum (CAAQS and NAAQS)	<0.01	7.10	7.10	105	365	No
	Annual maximum (NAAQS)	<0.01	1.10	1.10	--	80	No
PM_{10}	24-hour maximum (CAAQS) [b]	7.11	241.3	248	50	--	Yes
	24-hour average high-sixth-high (NAAQS)	4.34	142	146	--	150	No
	Annual maximum (CAAQS) [b]	0.64	39.8	40.4	20	--	Yes
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentiles (NAAQS)	1.96	21.0	23.0	--	35	No
	Annual maximum (CAAQS)	0.38	9.40	9.78	12	--	No
	5-year average of annual concentrations (NAAQS)	0.36	8.67	9.03	--	12.0	No

[a] Secondary standard.

[b] The PM_{10} CAAQS are not applicable as the area is designated as nonattainment.

Note:

-- = Not applicable and/or no standard

Table 5.1-32 presents the impacts associated with the MTU operations during the commissioning year. These operations are assumed to not occur concurrently with any onsite operations associated with the PTU, RM, and cooling towers, as the MTU is presumed to operate prior to the other emissions sources coming online. Furthermore, these operations would be temporary and spatially varying as a single MTU is expected to be moved from well pad to well pad during commissioning. As stated previously, emissions from the MTU would also only occur during the once-in-a-lifetime commissioning in the first year of operations. Subsequent years of routine operation would not include any MTU operations.

The impacts presented below indicate the 1-hour H_2S standard may be exceeded by MTU operations. Although the impacts exceed the standard, they likely represent a situation with low-likelihood of occurring given the probability of the MTU's limited operations occurring during worst-case meteorological conditions.

Table 5.1-32. MTU Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Conc. (µg/m³)	Background Conc. (µg/m³)	Total Conc. (µg/m³)	CAAQS (µg/m³)	NAAQS (µg/m³)	Exceeds Standard?
H_2S	1-hour maximum (CAAQS)	155	--	155	42	--	Yes

Note:

-- = Not applicable and/or no standard

5.1.10.1.2 Fumigation Analysis

Fumigation analyses with the EPA Model AERSCREEN (Version 21112) were conducted for inversion breakup conditions based on EPA guidance given in EPA-454/R-92-019 (EPA 1992b). Shoreline fumigation impacts were additionally assessed as the nearest distance to the shoreline of any large bodies of water is within 3 kilometers with the Salton Sea located less than 1,000 m to the west and northwest of the Project. Since AERSCREEN is a single point source model, only one representative cooling tower stack was modeled as it represents the Project's only source with a stack height greater than 10 m that emits criteria pollutants. Other AERSCREEN inputs included the cooling tower building data, cooling tower stack parameters, the minimum and maximum observed temperature values used by the ICAPCD for generating the Imperial County Airport meteorological data (27°F and 122°F [-3°C and 50°C], respectively), default seasonal and land cover data for cultivated land and average moisture, a minimum fence line distance of 50 m, rural dispersion conditions, no flagpole receptors, a minimum wind speed of 2.5 m/s with a 10-m anemometer height, and flat terrain. Impacts were initially evaluated for unitized emission rates (1.0 gram per second).

The results of the fumigation analysis in AERSCREEN indicated no meteorological hours fit the fumigation criteria; therefore, no fumigation calculations were possible. This is the result of the fact that no hours meeting the stability and wind speed criteria were present, causing AERCREEN to issue a notice that no hours meet the criteria. Based upon these facts, no fumigation impacts are expected to occur from the Project.

5.1.10.1.3 Nitrogen and Particulate Deposition Impacts

The Project may result in emissions of nitrogenous compounds such as NO_X and NH_3. Nitrogen oxide gases (NO and NO_2) convert to nitrate particulates in a form that is suitable for uptake by most plants and could promote plant growth and primary productivity. Coastal salt marshes are a common natural habitat in the vicinity of the Project where nitrogen deposition may occur. The critical load for atmospheric nitrogen deposition into coastal wetlands is difficult to establish because wetlands subject to tidal exchange have open nutrient cycles. In addition, nitrogen loading in wetlands is often affected by sources other than atmospheric deposition (Morris 1991). Various studies that have examined nitrogen loading in intertidal salt marsh wetlands have found critical loads to range from between 63 and 400 kilograms per hectare per year (kg $ha^{-1}yr^{-1}$) (Caffrey et al. 2007; Wigand et al. 2003). The wetlands near the Project are not expected to be sensitive to atmospheric nitrogen deposition as the impacts would likely be minimal compared to agricultural runoff nitrogen loading.

Regardless, a deposition analysis was performed using AERMOD with the options and inputs as described in Section 5.1.9.1. In addition, the following data were used/assumed for this analysis:

- AERMOD wet and dry deposition options. Depositional rates and parameters were based upon nitric acid (HNO_3) which, of all the depositing species, has the highest affinity for impacts to soils and vegetation and tendency to stick to what it is deposited on.
- Dry deposition land use characteristics were developed using satellite aerial imagery for each 10-degree increment within a 3-kilometer radius surrounding the Project.
- Dry deposition seasonal categories were assigned based upon historical meteorological trends for the region.
- NO_X and NH_3 were assumed to be 100 percent converted into atmospherically-derived nitrogen at the release point, where applicable, rather than allowing for the conversion of NO_X and NH_3 to occur over distance and time within the atmosphere, which is more realistic.
- Maximum settling velocities were selected to produce conservative deposition rates.

Emissions of depositional nitrogen were conservatively calculated as a complete conversion of in-stack NO_X and NH_3 from each of the combustion sources. This was done by multiplying the nitrogen mass fraction of each of the pollutants by the respective average annual emissions. Accordingly, modeled impacts will overstate potential effects. The modeled emission rates per source are presented in Appendix 5.1A.

The dry deposition algorithms in AERMOD include land use characteristics and some dry gas deposition resistance terms based on five seasonal categories and nine land use categories. The seasonal categories for each month of modeling are as follows:

- Midsummer: April, May, June, and July
- Autumn: August, September, and October
- Late Autumn/Winter without snow: November, December, and January
- Transitional Spring: February and March

Land use categories are used within AERMOD to calculate dry deposition of the emitted nitrogen compounds. For example, in areas of lush vegetation, the gaseous nitrogen compounds would have a higher uptake and, therefore, dry deposition would be higher at these areas than in bodies of water or urban areas with fewer trees. A determination for land use categories used in the analysis was conducted using satellite aerial imagery for which each 10-degree increment within a 3-kilometer radius surrounding the Project was defined as either grassy suburban area or unforested wetland.

AERMOD also requires the input of wet and dry depositional parameters based on the nitrogen-containing species being emitted. For this analysis, it was conservatively assumed that all nitrogen emitted was in the form of HNO_3, as HNO_3 is the most aggressive species with regards to deposition. Based on the above, over-predictive modeling approach, the maximum modeled annual deposition averaged over the wetland areas was 36 kg $ha^{-1}yr^{-1}$, with an absolute maximum of 208 kg $ha^{-1}yr^{-1}$. The Project's nitrogen deposition impacts are not expected to significantly contribute to nitrogen loading on coastal marshes because of several factors, including the fact that the area surrounding the Project is not a densely vegetated coastal marsh land and that depositional nitrogen formation requires time for the chemical reaction to occur. Because the predominate wind patterns (west to east) in the Project vicinity, among other factors, will result in a majority of the potential air quality impacts occurring away from the Project site and nearby wetlands, time and distance will reduce ground-level concentrations contributing to nitrogen deposition.

Particulate emissions will be controlled by diesel exhaust particulate filtration and the exclusive use of ultra-low sulfur diesel fuel for stationary combustion sources and high-efficiency drift eliminators for the cooling towers. The deposition of PM_{10} can affect vegetation through either physical or chemical mechanisms. Physical mechanisms include the blocking of stomata so that normal gas exchange is impaired, as well as potential effects on leaf adsorption and reflectance of solar radiation. Information on physical effects is limited, presumably in part because such effects are slight or not obvious except under extreme situations (Lodge et al. 1981). Given the emission controls incorporated into the Project design and modeled particulate impacts, no additional mitigation measures are required.

5.1.10.2 Project Construction

Based on the Section 5.1.9.7 delineation of modeled results to applicable standards, modeled construction impacts were compared with the SILs, NAAQS, and CAAQS. To determine the magnitude and location of the maximum potential impacts for each pollutant and averaging period, the AERMOD model was used with all 5 years of meteorological data. All modeled maximum facility impacts occurred well inside the fine gridded receptors with 25-m spacing. Therefore, additional 25-m refined receptor grids were not necessary.

The secondary formation of $PM_{2.5}$ and ozone from their precursors were also accounted in the Project's construction impacts based upon EPA MERPS View Qlik and EPA Methodology (EPA 2019). Specifically, secondary impacts were calculated and added to the respective modeled results. The calculated secondary impact results are presented in Table 5.1-33.

Table 5.1-33. Construction Air Quality Impact Results – Secondary Emissions from Precursors

Pollutant	Precursor	Modeled Precursor Emission Rate (tpy)	Modeled Secondary Impact Concentration ($\mu g/m^3$) [a]	Project Emissions (tpy)	Project Secondary Impact Concentration ($\mu g/m^3$)
24-Hour $PM_{2.5}$	NO_x	500	0.025	25.2	<0.01
	SO_2	500	0.077	0.23	<0.01
Annual $PM_{2.5}$	NO_x	500	0.001	25.2	<0.01
	SO_2	500	0.002	0.23	<0.01
8-Hour Ozone	NO_x	500	0.84	25.2	0.04
	VOC	500	0.06	9.64	<0.01

[a] The modeled secondary impacts were obtained from the Los Angeles County hypothetical source with a 10-m stack height.

The Project construction will not result in any direct emissions of ozone and, as seen in Table 5.1-33, the secondary impacts of ozone from its Project-emitted precursors of NO_x and VOC are 0.04 $\mu g/m^3$. This secondary ozone impact is well below the SIL of 1 ppb such that the Project would not cause or contribute to a violation of the NAAQS. As a result, no further analysis of ozone is necessary.

As can be seen in Table 5.1-34, potential impacts are less than the EPA's SILs for all pollutants and averaging periods except 1-hour and annual NO_2, 24-hour and annual PM_{10}, and annual $PM_{2.5}$. For pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis may be required. 1-hour and annual NO_2, 24-hour and annual PM_{10}, and annual $PM_{2.5}$ predicted concentrations exceed their respective SIL and may, therefore, require a cumulative modeling analysis unless otherwise stated below. Imperial County and CEC will receive the cumulative analysis under separate cover.

Table 5.1-34. Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maxima (NAAQS)	55.0	7.55	Yes
	Annual maximum	10.1	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	134	2,000	No
	8-hour maximum	107	500	No
SO_2	1-hour maximum	0.31	7.86	No
	3-hour maximum	0.28	25.0	No
	24-hour maximum	0.17	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	7.23	5.00	Yes
	Annual maximum	1.27	1.00	Yes
$PM_{2.5}$	5-year average of 24-hour yearly maxima (NAAQS)	1.13	1.20	No
	5-year average of annual concentrations (NAAQS)	0.23	0.20	Yes

Note:

-- = Not applicable and/or no standard

The Project's maximum modeled concentrations are compared to the CAAQS and NAAQS in Table 5.1-35. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS except for the PM_{10} CAAQS. The modeled exceedances of the PM_{10} CAAQS are due to high background concentrations, which already exceed the CAAQS (like the majority of the State, the area is designated as a nonattainment area for the PM_{10} CAAQS). The Project is not below the SIL for the 24-hour and annual PM_{10} standards though the Project owner will implement construction control measures as described in Section 5.1.7.2.2. These control measures would reduce particulate emissions to the extent required by ICAPCD, thus making the Project consistent with attainment plans for the PM_{10} standards. Additionally, the PM_{10} emissions associated with construction of the Project, as presented in Table 5.1-20, are below the ICAPCD significance threshold of 150 lbs/day. Therefore, the Project construction would likely result in less-than-significant impacts with respect to particulate emissions.

Table 5.1-35. Construction Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Conc. (µg/m^3)	Background Conc. (µg/m^3)	Total Conc. (µg/m^3)	CAAQS (µg/m^3)	NAAQS (µg/m^3)	Exceeds Standard?
NO_2	1-hour maximum (CAAQS)	55.9	105	161	339	--	No
	5-year average of 1-hour yearly 98th percentiles (NAAQS)	53.3	65.2	119	--	188	No
	Annual maximum	10.1	17.4	27.5	57	100	No
CO	1-hour maximum (CAAQS and NAAQS)	134	5,266	5,400	23,000	40,000	No
	8-hour maximum (CAAQS and NAAQS)	134	3,549	3,683	10,000	10,000	No

Pollutant	Averaging Period	Maximum Conc. (μg/m³)	Background Conc. (μg/m³)	Total Conc. (μg/m³)	CAAQS (μg/m³)	NAAQS (μg/m³)	Exceeds Standard?
SO_2	1-hour maximum (CAAQS and NAAQS)	0.31	22.5	22.8	655	196	No
	3-hour maximum (NAAQS)	0.28	22.5	22.8	--	1,300 [a]	No
	24-hour maximum (CAAQS and NAAQS)	0.17	7.10	7.27	105	365	No
	Annual maximum (NAAQS)	0.11	1.10	1.21	--	80.0	No
PM_{10}	24-hour maximum (CAAQS)[b]	7.23	241.3	249	50.0	--	Yes
	24-hour average high-sixth-high (NAAQS)	6.15	142	148	--	150	No
	Annual maximum (CAAQS) [b]	1.27	39.8	41.1	20.0	--	Yes
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentiles (NAAQS)	0.97	21.0	22.0	--	35.0	No
	Annual maximum (CAAQS)	0.24	9.40	9.64	12.0	--	No
	5-year average of annual concentrations (NAAQS)	0.23	8.67	8.91	--	12.0	No

[a] Secondary standard.

[b] The PM_{10} CAAQS are not applicable as the area is designated as nonattainment.

Note:

-- = Not applicable and/or no standard

5.1.11 Laws, Ordinances, Regulations, and Statutes

Table 5.1-36 presents a summary of federal, state, and local air quality LORS deemed applicable to the Project. Specific LORS related to air quality and climate change are discussed in greater detail in Sections 5.1.11.1 and 5.1.11.2, respectively.

Table 5.1-36. Summary of LORS – Air Quality

LORS	Purpose	Regulating Agency	Project Conformance
Federal Regulations (EPA)			
CAA Amendments of 1990, 40 CFR Part 50	Establishes ambient air quality standards for criteria air pollutants.	EPA Region IX	The modeling analysis for the Project presented in Section 5.1.10 demonstrates the Project will not cause or contribute to a violation of the state or federal ambient air quality standards during even the worst-case operating profile, except for 24-hour and annual $PM_{2.5}$. Although the Project meets the NAAQS for 24-hour and annual $PM_{2.5}$, a cumulative impacts analysis was performed and submitted under separate cover to demonstrate compliance when considering the cumulative impact of nearby sources.
40 CFR Part 51 (NSR) (ICAPCD Rule 207)	Requires preconstruction review and permitting of new or modified stationary sources of air pollution to allow industrial growth without interfering with the attainment and maintenance of ambient air quality standards.	ICAPCD with EPA Region IX oversight	Requires NSR permitting for construction of specified stationary sources. NSR applies to pollutants for which ambient concentration levels are higher than the NAAQS. The NSR requirements are implemented at the local level with EPA oversight (ICAPCD Rule 207). An ATC and permit to operate (PTO) will be obtained from ICAPCD prior to construction of the Project. As a result, the compliance requirements of 40 CFR 51 will be met.
40 CFR Part 52 (PSD)	Allows new sources of air pollution to be constructed, or existing sources to be modified in areas classified as attainment, while preserving the existing ambient air quality levels, protecting public health and welfare, and protecting Class I Areas (e.g., national parks and wilderness areas).	ICAPCD with EPA Region IX oversight	The PSD requirements apply on a pollutant-specific basis to any project that is a new major stationary source or a major modification to an existing major stationary source. ICAPCD classifies an unlisted source (which is not in the specified 28 source categories) that emits or has the PTE 250 tpy of any pollutant regulated by the CAA as a major stationary source. For listed sources, the threshold is 100 tpy. NO_x, VOC, or SO_2 emissions from a modified major source are subject to PSD if the cumulative emission increases for either pollutant exceeds 40 tpy. ICAPCD Rule 207 additionally outlines a significant increase as 15 tpy of PM_{10}. In addition, a modification at a nonmajor source is subject to PSD if the modification itself would be considered a major source. In May 2010, EPA issued the GHG permitting rule officially known as the "Prevention of Significant Deterioration and Title V Greenhouse Gas Tailoring Rule" (GHG Tailoring Rule), in which EPA defined six GHG pollutants (collectively combined and measured as CO_2e) as NSR-regulated pollutants. Under the GHG Tailoring Rule, new projects that emit GHG pollutants above certain threshold levels would be subject to PSD permitting beginning in July 2011. However, in July 2014, the U.S. Supreme Court ruled that EPA could not regulate GHG emissions alone. As a result, new sources with a GHG PTE equal to or greater than 75,000 tpy of CO_2e are no longer required to obtain a PSD permit specifically for GHG emissions. If the new source would require a PSD permit as a result of criteria pollutant PTE, a BACT analysis to evaluate GHG emissions control would still be required. The Project is a geothermal-powered PGF and would not be considered one of the 28 listed source categories. Therefore, the emission rates were compared to the 250-tpy threshold. As shown in Section 5.1.7, the emission increases from the Project would not exceed the 250-tpy threshold. Therefore, the Project would not be subject to PSD.

LORS	Purpose	Regulating Agency	Project Conformance
40 CFR Part 60 Subpart IIII (NSPS) (ICAPCD Regulation XI)	Establishes national standards of performance for new or modified stationary compression ignition internal combustion engines.	ICAPCD with EPA Region IX Oversight	The Project will include three diesel-fired emergency generators and one diesel fire pump which are subject to operations, maintenance, and emissions requirements of this subpart. The Project's diesel engines will be operated and maintained as per the manufacturer specifications. The emergency generators will be Tier 4 compliant, meaning their emissions will not exceed any of the emission limitations of this subpart. The fire pump will be Tier 3 compliant and will be certified to emission rates that meet the requirements of this subpart.
40 CFR Part 70 (Title V) (ICAPCD Regulation IX)	CAA Title V Operating Permits Program.	ICAPCD with EPA Region IX Oversight	The Title V Operating Permits Program requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. The requirements of 40 CFR Part 70 apply to facilities that are subject to NSPS requirements and are implemented at the local level through ICAPCD Regulation IX. According to Regulation IX, Rule 903, a facility would be required to submit a Title V application if the facility has a PTE greater than 100 tpy of any regulated air pollutant except GHGs or if the HAP PTE is greater or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. A Title V application is only required for GHGs if the facility has a PTE greater than 100,000 tpy CO_2e. The Project will not exceed any Title V thresholds itself, excluding commissioning years. However, if the Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed. All permitting will be conducted through ICAPCD and compliant with their rules and regulations.
40 CFR Part 64 (Compliance Assurance Monitoring [CAM] Rule)	Establishes onsite monitoring requirements for emission control systems.	ICAPCD with EPA Region IX Oversight	Requires facilities to monitor the operation and maintenance of emissions control systems and report any control system malfunctions to the appropriate regulatory agency. If an emission control system is not working properly, the CAM Rule also requires a facility to take action to correct the control system malfunction. The CAM Rule applies to emissions units with uncontrolled PTE levels greater than applicable major source thresholds. Emission control systems governed by Title V operating permits requiring continuous compliance determination methods are generally compliant with the CAM Rule. The only emission controls for the Project include H_2S, which is not a pollutant applicable to major source thresholds. Therefore, the unabated Project emissions presented in Section 5.1.7 would not exceed the major source thresholds and the CAM rule would not be applicable.
40 CFR Part 63 (HAPs, Maximum Available Control Technology [MACT])	Establishes national emission standards to limit emissions of HAPs or air pollutants identified by EPA as causing or contributing to the adverse health effects of air pollution but for which NAAQS have not been established from facilities in specific categories.	ICAPCD with EPA Region IX Oversight	Establishes emission standards to limit emissions of HAPs from specific source categories for major HAP sources. Sources subject to 40 CFR Part 63 requirements must either use the MACT, be exempted under 40 CFR Part 63, or comply with published emission limitations. Projects would be subject to the 40 CFR Part 63 requirements if the HAP PTE is greater or equal to 25 tpy for combined HAPs and 10 tpy for individual HAPs. As shown in Section 5.1.7, the Project would not exceed the major source thresholds for HAPs (10 tpy for any one pollutant or 25 tpy for all HAPs combined). Therefore, the Project would be less than the 40 CFR Part 63 applicability threshold.

LORS	Purpose	Regulating Agency	Project Conformance
State Regulations (CARB)			
California Health & Safety Code (CHSC), Section 41700	Prohibits emissions in quantities that adversely affect public health, safety, businesses, or property.	ICAPCD with CARB Oversight	The CEC Conditions of Certification and the ICAPCD ATC processes are developed to ensure that no adverse public health effects or public nuisances result from operation of the Project.
Senate Bill 32 – California Global Warming Solutions Act of 2016 (SB 32)	Aims to reduce carbon emissions within the state by approximately 40 percent from 1990 levels by the year 2030.	ICAPCD with CARB Oversight	Requires CARB to develop regulations to limit and reduce GHG emissions. As a geothermal-powered PGF, this Project will support the emission reduction goals of SB 32.
17 CCR, Article 5	Establishes GHG limitations, reporting requirements, and a Cap and Trade offsetting program.	CARB	CARB has promulgated a Cap and Trade regulation that limits or caps GHG emissions and requires subject facilities to acquire GHG allowances. The Project GHG emissions have been estimated, and the Project owner will report emissions and acquire allowances and offsets consistent with these regulations if required.
California Senate Bill 1368 – Emissions Performance Standards (SB 1368)	Limits long-term investments in baseload generation by the state's utilities to power plants that meet an emissions performance standard jointly established by the CEC and the California Public Utilities Commission (CPUC).	CEC with CARB Oversight	The Project is considered a baseload facility subject to this regulation with GHG emissions that satisfy this requirement, emitting 110 pounds CO_2 per megawatt-hour[9] compared to the threshold of 1,100 pounds CO_2 per megawatt-hour.
California Assembly Bill 617– Community Air Protection Plan (AB 617)	Establishes community air monitoring and emission reduction plans to reduce exposure in communities most impacted by air pollution.	ICAPCD with CARB Oversight	The Project is not located in a community identified in AB 617 though it is near Niland and Calipatria, California, which have been nominated multiple times for identification as an AB 617 affected community. The Project will comply with all applicable ICAPCD emissions reporting requirements and rules and regulations, including any future requirements associated with AB 617 should Niland or Calipatria be confirmed as an AB 617 community.

[9] Calculated as 67,704 tpy CO_2 x 2,000 pounds per ton / 140 MW-net / 8,760 hours per year.

LORS	Purpose	Regulating Agency	Project Conformance
Local Regulations (ICAPCD)			
Rule 201	Defines the types and permits required.	ICAPCD	An ATC and PTO will be obtained from ICAPCD prior to construction of the Project.
Rule 204	Outlines the information required for inclusion in a permit application.	ICAPCD	Requires permit applications to include sufficient information to allow ICAPCD's determination of compliance with applicable rules. The Project will include all required information from this AFC in the ICAPCD ATC/PTO application.
Rule 207	Establishes pre-construction review requirements for new or modified stationary sources.	ICAPCD	An ATC and PTO will be obtained from ICAPCD prior to construction of the Project.
Rule 208	Permits inspection of permitted sources by ICAPCD.	ICAPCD	The Project will be available for ICAPCD inspection upon notification.
Rule 400	Limits NO_X emissions from fuel burning equipment.	ICAPCD	The Project's emergency generators and fire pump emissions do not exceed the ICAPCD Rule 400 limit of 140 lbs/hr, as shown in Section 5.1.7.
Rule 400.3	Limits NO_X and CO emissions from fuel burning equipment.	ICAPCD	The Project's emergency generators will be Tier 4 compliant equipment with NO_X emission rates well below the ICAPCD Rule 400.3 limit of 90 ppm. The fire pump is not subject to this Rule as it will operate 50 hours per year or less for maintenance and testing or in an emergency situation to protect human life and public health.
Rule 401	Limits visible emissions.	ICAPCD	Rule 401 prohibits visible emissions other than water vapor as dark as or darker than Ringlemann No. 1 for periods greater than 3 minutes in any hour. Visible emissions from the Project would result from particulate emissions from the cooling tower and stationary internal combustion engines. All sources will be operated according to manufacturer specifications to minimize visibility impacts due to inadequate combustion and excess particulate emissions.
Rule 403	Establishes air contaminant maximum emission rates for particulate matter.	ICAPCD	The Project is exempt from this rule as it operates only emergency diesel generators and a fire pump as combustion sources. The power generation activities are steam-powered and are, therefore, not applicable combustion sources.
Rule 405	Limits sulfur compound emissions.	ICAPCD	Rule 405 limits sulfur compound emissions to no more than 0.2 percent by volume from any source and combusted diesel fuels must be less than 0.5 percent by weight. The primary Project sulfur compound emissions will be H_2S, which will be monitored through analytical testing of the NCG and cooling towers to confirm Rule 405 standards are not exceeded. All diesel fuel combusted at the Project will be ultra-low sulfur diesel with a sulfur content not to exceed 15 ppm by weight.
Rule 407	Prohibits public nuisances.	ICAPCD	The Project will obtain an ATC and PTO from ICAPCD which will confirm Project operations do not cause public nuisance.

LORS	Purpose	Regulating Agency	Project Conformance
Rule 800	Establishes fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will minimize fugitive dust emissions to the extent feasible. In addition, a SWPPP will be developed to further minimize fugitive dust emissions during construction and operation.
Rule 801	Establishes construction and earthmoving fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible. The Project will also prepare and file a Dust Control Plan with ICAPCD, as required.
Rule 803	Establishes carry-out and track-out fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Rule 804	Establishes open area fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Rule 805	Establishes paved and unpaved roads fugitive dust limits and mitigation measures.	ICAPCD	The Project will implement best available control measures during construction activities, as listed in Section 5.1.7.2.2. These measures will comply with the requirements of this rule and minimize fugitive dust emissions to the extent feasible.
Regulation IX (Title V)	Implements the operating permit requirements of Title V of the CAA as amended in 1990.	ICAPCD	The Project will consult with ICAPCD regarding permit applicability and apply for a Title V air permit if required.
Rule 1001	Implements federal NESHAP provisions of 40 CFR Part 61.	ICAPCD	The Project is not subject to Rule 1001 as there are no applicable 40 CFR Part 61 subparts listed in Rule 1001, Section D.
Rule 1002	Implements CARB's Airborne Toxic Control Measures (ATCM) provisions.	ICAPCD and CARB	The Project will implement best management practices during construction, consistent with Section 5.1.7.2.2, which will comply with all applicable construction-related ATCM provisions. The Project operations will include stationary internal combustion engines which will be fired using ultra-low sulfur diesel with a sulfur content not to exceed 15 ppm by weight.
Rule 1003	Establishes cooling tower emissions limits and hexavalent chromium provisions.	ICAPCD	The Project will not dose cooling tower circulating water with chromium containing compounds. Additionally, analytical data of the cooling tower condensate will be collected, as required by this rule, to ensure chromium levels do not exceed Rule 1003 levels of 0.15 milligrams per liter. A cooling tower compliance plan will also be submitted to the ICAPCD, as required, to ensure compliance with this rule.
Regulation XI (NSPS)	Implements federal NSPS provisions of 40 CFR Part 60.	ICAPCD	The Project will comply with all applicable NSPS regulations, as stated in the 40 CFR Part 60 LORS entry above.

5.1.11.1 Specific LORS Discussion – Air Quality

5.1.11.1.1 Federal LORS

The EPA implements and enforces the requirements of many of the federal air quality laws. EPA has adopted the following stationary source regulatory programs in its effort to implement the requirements of the CAA, each of which are described below:

- New Source Performance Standards (NSPS)
- National Emission Standards for Hazardous Air Pollutants (NESHAP)
- PSD
- NSR
- Title V: Operating Permits Program

National Standards of Performance for New Stationary Sources–40 CFR Part 60, Subpart IIII. The NSPS program provisions limit the emissions of criteria pollutants from new or modified facilities in specific source categories. The applicability of these regulations depends on the equipment size or rating; material or fuel process rate; and/or the date of construction, or modification. Reconstructed sources can be affected by NSPS as well.

Subpart IIII establishes emission and operational limits of criteria pollutants for new stationary compression ignition engines. All stationary diesel engines installed and operated at the Project will be compliant with operational and emission provisions in Subpart IIII specific to their respective engine types.

National Emission Standards for Hazardous Air Pollutants–40 CFR Part 63. The NESHAP program provisions limit HAP emissions from existing major sources of HAP emissions in specific source categories. The NESHAP program also requires the application of MACT to any new or reconstructed major source of HAP emissions to minimize those emissions. Subpart ZZZZ will be applicable to the Project's stationary diesel combustion engines (fire pump and emergency generators). Subpart Q will not be applicable to the proposed cooling tower as chromium-based water treatment will not be used in its operations.

Prevention of Significant Deterioration Program–40 CFR Parts 51 and 52. The PSD program requires the review and permitting of new or modified major stationary sources of air pollution to prevent significant deterioration of ambient air quality. PSD applies only to pollutants for which ambient concentrations do not exceed the corresponding NAAQS. The PSD program allows new sources of air pollution to be constructed, and existing sources to be modified, while maintaining the existing ambient air quality levels in the Project region and protecting Class I areas from air quality degradation. The Project is not expected to trigger the PSD permitting requirements.

New Source Review–40 CFR Parts 51 and 52. The NSR program requires the review and permitting of new or modified major stationary sources of air pollution to allow industrial growth without interfering with the attainment of NAAQS. NSR applies to pollutants for which ambient concentrations exceed the corresponding NAAQS. The Project's air quality impact analysis complies with all applicable NSR provisions, as shown in Section 5.1.10.

Title V – Operating Permits Program–40 CFR Part 70. The Title V Operating Permits Program requires the issuance of operating permits that identify all applicable federal performance, operating, monitoring, recordkeeping, and reporting requirements. Title V applies to major facilities, acid rain facilities, subject solid waste incinerator facilities, and any facility listed by EPA as requiring a Title V permit. The proposed facility will not be subject to Title V permitting itself. However, if the proposed Project is later connected to the existing Applicant-owned geothermal plants to share geothermal fluid and steam, Title V applicability will be reassessed.

5.1.11.1.2 State LORS

CARB's jurisdiction and responsibilities fall into the following five areas: (1) implement the state's motor vehicle pollution control program; (2) administer and coordinate the state's air pollution research program; (3) adopt and update the CAAQS; (4) review the operations of the local air pollution control districts (APCDs) to ensure compliance with state laws; and (5) review and coordinate preparation of the State Implementation Plan (SIP). Some key programs which support the above responsibilities, as applicable to the Project, are described below.

Assembly Bill 617 – Community Air Protection Program. AB 617 establishes the Community Air Protection Program (CAPP) to focus on reducing exposure in communities most impacted by air pollution. The CAPP establishes community-wide air monitoring and emission reduction programs as well as provides funding to incentivize early actions to deploy cleaner technologies in the affected communities.

Air Toxic "Hot Spots" Act – California Health & Safety Code Sections 44300-44384. The Air Toxics "Hot Spots" Information and Assessment Act requires the development of a statewide inventory of TAC emissions from stationary sources. The program requires affected facilities to: (1) prepare an emissions inventory plan that identifies relevant TACs and sources of TAC emissions; (2) prepare an emissions inventory report quantifying TAC emissions; and (3) prepare an HRA, if necessary, to quantify the health risks to the exposed public. Facilities with significant health risks must notify the exposed population, and in some instances must implement risk management plans to reduce the associated health risks. The Project's compliance with this program is detailed in Section 5.9.

Public Nuisance – California Health & Safety Code Section 41700. Prohibits the discharge from a facility of air pollutants that cause injury, detriment, nuisance, or annoyance to the public, or which endanger the comfort, repose, health, or safety of the public, or that damage business or property.

Airborne Toxic Control Measure for Stationary Compression Ignition Engines – 17 CCR Section 93115. This ATCM is aimed at reducing DPM and criteria pollutant emissions from stationary diesel-fueled compression ignition engines through fuel requirements, operational restrictions, and emission limits. The ATCM applies to points of sale of stationary compression ignition engines for use in California except portable engines, engines for motive power, auxiliary engines on marine vessels, and agricultural wind machines.

5.1.11.1.3 Local LORS – ICAPCD

The ICAPCD is responsible for implementing regulations at the local level which minimize air emissions for purposes of complying with federal standards. Key regulations applicable to the Project are summarized below.

ICAPCD Regulation II – Permits. ICAPCD Regulation II establishes the basic framework for acquiring permits to construct and operate from the air district. The Application for Certification (AFC) will be the basis for the District's Determination of Compliance. A separate ATC application will be submitted to the ICAPCD. The ATC application, for the purposes of maintaining consistency with the AFC, will be similar in scope and detail, and will contain the required District permit application forms.

ICAPCD Regulation VIII – Fugitive Dust Rules. Regulation VIII implements multiple fugitive dust requirements to limit particulate emissions. The ATC application to be filed with the ICAPCD will comply with all required fugitive dust rules and requirements through implementation of the best management practices identified in Section 5.1.7.2.2.

ICAPCD Regulation IX – Federal Operating Permit Program. Regulation IX (Title V Permits) implements the federal operating permit program at the local District level. The ATC application to be filed with the ICAPCD will contain all the required application forms.

ICAPCD Regulation X – Air Toxic Control Measures. Regulation X (ATCM) incorporates by reference the provisions regarding air toxic emissions including federal NESHAPs, CARB ATCMs, and specific limits for cooling towers operations. The Project will comply with all ATCMs and other operational limitations.

ICAPCD Prohibitory or Source-Specific Rules. Relevant ICAPCD prohibitory or source-specific rules include the following:

- **Rule 400 – Fuel Burning Equipment:** Establishes limits for NO_X emissions from stationary sources. Rule 400 prohibits NO_X emissions of 140 pounds or greater per hour from stationary fuel burning equipment. Stationary fuel burning operations at the Project are not expected to exceed 140 pounds per hour of NO_X.
- **Rule 400.3 – Internal Combustion Engines:** Establishes emission limitations for NO_X and CO from internal combustion engines greater than 50 horsepower. Internal combustion emissions from the Project will not exceed the emission limitations in Rule 400.3(C).
- **Rule 401 – Opacity of Emissions:** Prohibits discharges to the atmosphere of any air contaminant other than water darker than No. 1 on the Ringlemann Chart or similar obstruction for a period greater than three minutes in any hour. Emissions from the Project are not expected to cause high opacity plumes other than water vapor discharge.
- **Rule 403 – General Limitations on the Discharge of Air Contaminants:** Establishes limits for air contaminant emissions for multiple operation types. Section (B)(2) is relevant to the Project's proposed sources, as it limits air contaminant concentrations in standardized gas flows. The Project's proposed sources will not exceed the emission limitations for any air contaminant.
- **Rule 405 – Sulfur Compounds Emission Standards, Limitations, and Prohibitions:** Establishes limits for the sulfur emissions from all sources. Rule 405 limits the sulfur content of emissions to not exceed 0.2 percent by volume. The rule additionally specifies fuel sulfur content limitations of 0.5 percent by weight for liquid and solid fuels and emissions not to exceed 500 ppm by volume or 200 pounds per hour for fuel burning equipment. All diesel fuel combusted by the Project during construction and operations will be ultra-low sulfur diesel not to exceed 15 ppm sulfur.
- **Rule 407 – Nuisances:** Restricts discharges of air contaminants at any quantity that cause injury, detriment, nuisance, or annoyance to a considerable number of persons or the general public.

5.1.11.2 Specific LORS Discussion – Climate Change and Global Warming

State law defines GHGs to include the following: CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6 (California Health and Safety Code Section 38505[g]). The most common GHG that results from human activity is CO_2, followed by CH_4 and N_2O. Key federal, state, and local legislative actions associated with GHG emissions and climate change are described below.

5.1.11.2.1 Federal Legislative Action

Executive Order 13423, signed by President George W. Bush on May 14, 2007, directed the EPA and Department of Transportation (DOT) to establish regulations to reduce GHG emissions from on-road and non-road motor vehicles and non-road engines by 2008. In 2009, the National Highway Traffic Safety Administration (NHTSA) finalized a rule regulating fuel efficiency and GHG emissions from cars and light-duty trucks for model year 2011 and further expanded the rule to model years 2012 through 2016 in 2010.

On December 19, 2007, the EPA passed the Energy Independence and Security Act of 2007, that aims to reduce GHG emissions at a national level and strengthen the initiatives established by Executive Order 13423 (EPA 2007). The act's two key measures include the following: 1) increasing the supply of alternative fuel sources through mandatory Renewable Fuel Standards by requiring fuel producers to use at least 36 billion gallons of biofuel in 2022, and 2) establishing a target of 35 miles per gallon of fuel efficiency for a combined fleet of cars and light-duty trucks by model year 2020. The act also required the NHTSA to establish a fuel economy program for both medium and heavy-duty trucks and a fuel economy standard for work trucks.

On October 30, 2009, the EPA published the Mandatory Reporting Rule (codified in 40 CFR Part 98), that requires mandatory reporting of GHG emissions from large sources and suppliers in the U.S. (EPA 2023c).

In general, suppliers of fossil fuels or industrial GHGs, manufacturers of vehicles and engines, facilities that inject CO_2 underground, users of electrical transmission and distribution equipment, and facilities that emit 25,000 MT or more per year of CO_2e emissions are required to submit annual reports to the EPA. Despite the Project's annual emissions exceeding 25,000 MT CO_2e per year, the Project does not include large stationary sources, supply operations, electrical transmission and distribution equipment containing more than 17,820 pounds of SF_6 and PFCs, or other covered processes; therefore, GHG mandatory reporting would not apply to the Project.

On December 7, 2009, the EPA Administrator signed two findings regarding GHGs in direct response to the U.S. Supreme Court's decision in *Massachusetts v. EPA* (No. 05-1120). The first finds that the current and projected concentrations of the six key well-mixed GHGs in the atmosphere (CO_2, CH_4, N_2O, HFCs, PFCs, and SF_6) threaten the public health and welfare of current and future generations. The second finds that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution that threatens public health and welfare (EPA 2023b).

On June 3, 2010, the EPA promulgated the final GHG Tailoring Rule (75 Federal Register [FR] 31514). The GHG Tailoring Rule established clear applicability thresholds for stationary source emitters of GHGs under PSD and Title V regulations. In general, any new stationary source with GHG emissions of 100,000 tpy CO_2e or greater became subject to both PSD review and the Title V program. On June 23, 2014, the U.S. Supreme Court issued a decision prohibiting the EPA from considering GHG emissions when determining PSD review and Title V program applicability (*Utility Air Regulatory Group v. EPA*, No. 12-z1146). Per the U.S. Supreme Court decision, the EPA may continue to require GHG emission limitations in PSD and Title V permits, if PSD review and the Title V program are triggered by emissions of criteria pollutants (EPA 2023e). Because no stationary sources of this magnitude are associated with the Project, PSD and Title V regulations would not apply to the Project.

In 2010, the Obama Administration issued a memorandum directing the DOT, Department of Energy (DOE), EPA, and NHTSA to develop additional standards regarding fuel efficiency and GHG emissions reduction, clean fuels, and advanced vehicle infrastructure. In response to this memorandum, EPA and NHTSA proposed coordinated federal GHG and fuel economy standards for light-duty vehicles for model years 2017 through 2025. The proposed standards are projected to achieve 163 grams per mile of CO_2 in model year 2025, on an industry fleetwide average basis. This standard is equivalent to 54.5 miles per gallon if achieved solely through fuel efficiency. The final rule was adopted in 2012 for model years 2017 through 2021 only. On April 2, 2018, EPA determined that the proposed standards for model years 2022 through 2025 were not appropriate and required revision (EPA 2017b). In response, NHTSA is currently drafting language to further tighten fuel economy standards by increasing fuel efficiency by 8 percent annually for model years 2024 through 2026 and increasing the estimated fleetwide average by 12 miles per gallon for model year 2026, relative to model year 2021 (NHTSA 2021). Additionally, in December 2021, EPA revised the light-duty vehicle emissions standards for model years 2023 through 2026 to provide for more stringent emission reductions. These emission reductions would result in an estimated reduction of three billion tons of GHG emissions through 2050 (EPA 2023a).

In addition to the cars and light-duty truck regulations described above, the EPA and NHTSA developed fuel economy and GHG standards for medium- and heavy-duty trucks for model years 2014 through 2018 in 2011 (EPA & NHTSA 2023). The standards for CO_2 emissions and fuel consumption are specific to three main vehicle categories: combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. This regulatory program is expected to reduce GHG emissions and fuel consumption for the affected vehicles by 6 to 23 percent over the 2010 baselines.

In August 2016, EPA and NHTSA adopted the phase two program related to the fuel economy and GHG standards for medium- and heavy-duty trucks. The phase two program will apply to model years 2018 through 2027 vehicles with certain trailers and model years 2021 through 2027 for semi-trucks, large pickup trucks, vans, and all types and sizes of buses and work trucks. The final standards are expected to lower CO_2 emissions by approximately 1.1 billion MT and reduce oil consumption by up to 2 billion barrels over the lifetime of the vehicles sold under the program (EPA & NHTSA 2023). Note that this and other mobile source-oriented regulatory policies described in this section will have little effect on the Project as fuel economy requirements are most often implemented at the manufacturer level rather than by the end-user. However, availability of more fuel-efficient vehicles would have the positive effect of lowering criteria pollutant and GHG emissions associated with the Project's vehicle trips.

5.1.11.2.2 State Legislative Action

In response to the transportation sector accounting for more than half of California's CO_2 emissions, AB 1493 was passed in July 2002, requiring CARB to establish GHG emission standards for passenger vehicles, light-duty trucks, and other vehicles determined to be vehicles that are primarily used for non-commercial personal transportation within the state. Specifically, AB 1493 required that CARB set GHG emission standards for motor vehicles manufactured in 2009 and all subsequent model years. CARB adopted the standards in September 2004 which will reduce GHG emissions by approximately 22 percent in the near-term (2009 through 2012), as compared to emissions from the 2002 fleet, and by approximately 30 percent in the mid-term (2013 through 2016).

The framework for regulating GHG emissions in California falls under the implementation requirements of the Global Warming Solutions Act of 2006 (referred to as AB 32), which was signed into law by the California State Legislature in 2006 and updated by Senate Bill 32 (SB 32). AB 32 required CARB to design and implement emission limits, regulations, and other measures such that statewide GHG emissions are reduced in a technologically feasible and cost-effective manner to 1990 levels by 2020. The statewide 2020 emissions limit was 431 million MT CO_2e; CO_2 emissions account for approximately 90 percent of this value (CARB 2023c). In 2016, SB 32 provided a post-2020 GHG emission reduction target of 40 percent below 1990 levels by 2030.

Issued on January 18, 2007, Executive Order S-1-07 sets a declining Low Carbon Fuel Standard for GHG emissions measured in CO_2e grams per unit of fuel energy sold in California. The goal of the Low Carbon Fuel Standard is to reduce the carbon intensity of California passenger vehicle fuels by at least 10 percent by 2020. Carbon intensity is a measurement of the amount of GHG emissions in the lifecycle of a fuel, including extraction/feedstock production, processing, transportation, and final consumption, per unit of energy delivered. The regulation, adopted by CARB in April 2009, is expected to increase the production of biofuels, including those from alternative sources, such as algae, wood, and agricultural waste. The Low Carbon Fuel Standard was amended in 2011, 2015, and most recently in 2018, all of which strengthen the implementation and carbon benchmarks through 2030 to help achieve the statewide emission targets of AB 32 and SB 32.

In December 2007, CARB adopted the first regulation pursuant to AB 32, which requires mandatory reporting of GHG emissions from large emitting facilities, suppliers, and electricity providers. This regulation was significantly revised to better align with EPA's Mandatory Reporting Rule; the revised regulation became effective January 1, 2013. The current regulation, which includes additional minor revisions to accommodate the Cap and Trade Program, became effective January 1, 2015 (CARB 2023e). CARB adopted the California Cap and Trade Program on October 20, 2011. Under the California Cap and Trade Program, covered entities have had an obligation to secure GHG allowances and/or offsets since 2013; fuel suppliers have had an obligation to secure GHG allowances and/or offsets since 2015 (CARB 2023b). The California Cap and Trade Program will be in effect until at least December 31, 2030, through the 2017 adoption of AB 398 (Climate Action Reserve 2017). As a geothermal electricity generation source with emissions greater than 10,000 MT CO_2e per year, the Project would be required to report emissions from non-exempt sources[10] under 17 CCR Section 95101(a)(1)(B)(7). The facility would not, however, be subject to the Cap and Trade Program as the facility's fugitive emissions from geothermal steam processing do not count towards a covered compliance obligation, as defined in 17 CCR Section 95852.2(b)(1), making the facility's covered emissions (i.e., insulating gas) less than 25,000 MT CO_2e per year.

[10] Stationary combustion emissions from the Project's diesel fire water pump and diesel-fired emergency generators are not subject to GHG emissions reporting per the exclusions provided in 17 CCR Section 95101(f).

In 2008, SB 375 was signed into law, addressing GHG emissions associated with the transportation sector through regional transportation and sustainability plans. Specifically, SB 375 requires CARB to adopt regional GHG reduction targets for the automobile and light-duty truck sector for 2020 and 2035. Once adopted, regional metropolitan planning organizations (MPOs) are responsible for preparing a Sustainable Communities Strategy, to be included within their Regional Transportation Plan, which forecasts a regional development pattern that will achieve, if feasible, SB 375's GHG reduction targets. If a Sustainable Communities Strategy is unable to achieve the GHG reduction target, an MPO must prepare an Alternative Planning Strategy demonstrating how the GHG reduction target would be achieved through alternative development patterns, infrastructure, or additional transportation measures or policies.

The first Climate Change Scoping Plan, a plan required by AB 32, was also approved in 2008. This plan, which is to be updated at least every five years, includes a suite of policies to help the State achieve its GHG targets, in large part leveraging existing programs whose primary goal is to reduce harmful air pollution. The currently operative plan is the 2022 Scoping Plan, which assesses progress towards achieving the SB 32 2030 target and lays out a path to achieve carbon neutrality by 2045 (CARB 2023a).

In January 2012, CARB approved the Advanced Clean Cars program, a new emissions-control program for model years 2015 through 2025. The program presents a single coordinated package that includes elements for emission reductions of GHGs and smog- and soot-causing pollutants, promotion of clean cars, and providing fuels for clean cars. To improve air quality, CARB has implemented new emission standards to reduce smog-forming emissions beginning with 2015 model year vehicles. It is estimated that cars will emit 75 percent less smog-forming pollution in 2025 than the average new car sold in 2012. To reduce GHG emissions, CARB, in conjunction with the EPA and NHTSA, has adopted new vehicle GHG standards for model years 2017 through 2025; the new standards are estimated to reduce GHG emissions by 40 percent in 2025, as compared to model year 2012. The Zero Emissions Vehicle (ZEV) program will act as the focused technology of the Advanced Clean Cars program by requiring manufacturers to produce increasing numbers of ZEVs and plug-in hybrid electric vehicles for model years 2018 through 2025. The Advanced Clean Cars II Program (ACCII) was approved in 2022, which developed rules and standards for vehicle model years 2026 through 2035. The ACCII will rapidly scale down emissions of light-duty passenger cars, pickup trucks, and sport utility vehicles by amending the Zero-Emission Vehicle Regulation to require an increasing number of zero-emission vehicles and amending the Low-Emission Vehicle Regulation to increase the stringency of standards for gasoline cars and heavier passenger trucks (CARB 2022a).

Executive Order B-16-12 was also issued in 2012 and directs state entities under the Governor's direction and control to support and facilitate the development and distribution of ZEVs. This Executive Order also sets a long-term target of reaching 1.5 million ZEVs on California's roadways by 2025, effectively reducing GHG emissions from the transportation sector to 80 percent below 1990 levels by 2050. In furtherance of this Executive Order, the Governor convened an Interagency Working Group on ZEVs that has published multiple reports regarding the progress made on the penetration of ZEVs in the statewide vehicle fleet.

In 2015, SB 350 was signed into law, establishing new clean energy, clean air, and GHG reduction goals for 2030 and beyond. Specifically, SB 350 increases California's renewable electricity procurement goal from 33 percent by 2020 to 50 percent by 2030. SB 100, signed into law in 2018, requires California utilities to reach 50 percent renewable resources by December 31, 2026, and 60 percent by December 31, 2030. SB 100 also establishes policy that renewable energy resources and other zero-carbon resources supply 100 percent of all retail sales of electricity by December 31, 2045. As a renewable energy resource, the Project will support achievement of these goals.

AB 1236, signed into law in October 2015, requires a city, county, or city and county to approve applications for the installation of electric vehicle charging stations. The intent of AB 1236 is to implement the timely and cost-effective installation of electric vehicle charging stations, each of which meets specified statewide standards.

Under AB 32, CARB, as the principal state agency in charge of regulating sources of GHG emissions in California, has been tasked with adopting regulations for the reduction of GHG emissions. The effects of this proposed Project are evaluated based both upon the quantity of GHG emissions and whether the Project implements reduction strategies identified in the 2022 Scoping Plan.

5.1.11.2.3 Local Legislative Action

In 2021, Imperial County published the Imperial County Regional Climate Action Plan. This regional climate action plan helps establish goals for sustainability and GHG reductions across Imperial County to meet the goals established at the state level in AB 32, SB 32, and Executive Orders B-30-15 and S-3-05. To meet these targets, the plan calls for multiple sectors to implement reduction measures such as carpool, increased efficiency of new building construction, and the encouragement to procure energy from geothermal sources. The proposed Project will serve to directly support this Regional Climate Action Plan by providing another source of geothermal electricity for use in the region (Ascent 2021).

5.1.12 Agency Jurisdiction and Contacts

Table 5.1-37 presents the contact information for each agency contacted during the development of this Project which may exercise jurisdiction of air quality issues and permitting.

Table 5.1-37. Agency Contacts for Air Quality

Air Quality Concern	Agency	Contact
Public exposure to air pollutants	CEC	Mr. Joseph Hughes Air Resources Supervisor 1 California Energy Commission 715 P Street Sacramento, CA 95814 Phone: 916-980-7951 E-mail: Joseph.Hughes@energy.ca.gov
	ICAPCD	Jesus Ramirez APC Division Manager 150 S. 9th Street El Centro, CA 92243-2839 Phone: 442-265-1800 E-mail: jesusramirez@co.imperial.ca.us

5.1.13 Permit Requirements and Schedules

An ATC application and Dust Control Plan is required in accordance with the ICAPCD's rules. The ATC application submitted to the ICAPCD will consist of the Project Description, Air Quality, and Public Health sections of the AFC and appropriate Appendices, plus the ICAPCD application forms. In addition, the ICAPCD Title V forms will also be included in the application package, if required. The Dust Control Plan will consist of the Project Description and Air Quality sections of this AFC in addition to a summary of the Project conformance plan for ICAPCD Rule 801, Section F.

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Appendix 5.1A
Operational Emissions Inventory

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.1A ENGP_OperationEmissions_MCR_20231030_Protect.xls”

Appendix 5.1B
Operational Air Quality Impacts Analysis

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.1B ENGP_OpsAQIA_20231103_Protect.xlsx”

Appendix 5.1C
Air Dispersion Modeling Protocol

For the contents of this attachment have not changed from the filed version as part of Docket 23-AFC-02 TN# 249743.

Appendix 5.1D

Construction Emissions Inventory and Air Quality Impacts Analysis

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.1D-1 ENGP_ConstructionEmissions_20230609_Protect.xlsx”

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.1D-2 ENGP_ConstructionAQIA_20230403_Protect.xlsx”

Appendix 5.1E
Basis of BACT Determination

See Docket 23-AFC-02 TN# 249743 for the 2017 Elmore BACT Analysis.

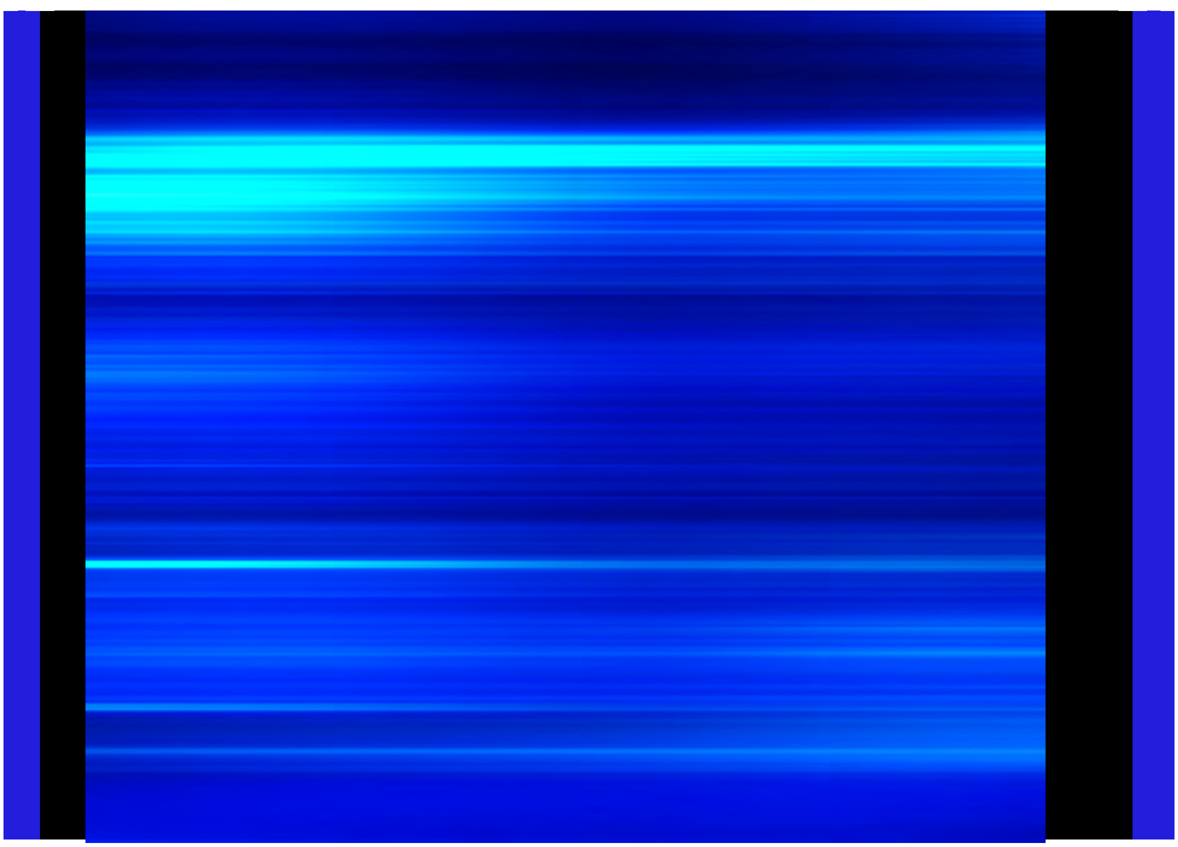
Jacobs

Cooling Tower and H_2S Abatement Technology BACT Addendum

Document no: 231104143648_d1088e41
Version: Final

Black Rock, Elmore North, and Morton Bay Geothermal Projects
Black Rock Geothermal LLC, Elmore North Geothermal LLC, and Morton Bay Geothermal LLC

November 10, 2023



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Acronyms and Abbreviations

^{o}F	degree(s) Fahrenheit
ACC	Air-cooled condenser
AFC	Application for Certification
BACT	Best Available Control Technology
BHER	BHE Renewables, LLC
BRGP	Black Rock Geothermal Project
ENGP	Elmore North geothermal project
H_2O_2	hydrogen peroxide
H_2S	hydrogen sulfide
ICAPCD	Imperial County Air Pollution Control District
MBGP	Morton Bay Geothermal Project
NCG	Non-condensable gas

1. Introduction

Jacobs Engineering Group Inc. is supporting the licensing and permitting of the following geothermal power plant projects, each of which will be owned and operated by indirect, wholly owned subsidiaries of BHE Renewables, LLC (BHER):

- Morton Bay Geothermal Project (MBGP; 23-AFC-01)
- Elmore North Geothermal Project (ENGP; 23-AFC-02)
- Black Rock Geothermal Project (BRGP; 23-AFC-03)

Applications for Certification (AFCs) for each of these projects were filed with the California Energy Commission on April 18, 2023. In accordance with Imperial County Air Pollution Control District (ICAPCD) Rule 207(C)(1), each project will implement Best Available Control Technology (BACT) for cooling tower particulate matter and hydrogen sulfide (H_2S) emissions. BACT selected for these projects was identified in Section 5.1.8 of each AFC, with supporting documentation provided in Appendix 5.1E of each AFC.

Information requests for each project were issued to the Applicants on September 29, 2023, including a request for an updated cooling tower BACT analysis. This memorandum presents a BACT analysis update to evaluate emission abatement technologies in addition to those addressed in the AFCs and including the technologies specified in the ICAPCD request. This BACT analysis update is meant as a supplement to the Elmore BACT Analysis approved by ICAPCD in March 2017, as referenced in each AFC. The BACT analysis update will follow the U.S. Environmental Protection Agency's top-down approach and include the following elements:

- Step1: 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

Because the MBGP, ENGP, and BRGP will be similar geothermal power plant projects employing similar emissions sources and technologies, this BACT analysis update is considered applicable to each without exception.

2. Step 1: Identify Potential Control Technologies

The 2017 Elmore BACT Analysis identified and evaluated several emission abatement technologies, separately focusing on H_2S and particulate matter emissions. Abatement controls previously evaluated for the sour condensate liquid H_2S include a bio-oxidation box, chemical oxidation with iron chelate, and the BIOX (liquid) system. Abatement controls previously evaluated for the non-condensable gas (NCG) H_2S include regenerative thermal oxidizers, bioreactors, and spargers with biocide abatement. In addition, drift eliminators were evaluated for particulate matter abatement. Because these technologies have been evaluated previously, they will not be included in Steps 1 and 2 of this update. The previously evaluated technologies will, however, be included at Step 3 based on the information presented in the 2017 Elmore BACT Analysis.

Steps 1 and 2 of this BACT analysis update will instead focus on the technologies specifically requested for evaluation by ICAPCD, which include 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 NCG (H_2S) abatement.

2.1 Particulate Matter Abatement Options

2.1.1 Air-cooled Condensers with Evaporative Pre-cooling

Waste heat from geothermal steam turbine discharge must be constantly rejected for proper operation. In ACCs, the condensing vapor flows inside a bank of tubes and ambient air blown across the tubes by fans serves as the coolant. Evaporative pre-cooling (adiabatic cooling) improves cooling capacity by misting the incoming ambient air, causing evaporation of the mist and thus reducing the temperature of the cooling air.

2.2 Sour Condensate Liquid (H2S) Abatement Options

2.2.1 Direct Injection of Condensate

In this process, the steam condensate produced at the condenser is mixed with the brine effluent from flash separators and reinjected into the geothermal reservoir. This process eliminates particulate matter and H_2S emissions that result from condensate use in wet cooling towers but requires procuring cooling tower makeup water to replace the condensate, typically from nearby freshwater sources.

2.3 Non-condensable Gas (H2S) Abatement Options

The following three liquid redox methods were identified as possible technologies for abatement of NCG H_2S emissions.

2.3.1 Stretford Process

The Stretford Process is a vanadium-based liquid redox system that removes H_2S from gas streams and catalytically oxidizes the captured H_2S to elemental sulfur. The process relies on an aqueous catalyst solution that is reduced by H_2S and then reoxidized by air. This is an older technology and has been replaced with iron redox technologies because of the high cost of vanadium and concerns around vanadium content in the waste streams.

2.3.2 SulFerox

SulFerox is a Shell proprietary redox-based process that converts the H_2S in sour gas to elemental sulfur through reaction with chelated iron (III). The H_2S in the sour gas stream reacts with the chelated iron (III) resulting in iron (II) and solid elemental sulfur particles that are removed from the process. Iron (II) is regenerated back to iron (III) by air. After the elemental sulfur is removed, it must be collected and stored until it can be sold or disposed of as a waste.

2.3.3 LO-CAT

Similar to the SulFerox process, LO-CAT is another liquid redox system for sulfur recovery using chelated iron. The chelated iron reacts with H_2S to form elemental sulfur particles that can then be removed from the process. Iron chelate is regenerated by air and the sulfur is collected and stored until it can be sold or disposed of as a waste.

3. Step 2: Eliminate Technically Infeasible Options

3.1 Air-cooled Condensers with Evaporative Cooling for Particulate Matter Abatement

The heat rejection system of a geothermal power plant is a large share of the capital cost and parasitic load to the system. ACC efficiency is predominantly influenced by dry-bulb temperature. The higher ambient temperature paired with an ACC will result in higher condenser vacuum back-pressure and, therefore, less power output. ACC systems implemented in higher temperature regions, such as southern California, are expected to experience reduced efficiency. Similarly, seasonal temperature variability leads to greater seasonal variability in efficiency of an ACC versus a wet cooling system. Although evaporative pre-cooling could help to mitigate the decreased efficiency of ACCs in semi-arid locations, it increases the cost and parasitic load of the process. An ACC system also would occupy a considerably larger space than wet cooling to meet cooling demands in hotter climates (Kiewit 2023).

A key benefit of ACC implementation is that it would reduce particulate matter and H_2S emissions associated with using the condensate as the primary cooling water in a wet cooling tower system and eliminate the need for secondary H_2S treatment of the condensate. However, NCG abatement would still be necessary. Evaporative pre-cooling using freshwater would create some particulate matter emissions based on the total dissolved solids in the water. In the absence of freshwater, using condensate water for evaporative pre-cooling would create emissions of particulate matter and H_2S, but at significantly lower levels than a wet cooling tower system.

The MBGP, ENGP, and BRGP have been designed as flash system geothermal plants (nonbinary geothermal plants). Although ACCs are often implemented for binary geothermal plants, which are lower-temperature systems requiring less cooling demand than flash geothermal plants, they have not been widely implemented for geothermal power plants using flash systems because of a number of challenges. First, as steam condenses, NCG content increases, which reduces heat transfer rates. This would require an increased ACC size to achieve necessary cooling, increasing the parasitic load of the system. The larger ACC footprint would result in greater impacts and may be infeasible in project-specific settings. Second, as NCG content increases, the pH of the condensed steam would be expected to drop, which would corrode mild steel tubes. Stainless-steel tubes are not as suitable because of the oval shape tube design of modern ACCs. Finally, air leaks could cause H_2S to oxidize and precipitate sulfur in the tubes, which would cause further reduced heat transfer rates (Kitz 2018). Both corrosion and potential for precipitated sulfur in the tubes increase the likelihood of ongoing maintenance issues for this system. This is likely to have a negative impact on plant availability and design life of the ACC.

Heat balance case studies run for the Elmore North Geothermal Project site indicated that, during summer months, as the temperature increases to 100 degrees Fahrenheit (^oF) and higher, when demand for power is at its highest, expected power output with ACC would be 15 percent lower than with a wet cooling system. At extremely high temperatures, the difference in power output could increase to as much as 35 percent (Kiewit 2023). Based on meteorological data collected through 2012, the Niland, California, area experiences approximately 200 days per year with temperatures in excess of 90^oF (WRCC 2023).

For these reasons, and based on the lack of demonstration of commercial ACCs on non-binary geothermal power plants, this technology is not considered technically feasible, and it will not be evaluated further in this analysis.

3.2 Direct Injection of Condensate for Sour Condensate Liquid (H2S) Abatement

Condensate is a significant cooling water makeup resource. Direct injection of condensate would significantly increase freshwater usage of the system in a region with limited freshwater resources. Potential issues associated with direct injection of condensate include wellbore and piping corrosion and gas breakthrough (Rodriguez et al. 2014). During cooler months, condensate water is sufficient for wet cooling demand. If direct injection of condensate was implemented, 100 percent of cooling water would have to be obtained from freshwater resources. There is a limited amount of Imperial Irrigation District water available for industrial use due to various federal/state agreements with Imperial Irrigation District. The implementation of direct injection of condensate would impact the already limited freshwater availability in the Imperial Valley. This technology is considered not technically feasible based on the already strained supply of freshwater available in the Imperial Valley and it will not be evaluated further in this analysis.

3.3 Liquid Redox Methods for NCG (H_2S) Abatement

The Stretford, SulFerox, and LO-CAT processes are all liquid redox methods for controlling H_2S emissions. Liquid redox methods are more suited to gas streams with low concentrations of ammonia (streams with an ammonia-to-H_2S ratio less than 1). High ammonia concentrations in the gas stream promote partitioning of H_2S into the condensate caused by acid-base interactions of the H_2S and ammonia, which leads to dissolved H_2S in the condensate being emitted to the atmosphere in the cooling tower or requiring additional treatment of the condensate for H_2S removal (Rodriguez et al. 2014). Ammonia concentrations in the gas stream from the MBGP, ENGP, and BRGP wells are expected to be high (an ammonia-to-H_2S ratio greater than 4) (Thermochem, Inc. 2023). As a result, approximately 40 percent of the H_2S is expected to be partitioned into the condensate.

Operating concerns with these liquid redox processes include solution foaming, plugging of vessels and piping with sulfur, and high amounts of chemical makeup to sustain the process (Mamrosh et al. 2012).

3.3.1 Stretford Process

Manufacture of Stretford units has been discontinued because of advancements of the other liquid redox technologies and the reliance on vanadium in the Stretford process (Thermochem, Inc. 2023). As such, the Stretford process is not considered technically feasible, and it will not be evaluated further in this analysis.

3.3.2 SulFerox

There are currently SulFerox units in use to control H_2S emissions in NCG at a similar geothermal field. However, the company offering the equipment package and engineering for these systems appears to have gone out of business. Furthermore, operating experience at the similar geothermal field suggests that the SulFerox process is more difficult and costly to maintain and operate compared to the LO-CAT technology (Thermochem, Inc. 2023). Based on the uncertainty of commercial availability of vendors and engineering to support installation, operation, maintenance, and routine like-kind replacement parts of this system, SulFerox is not considered technically feasible for this application and it will not be evaluated further in this analysis.

3.3.3 LO-CAT

The LO-CAT technology has proven to be successful and available for mitigating H_2S in NCG at geothermal plants. It is considered technically feasible for this application, but the overall reduction in H_2S emissions would be limited by the high concentrations of ammonia in the steam that will drive a significant portion of H_2S into the condensate. This will lead to a higher cost per ton of H_2S removed for this application compared to applications with lower ammonia concentrations. Operation of the LO-CAT technology would increase the parasitic load of the plant. The sulfur waste created by this process typically is not hazardous if mercury remains in the liquid form. The waste has no economic value, but it could potentially be sent to a fertilizer plant for reuse. Otherwise, the sulfur waste would be sent to a landfill. Additionally, the iron chelate required by this technology is a relatively expensive proprietary chemical that must be obtained from one specific LO-CAT vendor (Thermochem, Inc. 2023).

4. Step 3: Rank Remaining Control Technologies by Control Effectiveness

The ranking of remaining control technologies, based on average control efficiency, updated to include the control technologies originally considered in the 2017 Elmore BACT Analysis, is as follows:

For cooling tower particulate matter abatement:

1. Drift eliminators (greater than 99 percent efficient)

For H_2S condensate abatement:

1. BIOX (liquid, 98 percent efficient)
2. Bio-oxidation box (90.9 percent efficient)
3. Chemical oxidation (the control efficiency for using only hydrogen peroxide [H_2O_2] has not been determined)

For NCG H_2S abatement:

1. LO-CAT (99.9 percent efficient)
2. Bioreactor (99 percent efficient)
3. Regenerative thermal oxidizers (98 percent efficient)
4. Sparger system (90 percent efficient, on average)

The details for each of these technologies, including those that have been eliminated based on their feasibility, are presented in Table 4-1.

Table 4-1. Control Technology Efficiencies & Feasibilities

Parameter [a]	Technology Alternative	Control Efficiency	Technology Feasible?
Cooling Tower Particulate Matter	Drift Eliminators [b]	> 99%	Feasible
	Dry Cooling	100%	Not Feasible [c]
Sulfur Condensate Liquid (H_2S)	Bio-oxidation Box [b]	90.9% (3-year average)	Feasible
	Chemical Oxidation	40-70% (without iron chelate) 93-98% (iron catalyst + H_2O_2 combined system)	Feasible
	BIOX (Liquid)	98%	Feasible
	Direct Injection	100%	Not Feasible [c]
NCG (H_2S)	Regenerative Thermal Oxidizer + Caustic Scrubber and Venturi	98% but increases emissions of SO_X, NO_X, and PM_{10}	Not Feasible [c]
	Bioreactor	99%	Feasible
	Sparger System [b]	90%	Feasible
	Stretford Process	99%[d]	Not Feasible [c]
	SulFerox	99%[d]	Not Feasible [c]

Parameter [a]	Technology Alternative	Control Efficiency	Technology Feasible?
	LO-CAT	99-99.9%[e]	Feasible [f]

[a] Unless otherwise indicated, data presented in Table 1 was taken from the 2017 Elmore BACT Analysis approved by ICAPCD.

[b] This technology alternative is proposed as the control technology for the proposed projects.

[c] This technology alternative will no longer be considered in this BACT analysis as it is not feasible.

[d] 99 percent control efficiency for liquid redox systems (Nagl 1999).

[e] 99.9 percent control efficiency obtained from the Merichem (LO-CAT technology owner and supplier) website, available at https://www.merichem.com/sulfur-recovery-with-lo-cat/.

[f] An economic analysis for this technology has been prepared in Section 5.

Notes:
NO_X = nitrogen oxides
PM_{10} = particulate matter with aerodynamic diameter less than 10 microns
SO_X = sulfur oxides

5. Step 4: Evaluate Most Effective Controls

An economic analysis of previously identified feasible technologies has already been performed as a part of the 2017 Elmore BACT Analysis. As a technically feasible control option, a cost analysis of the LO-CAT technology is shown in Table 5-1.

Table 5-1. Cost of Control Technology

BACT Cost Summary	NCG H_2S Abatement LO-CAT
Cost	
Capital Costs	$9,000,000.00
Annual O&M Cost[a]	$130,000.00
Source Testing	$50,000.00
Capitol Recovery Cost[b]	$1,281,397.50
Annualized Cost	$1,461,397.50
Total Annualized Cost with 20% Contingency	$1,753,677.00
Abated Emissions	
Pre-abatement, lbs/hr	43.5
Post-abatement, lbs/hr	0.04
Abated, lbs/hr	43.46
Abated, tpy	190.35
BACT, $/ton abated	**$9,212.91**

Source: Thermochem, Inc. 2023
[a] Costs have not been broken down for maintenance.
[b] Capitol Recovery Cost Factor of 0.1423775 from 2017 Elmore BACT Analysis used for this calculation.
Notes:
$/ton = U.S. dollar per ton
lbs/hr = pound(s) per hour
O&M = operations and maintenance
tpy = ton(s) per year

This capital cost estimate is based on a 2021 estimate in U.S. dollars for a LO-CAT system at a small geothermal power plant (less than17 megawatts) (Thermochem, Inc. 2023). Cost of disposal of the waste sulfur was not included in the estimate. If the waste sulfur cannot be reused and must be landfilled, additional costs could be significant. Considering the larger size of the planned unit, this cost analysis is expected to be a conservative estimate, and the actual cost of the LO-CAT system would likely be significantly higher than the estimate used in this cost analysis.

By comparison to what is presented in Table 2, the 2017 Elmore BACT Analysis approved by ICAPCD estimated that a sparger system with oxidizing biocide would abate 171.48 tons per year of H_2S from the NCG stream at a cost of $1,599 per ton removed and that a bio-oxidation box would abate 83.4 tons per year of H_2S from condensate at a cost of $2,247 per ton removed (CalEnergy 2017). Even the combined costs of these two technologies are less than the abatement cost for the LO-CAT system.

6. Step 5: Select BACT

ACC was evaluated for particulate matter abatement and determined to be technically infeasible. Wet cooling with drift eliminators is considered technically and economically feasible for particulate matter abatement.

For H_2S abatement in the condensate, the 2017 Elmore BACT Analysis determined that the bio-oxidation box was more cost-effective than chemical oxidation and BIOX (liquid) technologies and, therefore, was preferred given its similar abatement efficiency with the other technologies considered. No additional, feasible technologies for H_2S abatement in the condensate have been identified with this addendum.

Even though the LO-CAT system is technically feasible and has higher abatement efficiency compared to the sparger system with oxidizing biocide, the sparger system is significantly more cost effective for abatement of NCG H_2S emissions. This is further supported considering the conservatively low capitol cost estimate of the LO-CAT system used in this analysis. Also, the LO-CAT system is much larger and requires more operator attention than the proposed bio-oxidation box/sparger system, complicating its implementation. The sparger system for NCG abatement is recommended over bioreactor technology based on cost effectiveness, faster response in improving abatement, and easier operation.

Evaluation of the technologies discussed previously does not change the conclusions of the 2017 Elmore BACT Analysis. BACT is still proposed as a drift eliminator for particulate matter from the cooling towers, a bio-oxidation box for H_2S in the condensate, and a sparger system for H_2S in the NCG stream based on process chemistry, waste product management, operating experience, and cost effectiveness of the technologies.

7. References

References below are available upon request.

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Attachment DRR 7-2
Revised AFC Section 5.9

5.9 Public Health

This section describes and evaluates the potential public health effects from construction and operation of the Elmore North Geothermal Project (ENGP or "Project"). Section 5.9.1 provides an overview of the Project. Section 5.9.2 describes the affected environment. Section 5.9.3 presents the analysis of public health effects of construction and operation of the power plant and associated facilities. Section 5.9.4 discusses potential other public health concerns associated with the Project, including hazardous materials, odors, electromagnetic fields (EMFs), and Legionella from cooling tower operations. Section 5.9.5 discusses potential cumulative health effects. Section 5.9.6 presents proposed mitigation measures to avoid or minimize any adverse impacts. Section 5.9.7 presents applicable laws, ordinances, regulations, and standards (LORS). Section 5.9.8 provides agency contacts. Section 5.9.9 presents permit requirements and schedules. Section 5.9.10 contains references cited or consulted in preparing this section. Appendices 5.9A and 5.9B contain supporting data for the operational and construction public health analyses, respectively.

5.9.1 Project Overview as it Relates to Public Health

The Project consists of a proposed geothermal Resource Production Facility (RPF), a Power Generation Facility (PGF), and associated facilities in Imperial County, California. Figure 1-1 shows the Project regionally, and Figure 1-4 depicts the Project area, including proposed generation interconnection gen-tie line and pipelines. The Project will be owned by Elmore North Geothermal LLC (Project owner or "Applicant"), along with the associated gen-tie. A complete description of the Project is presented in Section 2.

Air will be the dominant pathway for public exposure to chemical substances released by Project construction and operation. Airborne construction-related emissions will consist primarily of combustion by-products from onsite, diesel-fired construction equipment and vehicles. Airborne operation-related emissions will consist primarily of combustion by-products from three diesel-fired emergency generators and one diesel fire water pump, a hydrochloric acid (HCl) storage tank and associated scrubber, and those generated by the processing, condensing, and venting of geothermal fluid from the RPF. Potential health risks from public exposure to combustion emissions and geothermal fluid-related emissions were assessed by conducting a health risk assessment (HRA). Although exposure will occur almost entirely by direct inhalation, additional pathways were conservatively included in the HRA. The HRA was conducted in accordance with guidance established by the California Office of Environmental Health Hazard Assessment (OEHHA) and the California Air Resources Board (CARB).

Emissions with established California Ambient Air Quality Standards (CAAQS) or National Ambient Air Quality Standards (NAAQS), including nitrogen oxides (NO_x), carbon monoxide (CO), and fine particulate matter ($PM_{10}/PM_{2.5}$), are addressed in Section 5.1. However, some discussion of the potential health risks associated with these substances, in addition to the potential health risks associated with all toxic air contaminants (TACs), are presented in this section.

5.9.2 Affected Environment

The Project site is located in a region of the Imperial Valley, southeast of the Salton Sea, characterized mostly by agriculture and geothermal power production, with more recent additions of utility scale solar power plants. The area surrounding the plant site is primarily agricultural land. The Imperial Valley is the southwest part of the Colorado Desert that merges northwestward into the Coachella Valley near the northern shore of the Salton Sea.

The PGF will be located on approximately 63 acres (plant site) of a 160-acre parcel (APN 020-100-038) (Township 11 South, Range 13 East, Section 27, SE 1/4) within Imperial County, California. The plant site is located north of the existing Elmore Power Plant.

The Project site is bounded by Sinclair Road to the south, Cox Road to the west, and Garst Road to the east. The town of Niland is approximately six miles northeast of the plant site, and the town of Calipatria is approximately six miles southeast of the plant site. The Sonny Bono Wildlife Refuge Headquarters is approximately one mile west of the PGF. The Alamo River is approximately one mile east of the plant site, and the New River is approximately six miles southwest of the plant site.

Sensitive receptors are defined as groups of individuals that may be more susceptible to health risks due to chemical exposure. Schools, both public and private, day care facilities, convalescent homes, and hospitals are of particular concern. Although residences and worker receptors are not technically defined as "sensitive receptors" by OEHHA, they were conservatively analyzed as sensitive receptors in this analysis due to the lack of sensitive receptors near the facility. The nearby receptors of these types are included in Appendix 5.9A. The Project site is situated in Imperial County census tract 010102.1010, which has a population value of zero individuals per the 2020 census update (USCB 2022). Appendix 5.9A delineates data on the population by census tract within a 6-mile radius of the Project site, as well as a comprehensive list of sensitive receptors analyzed in the HRA.

Statewide air quality and health risk data presented by CARB in the 2013 Almanac of Emissions and Air Quality (Almanac) show that, over the period from the mid-1990s through 2009, the average concentrations for the most prominent TACs have been substantially reduced; the associated statewide health risks are similarly showing a steady downward trend (CARB 2014). This statewide trend is expected to have occurred within the Salton Sea Air Basin (SSAB) as well. The Applicant is not aware of any recent (within the last 5 years) public health studies related to respiratory illnesses, cancers or related diseases concerning the local area within a 6-mile radius of the Project site.

5.9.3 Environmental Analysis

The analysis of potential environmental effects on public health from construction and operation of the Project is presented in the following sections.

5.9.3.1 Risk Types

Three different types of risk were evaluated for this Project: cancer risk, non-cancer chronic risk, and non-cancer acute risk. Each of these risk types is described below.

Cancer Risk. Cancer risk is the probability or chance of contracting cancer over a human life span (assumed to be 30 years, which is equivalent to the projected Project lifetime). Carcinogens are not assumed to have a threshold below which there would be no human health effect. In other words, any exposure to a carcinogen is assumed to have some probability of causing cancer; the lower the exposure, the lower the cancer risk (i.e., a linear, no threshold model). Under various state and local regulations, an incremental cancer risk greater than 10 in one million due to a project is considered to be a significant effect on public health. For example, the 10 in one million risk level is used by the Air Toxics Hot Spots (Assembly Bill [AB] 2588) program and Proposition 65 as the public notification level for air toxic emissions from existing sources. When evaluating cancer risks from a single facility, it is important to note that the overall lifetime risk of developing cancer for the average male in the United States is approximately 43 in 100, or 430,000 per million, and about 42 in 100, or 420,000 per million for the average female (NIH 2022). In California, from 2015 to 2019, the cancer incidence rates were 4,883 per million for males and 4,233 per million for females. The cancer death rates in California in the same period (2015-2019) were 1,775 per million for males, and 1,287 per million for females (NIH 2023).

An incremental lifetime cancer risk of 1×10^{-6} (one in one million) is typically used as a screening threshold of significance for potential exposure to carcinogenic substances in air. The incremental cancer risk level of one in one million, which has historically been judged to be an acceptable risk, originates from efforts by the Food and Drug Administration to use quantitative HRA for regulating carcinogens in food additives in light of the zero tolerance provision of the Delany Amendment (Hutt 1985). The associated dose, known as a "virtually safe dose," has become a standard used by many policy makers and the lay public for evaluating cancer risks. However, a study of regulatory actions pertaining to carcinogens found that an acceptable risk level can often be determined on a case-by-case basis. This analysis of 132 regulatory decisions found that regulatory action was not taken to control estimated risks below one in one million, which are called *de minimis* risks. *De minimis* risks are historically considered risks of no regulatory concern. Chemical exposures with risks above 4×10^{-3} (four in ten thousand), called *de manifestis* risks, were consistently regulated. *De manifestis* risks are typically risks of regulatory concern. The risks falling between these two extremes were regulated in some cases, but not in others (Travis et al. 1987).

Since risks at low levels of exposure cannot be quantified directly by either animal or epidemiological studies, mathematical models have estimated such risks by extrapolation from high to low doses. This modeling procedure is designed to provide a highly conservative estimate of cancer risks based on the most sensitive species of laboratory animal for extrapolation to humans. In other words, the assumption is that humans are as sensitive as the most sensitive animal species. Therefore, the true risk is not likely to be higher than risks estimated using unit risk factors and is most likely lower, and could even be zero.

Non-Cancer Risk. Non-cancer health effects can be classified as either chronic or acute. In determining the potential health risks of non-cancerous air toxics, it is assumed there is a dose of the chemical of concern below which there would be no effect on human health. The air concentration corresponding to this dose is called the Reference Exposure Level (REL). Non-cancer health risks are measured in terms of a hazard quotient, which is the calculated exposure of each contaminant divided by its REL. Hazard quotients for pollutants affecting the same target organ are typically summed with the resulting totals expressed as hazard indices for each organ system. A hazard index (HI) of less than 1.0 is considered to be an insignificant health risk. RELs used in the HI calculations of this HRA were those published in December 2022 by CARB/OEHHA (CARB 2022a).

Chronic toxicity is defined as adverse health effects from prolonged chemical exposure, caused by chemicals accumulating in the body. Because chemical accumulation to toxic levels typically occurs slowly, symptoms of chronic effects usually do not appear until long after exposure commences. The lowest no effect chronic exposure level for a non-carcinogenic air toxic is the chronic REL. Below this threshold, the body is capable of eliminating or detoxifying the chemical rapidly enough to prevent its accumulation. Chronic hazard quotients are derived from modeling annual TAC emissions.

Acute toxicity is defined as adverse health effects caused by a brief chemical exposure of no more than 24 hours. For most chemicals, the air concentration required to produce acute effects is higher than the level required to produce chronic effects because the exposure duration is shorter. Because acute toxicity is predominantly manifested in the upper respiratory system at threshold exposures, all hazard quotients are typically summed to calculate the acute HI. One-hour average concentrations are divided by the acute RELs to obtain a hazard quotient for health effects caused by relatively high, short-term exposures to air toxics.

5.9.3.2 Significance Criteria

The Imperial County Air Pollution Control District (ICAPCD) does not have established health risk thresholds; therefore, this analysis has conservatively relied on the risk thresholds for the neighboring South Coast Air Quality Management District (SCAQMD), as presented in Table 5.9-1. These are consistent with the notification levels established by CARB for Imperial County under AB 2588 (CARB 2021).

Table 5.9-1. Health Risk Significance Threshold Levels for SCAQMD

Category	Risk Threshold	Source
Facility-wide	Incremental Cancer Risk $\geq 10 \times 10^{-6}$ Acute/Chronic HI $\geq$ 1.0 Cancer Burden $\geq$ 0.5	SCAQMD CEQA Handbook (SCAQMD 2019)

Note:

CEQA = California Environmental Quality Act

5.9.3.3 TAC Emissions

The following sections present the TAC emissions used in the HRA.

5.9.3.3.1 Project Operation

Environmental consequences associated with the operation of the Project are potential human exposure to chemical substances emitted to the air. The human health risks potentially associated with these chemical substances were evaluated in an HRA. The chemical substances potentially emitted to the air by the Project are listed in Table 5.9-2; details of the Project's emission sources are provided in Section 5.1.

Table 5.9-2. TACs Potentially Emitted by the Project

TACs [a, b]		
Lead	Zinc (Zn)	Acrolein
Hydrogen sulfide (H_2S) [c]	Diesel Particulate Matter (DPM)	Benzene
Ammonia (NH_3)	Radon	Ethylbenzene
Arsenic (As)	Copper (Cu)	Formaldehyde
Mercury (Hg)	Manganese (Mn)	Naphthalene
Aluminum (Al)	Nickel (Ni)	Propylene
Antimony (Sb)	Selenium (Se)	Toluene
Barium (Ba)	Silica (Si)	Xylene
Beryllium (Be)	Silver (Ag)	Carbon dioxide (CO_2)
Cadmium (Cd)	Vanadium (V)	Methane (CH_4)
Chromium (Cr)	PAHs (excluding naphthalene)	Nitrous oxide (N_2O)
Cobalt (Co)	Acetaldehyde	HCl
	1,3-Butadiene	

[a] Although the Project is also expected to emit argon, hydrogen, lithium, nitrogen, and strontium, they are not classified as TACs by OEHHA and CARB and have not been included in this analysis.

[b] Although CO_2, CH_4, and N_2O are classified as greenhouse gases, OEHHA and CARB have assigned health risk values for them.

[c] Refer to Section 5.9.4.1.2 for a discussion of H_2S.

Note:

PAHs = polynuclear (or polycyclic) aromatic hydrocarbons

Table 5.9-3 summarizes the different scenarios which were considered for conducting the HRA, based on factors including the likelihood of concurrent operations of emissions sources, whether each emissions source would operate on a long-term or temporary basis, and whether a particular operational year would result in higher or lower emissions compared to others.

Table 5.9-3. Operational Scenarios for HRA Modeling

Risk to Evaluate	Emissions Sources Included in Modeled Scenario 1	Emissions Sources Included in Modeled Scenario 2
Cancer and Non-cancer Chronic Risk	PTU, RM, routine operation of the CT with startups and shutdowns, emergency generators, fire pump, and HCl scrubber	Routine operation of the CT without startups and shutdowns (i.e., 8,760 hours of operation), emergency generators, fire pump, and HCl scrubber (Note that the PTU and RM only operate during startups and shutdowns and, therefore, are not included in this scenario)
Non-cancer Acute Risk	Routine operation of the CT with startups and shutdowns, emergency generators, fire pump, and HCl scrubber	MTU only (Note that no other onsite emission sources are anticipated to be operational during MTU operations)

Notes:
CT = Cooling Tower, Sparger, and Biological Oxidation Box
MTU = Mobile Testing Unit
PTU = Production Testing Unit
RM = Rock Muffler

As shown in Table 5.9-3, the non-cancer acute risk scenarios are based on the following:

- Routine operation of the cooling tower, sparger, and biological oxidation box. This is because emissions resulting from the production testing unit (PTU), rock muffler (RM), mobile testing unit (MTU), and cooling tower/sparger/biological oxidation box bypass/breakdown operations are limited, infrequent, and not to occur in the same hour as routine operation of the cooling tower, sparger, and biological oxidation box.
- Combustion emissions from the diesel fire water pump and three diesel-fired emergency generators, as well as emissions from the HCl scrubber, are also included in this scenario.
- Operation of the MTU. Although the MTU would only operate during the once-in-a-lifetime commissioning phase in the first year of operation and at varying offsite locations, the MTU will be operated for more hours in that first year than the PTU in subsequent years. As a result, the California Energy Commission (CEC) requested that worst-case health risks from the MTU alone be estimated. Because the MTU will operate as other Project features are brought online, no other geothermal brine flashing activities, HCl scrubber activities, or diesel combustion activities would occur in the same hour.

The hourly TAC emissions associated with each of the above scenarios are presented in Table 5.9-4, per modeled source.

As shown in Table 5.9-3, the cancer and non-cancer chronic risk scenarios are based on the following:

- Routine operation of the cooling tower, sparger, and biological oxidation box, including startups and shutdowns, as well as operation of the PTU and RM.
- Routine operation of the cooling tower, sparger, and biological oxidation box assuming no facility downtime and 8,760 hours of continuous power generation. For this scenario, operation of the PTU and RM is not required since power generation is continuous.

The annual TAC emissions associated with each of the above scenarios are presented in Tables 5.9-5 and 5.9-6, respectively, per modeled source. These scenarios are only based on a routine production year (i.e., a year in which once-per-lifetime commissioning activities are not occurring). Beyond these activities only occurring once during the Project's lifetime, emissions from the commissioning year are not proposed for analysis based on the annual TAC emissions in the commissioning year being less than those in subsequent years of operation. Periods of sparger and biological oxidation box bypass/breakdown (i.e., emission controls downtime) are also excluded because they represent unforeseeable and non-preventable scenarios which would be subject to ICAPCD breakdown requirements. The Applicant has included these conservative emission estimates (i.e., assumptions that tend to overpredict estimated versus actual) for PTE purposes only to determine potential permit applicability. This approach of including unforeseeable emissions in a facility's PTE for permit applicability determinations but not modeling analyses is consistent with the Bay Area Air Quality Management District's 2019 policy titled "Calculating Potential to Emit for Emergency Backup Power Generators" (BAAQMD 2019). Combustion emissions from the diesel fire water pump and three diesel-fired emergency generators, as well as emissions from the HCl scrubber, are included in both scenarios.

Emissions resulting from operation and maintenance (O&M) activities, including construction vehicles and equipment, were not included in the HRA. These vehicles and equipment operate in limited capacity throughout the year in varying locations throughout or near the plant site. As such, they are not expected to significantly contribute to long-term health risk impacts.

Detailed emissions calculations are provided in Appendix 5.1A, per the methodology described in Section 5.1. A description of each modeled emissions source is also included in Section 5.1.

Table 5.9-4. Operational Hourly TAC Emissions Estimates

Pollutant	Hourly Emissions (lbs/hr) per Emissions Source [a]				MTU
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	CT [c]	
Lead	--	--	--	1.36E-06	--
H_2S	--	--	--	1.44E-01	4.04E+01
HCl	--	1.15E-01	--	--	--
NH_3	--	--	3.38E-01	9.11E+00	4.09E-01
As	--	--	--	1.80E-05	1.72E-04
Hg	--	--	--	1.02E-06	2.81E-04
Benzene	7.46E-04	--	4.69E-03	3.20E-02	1.35E-01
Toluene	3.27E-04	--	1.70E-03	2.07E-04	7.20E-04
Ethylbenzene	--	--	--	1.77E-04	5.95E-04
Xylenes	2.28E-04	--	1.17E-03	2.13E-04	5.95E-04
1,3-Butadiene	3.13E-05	--	--	--	--
Al	--	--	--	1.91E-06	--
Sb	--	--	--	2.86E-07	--
Ba	--	--	--	9.16E-06	--
Be	--	--	--	1.91E-08	--
Cd	--	--	--	5.73E-08	--
Co	--	--	--	1.91E-08	--
Total Chromium	--	--	--	9.54E-08	--
Cu	--	--	--	9.16E-07	--
V	--	--	--	9.54E-08	--
Mn	--	--	--	8.78E-05	--
Ni	--	--	--	2.33E-07	--
Se	--	--	--	3.02E-06	--
Si	--	--	--	9.54E-05	--
Ag	--	--	--	9.54E-08	--
Zn	--	--	--	5.44E-05	--
DPM	5.72E-02	--	2.15E-01	--	--
Formaldehyde	9.44E-04	--	4.77E-04	--	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--	--
Naphthalene	6.78E-05	--	7.86E-04	--	--
Acetaldehyde	6.14E-04	--	1.52E-04	--	--
Acrolein	7.40E-05	--	4.77E-05	--	--
Propylene	2.06E-03	--	1.69E-02	--	--
Radon [d]	--	--	--	9.29E-05	3.92E-04

Pollutant	Hourly Emissions (lbs/hr) per Emissions Source [a]				MTU
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	CT [c]	
Acenaphthylene	4.05E-06	--	5.58E-05	--	--
Acenaphthene	1.14E-06	--	2.83E-05	--	--
Fluorene	2.34E-05	--	7.74E-05	--	--
Phenanthrene	2.35E-05	--	2.47E-04	--	--
Anthracene	1.50E-06	--	7.44E-06	--	--
Fluoranthene	6.09E-06	--	2.44E-05	--	--
Pyrene	3.82E-06	--	2.24E-05	--	--
Benz(a)anthracene	1.34E-06	--	3.76E-06	--	--
Chrysene	2.82E-07	--	9.26E-06	--	--
Benzo(b)fluoranthene	7.93E-08	--	6.72E-06	--	--
Benzo(k)fluoranthene	1.24E-07	--	1.32E-06	--	--
Benzo(a)pyrene	1.50E-07	--	1.55E-06	--	--
Indeno(1,2,3-cd)pyrene	3.00E-07	--	2.50E-06	--	--
Dibenz(a,h)anthracene	4.66E-07	--	2.09E-06	--	--
Benzo(g,h,l)perylene	3.91E-07	--	3.36E-06	--	--
CO_2	1.30E+02	--	4.93E+03	1.07E+03	4.54E+03
CH_4	5.29E-03	--	2.00E-01	2.69E+00	1.13E+01
N_2O	1.06E-03	--	4.00E-02	--	--

[a] Speciated emissions are presented for the fire pump and generators and were conservatively used for modeling in lieu of modeling only DPM (as a surrogate). NH_3 was also included in the modeling, where applicable.
[b] The Project includes a total of three 3.25 MW generators.
[c] Emissions are per each of the 14 cooling tower cells.
[d] Radon emissions presented in units of curies per hour.
Notes:
-- = Pollutant not emitted by source
lbs/hr = pound(s) per hour
MW = megawatt(s)

Table 5.9-5. Operational Annual TAC Emissions Estimates – Routine Operating Year Including Startups and Shutdowns

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a]					
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	PTU [c]	RM	CT [d]
Lead	--	--	--	--	--	1.03E-02
H_2S [e]	--	--	--	7.99E+03	8.02E+04	1.07E+03
HCl	--	1.00E+03	--	--	--	--
NH_3	--	--	1.69E+01	8.10E+01	8.12E+02	7.55E+04
As	--	--	--	3.40E-02	3.42E-01	1.37E-01
Hg	--	--	--	5.56E-02	5.58E-01	7.77E-03
Benzene	3.73E-02	--	2.35E-01	2.67E+01	2.68E+02	2.40E+02
Toluene	1.64E-02	--	8.50E-02	1.43E-01	1.43E+00	1.56E+00
Ethylbenzene	--	--	--	1.18E-01	1.18E+00	1.33E+00

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a]					
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	PTU [c]	RM	CT [d]
Xylenes	1.14E-02	--	5.84E-02	1.18E-01	1.18E+00	1.61E+00
1,3-Butadiene	1.56E-03	--	--	--	--	--
Al	--	--	--	--	--	1.45E-02
Sb	--	--	--	--	--	2.18E-03
Ba	--	--	--	--	--	6.96E-02
Be	--	--	--	--	--	1.45E-04
Co	--	--	--	--	--	1.45E-04
Cd	--	--	--	--	--	4.35E-04
Total Chromium	--	--	--	--	--	7.25E-04
Cu	--	--	--	--	--	6.96E-03
V	--	--	--	--	--	7.25E-04
Mn	--	--	--	--	--	6.67E-01
Ni	--	--	--	--	--	1.77E-03
Se	--	--	--	--	--	2.29E-02
Si	--	--	--	--	--	7.25E-01
Ag	--	--	--	--	--	7.25E-04
Zn	--	--	--	--	--	4.13E-01
DPM	2.86E+00	--	1.07E+01	--	--	--
Formaldehyde	4.72E-02	--	2.39E-02	--	--	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--	--	--
Naphthalene	3.39E-03	--	3.93E-02	--	--	--
Acetaldehyde	3.07E-02	--	7.62E-03	--	--	--
Acrolein	3.70E-03	--	2.38E-03	--	--	--
Propylene	1.03E-01	--	8.44E-01	--	--	--
Radon [f]	--	--	--	7.76E-02	7.78E-01	6.98E-01
Acenaphthylene	2.02E-04	--	2.79E-03	--	--	--
Acenaphthene	5.68E-05	--	1.42E-03	--	--	--
Fluorene	1.17E-03	--	3.87E-03	--	--	--
Phenanthrene	1.18E-03	--	1.23E-02	--	--	--
Anthracene	7.48E-05	--	3.72E-04	--	--	--
Fluoranthene	3.04E-04	--	1.22E-03	--	--	--
Pyrene	1.91E-04	--	1.12E-03	--	--	--
Benz(a)anthracene	6.72E-05	--	1.88E-04	--	--	--
Chrysene	1.41E-05	--	4.63E-04	--	--	--
Benzo(b)fluoranthene	3.96E-06	--	3.36E-04	--	--	--
Benzo(k)fluoranthene	6.20E-06	--	6.59E-05	--	--	--
Benzo(a)pyrene	7.52E-06	--	7.77E-05	--	--	--
Indeno(1,2,3-cd)pyrene	1.50E-05	--	1.25E-04	--	--	--
Dibenz(a,h)anthracene	2.33E-05	--	1.05E-04	--	--	--
Benzo(g,h,l)perylene	1.96E-05	--	1.68E-04	--	--	--
CO_2	6.52E+03	--	2.47E+05	8.98E+05	9.01 E+06	8.07E+06

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a]					
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	PTU [c]	RM	CT [d]
CH_4	2.65E-01	--	1.00E+01	2.24E+03	2.25E+04	2.02E+04
N_2O	5.29E-02	--	2.00E+00	--	--	--

[a] Speciated emissions are presented for the fire pump and generators and were conservatively used for modeling in lieu of modeling only DPM (as a surrogate). NH_3 was also included in the modeling, where applicable.
[b] The Project includes a total of three 3.25 MW generators.
[c] Emissions are the sum of the two PTU stacks.
[d] Emissions are per each of the 14 cooling tower cells.
[e] Annual H_2S emissions from the cooling towers do not include emission control breakdown PTE and assume normal operations for those hours assumed in the PTE. Other pollutants are not impacted as the sparger and biological oxidation box controls are only for the reduction of H_2S emissions.
[f] Radon emissions presented in units of curies per year.
Notes:
-- = Pollutant not emitted by source
lbs/yr = pound(s) per year

Table 5.9-6. Operational Annual TAC Emissions Estimates – Routine Operating Year Assuming No Facility Downtime and 8,760 Hours of Continuous Power Generation

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a]					
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	PTU [c]	RM [c]	CT [d]
Lead	--	--	--	--	--	1.19E-02
H_2S	--	--	--	--	--	1.26E+03
HCl	--	1.00E+03	--	--	--	--
NH_3	--	--	1.69E+01	--	--	7.98E+04
As	--	--	--	--	--	1.57E-01
Hg	--	--	--	--	--	8.95E-03
Benzene	3.73E-02	--	2.35E-01	--	--	2.80E+02
Toluene	1.64E-02	--	8.50E-02	--	--	1.81E+00
Ethylbenzene	--	--	--	--	--	1.55E+00
Xylenes	1.14E-02	--	5.84E-02	--	--	1.87E+00
1,3-Butadiene	1.56E-03	--	--	--	--	--
Al	--	--	--	--	--	1.67E-02
Sb	--	--	--	--	--	2.51E-03
Ba	--	--	--	--	--	8.03E-02
Be	--	--	--	--	--	1.67E-04
Co	--	--	--	--	--	1.67E-04
Cd	--	--	--	--	--	5.02E-04
Total Chromium	--	--	--	--	--	8.36E-04
Cu	--	--	--	--	--	8.03E-03
V	--	--	--	--	--	8.36E-04
Mn	--	--	--	--	--	7.69E-01
Ni	--	--	--	--	--	2.04E-03
Se	--	--	--	--	--	2.64E-02

Pollutant	Annual Emissions (lbs/yr) per Emissions Source [a]					
	Fire Pump	HCl Scrubber	3.25 MW Generator [b]	PTU [c]	RM [c]	CT [d]
Si	--	--	--	--	--	8.36E-01
Ag	--	--	--	--	--	8.36E-04
Zn	--	--	--	--	--	4.77E-01
DPM	2.86E+00	--	1.07E+01	--	--	--
Formaldehyde	4.72E-02	--	2.39E-02	--	--	--
PAHs (unspeciated, excluding naphthalene)	--	--	--	--	--	--
Naphthalene	3.39E-03	--	3.93E-02	--	--	--
Acetaldehyde	3.07E-02	--	7.62E-03	--	--	--
Acrolein	3.70E-03	--	2.38E-03	--	--	--
Propylene	1.03E-01	--	8.44E-01	--	--	--
Radon [e]	--	--	--	--	--	8.14E-01
Acenaphthylene	2.02E-04	--	2.79E-03	--	--	--
Acenaphthene	5.68E-05	--	1.42E-03	--	--	--
Fluorene	1.17E-03	--	3.87E-03	--	--	--
Phenanthrene	1.18E-03	--	1.23E-02	--	--	--
Anthracene	7.48E-05	--	3.72E-04	--	--	--
Fluoranthene	3.04E-04	--	1.22E-03	--	--	--
Pyrene	1.91E-04	--	1.12E-03	--	--	--
Benz(a)anthracene	6.72E-05	--	1.88E-04	--	--	--
Chrysene	1.41E-05	--	4.63E-04	--	--	--
Benzo(b)fluoranthene	3.96E-06	--	3.36E-04	--	--	--
Benzo(k)fluoranthene	6.20E-06	--	6.59E-05	--	--	--
Benzo(a)pyrene	7.52E-06	--	7.77E-05	--	--	--
Indeno(1,2,3-cd)pyrene	1.50E-05	--	1.25E-04	--	--	--
Dibenz(a,h)anthracene	2.33E-05	--	1.05E-04	--	--	--
Benzo(g,h,l)perylene	1.96E-05	--	1.68E-04	--	--	--
CO_2	6.52E+03	--	2.47E+05	--	--	9.42E+06
CH_4	2.65E-01	--	1.00E+01	--	--	2.35E+04
N_2O	5.29E-02	--	2.00E+00	--	--	--

[a] Speciated emissions are presented for the fire pump and generators and were conservatively used for modeling in lieu of modeling only DPM (as a surrogate). NH_3 was also included in the modeling, where applicable.
[b] The Project includes a total of three 3.25 MW generators.
[c] The PTU and RM do not operate during this emissions scenario; as a result, emissions are reported as zero.
[d] Emissions are per each of the 14 cooling tower cells.
[e] Radon emissions presented in units of curies per year.
Notes:
-- = Pollutant not emitted by source

Criteria pollutant emissions from Project operation were shown in Section 5.1 to comply with the NAAQS and CAAQS. The Project will also include emissions control technologies necessary to meet the criteria pollutant emission standards specified in ICAPCD's rules. Offsets will not be required because the Project will not be a major source under the ICAPCD's New Source Review (NSR) rule. The NAAQS and CAAQS are intended to protect the general public with a wide margin of safety. Therefore, the Project's criteria pollutant emissions are not anticipated to have a significant effect on public health.

5.9.3.3.2 Project Construction

The construction phase of the Project is expected to take approximately 29 months, with a few months on both ends for equipment delivery and demobilization (followed by several months of startup and commissioning). During this time, strict construction practices that incorporate safety and compliance with applicable LORS will be followed (see Section 5.9.6). In addition, mitigation measures to reduce criteria pollutant emissions from construction activities will be implemented, as described in Section 5.1.

The primary air toxic pollutant of concern associated with construction activities is diesel particulate matter (DPM) generated during movement of onsite diesel-fueled construction equipment and vehicles. The total DPM exhaust emissions from construction activities, calculated in Appendix 5.1D per methodology presented in Section 5.1, were averaged over the 29-month construction period and spatially distributed in the area associated with the construction of the Project. These modeled emission rates are presented in Table 5.9-7.[1]

Table 5.9-7. Construction TAC Emissions Estimates

Pollutant	Exhaust Emissions		
	Total (tons/Project)	Annualized (tpy) [a]	Per Emissions Source (lbs/yr) [b]
DPM	0.48	0.20	0.98

[a] Annualized emissions were calculated by averaging the total emissions over a 29-month construction period.

[b] The model includes 408 construction point sources.

Note:

tpy = ton(s) per year

5.9.3.4 Air Toxics Exposure Assessment Methodology

5.9.3.4.1 Project Operation

Emissions of toxic pollutants potentially associated with operations of the Project were estimated using emission factors approved by CARB and the U.S. Environmental Protection Agency (EPA) or representative analytical data from other geothermal power plants in the area, as detailed in Section 5.1 and Appendix 5.1A. Concentrations of these pollutants in air potentially associated with the Project were estimated using the American Meteorological Society/Environmental Protection Agency Regulatory Model (AERMOD) dispersion modeling program, consistent with Section 5.1 methodology. Modeling allows the estimation of both short-term and long-term average concentrations in air for use in an HRA, accounting for site-specific terrain and meteorological conditions.

Health Risk Characterization. Health risks potentially associated with concentrations of carcinogenic air pollutants were calculated as estimated incremental lifetime cancer risks. The incremental lifetime cancer risk for a pollutant is estimated based on the concentration in air, breathing rates of the exposed person, inhalation cancer potency, oral slope factor, frequency and duration of exposure at the receptor, and age sensitivity factor.

Evaluation of potential non-cancer health risks from exposure to short-term and long-term concentrations in the air was performed by comparing modeled concentrations in air with the RELs. An REL is a concentration in the air at or below which no adverse health effects are anticipated. RELs are based on the

[1] Note that hourly emissions estimates were not required as there is no short-term health risk associated with exposure to DPM.

most sensitive adverse effects reported in the medical and toxicological literature. Potential non-cancer effects were evaluated by calculating a ratio of the modeled concentration in the air and the REL to develop the hazard quotient.

Health Risk Modeling Software. Risk characterization from toxics emitted by the facility was carried out according to the procedures specified by OEHHA guidance for both carcinogenic and non-carcinogenic risks (OEHHA 2015), as summarized above. As recommended by the 2015 OEHHA Guidance, a Tier 1 assessment was performed. The Tier 1 assessment is the most conservative of the four tier assessment methodologies identified in the OEHHA guidance and uses a standard point-estimate approach with standard OEHHA assumptions.

Residential and sensitive cancer risks were evaluated using the 30-year continuous exposure duration scenario and worker cancer risk was evaluated using the 25-year exposure duration (8 hours per day starting at age 16 years old), as recommended in the OEHHA guidance (OEHHA 2015). Based on the OEHHA guidance, the derived (adjusted) method in HARP2 was used for the cancer risk evaluation, which uses the 95^{th} percentile breathing rate from the third trimester to 2 years and the 80^{th} percentile inhalation rate from 2 years to 70 years for residential cancer risk assessments (CARB 2015). The 30-year and 25-year exposure durations for residential and commercial/industrial receptors, respectively, are obtained from the OEHHA guidance (OEHHA 2015).

The exposure pathways included for each risk scenario in this HRA are specified in Table 5.9-8. The dose-risk assessment values and RELs used to characterize health risks associated with modeled concentrations in the air, as well as from other pathways, were obtained from the *Consolidated Table of OEHHA/ARB Approved Risk Assessment Health Values* (CARB 2022a).

Table 5.9-8. Summary of HARP2 Exposure Pathways

Risk Analysis	Model Exposure Pathways	Intake Rate Percentile
Acute	Inhalation	Not applicable
Non-cancer Chronic	Inhalation Soil Ingestion Dermal Absorption Mother's Milk Homegrown Produce Beef/Dairy (Farming) Pig/Chicken/Egg (Farming)	Not applicable
Cancer	Inhalation Soil Ingestion Dermal Absorption Mother's Milk Homegrown Produce Beef/Dairy (Farming) Pig/Chicken/Egg (Farming)	Risk Management Plan (RMP) Using the Derived Method

Health Risk Impact Locations. Health risks were evaluated for a hypothetical point of maximum impact (PMI) located at the receptor with the highest impact. The hypothetical PMI is an individual assumed to be located at the PMI location, where the highest concentrations of air pollutants associated with the Project emissions are predicted to occur, based on the air dispersion modeling. This location was assumed to be equivalent to a residential receptor exposed for the maximum Project lifetime of 30 years. Human health risks associated with emissions from the Project are unlikely to be higher at any other location than at the location of the PMI. If there is no significant effect associated with concentrations in air at the PMI location, it is unlikely that there would be significant effects in any location in the vicinity of the Project. The highest offsite concentration location represents the PMI.

Health risks were also evaluated at the maximally exposed individual resident (MEIR), maximally exposed individual worker (MEIW), and maximally exposed sensitive receptor locations. These locations correspond to the location of a residence, industrial/commercial business, and sensitive receptor, respectively, with the highest health risk impact. A list of the nearby sensitive receptors, including residences, is included in Appendix 5.9A. It was conservatively assumed that most receptors within the receptor grid could represent a worker location.

Cancer Burden. To evaluate population risk, regulatory agencies have used the cancer burden as a method to account for the number of incremental cancer cases that could potentially occur in a population. The population burden can be calculated by multiplying the cancer risk at a census block centroid multiplied by the number of people who live in the census block, and summing the cancer cases across the zone of impact. A census block is defined as the smallest entity for which the Census Bureau collects and tabulates decennial census information; it is bounded on all sides by visible and non-visible features shown on Census Bureau maps. A centroid is defined as the central location within a specified geographic area.

Cancer burden is calculated on the basis of OEHHA (70-year) risks and is independent of how many people move in or out of the vicinity of an individual facility. The number of cancer cases is considered independent of the number of people exposed, within some lower limits of exposed population size, and the length of exposure (within reason). For example, if 10,000 people are exposed to a carcinogen at a concentration with a $1x10^{-5}$ cancer risk for a lifetime, the cancer burden is 0.1, and if 100,000 people are exposed to a 1×10^{-5} risk, the cancer burden is 1.

There are different methods that can be used as a measure of population burden. Another potential measure of population burden is based upon the number of individuals residing within a 1×10^{-6}, 1×10^{-5}, and/or 1×10^{-4} isopleth. The approach used for this Project is based on this method using the 1×10^{-6} isopleth distance and the estimated population values within that established radius. Appendix 5.9A presents the data assumptions used to calculate cancer burden for the Project.

5.9.3.4.2 Project Construction

Although construction-related emissions are considered temporary and localized, resulting in no long-term effects to the public, a screening HRA was conservatively conducted to estimate potential health risks associated with public exposure to DPM during the Project construction. The construction HRA estimated the rolling cancer risks for each 29-month period[2] during a 30-year exposure duration (starting with exposure during the third trimester), aligned with the expected construction duration, at the PMI, MEIR, MEIW, and maximally exposed sensitive receptor. The incremental cancer risks were estimated using the following:

- Equations 5.4.1.1 and 8.2.4A from the *Air Toxic Hot Spots Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015) for residential exposure
- Equations 5.4.1.2A, 5.4.1.2B, and 8.2.4B from the *Air Toxic Hot Spots Guidance Manual for Preparation of Health Risk Assessments* (OEHHA 2015) for worker exposure
- The maximum annual ground-level concentrations used to estimate risk were determined through dispersion modeling with AERMOD
- The AERMOD modeling approach followed that used to prepare the criteria pollutant modeling analysis described in Section 5.1, except that the receptor grid included census and sensitive receptors (see Appendix 5.1B for the AERMOD setup)
- The construction emission estimates modeled are presented in Table 5.9-7, and were developed per the methodology provided in Section 5.1

Chronic risks were also estimated for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor, based on the same emission rates and ground-level concentrations described above. To calculate chronic

[2] Although Project construction is expected to last only 29 months, a rolling 3-year (i.e., 36-month) period was conservatively used for determining cancer risks.

risk, as characterized by an HI, the maximum annual ground-level concentration was divided by the DPM REL of 5 μg/m^3 (CARB 2022a).

5.9.3.5 Air Toxics Exposure Assessment Results

5.9.3.5.1 Project Operation

Estimates of the incremental lifetime cancer risk and non-cancer HIs associated with operational-related concentrations in air for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor are presented in Table 5.9-9 for comparison to the SCAQMD's CEQA significance thresholds.[3] The results presented reflect the worst-case estimates of the two operational year scenarios and the non-MTU hourly scenario previously described in Section 5.9.3.3.1. The locations associated with these impacts are presented in Figure 5.9-1.

Table 5.9-9. Operation HRA Summary – Project

Receptor Type	Receptor #	UTM E (m)	UTM N (m)	Cancer Risk (per million)	Chronic HI	Acute HI
PMI	50 [a] 75 [b]	630,714.83 [a] 630,254.29 [b]	3,672,138.02 [a] 3,671,995.77 [b]	18.7	1.29	2.41
MEIR	5,729 [a] 5,724 [b]	638,180.33 [a] 629,090.70 [b]	3,672,664.25 [a] 3,671,844.15 [b]	0.46	0.03	0.96
MEIW	50 [a] 75 [b]	630,714.83 [a] 630,254.29 [b]	3,672,138.02 [a] 3,671,995.77 [b]	0.82	1.29	2.41
Maximally Exposed Sensitive Receptor	5,729 [a] 5,724 [b]	638,180.33 [a] 629,090.70 [b]	3,672,664.25 [a] 3,671,844.15 [b]	0.46	0.03	0.96

[a] Receptor number and coordinates associated with cancer and chronic analyses.
[b] Receptor number and coordinates associated with acute analyses.
Notes:
E = Easting
m = meter(s)
N = Northing
UTM = Universal Transverse Mercator

[3] ICAPCD does not have its own established significance thresholds for health risk impacts.

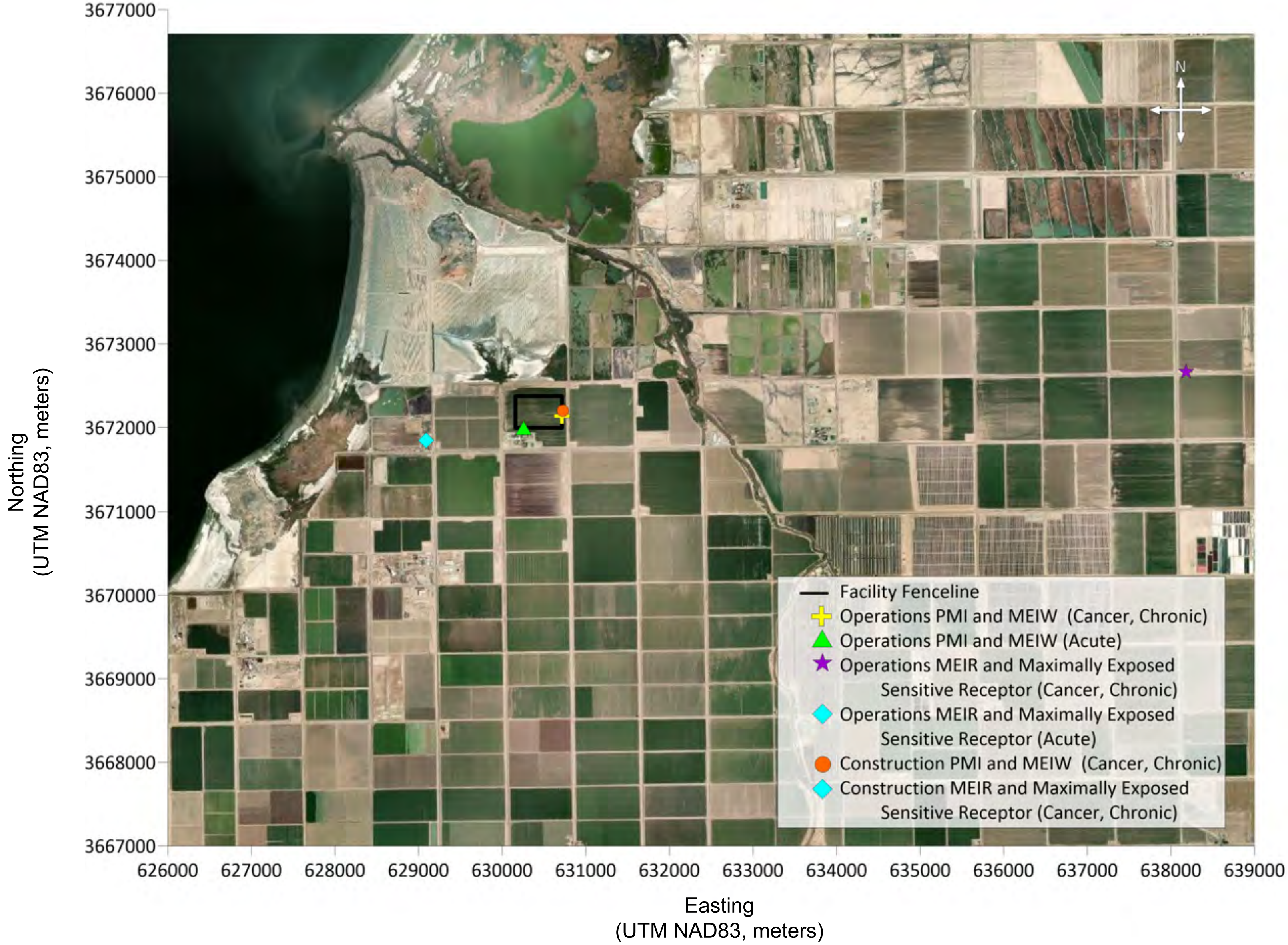

Figure 5.9-1
Health Risk Assessment Impact Locations
Elmore North Geothermal Project
Imperial County, California

Jacobs

As shown, predicted facility-wide impacts are below the cancer risk threshold of 10 in one million at all locations except the PMI. These facility-wide cancer risks are less than significant given the PMI does not constitute a location that would present a potential for long-term exposure as it is typically located along the Project fence line. As described previously, human health risks associated with operational emissions from the Project are unlikely to be higher at any location other than that of the PMI. In fact, human health risks at locations other than that of the PMI are often significantly lower, as evidenced by the risks at the MEIR and maximally exposed sensitive receptor. Furthermore, incremental lifetime cancer risks higher than one in one million may or may not be of concern, depending upon several factors. These include the conservatism of assumptions used in risk estimation, size of the potentially exposed population, and toxicity of the risk-driving chemicals. Additionally, as described in Section 5.9.6, the diesel fire water pump, diesel-fired emergency generators, and cooling tower will be equipped with emission control technologies to minimize TAC emissions where feasible.

The facility-wide chronic risk impacts are below the HI threshold of 1.0 at all locations except the PMI and MEIW, which is conservatively assumed to occur at the PMI. Similar to the cancer risk discussion above, these facility-wide chronic HIs are less than significant given the PMI does not constitute a location that would present a potential for long-term exposure as it is typically located in the vicinity immediately surrounding the Project. As described previously, HIs associated with operational emissions from the Project are unlikely to be higher at any location other than that of the PMI. In fact, chronic HIs at locations other than that of the PMI are often significantly lower, as evidenced by the chronic HIs at the MEIR and maximally exposed sensitive receptor.

The facility-wide acute risk impacts are below the HI threshold of 1.0 at all residential and sensitive receptors, but exceed the HI threshold of 1.0 at the PMI and MEIW, which is conservatively assumed to occur at the PMI. Consistent with CARB's *Risk Management Guidance for Stationary Sources of Air Toxics*, acute health risks greater than the threshold of 1.0 will trigger the need for source-specific Best Available Control Technology for Toxics (TBACT) (CARB 2015). The primary risk drivers for these acute health risk impacts are particulate and hydrogen sulfide (H_2S) emissions associated with the cooling tower operations. As described in Section 5.1.8, the cooling tower will be equipped with a 0.0005 percent drift eliminator as well as a sparger/biological oxidation box with a minimum combined control efficiency of 98.5 percent. These control technologies are expected to meet the definition of TBACT as they are identified Best Available Control Technology (BACT) which control emissions of H_2S (an identified TAC) as well as toxic metals (in particulate form).[4] The Applicant may also be required to perform public notification to areas with modeled acute HIs greater than the threshold of 1.0 in accordance with the requirements of AB 2588[5]. Based on the above, the Project may have a significant impact associated with acute health risk by exceeding the HI threshold but will work with ICAPCD for continued compliance with AB 2588 requirements.

As described previously, human health risks associated with routine operational impacts from the Project are unlikely to be higher at any location other than that of the PMI. Therefore, the cancer risk for all individuals exposed to the Project's emissions would be lower (and in most cases, substantially lower) than 18.7 in one million, as illustrated in the isopleths provided in Figure 5.9-2, which show the risk values of one, five, and 10 in one million. This is further supported by the estimated cancer burden of less than 0.001, which indicates that impacts from the Project would not be associated with any significant increase in cancer cases in the previously defined population. In addition, the cancer burden is less than the SCAQMD's significance threshold value of 0.5. As stated previously, the methods used in this calculation considerably overstate the potential cancer burden, further suggesting that Project emissions are unlikely to represent a significant public health effect in terms of cancer risk.

[4] SCAQMD Rule 1401 defines TBACT as "the most stringent emissions limitation or control technique which (A) has been achieved in practice for such permit unit category or class of source; or (B) is any other emissions limitation or control technique, including process and equipment changes of basic and control equipment, found by the [Air District] to be technologically feasible for such class or category of sources, or for a specific source."

[5] See https://ww2.arb.ca.gov/ab-2588-district-prioritization-scores-and-risk-threshold-levels for ICAPCD's public notification levels.

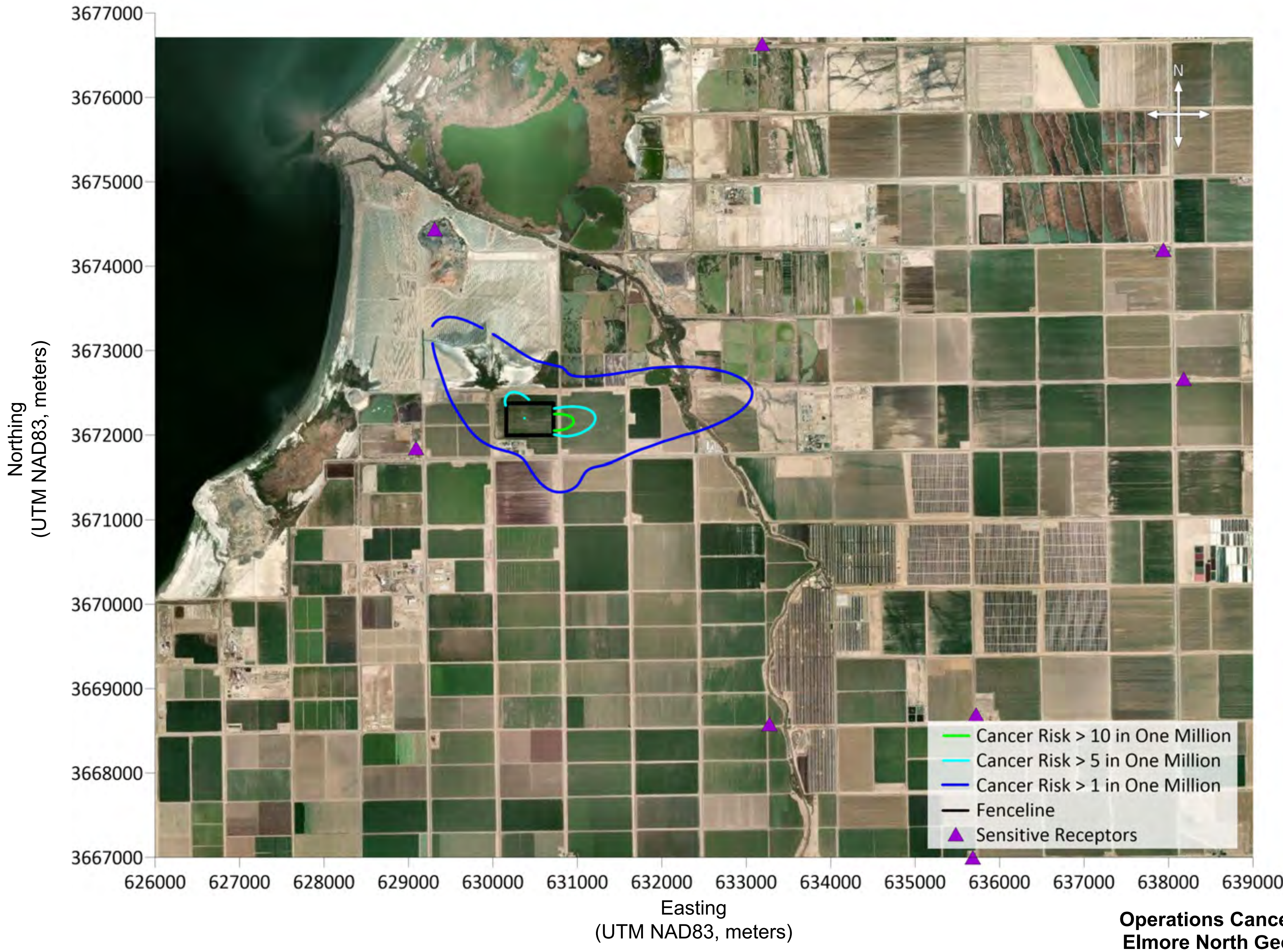

Figure 5.9-2
Operations Cancer Risk Isopleths
Elmore North Geothermal Project
Imperial County, California

Jacobs

Estimates of the non-cancer acute HIs associated with hourly operation of the MTU for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor are presented in Table 5.9-10 for comparison to the SCAQMD's CEQA significance thresholds. The MTU acute risk impacts are above the HI threshold of 1.0 at the PMI and MEIW, which is conservatively assumed to occur at the PMI, but below the HI threshold of 1.0 at all residential and sensitive receptors. Receptor locations with a modeled HI of greater than 1.0 are presented in Figure 5.9-3. The MTU operations are expected to occur no more than 23 days at any specific location and would only occur during the once-in-a-lifetime commissioning of the plant in the first year of operation. Additionally, the results of this analysis are based upon a five-year meteorological data period and represent the worst-case conditions that occur during that period. There is a low probability that a single person would be within the area defined by the receptors with an acute HI greater than 1.0 during MTU operations and coincident worst-case meteorological conditions. Therefore, the predicted acute health risks associated with MTU operation during Project commissioning are considered to be less than significant.

Table 5.9-10. Operation HRA Summary – Project MTU

Receptor Type	Receptor #	UTM E (m)	UTM N (m)	Acute HI
PMI	1,910	630,675.00	3,672,450.00	3.70
MEIR	5,725	629,310.70	3,674,439.02	0.66
MEIW	1,910	630,675.00	3,672,450.00	3.70
Maximally Exposed Sensitive Receptor	5,725	629,310.70	3,674,439.02	0.66

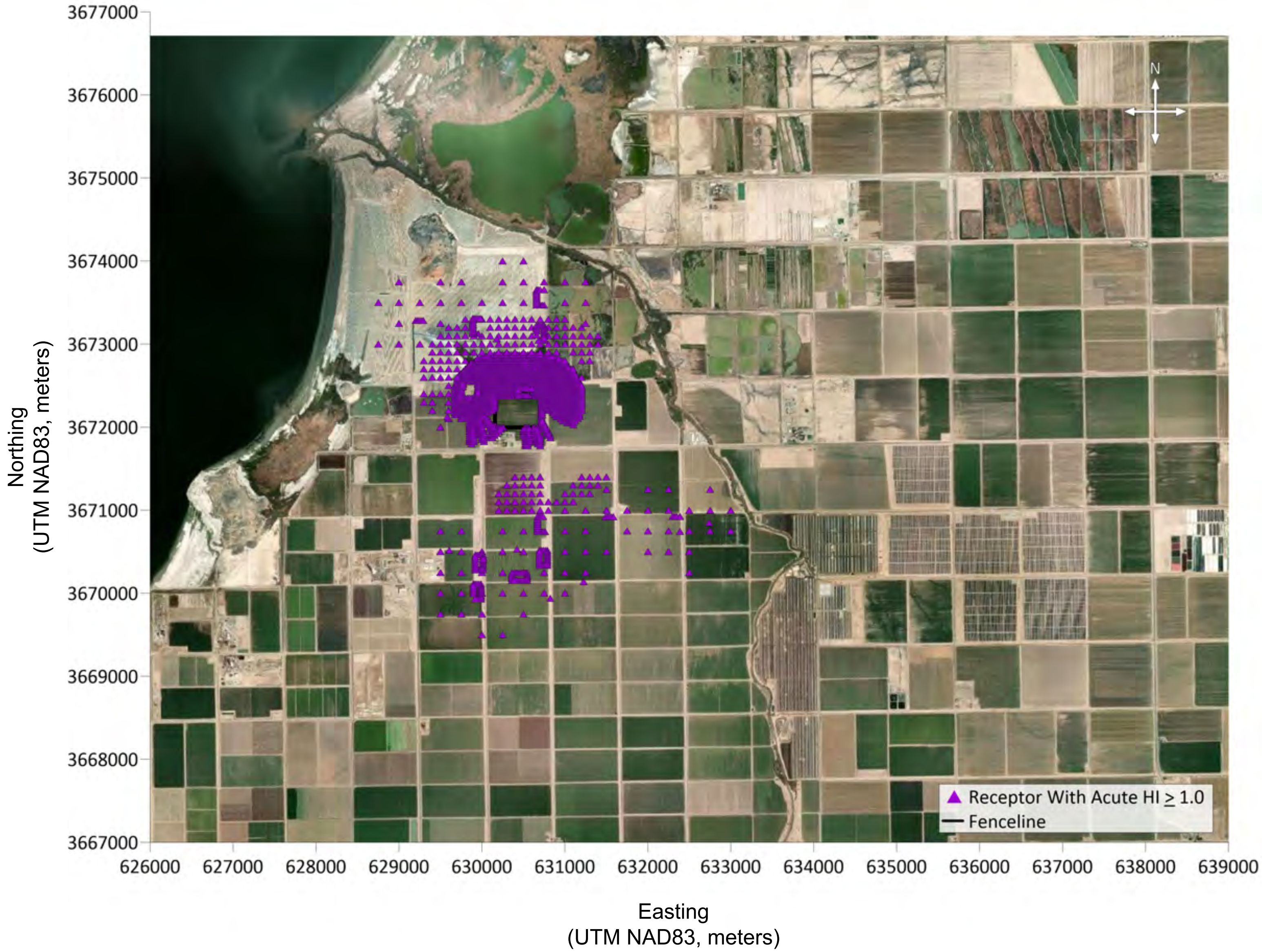

Figure 5.9-3
MTU Operations Acute Risk Impacts
Elmore North Geothermal Project
Imperial County, California

Jacobs

Detailed risk and hazard values provided in the HARP input and output files are included with this submission on compact disc and summarized in Appendix 5.9A.

5.9.3.5.2 Project Construction

Estimates of the facility-wide incremental lifetime cancer risk and chronic HI associated with construction-related concentrations in air for the PMI, MEIR, MEIW, and maximally exposed sensitive receptor are presented in Table 5.9-11, with locations presented in Figure 5.9-1. These risks are below the SCAQMD's CEQA significance thresholds of 10 in one million and 1.0, respectively, with the exception of the PMI.[6] Isopleths showing the cancer risk values of one, five, and 10 in one million are provided in Figure 5.9-4. The construction period will be a finite duration, during which no long-term exposure is expected to occur at the PMI; therefore, it is not considered applicable for comparison to SCAQMD's CEQA significance thresholds. Therefore, predicted impacts associated with the finite construction activities are less than significant.

Table 5.9-11. Construction HRA Summary – Project

Receptor Type	UTM E (m)	UTM N (m)	Cancer Risk (per million)	Chronic HI	Acute HI
PMI	630,725.00	3,672,200.00	28.3	0.02	--
MEIR	629,090.70	3,671,844.15	0.93	0.0006	--
MEIW	630,725.00	3,672,200.00	0.65	0.02	--
Maximally Exposed Sensitive Receptor	629,090.70	3,671,844.15	0.93	0.0006	--

Note:

-- = Acute risk not estimated for construction activities

A cancer burden analysis was not performed for the construction phase of the Project as it is a temporary phase and will occur for no longer than 29 months. This duration is far less than the 70-year exposure period assumed for a cancer burden analysis. Therefore, it is assumed Project construction would have negligible impacts on cancer burden in the area.

Detailed risk and hazard values are provided in Appendix 5.9B and the air modeling input and output files are included with this submission on compact disc.

[6] ICAPCD does not have its own established significance thresholds for health risk impacts.

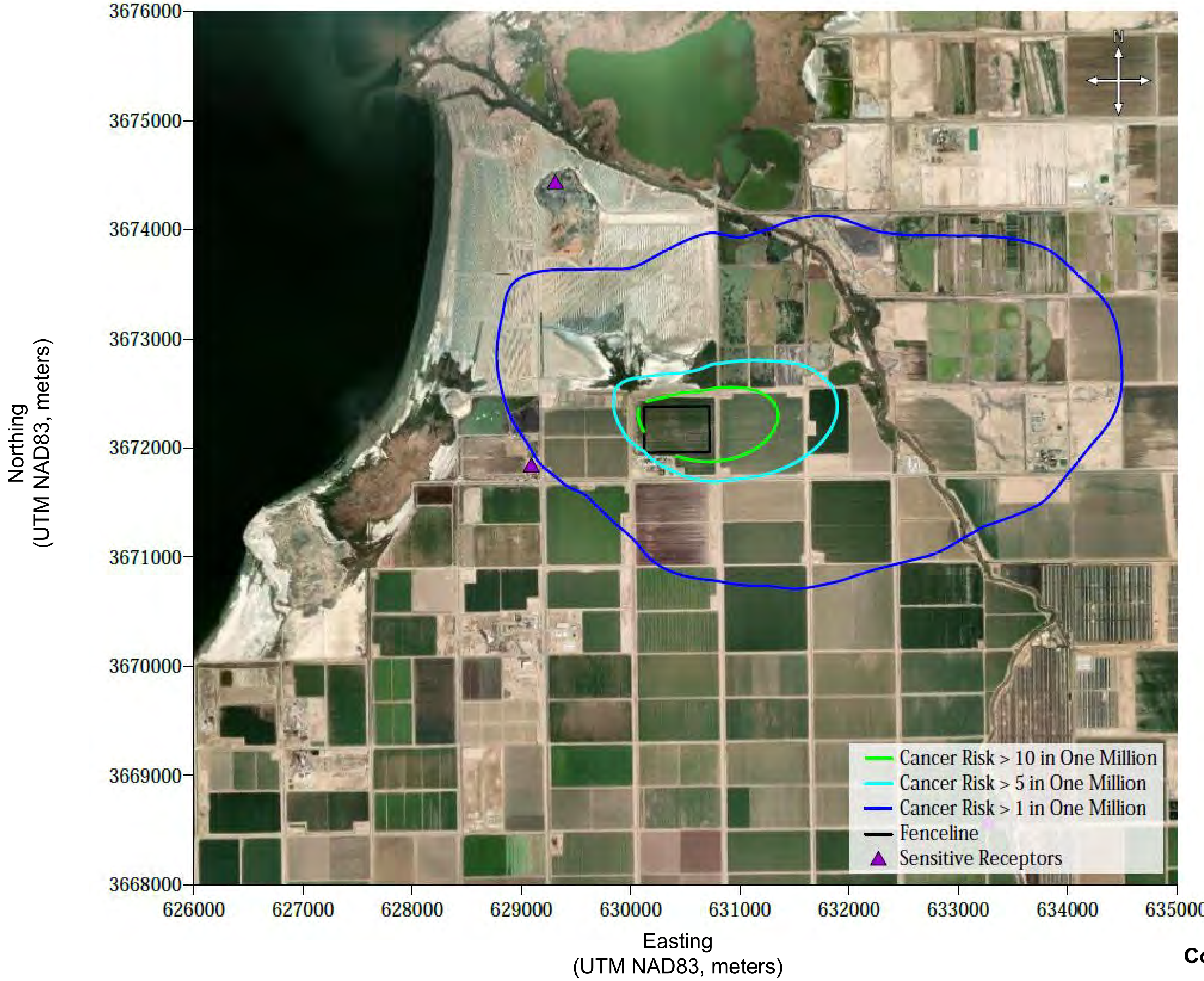

Figure 5.9-4
Construction Cancer Risk Isopleths
Elmore North Geothermal Project
Imperial County, California

Jacobs

5.9.4 Other Public Health Concerns

5.9.4.1.1 Hazardous Materials

Hazardous materials may be used and stored at the Project site. The hazardous materials stored in significant quantities on-site and descriptions of their uses are presented in Section 5.5. Use of chemicals at the Project site will be in accordance with standard practices for storage and management of hazardous materials. Normal use of hazardous materials, therefore, will not pose significant risk to public health. While mitigation measures will be in place to prevent releases, accidental releases that migrate off-site could result in potential effects to the public.

The California Accidental Release Prevention (CalARP) Program regulations and Code of Federal Regulations (CFR), Title 40, Part 68 under the Clean Air Act (CAA) establish emergency response planning requirements for acutely hazardous materials. These regulations require preparation of a RMP, which is a comprehensive program to identify hazards and predict the areas that may be affected by a release of a program-listed hazardous material. The Project will not be subject to these regulations because it is not expected to use any RMP-listed materials in quantities above the applicability thresholds.

5.9.4.1.2 Operational Odors

Project operation will result in emissions of H_2S, which is a known odorous compound. Specifically, the 1-hour H_2S CAAQS was adopted in 1969 for purposes of odor control and not for protection of public and environmental health. People have experienced eye irritation at concentrations of 50 parts per million (ppm). which is much greater than the CAAQS of 0.03 ppm (CARB 2022b). Therefore, temporary exceedances of the H_2S CAAQS would not result in elevated exposure of the public and environment to H_2S health-related risks but would be characterized as a nuisance and an odor impact.

The results of the dispersion modeling analysis, as presented in Section 5.1, indicate that the estimated routine operational impacts from the Project will be below the H_2S CAAQS at all receptors, suggesting less-than-significant odor impacts. Non-routine operations of the Project, including commissioning, startup, shutdown, and downtime of emission controls, would occur infrequently throughout the year and were not included in the modeled scenarios. These operational conditions would occur for unknown durations randomly during the year and are difficult to predict with any reasonable certainty given their strong dependence on meteorological conditions. The potential for these infrequent events to occur during meteorological conditions hindering dispersion is expected to be minimal.

5.9.4.1.3 EMF Exposure

EMFs occur independently of one another as electric and magnetic fields at the 60-hertz (Hz) frequency used in gen-tie lines, and both are created by electric charges. Electric fields exist when these charges are not moving. Magnetic fields are created when the electric charges are moving. The magnitude of both electric and magnetic fields falls off rapidly as the distance from the source increases (proportional to the inverse of the square of distance). Because the electric transmission lines do not typically travel through residential areas and based on findings of the National Institute of Environmental Health Sciences (NIEHS) (1999), EMF exposures are not expected to result in a significant effect on public health. The NIEHS report to the U.S. Congress found that “the probability that EMF exposure is truly a health hazard is currently small. The weak epidemiological associations and lack of any laboratory support for these associations provide only marginal scientific support that exposure to this agent is causing any degree of harm” (NIEHS 1999).

Additional details regarding EMFs are included in Section 3.5.

5.9.4.1.4 Legionella

In addition to being a source of potential TACs, the possibility exists for bacterial growth to occur in cooling tower cells, including Legionella. Legionella is a bacterium that is ubiquitous in natural aquatic environments and is also widely distributed in man-made water systems. It is the principal cause of legionellosis, otherwise known as Legionnaires' disease, which is similar to pneumonia. Transmission to people results mainly from inhalation or aspiration of aerosolized contaminated water. Untreated or inadequately treated cooling systems, such as industrial cooling tower cells and building heating, ventilating, and air conditioning systems, have been correlated with outbreaks of legionellosis.

Legionella can grow symbiotically with other bacteria and can infect protozoan hosts. This provides Legionella with protection from adverse environmental conditions, including making it more resistant to water treatment with chlorine, biocides, and other disinfectants. Thus, if not properly maintained, cooling water systems and their components can amplify and disseminate aerosols containing Legionella.

The State of California regulates recycled water for use in cooling tower cells in California Code of Regulations (CCR), Title 22, Section 60303. This section requires that, in order to protect workers and the public who may come into contact with cooling tower mists, chlorine or another biocide must be used to treat the cooling system water to minimize the growth of Legionella and other micro-organisms. This regulation does not apply to the Project since it does not intend to use reclaimed water for cooling purposes.

EPA published an extensive review of Legionella in a human health criteria document (EPA 1999). In this document, the EPA noted that Legionella may propagate in biofilms (collections of micro-organisms surrounded by slime they secrete, attached to either inert or living surfaces) and that aerosol-generating systems such as cooling tower cells can aid in the transmission of Legionella from water to air. EPA has inadequate quantitative data on the infectivity of Legionella in humans to prepare a dose-response evaluation. Therefore, sufficient information is not available to support a quantitative characterization of the threshold infective dose of Legionella. Thus, the presence of even small numbers of Legionella bacteria presents a risk – however small – of disease in humans.

In 2008, the Cooling Tower Institute (CTI) issued its revised report and guidelines for the best practices for control of Legionella (CTI 2008). To minimize the risk from Legionella, the CTI noted that consensus recommendations included minimization of water stagnation, minimization of process leads into the cooling system that provide nutrients for bacteria, maintenance of overall system cleanliness, the application of scale and corrosion inhibitors as appropriate, the use of high-efficiency mist eliminators on cooling tower cells, and the overall general control of microbiological populations. Good preventive maintenance is very important in the efficient operation of cooling tower cells and other evaporative equipment. Preventive maintenance includes having effective drift eliminators, periodically cleaning the system if appropriate, maintaining mechanical components in working order, and maintaining an effective water treatment program with appropriate biocide concentrations. The efficacy of any biocide in ensuring that bacteria, and in particular Legionella growth, is kept to a minimum is contingent upon a number of factors including but not limited to proper dosage amounts, appropriate application procedures, and effective monitoring.

In order to ensure that Legionella growth is kept to a minimum, thereby protecting both nearby workers as well as members of the public, an appropriate biocide program and anti-biofilm agent monitoring program would be prepared and implemented for the cooling tower cells associated with the Project. These programs would ensure that proper levels of biocide and other agents are maintained within wet cooling tower water at all times, that periodic measurements of Legionella levels are conducted, and that periodic cleaning is conducted to remove bio-film buildup.

5.9.5 Cumulative Effects

The operational HRA indicates that the maximum cancer risk due to exposure to air toxics emitted by PGF operations will be approximately 18.7 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million. Although this risk level is greater than the SCAQMD's "significant health risk" threshold, its location represents the maximum possible cancer risk outside of the facility boundary. In actuality, cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 0.46, 0.82, and 0.46, respectively, which are all less than the significance threshold, as is the estimated cancer burden rate. Non-cancer chronic and acute effects (i.e., HI values) from Project operations are below the SCAQMD significance thresholds of 1.0 at all residential and sensitive receptor locations, but above the SCAQMD significance thresholds of 1.0 at the PMI and MEIW, as described in Section 5.9.3.5.1. As described in Section 5.9.6, emission control technologies for key TACs will be installed as part of the Project; these technologies will reduce TAC emissions to the extent technically feasible and are expected to meet the definition and requirements for TBACT. Therefore, the potential cumulative health risk impacts from operation are expected to be less than significant.

The construction HRA indicates that the maximum cancer risk due to exposure to air toxics emitted during construction will be approximately 28.3 in one million at the PMI, which is above the SCAQMD's "significant health risk" threshold of 10 in one million. Although this risk level is greater than the SCAQMD's "significant health risk" threshold, its location represents the maximum possible cancer risk outside of the facility boundary. In actuality, cancer risks are expected to be much less in locations where long-term exposure is more likely to occur, such as at the locations of the MEIR, MEIW, and maximally exposed sensitive receptor. Cancer risks at these locations are 0.93, 0.65, and 0.93, respectively, which are all less than the significance threshold. Non-cancer chronic effects (i.e., HI values) from Project construction are also well below the SCAQMD significance threshold of 1.0 at all receptor locations. Additionally, the Project construction activities will be finite, and best available emission control techniques would be used throughout the 29-month construction period to control pollutant emissions. Therefore, the potential cumulative health risk impacts from construction are also expected to be less than significant.

Based on modeling studies conducted by CEC staff for other projects, an analysis of a project's cumulative impacts is typically only required if the proposed facility is generally within less than 0.5 mile of another existing major or large toxics emissions source. The Elmore Power Plant is another geothermal power plant in Imperial County, which is located less than 0.5 mile south of the Project. However, the Elmore Power Plant is not a major source of air toxic pollutants. There are no other existing major or large toxics emissions sources within 0.5 mile of the Project. Therefore, a cumulative impacts analysis for potential health risks is not required.

5.9.6 Mitigation Measures

5.9.6.1 Project Operation

Emissions of TACs to the air due to Project operation will be minimized through the use of high-efficiency drift eliminators and H_2S sparging, which are considered BACT for the Project's cooling towers and geothermal processes, respectively. The diesel-fired emergency generators will be Tier 4 certified engines, meaning DPM and criteria pollutant emissions will be minimized through the use of Tier 4 controls, including selective catalytic reduction, diesel particulate filtration, and a diesel oxidation catalyst. Additionally, the diesel fire pump engine will be BACT compliant with a Tier 3 certified engine.

The potential health risk impacts presented in Section 5.9.3.5.1 indicate that the Project will not have a significant impact when compared to the SCAQMD's significance thresholds for cancer and non-cancer chronic risks. Although the Project may have a potentially significant impact for non-cancer acute risks, emission control technologies which meet the definition of TBACT will be employed to reduce TAC emissions to the extent technically feasible.[7] As a result, additional mitigation measures are not required for the air toxic emissions from operation of the Project.

[7] ICAPCD does not have its own established significance thresholds for health risk impacts.

5.9.6.2 Project Construction

The construction activities from the Project would be finite and best available control techniques would be used throughout the 29-month construction period to control criteria pollutant and DPM emissions. Construction impacts would further be reduced with the implementation of the additional construction mitigation measures presented in Section 5.1.

The potential health risk impacts presented in Section 5.9.3.5.2 indicate that the Project will not have a significant impact when compared to the SCAQMD's significance thresholds. As a result, additional mitigation measures are not required for the air toxic emissions from construction of the Project.

5.9.7 Laws, Ordinances, Regulations, and Standards

The relevant LORS that affect public health and are applicable to the Project are identified in Table 5.9-12, along with the conformity of the Project to each listed LORS. Table 5.9-12 also summarizes the agencies responsible for regulating public health under each of the applicable LORS.

Table 5.9-12. Summary of LORS – Public Health

LORS	Purpose	Regulating Agency	Project Conformance
CAA Title III	Establishes a plan for achieving significant reductions in emissions of hazardous air pollutants from major sources.	EPA Region 9 CARB ICAPCD	Based on the HRA results presented in Section 5.9.3.5, the Project's cancer and chronic health risks do not exceed acceptable levels. Although acute health risks may potentially exceed acceptable levels, they will be minimized to the extent technically feasible through the use of TBACT. Emissions of criteria pollutants will be minimized by applying BACT to the Project, where feasible. The facility will comply with applicable federal, state, and ICAPCD rules and regulations.
40 CFR Part 68 (RMP), 19 CCR Sections 2735.1 to 2785.1 (CalARP Program), and California Health and Safety Code (CHSC) Sections 25531 to 25541	Prevents or minimizes accidental releases of acutely hazardous substances that can cause serious harm to the public and the environment.	EPA Region 9 Department of Toxic Substances Control (DTSC) Imperial Certified Unified Program Agency (CUPA)	A vulnerability analysis will be performed to assess potential risks from a spill or rupture from any affected storage tank, if required. An RMP is not expected to be required.
CHSC Section 25249.5 et seq. (Safe Drinking Water and Toxic Enforcement Act of 1986—Proposition 65)	Provides notification of Proposition 65 chemicals.	OEHHA	The facility will determine Proposition 65 status and comply with all signage and notification requirements, as applicable. See Sections 5.5 and 5.15 for additional discussion regarding hazardous materials and water quality, respectively.

LORS	Purpose	Regulating Agency	Project Conformance
CHSC Sections 25500 to 25510	Establishes requirements for developing business and area plans relating to the handling and release of hazardous materials.	State Office of Emergency Services DTSC Imperial CUPA	An HMBP, including a hazardous materials inventory and emergency response plan, will be prepared for distribution to affected agencies, as required. Additionally, releases of hazardous materials will be immediately reported to affected agencies, as required. See Section 5.5 for additional discussion regarding hazardous materials.
CHSC Section 44300 to 44384 (Air Toxics "Hot Spots" Information and Assessment Act—AB 2588)	AB 2588 requires the development of a statewide inventory of TAC emissions from stationary sources. The program requires affected facilities to: (1) prepare an emissions inventory plan that identifies relevant TACs and sources of TAC emissions; (2) prepare an emissions inventory report quantifying TAC emissions; and (3) prepare an HRA, if necessary, to quantify the health risks to the exposed public. Facilities with significant health risks must notify the exposed population, and in some instances must implement RMPs to reduce the associated health risks.	CARB OEHHA ICAPCD	The Project will participate in the AB 2588 inventory and reporting program, as required and implemented by ICAPCD. Based on the HRA results presented in Section 5.9.3.5, the Project's cancer and chronic health risks do not exceed acceptable levels. Although acute health risks may potentially exceed acceptable levels, they will be minimized to the extent technically feasible through the use of TBACT.
40 CFR Part 63 and ICAPCD Regulation X	Establishes National Emission Standards for Hazardous Air Pollutants (NESHAP). [a]	EPA Region 9 ICAPCD	The Project will comply with applicable NESHAP, including hexavalent chromium emissions from cooling towers and emissions from engines.
ICAPCD Rule 207	Requires preconstruction review and permitting of new or modified stationary sources of air pollution, including air toxics.	ICAPCD	An Authority to Construct and Permit to Operate will be obtained from ICAPCD prior to construction and operation of the Project, respectively. As a result, the Project will comply with the ICAPCD's permitting requirements.

[a] These are standards for air pollutants identified by the EPA as causing or contributing to the adverse health effects of air pollution but for which NAAQS have not been established.

Note:

HMBP = Hazardous Materials Business Plan

5.9.8 Agency Jurisdiction and Contacts

Table 5.9-13 presents the contact information for each agency contacted during the development of this Project which may exercise jurisdiction of public health issues and permitting.

Table 5.9-13. Agency Contacts for Public Health

Public Health Concern	Agency	Contact
Public exposure to air pollutants	CEC	Mr. Joseph Hughes Air Resources Supervisor 1 California Energy Commission 715 P Street Sacramento, CA 95814 Phone: 916-980-7951 E-mail: Joseph.Hughes@energy.ca.gov
	ICAPCD	Jesus Ramirez APC Division Manager 150 S. 9th Street El Centro, CA 92243-2839 Phone: 442-265-1800 E-mail: jesusramirez@co.imperial.ca.us

5.9.9 Permit Requirements and Schedules

Agency-required permits or plans related to public health may include an HMBP and an ICAPCD-issued Authority to Construct/Permit to Operate. These requirements are discussed in detail in Sections 5.5 and 5.1, respectively.

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Appendix 5.9A
Operational Health Risk Assessment

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.9A ENGP_OpsHRA_20231106_Protect.xlsx”

Appendix 5.9B
Construction Health Risk Assessment

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.9B ENGP_ConstructionHRA_20230403_Protect.xlsx”

Attachment DRR 12-1
Cumulative Impacts Analysis Modeling Report

Jacobs

Air Dispersion Modeling Report for Black Rock, Elmore North, and Morton Bay Geothermal Projects

Revision No: 0

Black Rock, Elmore North, and Morton Bay Geothermal Projects
Black Rock Geothermal LLC, Elmore North Geothermal LLC, and Morton Bay Geothermal LLC
23-AFC-03, 23-AFC-02, and 23-AFC-01

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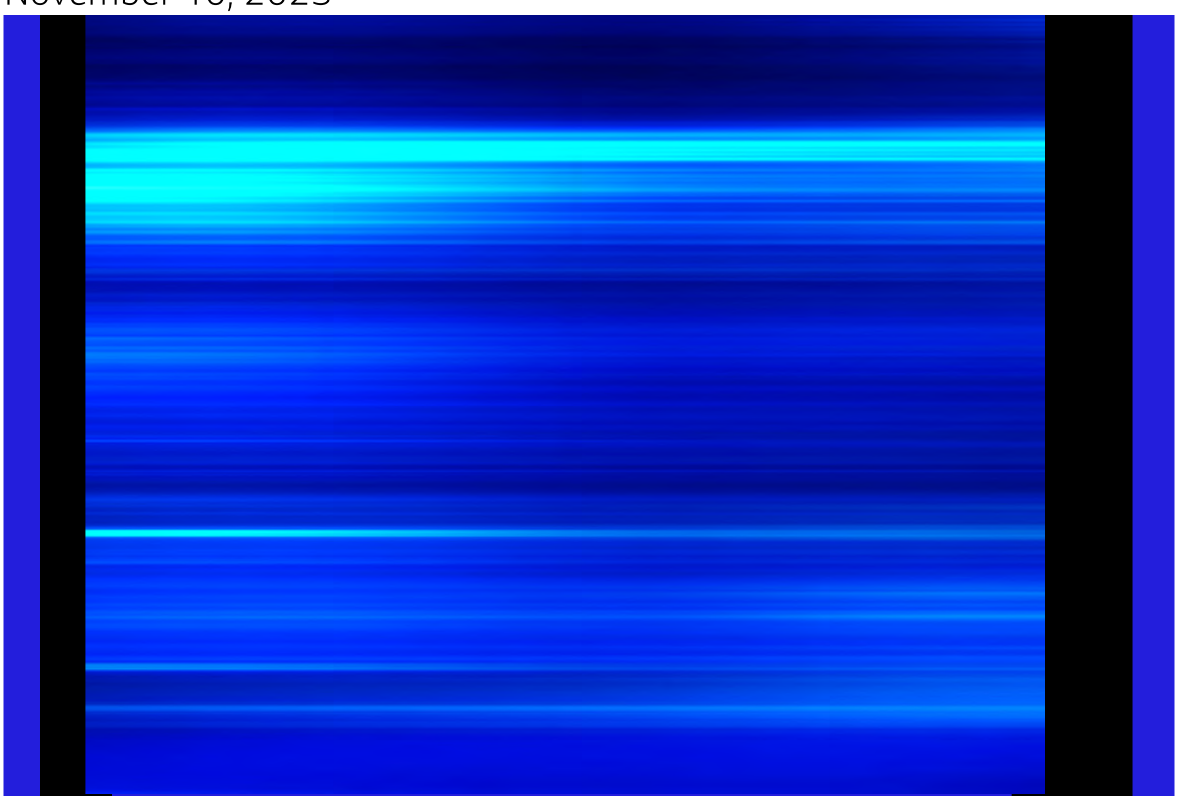

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Acronyms and Abbreviations

AFC	Application for Certification
Applicant	Morton Bay Geothermal LLC, Black Rock Geothermal LLC, or Elmore North Geothermal LLC
BHER	BHE Renewables, LLC
BRGP	Black Rock Geothermal Project
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CEC	California Energy Commission
CEQA	California Environmental Quality Act
CFR	*Code of Federal Regulations*
CO	carbon monoxide
ENGP	Elmore North Geothermal Project
EPA	U.S. Environmental Protection Agency
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
ICAPCD	Imperial County Air Pollution Control District
lbs/day	pound(s) per day
MBGP	Morton Bay Geothermal Project
MTU	Mobile Testing Unit
NAAQS	National Ambient Air Quality Standards
NO_2	nitrogen dioxide
NO_X	oxides of nitrogen
$PM_{2.5}$	particulate matter less than 2.5 micrometers in diameter
PM_{10}	particulate matter less than 10 micrometers in diameter
PSD	Prevention of Significant Deterioration
SIL	Significant Impact Levels
SO_2	sulfur dioxide
VOC	volatile organic compound

1. Project Overview

BHE Renewables, LLC (BHER) is the owner of three subsidiaries, Black Rock Geothermal LLC, Elmore North Geothermal LLC, and Morton Bay Geothermal LLC (the Applicants). The Applicants each submitted an Application for Certification (AFC) to the California Energy Commission (CEC) on April 18, 2023[1] for their respective geothermal power plant projects. In response to the AFCs, the CEC issued Data Request Set 1 for each project on August 31, 2023 (Docket Numbers 23-AFC-03, TN #252096; 23-AFC-02, TN #252098; and 23-AFC-01, TN #252095, respectively). Specifically, each data request states the following: "Please provide an update on the cumulative impacts analyses mentioned in the AFC." This document provides the results of the cumulative impact analyses conducted for the Black Rock Geothermal Project (BRGP), Elmore North Geothermal Project (ENGP), and Morton Bay Geothermal Project (MBGP).

The goal of this cumulative impact analysis was to determine the potential ambient air concentrations through modeling that result from construction and operation of each project in addition to existing background concentrations, existing nearby sources of air pollution not represented in the background monitoring data, and future development (including these three geothermal power plant projects). The cumulative impact analysis is used to determine the cumulative impacts and exposure that may be experienced in the area surrounding a specific project. This cumulative air quality impacts analysis outlines the methodology used to determine what sources of air pollution were considered in the modeling analysis and the associated cumulative impacts in the surrounding area. The methodology and results presented in this modeling report generally align with the specific models, data, and approach specified in Section 5.1 of each of the AFCs and this report serves as an addendum to those modeling analyses.

[1] The CEC websites for the projects are:

- https://www.energy.ca.gov/powerplant/steam-turbine/black-rock-geothermal-project-brgp,
- https://www.energy.ca.gov/powerplant/steam-turbine/elmore-north-geothermal-project-engp, and
- https://www.energy.ca.gov/powerplant/steam-turbine/morton-bay-geothermal-project-mbgp.

2. Area and Facility Classification

The projects would be situated to the southeast of the Salton Sea, southwest from the town of Niland, in Imperial County, California. Being located in California, the projects would be subject to both the National Ambient Air Quality Standards (NAAQS) and the California Ambient Air Quality Standards (CAAQS).

The primary North American Industrial Classification System for each facility is 221116. The projects are not expected to be "major" sources of air pollution because each facility would emit less than 100 tons per year of any regulated pollutant. Additionally, each facility is expected to be a minor source for hazardous air pollutants (HAPs), with total potential aggregate HAP emissions of less than 25 tons per year and emissions of any single HAP of less than 10 tons per year. These projects are not listed facilities in 40 *Code of Federal Regulations* (CFR) Part 52 (100 tons per year threshold) and are not otherwise subject to Part 52 Prevention of Significant Deterioration (PSD) requirements because potential emissions would be less than 250 tons per year per criteria air pollutant for which the area is designated as being in attainment. Each facility's emissions are also expected to be below the applicable Nonattainment New Source Review thresholds of 100 tons per year for moderate nonattainment particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and 100 tons per year each for oxides of nitrogen (NO_X) and for volatile organic compounds (VOCs) for the marginal nonattainment ozone designation as per 40 CFR Part 51.165.

Imperial County is designated as being in attainment for the carbon monoxide (CO), sulfur dioxide (SO_2), and nitrogen dioxide (NO_2) NAAQS. The county is in moderate nonattainment for $PM_{2.5}$, and marginal nonattainment for the 8-hour ozone NAAQS. Particulate matter less than 10 micrometers in diameter (PM_{10}) was redesignated to attainment in September 2020.

At the state level, Imperial County is designated as being in attainment or being unclassified for the $PM_{2.5}$, CO, NO_2, SO_2, sulfates, lead, hydrogen sulfide (H_2S), and visibility reducing particulates CAAQS. The county is designated as nonattainment for the ozone and PM_{10} CAAQS.

The closest and most representative ambient air monitoring data to the project sites are from the following monitoring stations, as shown on Figure 2-1:

- Niland – English Road (AQS ID: 60254004) [2.3 to 7.6 miles from the projects]
- Brawley – 220 Main Street (AQS ID: 60250007) [13.8 to 15.7 miles from the projects]
- El Centro – 9th Street (AQS ID: 60251003) [26.1 to 28.4 miles from the projects]
- Calexico – Ethel Street (AQS ID: 60250005) [34.6 to 36.9 miles from the project]

Table 2-1 provides a summary from the AFCs of measured ambient air quality concentrations by year and site for the period 2019 through 2021. Data from these sites are a reasonable representation of background air quality for the project areas.

Figure 2-1
Nearby Ambient Air Monitoring Stations
BRGP, ENGP, and MBGP
Imperial County, California

Jacobs

Table 2-1. Measured Ambient Air Quality Concentrations by Year

Pollutant	Units	Averaging Time	Basis	Site	2019	2020	2021
Ozone	ppm	1-hour	CAAQS-1st High	Niland	0.06	0.054	0.065
		8-hour	CAAQS-1st High	Niland	0.055	0.046	0.055
			NAAQS-4th High	Niland (2019) and Calexico (2020-2021)	0.054	0.078	0.080
NO_2	ppb	1-hour	CAAQS-1st High	El Centro	37	45	56
			NAAQS-98th percentile	El Centro	30	36	38
		Annual	CAAQS/NAAQS-AAM	El Centro (2020-2021) and Calexico (2019)	9.26	7.93	6.73
CO	ppm	1-hour	CAAQS/NAAQS-2nd High	Calexico	4.30	4.60	3.80
		8-hour	CAAQS/NAAQS-2nd High	Calexico	3.10	2.70	2.90
SO_2	ppb	1-hour	CAAQS/NAAQS-1st High	Calexico	7.5	7.1	8.6
		24-hour	CAAQS/NAAQS-1st High	Calexico	1.6	1.9	2.7
		Annual	CAAQS/NAAQS-AAM	Calexico	0.31	0.4	0.42
PM_{10}	$\mu g/m^3$	24-hour	CAAQS-1st High	Niland	156.3	241.3	218.2
			NAAQS-2nd High	Niland	124	142	156
		Annual	CAAQS-AAM	Niland	32.7	35.9	39.8
$PM_{2.5}$	$\mu g/m^3$	24-hour	NAAQS-98th percentile	Brawley	21.0	21.0	21.0
		Annual	CAAQS/NAAQS-AAM	Brawley (2019-2020) and El Centro (2021)	8.30	9.40	8.30

Notes:

$\mu g/m^3$ = microgram(s) per cubic meter

AAM = annual arithmetic mean

ppb = part(s) per billion

ppm = part(s) per million

The maximum representative background concentrations for the 3-year evaluation period (2019 through 2021) are summarized in Table 2-2. These background values represent the highest values reported for the most representative air quality monitoring site during any single year of the 3-year evaluation period for the CAAQS assessments. These CAAQS maximums are conservatively used for some of the NAAQS modeling assessments (CO and SO_2). The appropriate values for the NAAQS, according to the format of the standard, are used for the remainder of the NAAQS modeling assessments (NO_2, PM_{10}, and PM_{25}), and also summarized in Table 2-2.

Table 2-2. Background Air Quality Data

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

[a] Where applicable, monitored concentrations were converted from ppm/ppb to μg/m^3 using the standard molar volume of air at normal temperature and pressure conditions of 24.45 liters per mole.

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

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

3. Project Air Quality Impact Analysis Summary

The following section presents the results of the air quality impact analyses from each AFC for determining the changes to ambient air quality concentrations in the region as a result of each project's operation and construction.

3.1 Project Operation

As can be seen in Table 3-1 through Table 3-3, operation impacts are less than the U.S. Environmental Protection Agency's (EPA) Significant Impact Levels (SILs) for all pollutants and averaging periods except $PM_{2.5}$ (for all projects) and PM_{10} (for ENGP and MBGP). For pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis may be required. The 24-hour and annual $PM_{2.5}$ predicted concentrations exceed their respective SILs for each project. Therefore, a cumulative modeling analysis was conducted for 24-hour and annual $PM_{2.5}$. Although 24-hour PM_{10} predicted concentrations for ENGP and MBGP also exceeded the SIL, a cumulative modeling analysis was not conducted for PM_{10}, as noted later in this report.

Table 3-1. BRGP Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m³)	Class II SIL (µg/m³)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximum (NAAQS)	1.17	7.55	No
	Annual maximum	0.07	1.00	No
Ozone	8-hour maximum	0.01	1.96	No
CO	1-hour maximum	828	2,000	No
	8-hour maximum	83.5	500	No
SO_2	1-hour maximum	<0.01	7.86	No
	3-hour maximum	<0.01	25.0	No
	24-hour maximum	<0.01	5.00	No
	Annual maximum	<0.01	1.00	No
PM_{10}	24-hour maximum	4.48	5.00	No
	Annual maximum	0.41	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maximum (NAAQS)	1.91	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.23	0.20	Yes

Table 3-2. ENGP Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximum (NAAQS)	1.37	7.55	No
	Annual maximum	0.06	1.00	No
Ozone	8-hour maximum	0.01	1.96	No
CO	1-hour maximum	1,421	2,000	No
	8-hour maximum	114	500	No
SO_2	1-hour maximum	<0.01	7.86	No
	3-hour maximum	<0.01	25.0	No
	24-hour maximum	<0.01	5.00	No
	Annual maximum	<0.01	1.00	No
PM_{10}	24-hour maximum	7.11	5.00	Yes
	Annual maximum	0.64	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maximum (NAAQS)	3.08	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.36	0.20	Yes

Table 3-3. MBGP Operation Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximum (NAAQS)	1.37	7.55	No
	Annual maximum	0.06	1.00	No
Ozone	8-hour maximum	<0.01	1.96	No
CO	1-hour maximum	1,327	2,000	No
	8-hour maximum	120	500	No
SO_2	1-hour maximum	<0.01	7.86	No
	3-hour maximum	<0.01	25.0	No
	24-hour maximum	<0.01	5.00	No
	Annual maximum	<0.01	1.00	No
PM_{10}	24-hour maximum	7.23	5.00	Yes

Pollutant	Averaging Period	Maximum Concentration (µg/m³)	Class II SIL (µg/m³)	Exceeds Class II SIL?
	Annual maximum	0.71	1.00	No
$PM_{2.5}$	5-year average of 24-hour yearly maximum (NAAQS)	3.18	1.20	Yes
	5-year average of annual concentrations (NAAQS)	0.41	0.20	Yes

As shown in Table 3-2 and Table 3-3, the ENGP and MBGP, respectively, are expected to have maximum impacts that exceed the 24-hour SIL for PM_{10}. However, each project's emissions are expected to be less than the Imperial County Air Pollution Control District (ICAPCD) Rule 207 PM_{10} offset threshold of 137 pounds per day (lbs/day) and California Environmental Quality Act (CEQA) PM_{10} significance threshold of 150 lbs/day, as presented in Table 3-8. Furthermore, each project will implement Best Available Control Technology to reduce particulate matter emissions from cooling towers and to minimize emissions from diesel combustion by using Tier 3-certified fire pumps and Tier 4-certified emergency generators. Thus, each project would have a less-than-significant impact for PM_{10} and not require further analysis, including a cumulative impacts analysis.[2]

Table 3-4. ENGP and MBGP Operational PM_{10} Emissions

Project	Project Operational Emissions	Significance Threshold	Purpose	Exceeds Threshold?
ENGP	81.7 lbs/day[a]	137 lbs/day	Offset	No
	83.6 lbs/day[b]	150 lbs/day	CEQA	No
MBGP	87.0 lbs/day[a]	137 lbs/day	Offset	No
	88.9 lbs/day[b]	150 lbs/day	CEQA	No

[a] Emissions do not include operations and maintenance activities, which are not subject to permitting, and assume a maximum of two diesel-fired emergency generators would operate up to two hours per day for maintenance and testing at each facility.

[b] Emissions include those associated with operations and maintenance activities.

3.2 Project Construction

As can be seen in Table 3-5 through Table 3-7, construction impacts for each project are less than the EPA SILs for all pollutants and averaging periods except 1-hour and annual NO_2, 24-hour and annual PM_{10}, and annual $PM_{2.5}$. For pollutants and averaging periods with a predicted concentration that is not significant (that is, if they are less than the SIL), the modeling is complete for that pollutant and averaging period and compliance with the NAAQS/CAAQS is demonstrated by not causing or contributing to a violation. If impacts are above the SIL, a cumulative modeling analysis may be required. The 1-hour and annual NO_2 and annual $PM_{2.5}$ predicted concentrations exceed their respective SILs. Therefore, a cumulative modeling analysis was conducted for 1-hour and annual NO_2 and annual $PM_{2.5}$. Although 24-hour and annual PM_{10} predicted concentrations also exceed their respective SILs, a cumulative modeling analysis was not conducted for PM_{10}, as discussed later in this report.

[2] PM_{10} background concentrations already exceed the CAAQS; therefore, a cumulative impacts analysis for PM_{10} does not provide any additional value.

Table 3-5. BRGP Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximums (NAAQS)	56.1	7.55	Yes
	Annual maximum	10.2	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	116	2,000.00	No
	8-hour maximum	93.2	500.00	No
SO_2	1-hour maximum	0.31	7.86	No
	3-hour maximum	0.28	25.0	No
	24-hour maximum	0.15	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	5.60	5.00	Yes
	Annual maximum	1.11	1.00	Yes
$PM_{2.5}$	5-year average of 24-hour yearly maximums (NAAQS)	1.00	1.20	No
	5-year average of annual concentrations (NAAQS)	0.22	0.20	Yes

Table 3-6. ENGP Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximums (NAAQS)	55.0	7.55	Yes
	Annual maximum	10.1	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	134	2,000.00	No
	8-hour maximum	107	500.00	No
SO_2	1-hour maximum	0.31	7.86	No
	3-hour maximum	0.28	25.0	No
	24-hour maximum	0.17	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	7.23	5.00	Yes

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
$PM_{2.5}$	Annual maximum	1.27	1.00	Yes
	5-year average of 24-hour yearly maximums (NAAQS)	1.13	1.20	No
	5-year average of annual concentrations (NAAQS)	0.23	0.20	Yes

Table 3-7. MBGP Construction Air Quality Impact Results – Significant Impact Levels

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Class II SIL (µg/m^3)	Exceeds Class II SIL?
NO_2	5-year average of 1-hour yearly maximums (NAAQS)	55.7	7.55	Yes
	Annual maximum	10.2	1.00	Yes
Ozone	8-hour	0.03	1.96	No
CO	1-hour maximum	135	2,000.00	No
	8-hour maximum	108	500.00	No
SO_2	1-hour maximum	0.32	7.86	No
	3-hour maximum	0.29	25.00	No
	24-hour maximum	0.17	5.00	No
	Annual maximum	0.11	1.00	No
PM_{10}	24-hour maximum	7.37	5.00	Yes
	Annual maximum	1.35	1.00	Yes
$PM_{2.5}$	5-year average of 24-hour yearly maximums (NAAQS)	1.15	1.20	No
	5-year average of annual concentrations (NAAQS)	0.24	0.20	Yes

Each project is expected to have maximum impacts that exceed the 24-hour and annual PM_{10} SILs. However, the Project Owners will implement construction control measures as described in Section 5.1.7.2.2 of each AFC. These control measures would reduce particulate emissions to the levels required by the ICAPCD, thus making the projects consistent with attainment plans for the PM_{10} standards. Additionally, the PM_{10} emissions associated with construction of each project, as presented in Table 3-8, are less than the CEQA significance threshold of 150 lbs/day. Therefore, each project's construction would likely result in less-than-significant impacts with respect to PM_{10} emissions and they do not require further analysis, including a cumulative impacts analysis.[3]

Table 3-8. BRGP, ENGP, and MBGP Construction PM_{10} Emissions

Project	Project Construction Emissions	Significance Threshold	Purpose	Exceeds Threshold?
BRGP	23.6 lbs/day	150 lbs/day	CEQA	No
ENGP	23.6 lbs/day	150 lbs/day	CEQA	No
MBGP	23.1 lbs/day	150 lbs/day	CEQA	No

[3] PM_{10} background concentrations already exceed the CAAQS; therefore, a cumulative impacts analysis for PM_{10} does not provide any additional value.

4. Cumulative Impact Analysis Methodology

4.1 Applicable Pollutants and Averaging Periods

4.1.1 Project Operation

Operational emissions from the BRGP, ENGP, and MBGP would result in modeled impacts that exceed the SILs for 24-hour and annual $PM_{2.5}$, as illustrated in Table 3-1 through Table 3-3, thus requiring a cumulative impact analysis based on the potential to cause or contribute to a violation of the NAAQS.[4] The significant impact radius for each of these pollutant averaging periods is included in Table 4-1. Appendix A includes the receptor locations with modeled impacts greater than the SIL for each of these pollutant averaging periods.

Table 4-1. BRGP, ENGP, and MBGP Operation Impacts – Significant Impact Radius

Project	Pollutant	Averaging Period	Significant Impact Radius (km)
BRGP	$PM_{2.5}$	24-hour	0.1
		Annual	<0.1
ENGP	$PM_{2.5}$	24-hour	0.3
		Annual	0.2
MBGP	$PM_{2.5}$	24-hour	0.3
		Annual	0.2

At the request of the CEC, 1-hour H_2S also was included in this cumulative impacts analysis for operations. The H_2S analysis considers H_2S emissions from routine operation of each facility, consistent with discussion provided in Section 5.1.9.6 of each AFC. Note that the Mobile Testing Unit (MTU) operations are not included in this cumulative analysis as those operations would vary both spatially and temporally and would not likely occur concurrently with MTU operations at other facilities included in this analysis.

4.1.2 Project Construction

Construction emissions from the BRGP, ENGP, and MBGP would result in modeled impacts that exceed the SILs for 1-hour and annual NO_2 and annual $PM_{2.5}$, as illustrated in Table 3-5 through Table 3-7, thus requiring a cumulative impact analysis based on the potential to cause or contribute to a violation of the NAAQS.[5] The significant impact radius for each of these pollutant averaging periods for each project is presented in Table 4-1 through Table 4-3. Appendix B includes the receptor locations with modeled impacts greater than the SIL for each of these pollutant averaging periods.

[4] Although the ENGP and MBGP also result in modeled impacts that exceed the SIL for 24-hour PM_{10}, a cumulative impacts analysis was not conducted for PM_{10} based on the discussion provided in Section 3.1.

[5] Although the projects also result in modeled impacts that exceed the SILs for 24-hour and annual PM_{10}, a cumulative impacts analysis was not conducted for PM_{10} based on the discussion provided in Section 3.2.

Table 4-2. BRGP Construction Impacts – Significant Impact Radius

Pollutant	Averaging Period	Significant Impact Radius (km)
NO_2	1-hour	10
	Annual	1.7
$PM_{2.5}$	Annual	<0.1

Table 4-3. ENGP Construction Impacts – Significant Impact Radius

Pollutant	Averaging Period	Significant Impact Radius (km)
NO_2	1-hour	10
	Annual	1.9
$PM_{2.5}$	Annual	<0.1

Table 4-4. MBGP Construction Impacts – Significant Impact Radius

Pollutant	Averaging Period	Significant Impact Radius (km)
NO_2	1-hour	10
	Annual	1.9
$PM_{2.5}$	Annual	<0.1

4.2 Analysis of Nearby Existing Sources

A review of existing and permitted sources of $PM_{2.5}$ and NO_2 air pollution surrounding the projects yields multiple geothermal power plants, agricultural operations, and the Salton Sea as a source of naturally occurring air pollution.

As presented in Section 2, the associated $PM_{2.5}$ and NO_2 background monitoring data were obtained from the Brawley monitoring site south of the projects and the El Centro monitoring site south of the projects. Each of these monitoring sites is located in an urban area with nearby major vehicle-related emissions sources. Specifically, the Brawley monitor is located adjacent to State Route 86 (Main Street) and near South 1st Street, both of which represent major vehicle routes in the area. Similarly, the El Centro monitor is located near multiple arterial streets, with Interstate 8 located approximately 1 mile to the south.

As per the California Air Resources Board (CARB) Criteria Pollutant Emission Inventory Data[6], windblown dust is the major contributor to $PM_{2.5}$ emissions within Imperial County. Emissions from windblown dust would be generated in predominantly undeveloped areas and would result in regional impacts that are generally not localized. Therefore, these regional impacts would be expected to occur both around the town of Brawley and the project areas because all areas are surrounded by undeveloped land in most directions. The proposed project sites also are surrounded by the Salton Sea from the west to the north, which is not a source of fugitive $PM_{2.5}$ dust. Accordingly, background concentrations from the monitoring data represent conservative estimates of windblown $PM_{2.5}$ impacts at the project sites. As a

[6] CARB's emissions inventory data is available at: https://ww2.arb.ca.gov/applications/cepam2019v103-standard-emission-tool.

result, no existing areas of fugitive sources of pollution are proposed to be included in the cumulative impacts analysis.

Apart from windblown dust, onroad vehicles are a greater contributor of $PM_{2.5}$ emissions within Imperial County than electric utilities. With the background monitors being located near arterial streets, an interstate, and a highway, the background concentration reflects a potentially higher localized $PM_{2.5}$ loading than would likely occur from the stationary sources of emissions near the projects. Therefore, the background concentrations from the monitoring data represent conservative estimates of ambient air concentrations and nearby stationary source $PM_{2.5}$ impacts at the project sites. As a result, no existing stationary sources of pollution are proposed to be included in the cumulative impacts analysis.

Emissions resulting from the combustion of vehicles represents a large regional source of NO_2. With the background monitors being located near arterial streets, an interstate, and a highway, the background concentration reflects a potentially higher regional NO_2 loading caused by diesel traffic. Nearby sources of NO_2 would likely include emergency generators and agricultural equipment, both of which would operate intermittently and in potentially varying locations. Therefore, the background concentrations likely represent a higher concentration of NO_2 than would be observed surrounding the projects and should be considered representative of nearby operating sources. As a result, no existing sources of pollution are proposed to be included in the NO_2 cumulative impacts analysis.

4.3 Analysis of Nearby Proposed Sources

A review of other stationary emissions sources within a 6-mile radius that have received construction permits but are not yet operational or are in the permitting process (such as the New Source Review or CEQA permitting process) was performed. These stationary emissions sources were screened to include only new or modified sources (individual emission units) that would cause a net increase of 5 tons per year or more per modeled criteria pollutant. Therefore, VOC sources, equipment shutdowns, permit-exempt equipment registrations, rule compliance, permit renewals, and replacement/upgrading of existing systems will not be included in the cumulative impacts analysis. The facilities with sources identified for screening in the operational cumulative air quality impacts analysis are presented in Table 4-5.

Table 4-5. Cumulative Impacts Assessment – Facility List

CUP-0011	Project Name	Applicant	Area-Location	Phase	Greater than 5 TPY of $PM_{2.5}$, NO_2, or H_2S Emissions?	Include in Cumulative Analysis?
13-0031	Wilkinson Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
13-0032	Lindsey Solar Farm	8 Minute Energy	Niland	Pending Construction	No	No
17-0014	Midway Solar Farm IV	8 Minute Energy	Calipatria	Pending Construction	No	No
18-0040	Ormat Wister Solar	Omi 22 LLC/Ormat	Niland	Operational	No	No

CUP-0011	Project Name	Applicant	Area-Location	Phase	Greater than 5 TPY of $PM_{2.5}$, NO_2, or H_2S Emissions?	Include in Cumulative Analysis?
21-0021	Hell's Kitchen Geothermal Exploration Project	Controlled Thermal Resources	Niland	Entitlement Process[a]	N/A	No
20-0008	Energy Source Mineral ALTiS	Energy Source Minerals	Imperial County	Pending Construction	No	No
--	Black Rock Geothermal Project (BRGP)	Black Rock Geothermal LLC	Imperial County	AFC Under Review	Yes	Yes
--	Elmore North Geothermal Project (ENGP)	Elmore North Geothermal LLC	Imperial County	AFC Under Review	Yes	Yes
--	Morton Bay Geothermal Project (MBGP)	Morton Bay Geothermal LLC	Imperial County	AFC Under Review	Yes	Yes

[a] Hell's Kitchen Geothermal Exploration Project is in the entitlement process, which occurs before any air emissions-related permitting and licensing.

Notes:
N/A = Not applicable
tpy = ton(s) per year

As presented in Table 4-5, three proposed sources within 6 miles of BRGP, ENGP, or MBGP were identified as having emissions greater than 5 tons per year of $PM_{2.5}$, NO_2, or H_2S and are in the permitting process. Because none of the projects' operation is expected to overlap with construction, only their operational emissions will be considered in the operational cumulative impacts analysis. Similarly, because each project's construction is not expected to overlap with operation of each other, only their construction emissions will be considered in the construction cumulative impacts analysis. Therefore, it is proposed that the BRGP, ENGP, and MBGP operations be included in the H_2S and $PM_{2.5}$ cumulative air quality impacts analysis for operations and that the BRGP, ENGP, and MBGP construction be included in the NO_2 and $PM_{2.5}$ cumulative air quality impacts analysis for construction.

5. Cumulative Impact Analysis Inputs

The models, inputs, and supporting data used in this modeling analysis are consistent with each project's AFC ambient air quality analyses. Additional information on these data can be found in Sections 5.1.9 and 5.1.10 of each AFC, as follows:

- AFC Section 5.1.9.1 – Dispersion Model Selection and Options
  - AFC Section 5.1.9.1.1 – Meteorological Data
  - AFC Section 5.1.9.1.2 – Receptor Grid Selection and Coverage
  - AFC Section 5.1.9.1.3 – Ambient Air Boundary
  - AFC Section 5.1.9.1.4 – Building Downwash
  - AFC Section 5.1.9.1.5 – Rural Versus Urban Option
- AFC Section 5.1.9.2 – Source Characterization
  - AFC Section 5.1.9.2.1 – Project Operation
  - AFC Section 5.1.9.2.2 – Project Construction
- AFC Section 5.1.9.3 – Additional Model Selection
- AFC Section 5.1.9.4 – Oxides of Nitrogen Methodology
- AFC Section 5.1.9.6 – H2S Analysis
- AFC Section 5.1.9.7 – Model Outputs

A depiction of the model receptor grid and source layout for the operation and construction cumulative impact analyses is included as Figure 5-1 and Figure 5-2, respectively.

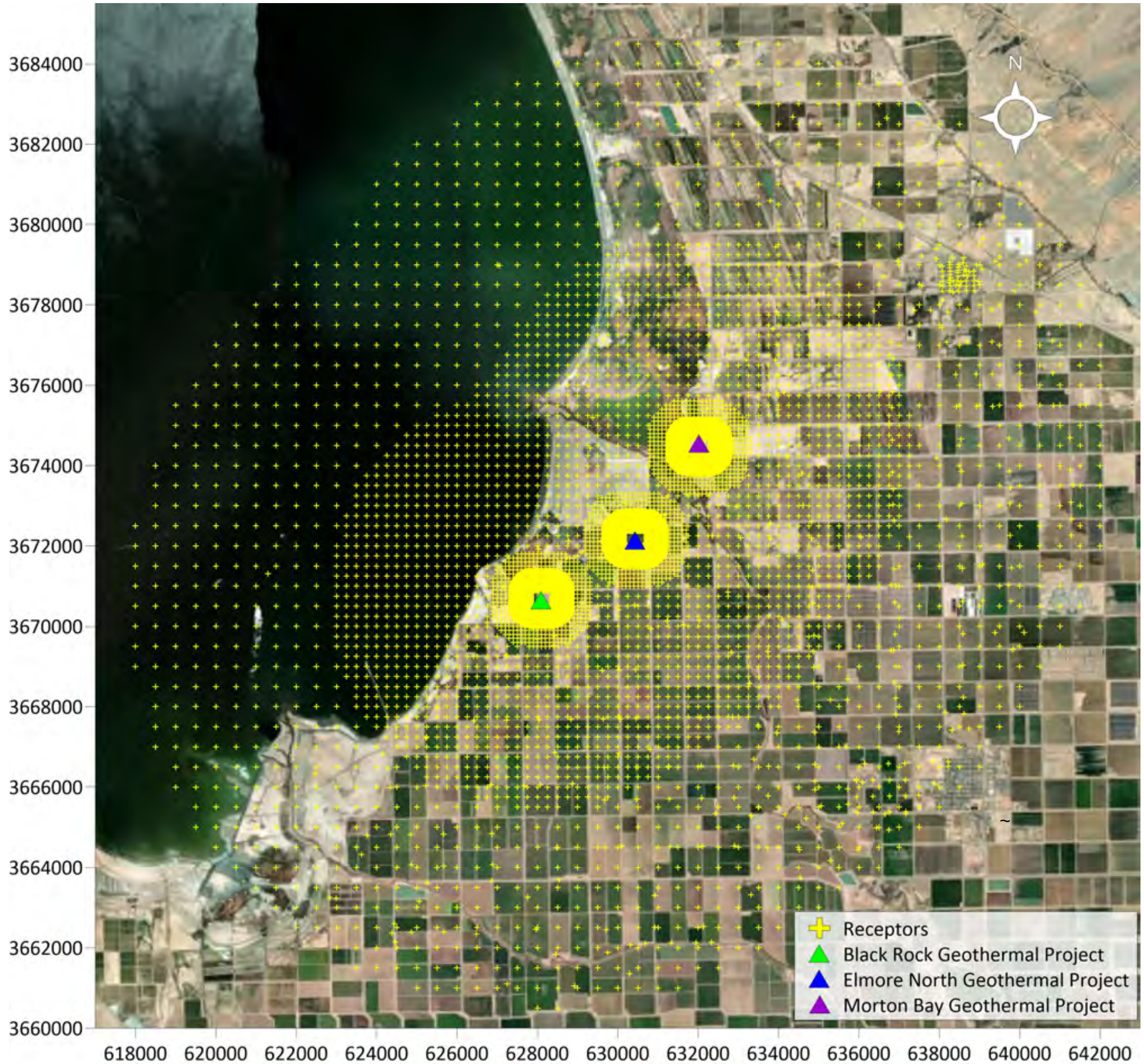


Figure 5-1
Operation Analysis Model Receptor Grid and Layout
BRGP, ENGP, and MBGP
Imperial County, California

Jacobs

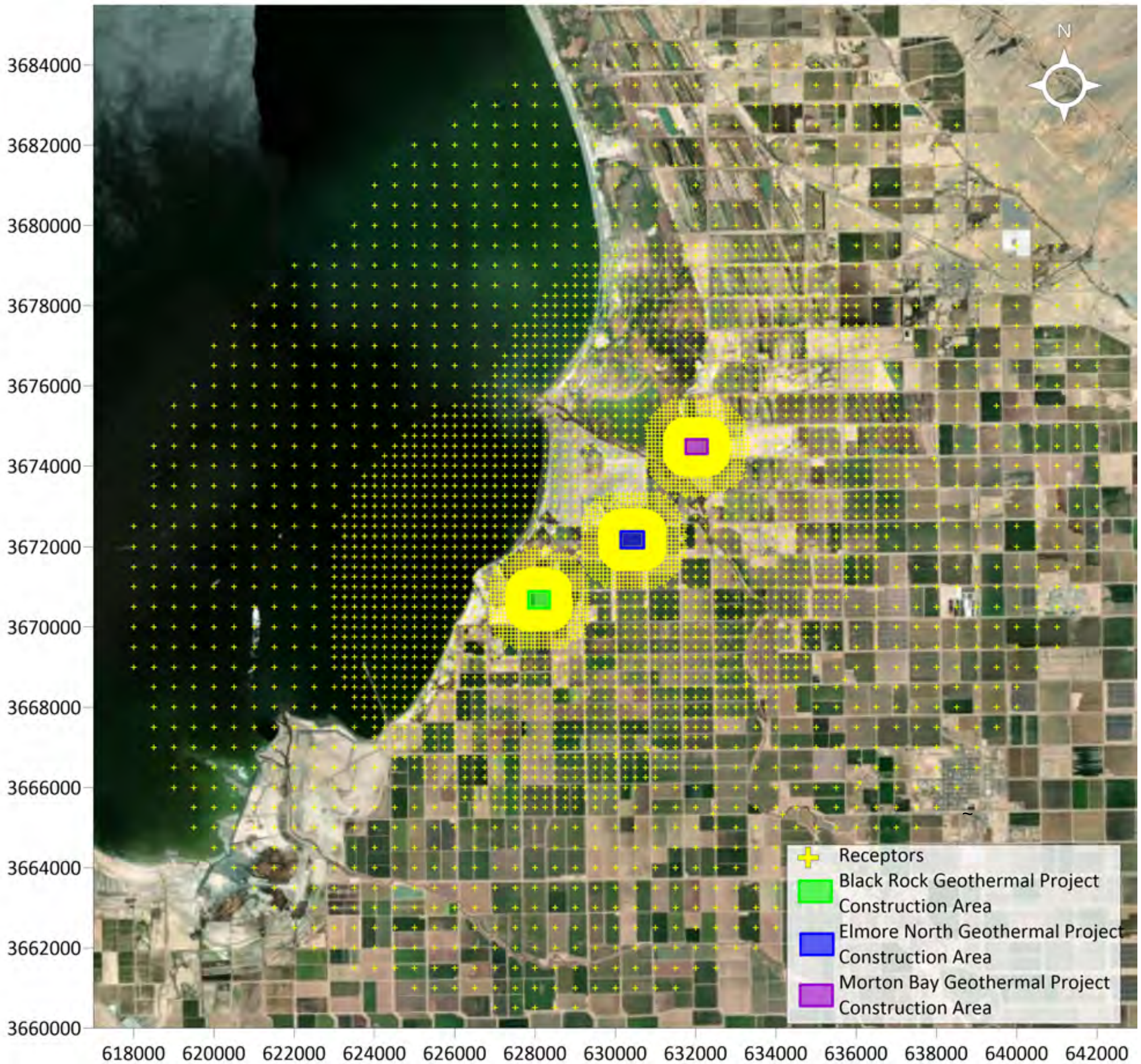


Figure 5-2
Construction Analysis Model Receptor Grid and Layout
BRGP, ENGP, and MBGP
Imperial County, California

Jacobs

6. Cumulative Impact Analysis Results

6.1 Project Operation

The cumulative impacts associated with the concurrent operation of BRGP, ENGP, and MBGP are presented in Table 6-1. The concentrations presented reflect the modeled impact associated with the concurrent operational emissions from each facility and their respective background concentration for comparison to the CAAQS and NAAQS. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS for each modeled pollutant. Thus, operation of each project would have a less-than-significant impact on ambient air quality.

Table 6-1. Cumulative Operation Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m^3)	CAAQS (µg/m^3)	NAAQS (µg/m^3)	Exceeds Standard?
H_2S	1-hour maximum (CAAQS)	37.5	--	37.5	42	--	No
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentile (NAAQS)	2.16	21.0	23.2	--	35	No
	Annual maximum (CAAQS)	0.43	9.40	9.83	12	--	No
	5-year average of annual concentrations (NAAQS)	0.41	8.67	9.08	--	12.0	No

Note:

-- = Not applicable and/or no standard

6.2 Project Construction

The cumulative impacts associated with the concurrent construction of BRGP, ENGP, and MBGP are presented in Table 6-2. The concentrations presented reflect the modeled impact associated with the concurrent construction-related emissions from each facility and their respective background concentration for comparison to the CAAQS and NAAQS. As shown, maximum combined impacts (modeled plus background) are less than all the CAAQS and NAAQS for each modeled pollutant. Thus, construction of each project would have a less-than-significant impact on ambient air quality.

Table 6-2. Cumulative Construction Air Quality Impact Results – Ambient Air Quality Standards

Pollutant	Averaging Period	Maximum Concentration (µg/m^3)	Background Concentration (µg/m^3)	Total Concentration (µg/m^3)	CAAQS (µg/m^3)	NAAQS (µg/m^3)	Exceeds Standard?
NO_2	1-hour maximum (CAAQS)	72.7	105	178	339	--	No
	5-year average of 1-hour yearly 98th percentile (NAAQS)	68.9	65.2	134	--	188	No
	Annual maximum	11.6	17.4	29.0	57	100	No
$PM_{2.5}$	5-year average of 24-hour yearly 98th percentile (NAAQS)	1.13	21.0	22.1	--	35	No
	Annual maximum (CAAQS)	0.28	9.40	9.68	12	--	No
	5-year average of annual concentrations (NAAQS)	0.27	8.67	8.94	--	12	No

Note:

-- = Not applicable and/or no standard

Appendix A
Operation Significant Impact Radius Figures

Figure A-1: Black Rock Operation 24-Hour $PM_{2.5}$ Significant Impact Radius

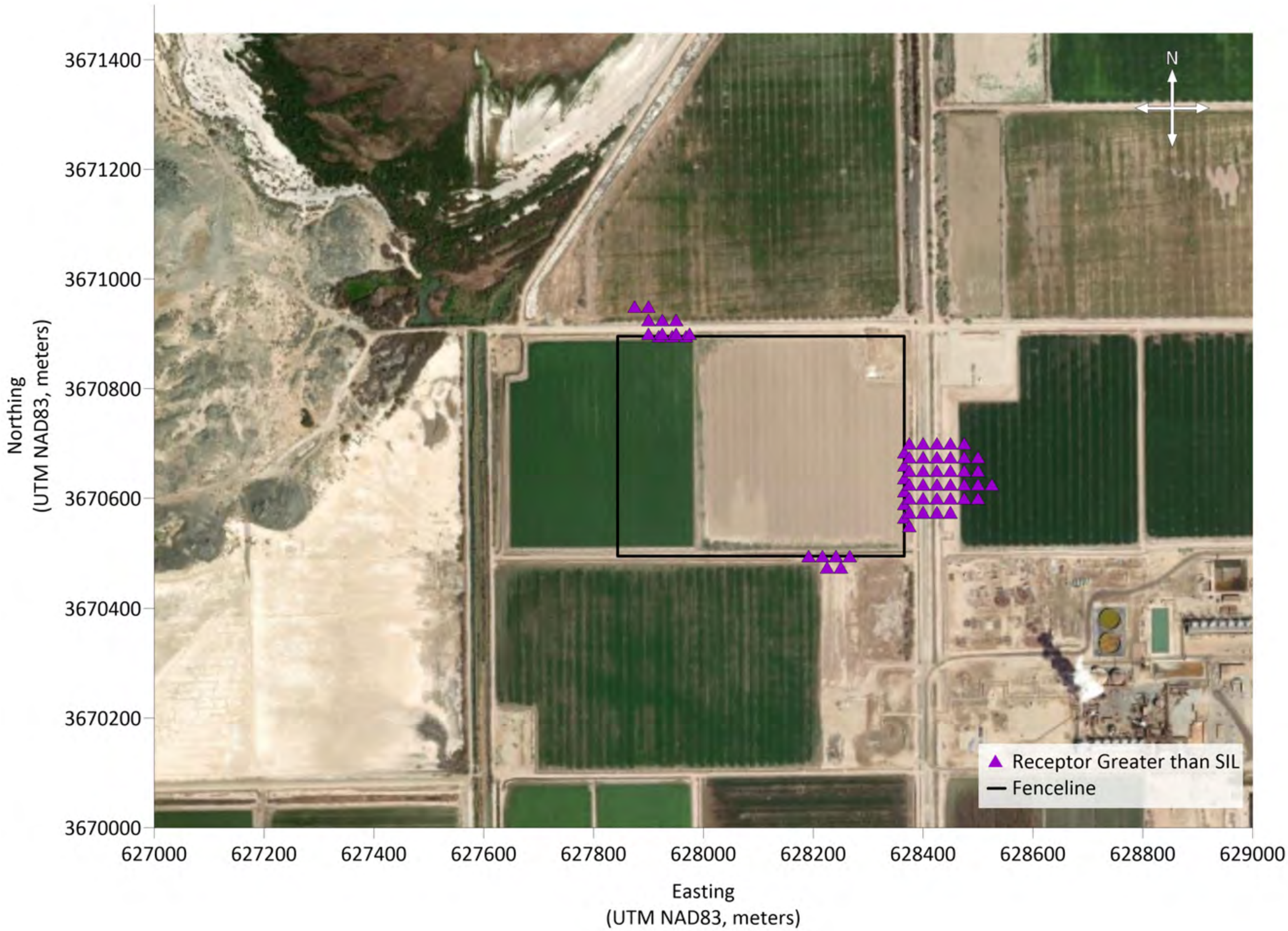


Figure A-2: Black Rock Operation Annual $PM_{2.5}$ Significant Impact Radius

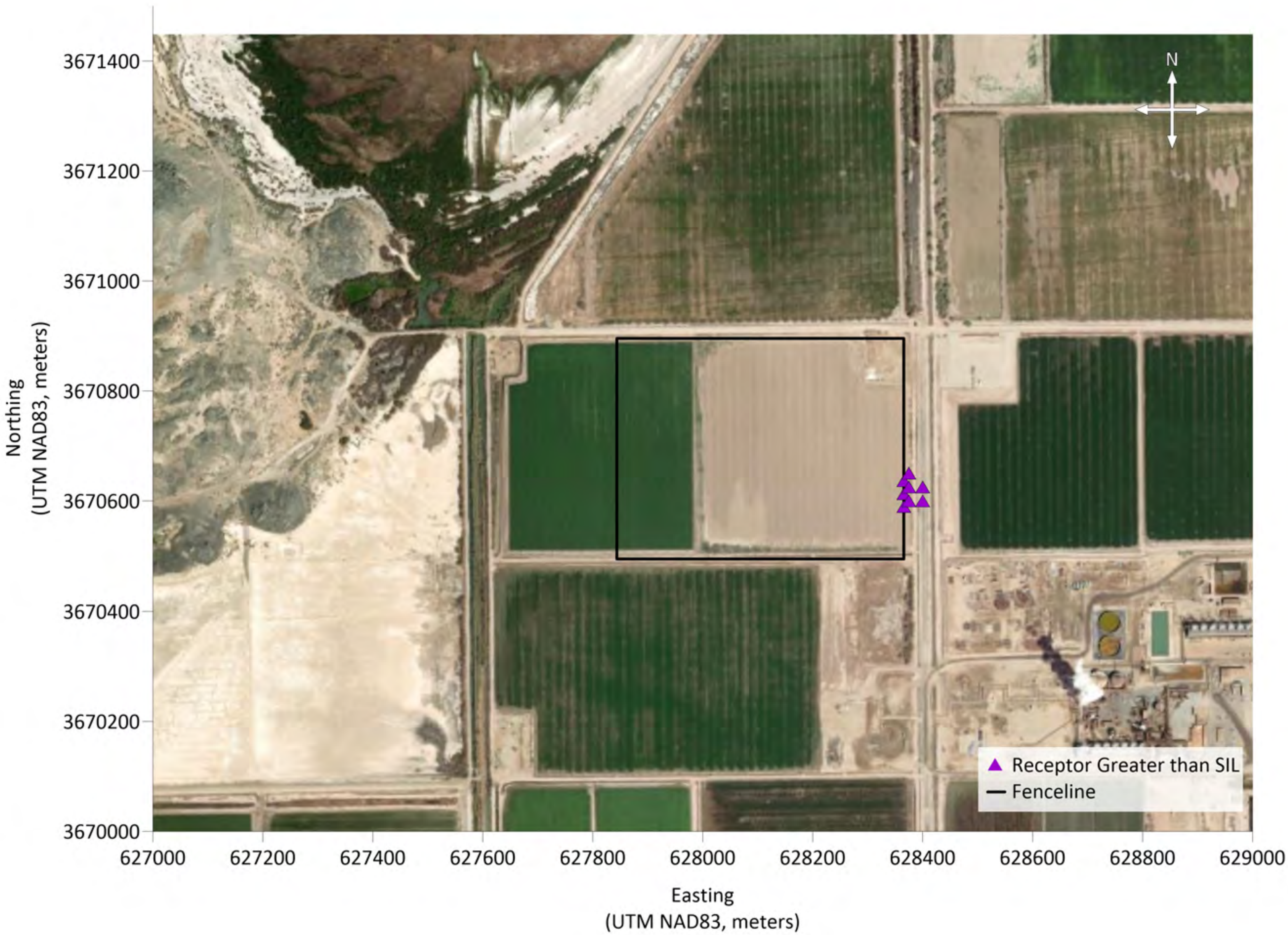


Figure A-3: Elmore North Operation 24-Hour $PM_{2.5}$ Significant Impact Radius

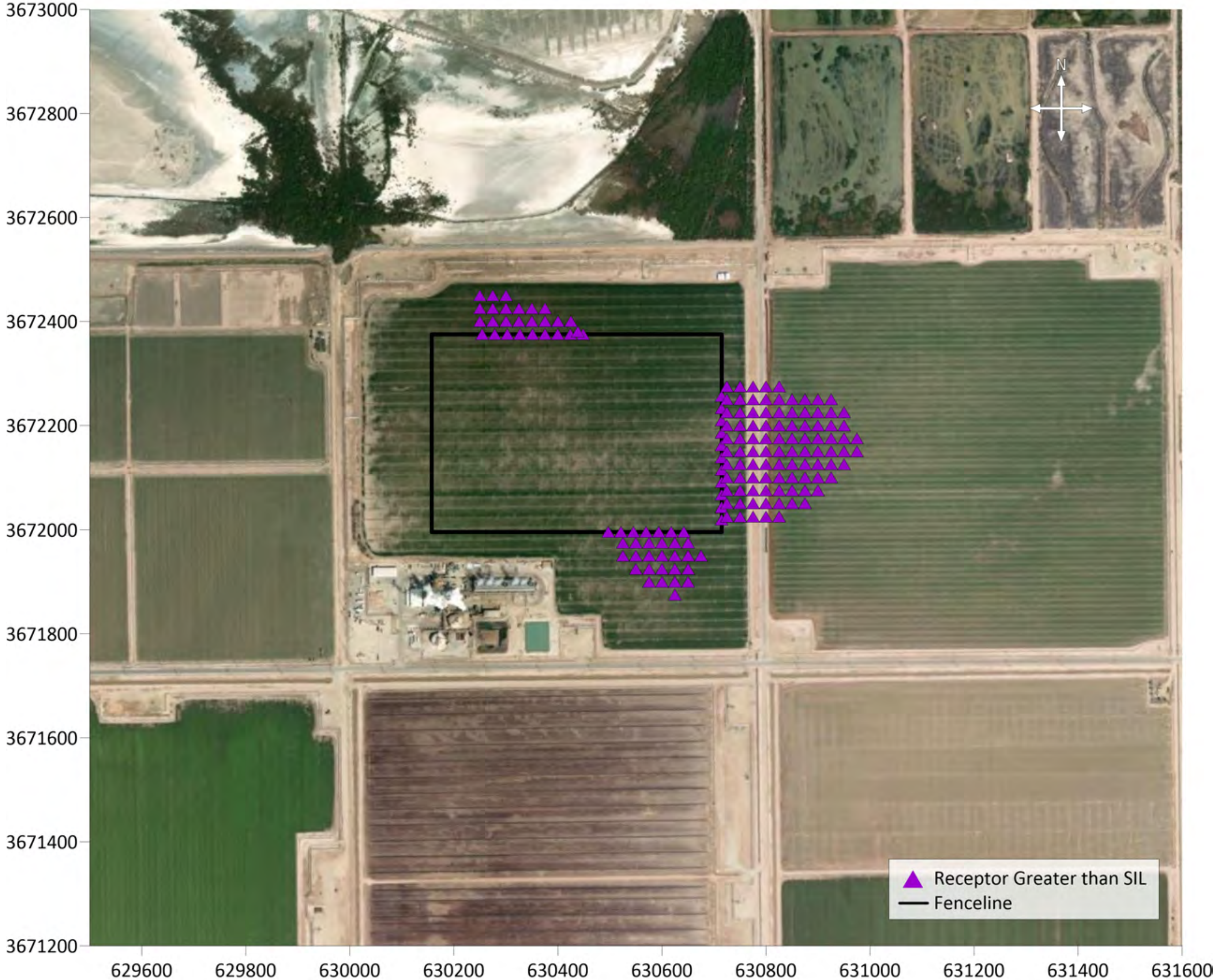


Figure A-4: Elmore North Operation Annual $PM_{2.5}$ Significant Impact Radius

Figure A-5: Morton Bay Operation 24-Hour $PM_{2.5}$ Significant Impact Radius

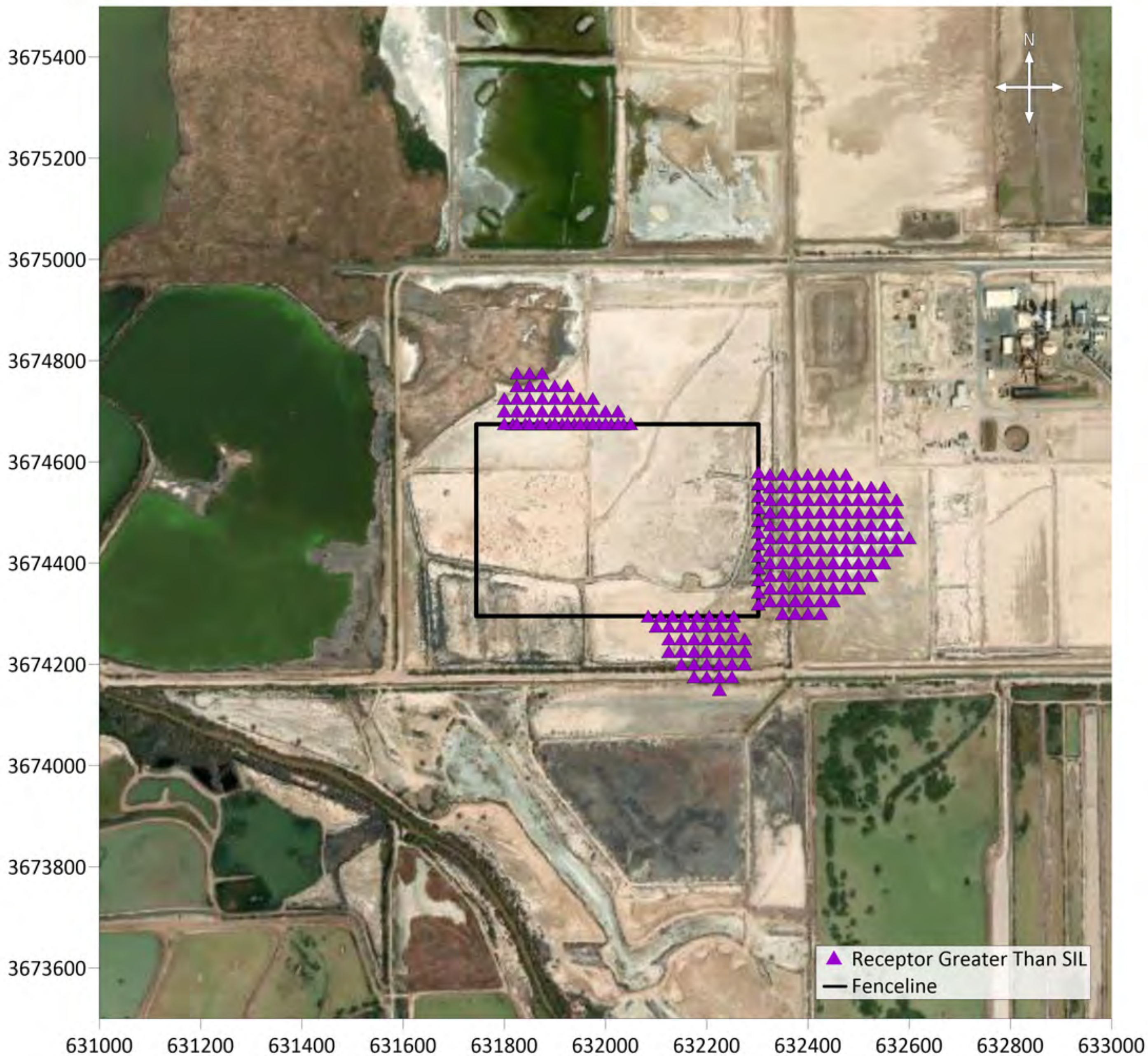
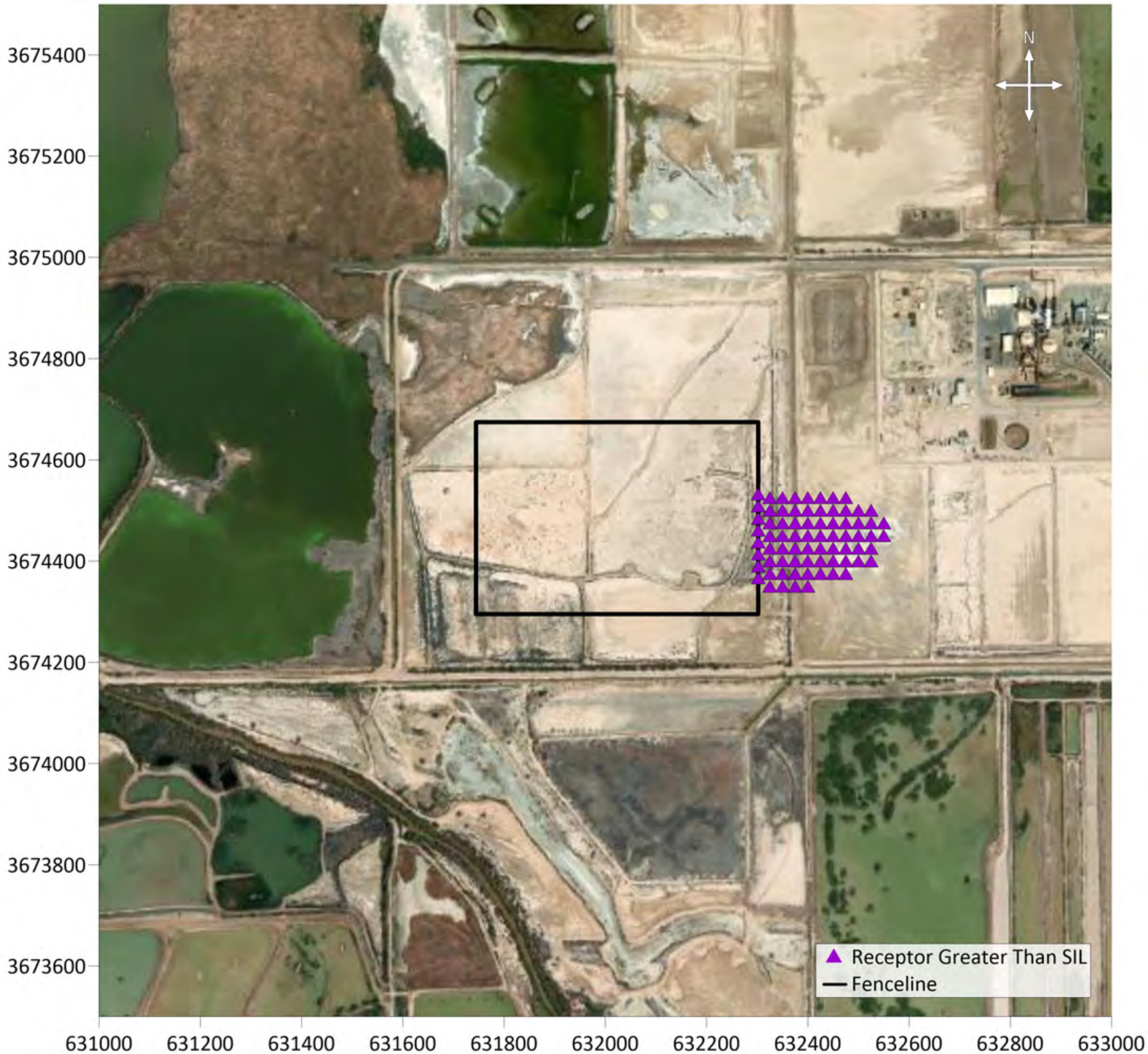


Figure A-6: Morton Bay Operation Annual $PM_{2.5}$ Significant Impact Radius



Appendix B
Construction Significant Impact Radius Figures

Figure B-1: Black Rock Construction 1-Hour NO_2 Significant Impact Radius

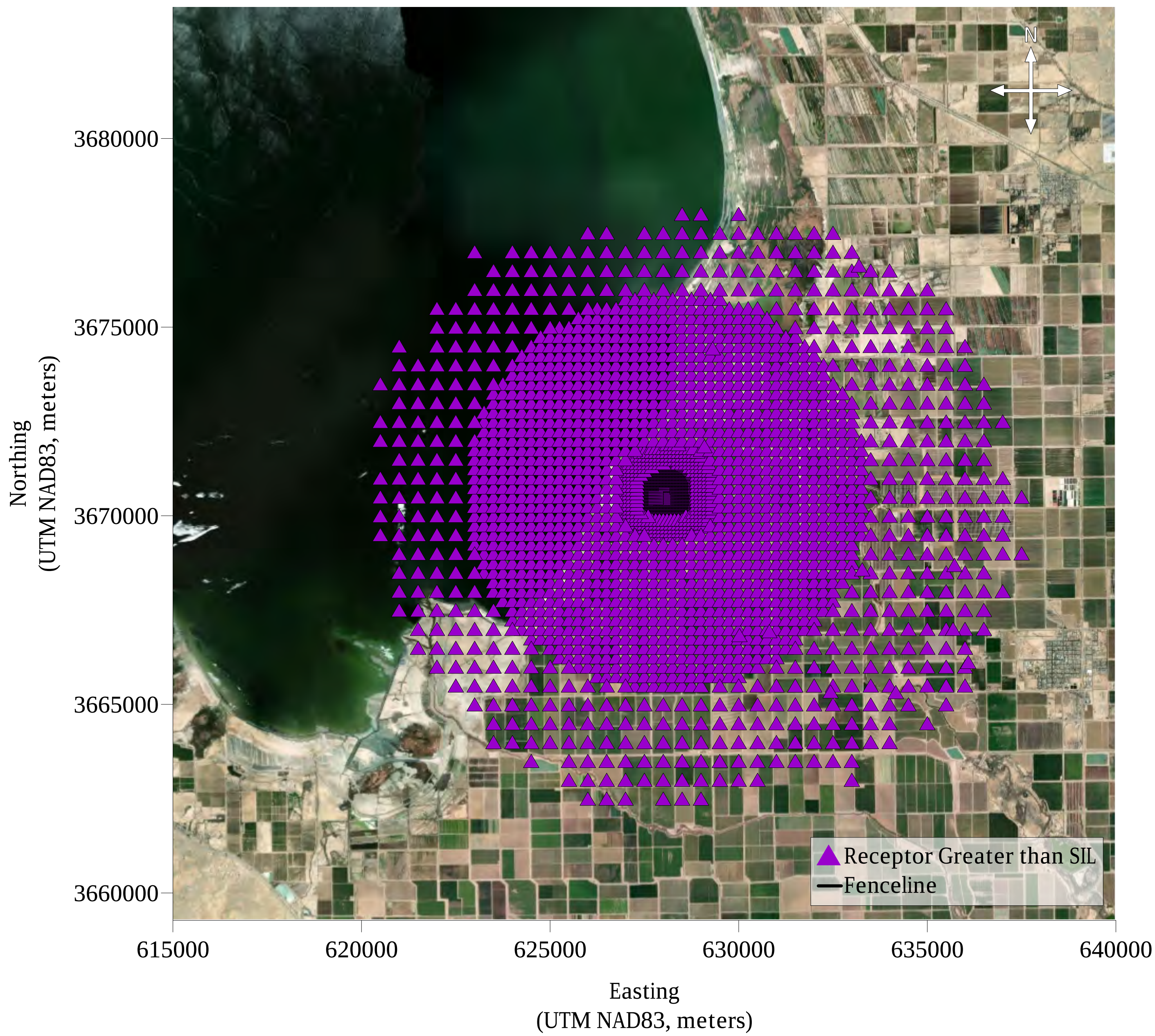


Figure B-2: Black Rock Construction Annual NO_2 Significant Impact Radius

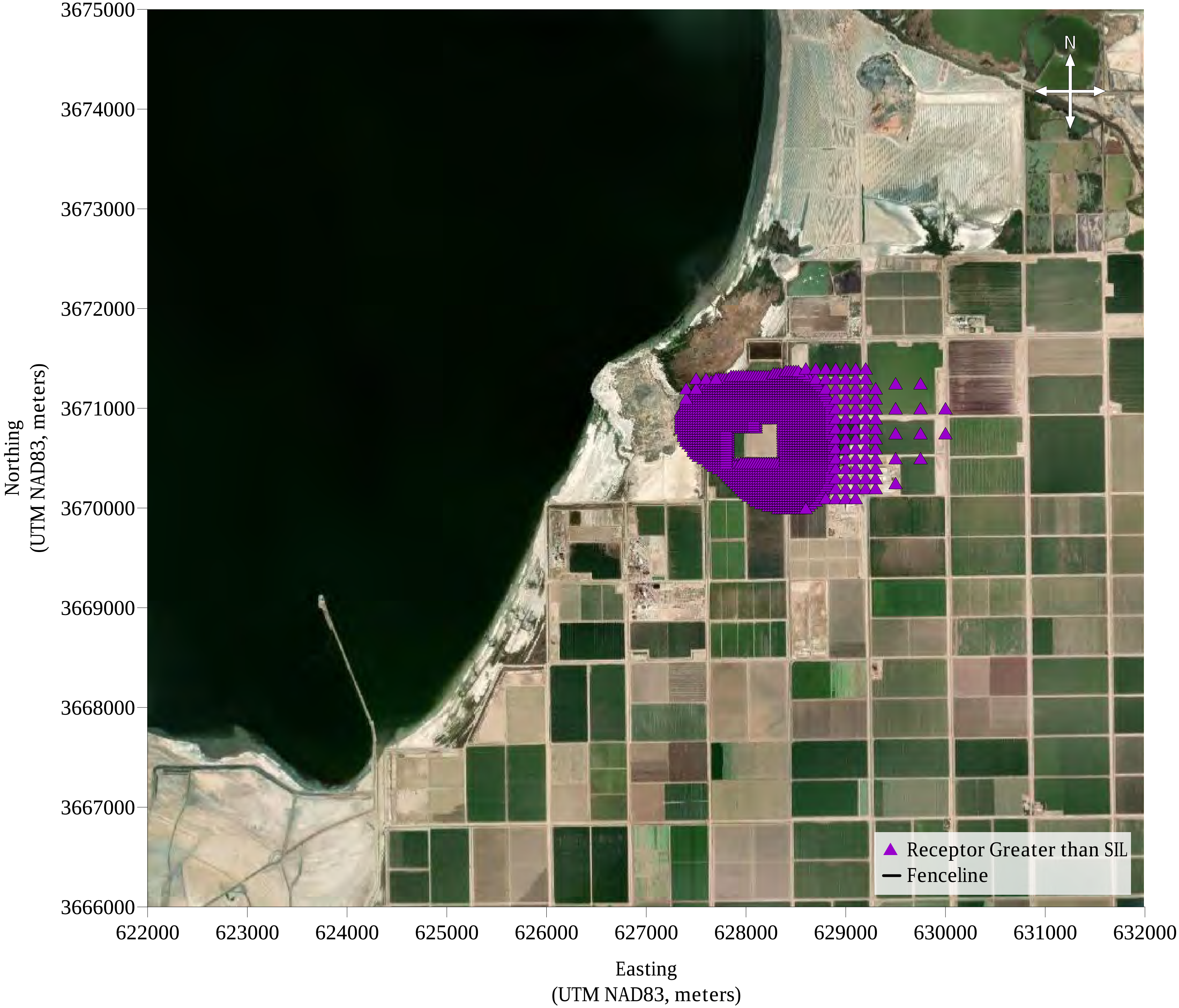


Figure B-3: Black Rock Construction Annual $PM_{2.5}$ Significant Impact Radius

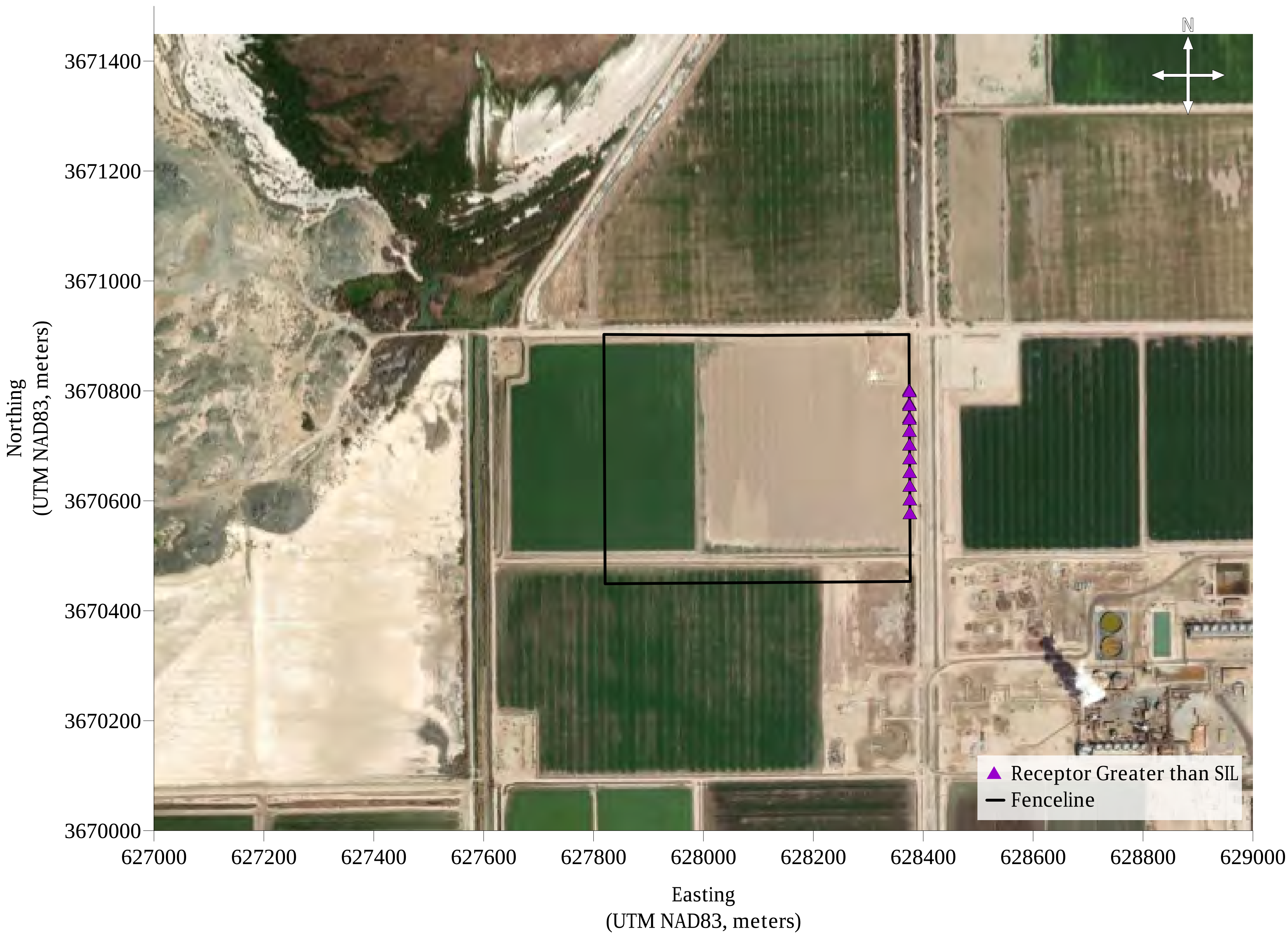


Figure B-4: Elmore North Construction 1-Hour NO_2 Significant Impact Radius

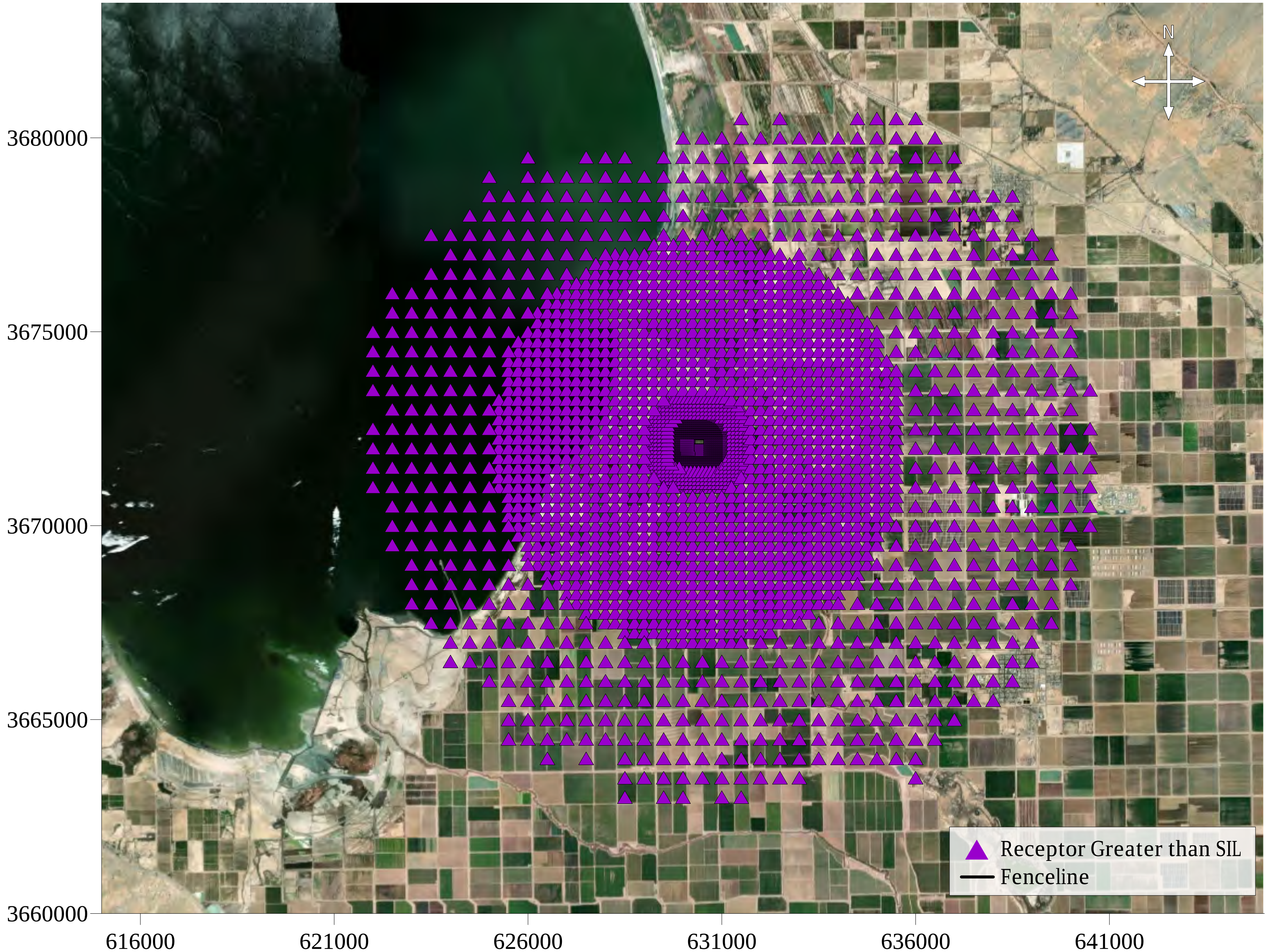


Figure B-5: Elmore North Construction Annual NO_2 Significant Impact Radius

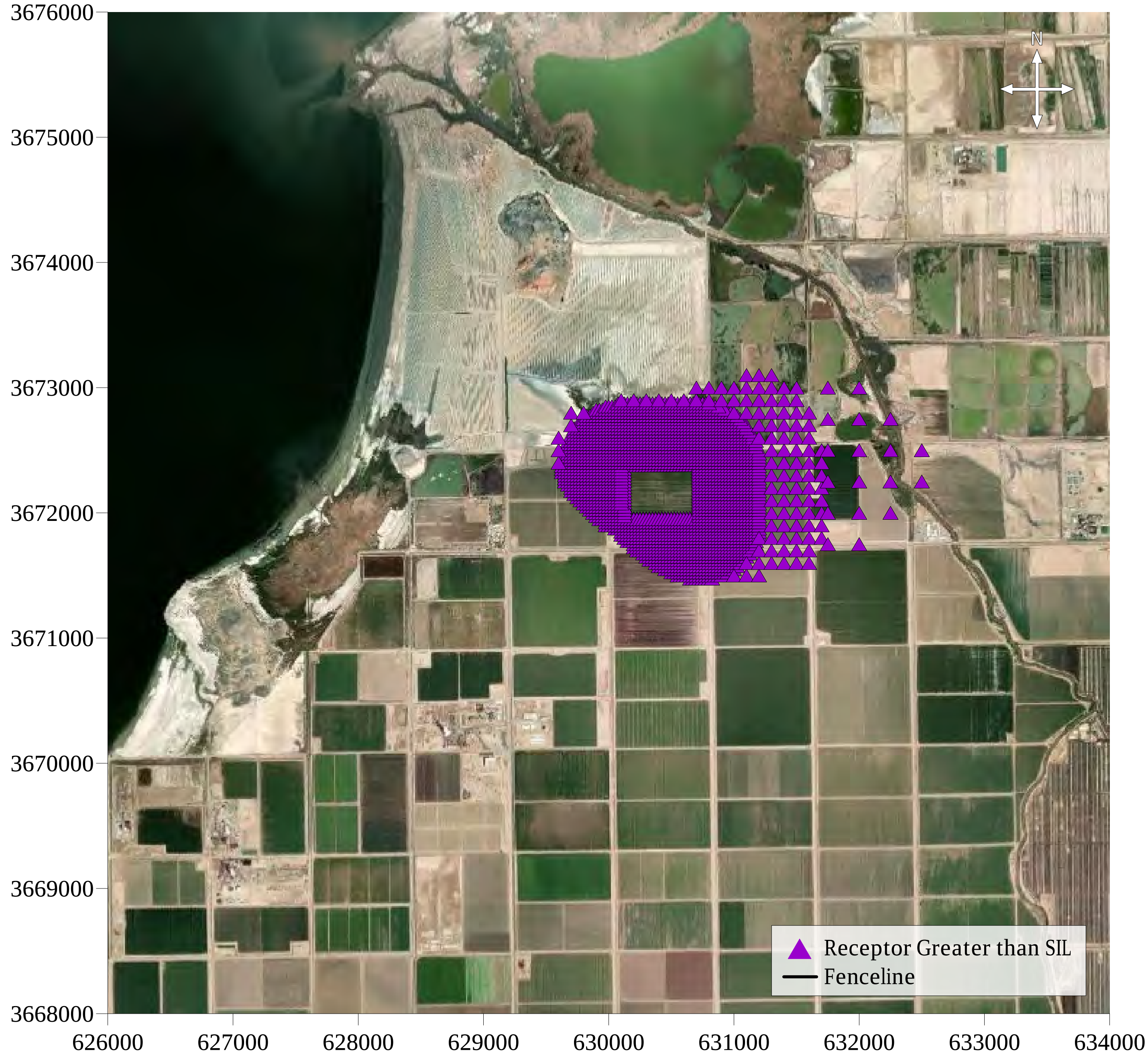


Figure B-6: Elmore North Construction Annual $PM_{2.5}$ Significant Impact Radius

Figure B-7: Morton Bay Construction 1-Hour NO_2 Significant Impact Radius

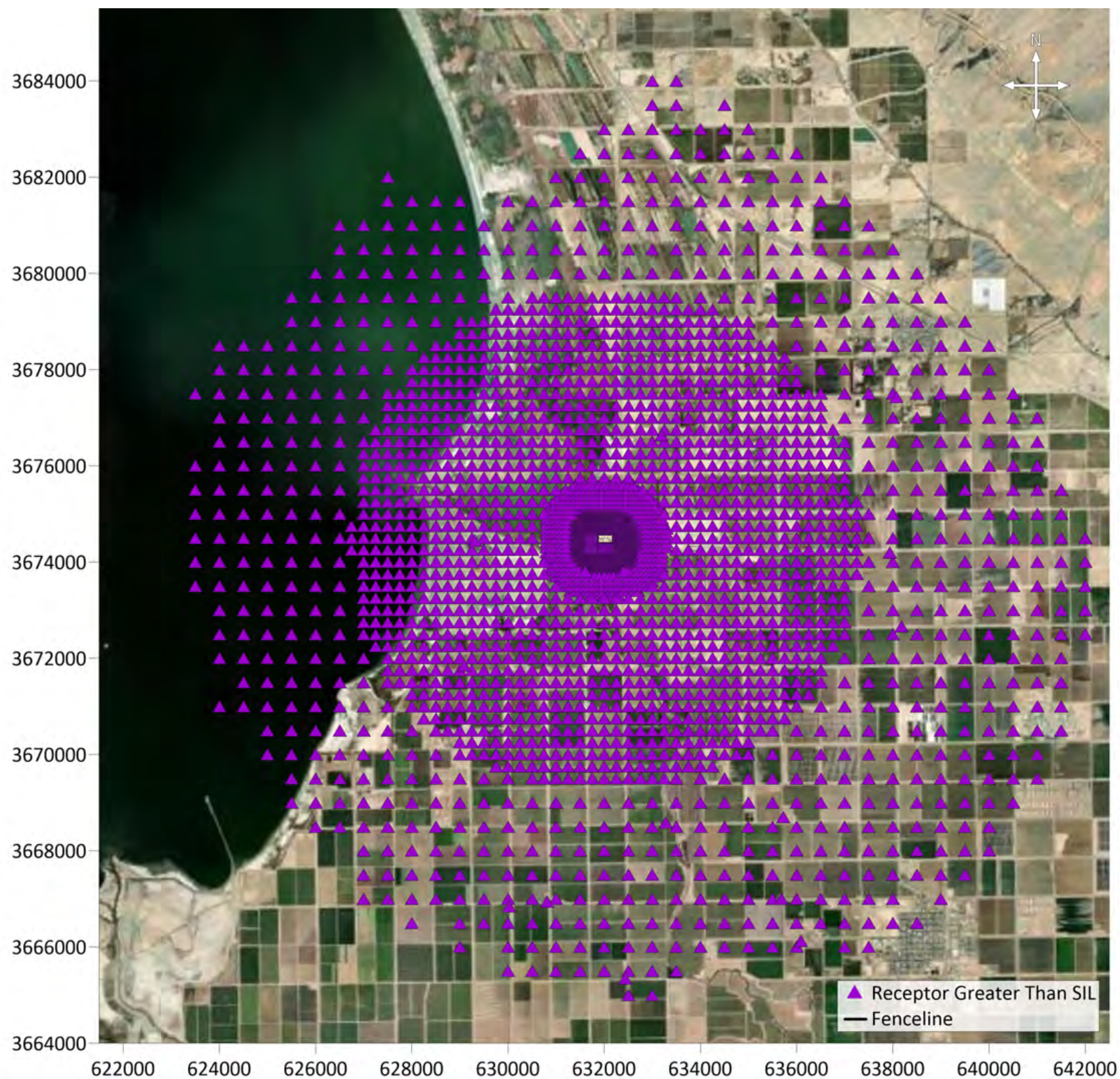


Figure B-8: Morton Bay Construction Annual NO_2 Significant Impact Radius

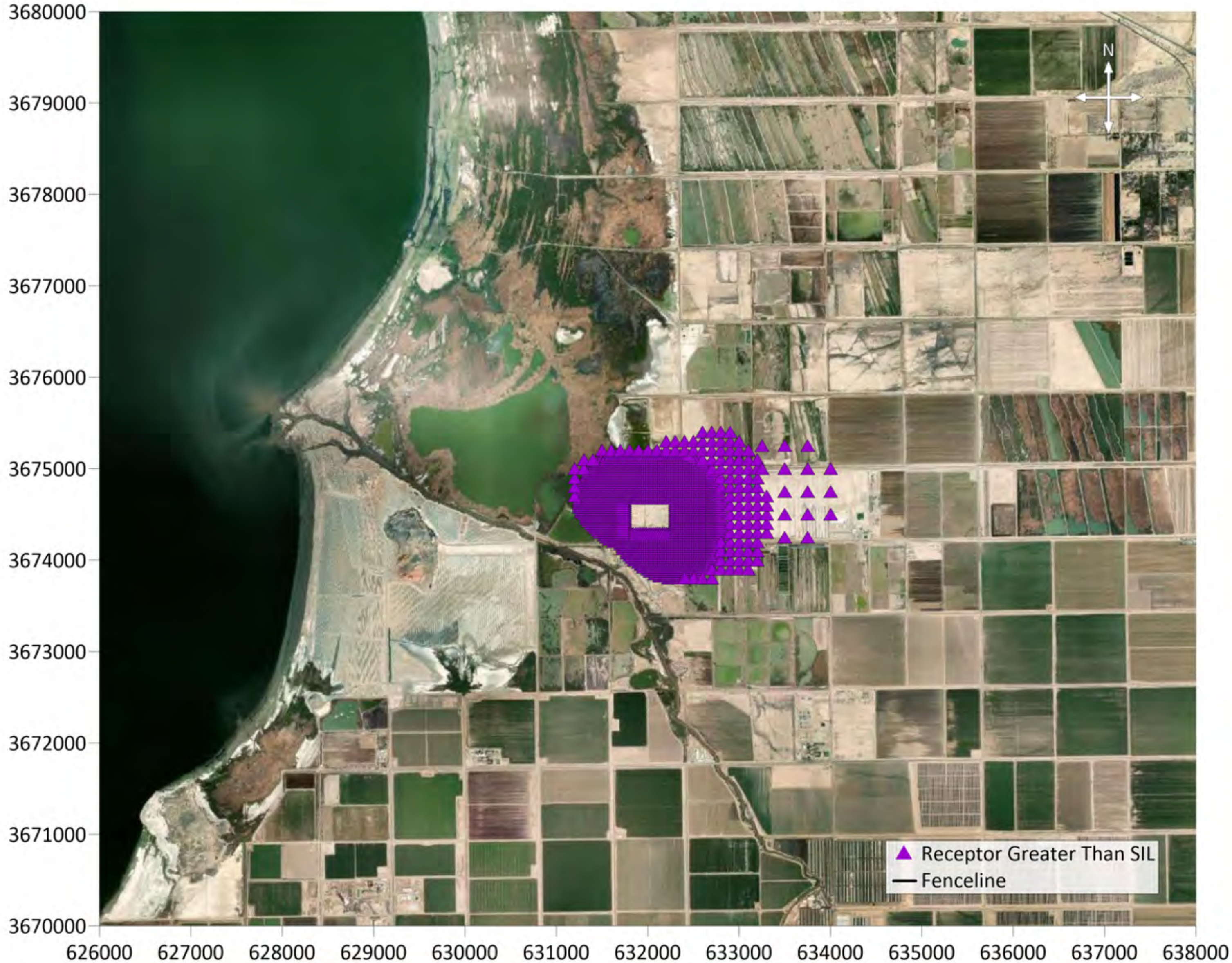
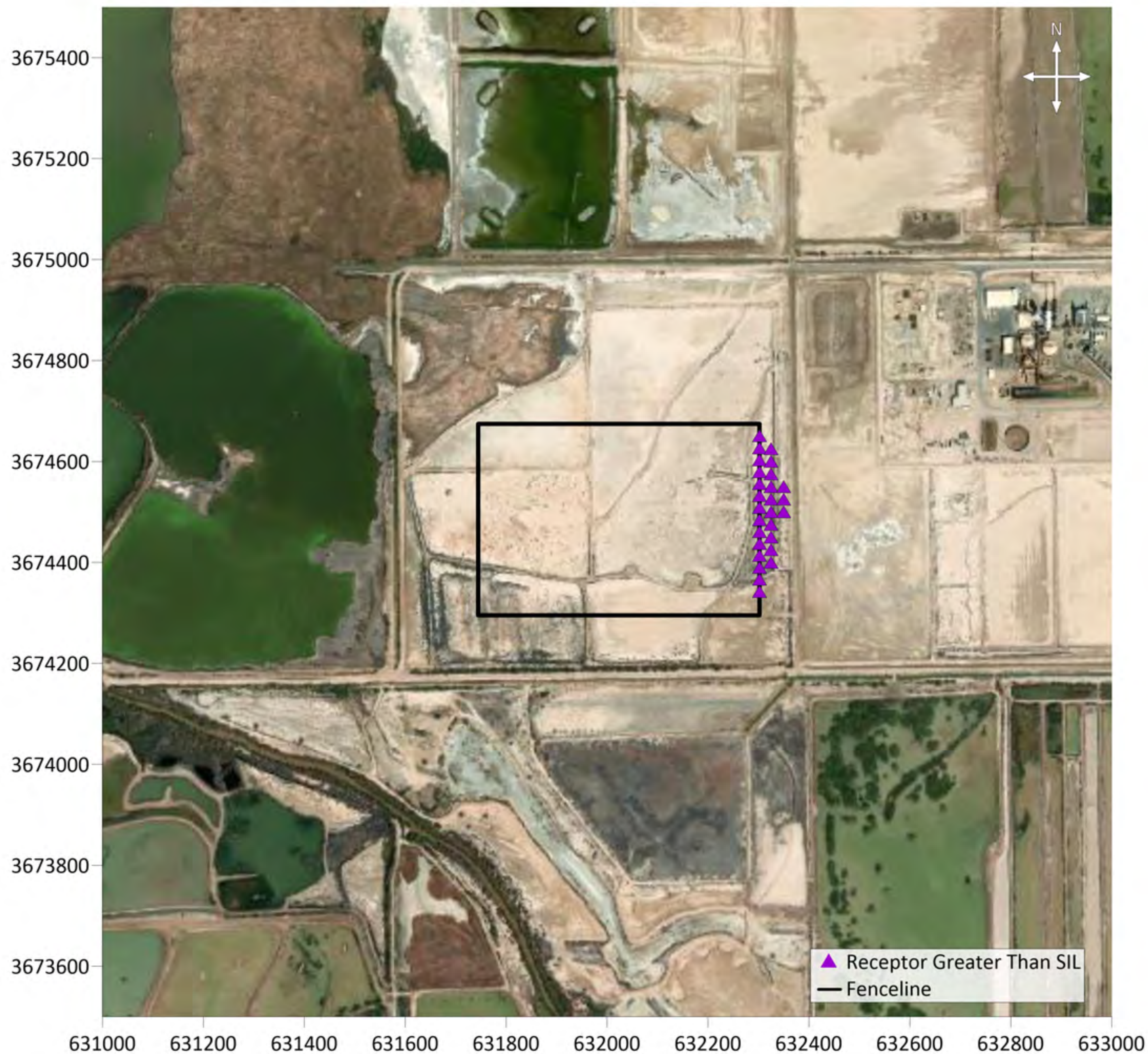


Figure B-9: Morton Bay Construction Annual $PM_{2.5}$ Significant Impact Radius



Attachment DRR 69R
Revised Construction Health Risk Assessment Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.9B ENGP_ConstructionHRA_20230403_Protect.xlsx”

Attachment DRR 71-1
Revised Operation Health Risk Assessment Spreadsheets

For the contents of this attachment, please refer to the spreadsheet titled “Appendix 5.9A ENGP_OpsHRA_20231106_Protect.xlsx”