Sienna Solar and Storage Project

Air Quality and Greenhouse Gas Study

prepared for

99MT 8me, LLC
211 Sutter Street, 6th FloorSan Francisco, California 94108
Contact: Erec DeVost

prepared by

Rincon Consultants, Inc.
180 North Ashwood Avenue
Ventura, California 93003

July 2023

RINCON CONSULTANTS, INC.
Environmental Scientists | Planners | Engineers
rinconconsultants.com

Table of Contents

Tables

Figures

Appendices

1 Project Description

1.1 Introduction

This study analyzes the air quality and greenhouse gas (GHG) emissions from proposed Sienna Solar and Storage Project (Project) located in unincorporated San Bernardino County, California. Rincon Consultants, Inc. (Rincon) prepared this study under contract to99MT 8me, LLC (applicant). The purpose of this study is to analyze the Project's air quality and GHG impacts related to both temporary construction activity and long-term operation of the Project.

1.2 Project Area and Description

The proposed Sienna Solar and Storage Project is a 525-megawatt (MW) utility-scale solar farm with 525 MW battery storage located in unincorporated San Bernardino County. The site is located east of Barstow Road/State Route (SR) 247 roughly between Northside Road and Wilshire Road, northeast of the community of Lucerne Valley.

The Project consists of the installation of a photovoltaic (PV) solar facility, Battery Energy Storage System (BESS), Project substation, Operations and Maintenance building(s), underground collection system, and a 230-kV generation-interconnect (gen-tie) line. The Sienna Project will interconnect at the SCE Calcite Substation (currently pending environmental clearance and construction) via a proposed overhead and/or underground 230-kV gen-tie line in addition to other ancillary facilities utilizing private and potentially public ROWs. The Project area encompasses 1,854 acres with an additional 77.3-acre SCE Calcite Substation site. Approximately 39 miles of collector lines and gen-tie alternatives will be analyzed in this assessment, although not all routes will be developed.

The Project area is characterized by a mixture of residential properties, undeveloped playa and desert scrub communities, and agricultural land that includes alfalfa and jojoba farms and large-scale hemp growing operations. Small-scale abandoned and operational hemp and/or marijuana growing operations were present throughout the playa region of the Project area.

Figure 1 Regional Location

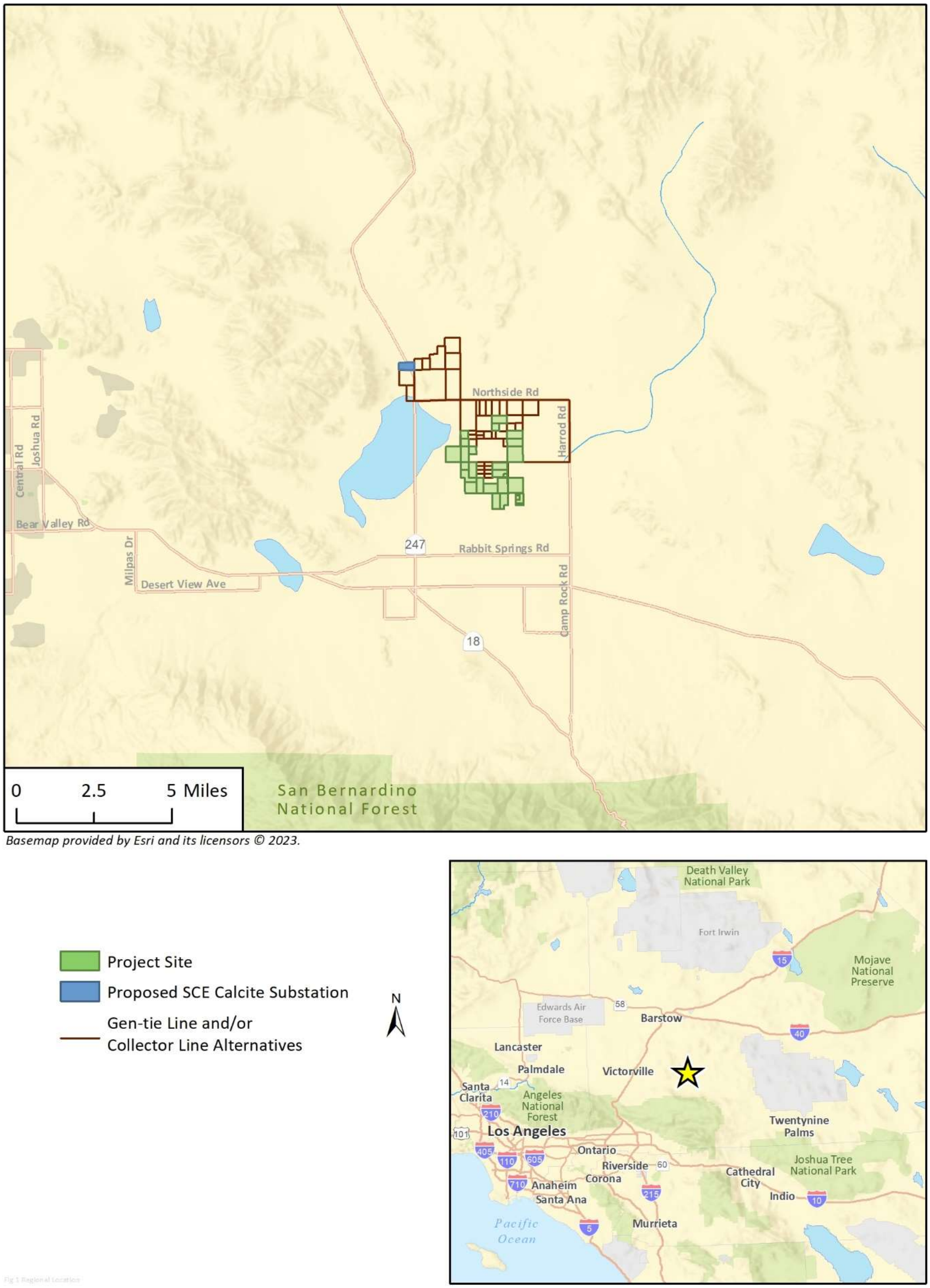
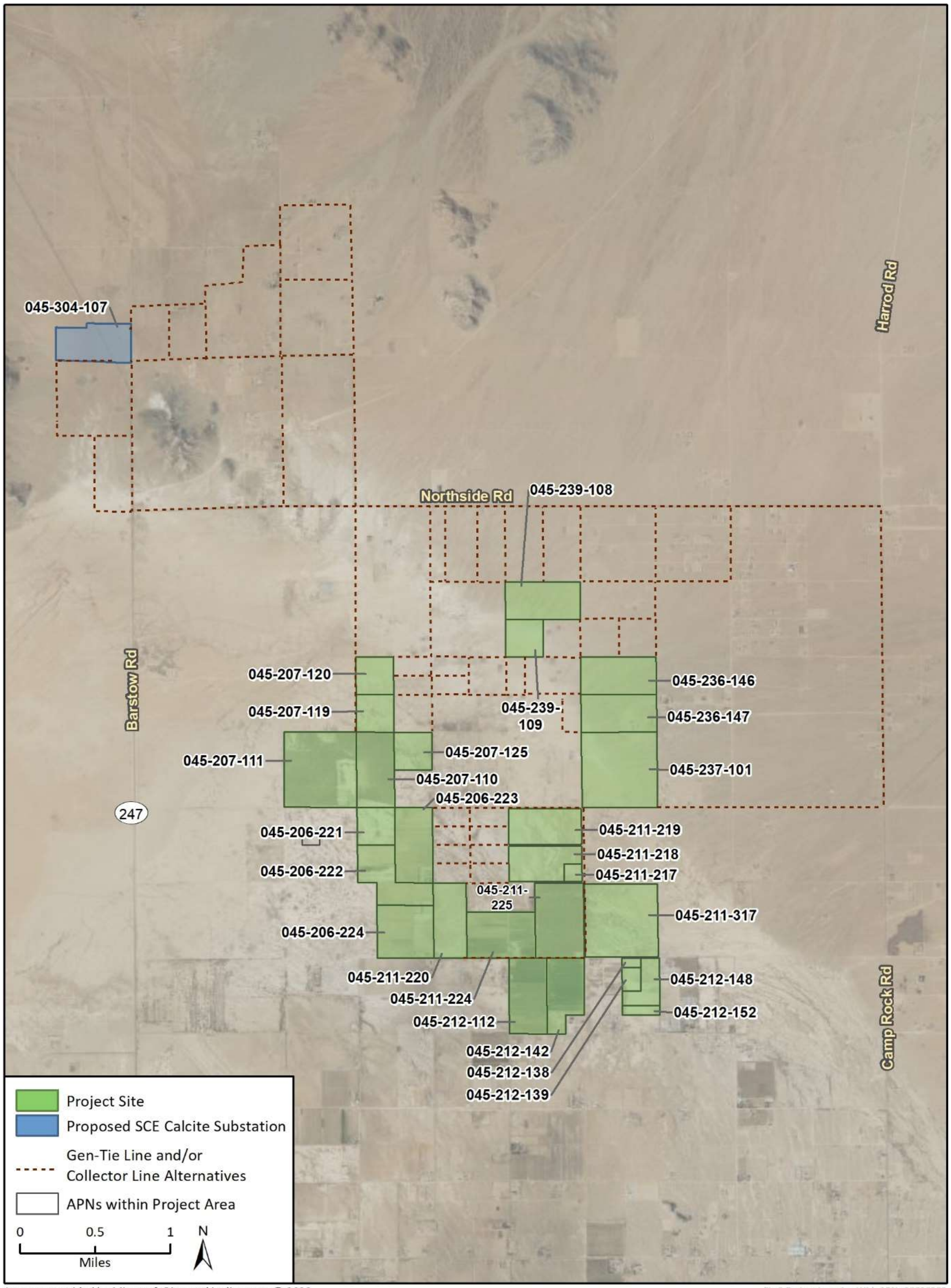


Figure 2 Project Location



Imagery provided by Microsoft Bing and its licensors © 2023.

1.3 Construction Activities

Construction of all Project components would occur over approximately 12 to 24 months beginning as early as the first quarter of 2023 (i.e., January 1, 2023). Construction would take a maximum of 12 months to complete, however due to weather and other constraints the 12 months of construction activity may require up to 24 months to complete (for example, if March sees excessive precipitation, construction activities would have been postponed and no on-site activity would have occurred in March). Construction of the Project would include the following types of activities:[1]

- Site preparation
- Grading and earthwork
- Concrete foundations
- Structural steel work
- Electrical/instrumentation work
- Collector line installation
- Architecture and landscaping

Each parcel that comprises the Sienna Solar and Storage Project may be constructed simultaneously, and phases of construction would overlap.

Table 1 shows the assumed construction schedule, number of workdays, and overlapping phases that were used in the following analysis.

Table 1 Overall Project Construction Schedule

		Months											
Construction Phase	**Workdays**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**
Phase 1: Site preparation & Grading	66												
Phase 2: Tracker Foundations (Piles)	125												
Phase 3: Underground Cabling	125												
Phase 4: Mechanical Installation	146												
Phase 5: Electrical Installation	167												

Note: Construction schedule assumptions are based on Eland 1 Solar Project, where number of days per phase were scaled down based a decrease in acreage. The solar capacity of Eland I and Sienna Solar Storage Project is the same.

[1] This list of types of construction activities is not all inclusive of the various activities that will be conducted during each phase of construction and is provided as an example of some of the work that will be conducted. For example, Phase 1 would include activities such as site preparation, grading, and earth work; Phase 2 would include activities such as concrete foundations; Phase 3 would include activities such as trenching and collector line installation; Phase 4 would include activities such as structural steel work; Phase 5 would include activities such as electrical/instrumentation work. Additional activities not listed above such as material delivery would also occur during various phases of construction. As such, this list of types of construction activities is presented without respect to the construction schedule shown in Table 1. Construction could take up to 24 months, however the analysis assumes a 12-month construction schedule as a conservative analysis.

Construction traffic would access the Project area locally from Barstow Road, Camp Rock Road, and Old Woman Springs Road to parcels located in the southern portion of the development areas. The substation located in the north would gain access from Haynes Road. It is estimated that up to 800 workers per day (during peak construction periods) would be required during construction. On-road traffic would consist of employee and vendor vehicle trips. The number of vehicle trips would vary by month depending on the construction activities.

Heavy construction is expected to occur anytime between 7:00 a.m. and 7:00 p.m., Monday through Friday. Additional hours may be necessary to make-up schedule deficiencies or to complete critical construction activities. Some activities may continue 24 hours per day, seven days per week. Nighttime activities could include, but are not limited to: equipment refueling, staging material for the following day's construction activities, quality assurance/control, and commissioning. Earthmoving activities are expected to be limited to the construction of access roads, operation and maintenance (O&M) buildings, substations, energy storage systems, and storm water protection or storage (detention) facilities. Final grading may include revegetation with low lying grass or applying earth-binding materials to disturbed areas. Materials and supplies would be delivered to the Project area by truck. Truck deliveries would normally occur during daylight hours. However, there could be offloading and/or transporting of materials to the Project area on weekends and during evening hours.

1.4 Operational Activities

Once completed, the Project would generally be limited to the following maintenance activities:

- Cleaning PV panels
- Monitoring electricity generation
- Providing site security
- Maintaining the facility: replacing or repairing inverters, wiring, and PV modules

The Project would operate continuously, 24 hours per day, seven days a week. The Project would require an operational staff of up to 15 full-time employees. The facility would generate electricity during normal daylight hours when solar energy is available. Maintenance activities may occur seven days a week, 24 hours a day to ensure PV panel output when solar energy is available.

1.5 Decommissioning Activities

After 30 to 40 years, the Project would be repowered or decommissioned. If decommissioned, then the site would be reverted to undeveloped land. The decommissioning and restoration process would involve removing aboveground and belowground structures, restoring topsoil, revegetation, and seeding. All debris would be removed from the area.

2 Air Quality

2.1 Environmental Setting

Local Climate and Meteorology

The Project area is within the Mojave Desert Air Basin (MDAB), an inland region in southern California includes the desert portions of northwestern Los Angeles County, eastern Kern County, northeastern Riverside County, and San Bernardino County. The region is closed off from southern coast of California and central California by mountain ranges with the Sierra Nevada Mountains to the north, the Tehachapi Mountains to the northwest, and the San Gabriel and San Bernardino Mountains to the south. The Sonoran Desert borders the eastern and southern portions of the air basin. The regional climate in the MDAB is dry-host desert climate characterized by little cloud formation, daytime solar heating, and infrequent precipitation. During summer, the MDAB is normally influenced by the Pacific subtropical high cell off the coast that prevents cloud formation and encourages daytime solar heating. Cold air masses moving south from Canada and Alaska do not generally influence the MDAB because the frontal systems are weak and diffuse before they reach the desert. Therefore, desert moisture comes in the form of warm, moist, unstable air masses from the south and the MDAB averages three to seven inches of rain annually. The air quality within the MDAB is primarily influenced by meteorology, topography, and a wide range of emission sources, such as dense population centers, substantial vehicular traffic, and industry. The Mojave Desert Air Quality Management District (MDAQMD) monitors and regulates local air quality in Riverside County (MDAQMD 2020a).

Air Pollutants of Concern

The United States Environmental Protection Agency (USEPA) has identified criteria air pollutants that are a threat to public health and welfare. Primary criteria pollutants are emitted directly from a source (e.g., vehicle tailpipe, an exhaust stack of a factory, etc.) into the atmosphere. Primary criteria pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), fine particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead. Ozone (O_3) is considered a secondary criteria pollutant because it is created by atmospheric chemical and photochemical reactions between reactive organic gases (ROG) and nitrogen oxides (NO_X). The Project would generate CO, PM_{10}, $PM_{2.5}$, SO_2, and lead as well as ozone precursors ROG and NO_X (including NO_2) during construction and operation. These pollutants can have adverse impacts on human health at certain levels of exposure. These pollutants are called “criteria” air pollutants because standards have been established for each of them to meet specific public health and welfare standards. The following subsections describe the characteristics, sources, and health and atmospheric effects of air pollutants.

Ozone

Ozone (O_3) is produced by a photochemical reaction (triggered by sunlight) between nitrogen oxides (NO_X) and volatile organic compounds (VOC[2]). NO_X is formed during the combustion of fuels, while ROG

[2] Organic compound precursors of ozone are routinely described by a number of variations of three terms: hydrocarbons (HC), organic gases (OG), and organic compounds (OC). These terms are often modified by adjectives such as total, reactive, or volatile, and result in a rather confusing array of acronyms: HC, THC (total hydrocarbons), RHC (reactive hydrocarbons), TOG (total organic gases), ROG (reactive organic gases), TOC (total organic compounds), ROC (reactive organic compounds), and VOC (volatile organic compounds). While most of these differ in some significant way from a chemical perspective, two groups are important from an air quality perspective: non-photochemically reactive in the lower atmosphere, or photochemically reactive in the lower atmosphere (HC, RHC, ROG, ROC, and VOC).

are formed during combustion and evaporation of organic solvents. Because O_3 requires sunlight to form, it usually occurs in substantial concentrations between the months of April and October. Ozone is a pungent, colorless, toxic gas with direct health effects on humans including respiratory and eye irritation and possible changes in lung functions (USEPA 2021a). Groups most sensitive to O_3 include children, the elderly, people with respiratory disorders, and people who exercise strenuously outdoors.

Nitrogen Dioxide

Nitrogen dioxide is a byproduct of fuel combustion, with the primary source being motor vehicles and industrial boilers and furnaces. The principal form of nitrogen oxide produced by combustion is nitric oxide (NO), but NO reacts rapidly to form NO_2, creating the mixture of NO and NO_2 commonly called NO_X. NO_2 is an acute irritant. A relationship between NO_2 and chronic pulmonary fibrosis may exist, and an increase in bronchitis in young children at concentrations below 0.3 parts per million (ppm) may occur. Elevated levels of NO_2 can also cause respiratory irritation, impaired pulmonary function, and bronchitis (USEPA 2021a). Nitrogen dioxide absorbs blue light, gives a reddish-brown cast to the atmosphere, and reduces visibility. It can also contribute to the formation of ozone/smog and acid rain.

Carbon Monoxide

Carbon monoxide is a local pollutant that is found in high concentrations near fuel combustion equipment and other sources of CO. The primary source of CO, a colorless, odorless, poisonous gas, is automobile traffic. Therefore, elevated concentrations are usually only found near areas of high traffic volumes. The health effects of CO are related to its affinity for hemoglobin in the blood. At high concentrations, CO reduces the amount of oxygen in the blood, causing heart difficulty in people with chronic diseases, nausea, reduced lung capacity, and impaired mental abilities (USEPA 2021a).

Sulfur Dioxide

Sulfur dioxide (SO_2) is a colorless, pungent, irritating gas formed primarily by the combustion of sulfur-containing fossil fuels. When SO_2 oxidizes in the atmosphere, it forms sulfur trioxide (SO_3). Collectively, these pollutants are referred to as sulfur oxides (SO_X). In humid atmospheres, SO_2 can also form sulfuric acid mist, which can eventually react to produce sulfate particulates that can inhibit visibility. Combustion of high sulfur-content fuels is the major source, while chemical plants, sulfur recovery plants, and metal processing are minor contributors. At sufficiently high concentrations, SO_2 irritates the upper respiratory tract. At lower concentrations, when in conjunction with particulates, SO_2 appears to do still greater harm by injuring lung tissues. This compound also constricts the breathing passages, especially in people with asthma and people involved in moderate to heavy exercise. Sulfur dioxide causes respiratory irritation, including wheezing, shortness of breath, and coughing (USEPA 2021a). Long-term SO_2 exposure has been associated with increased risk of mortality from respiratory or cardiovascular disease. Sulfur oxides, in combination with moisture and oxygen, can yellow leaves on plants, dissolve marble, and eat away iron and steel.

Particulate Matter

Atmospheric particulate matter is comprised of finely divided solids and liquids such as dust, soot, aerosols, fumes, and mists. The particulates that are of particular concern are PM_{10} (small particulate matter that measures no more than 10 microns in diameter) and $PM_{2.5}$ (fine particulate that measures no more than 2.5 microns in diameter). The characteristics, sources, and potential health effects associated with the PM_{10} and $PM_{2.5}$ can be different. Major man-made sources of PM_{10} are agricultural

---

MDAQMD uses the term VOC to denote organic precursors.

operations, industrial processes, combustion of fossil fuels, construction, demolition operations, and entrainment of road dust into the atmosphere. Natural sources include windblown dust, wildfire smoke, and sea spray salt. The finer $PM_{2.5}$ particulates are generally associated with combustion processes as well as formation in the atmosphere as a secondary pollutant through chemical reactions. Elevated levels of PM_{10} can cause respiratory irritation, reduced lung function, aggravation of cardiovascular disease, and cancer (USEPA 2021a). $PM_{2.5}$ is more likely to penetrate deeply into the lungs and poses a serious health threat to all groups, but particularly to the elderly, children, and those with respiratory problems. Elevated levels of $PM_{2.5}$ can cause respiratory stress and decreased lung function and increase the risk of long-term disease (USEPA 2021a). More than half of the small and fine particulate matter that is inhaled into the lungs remains there, which can cause permanent lung damage. These materials can damage health by interfering with the body's mechanisms for clearing the respiratory tract or by acting as carriers of an absorbed toxic substance.

Lead

Lead (Pb) is a metal found naturally in the environment, as well as in manufacturing products. Lead occurs in the atmosphere as particulate matter. The major sources of Pb emissions historically have been mobile and industrial sources. In the early 1970s, the USEPA set national regulations to gradually reduce the lead content in gasoline. In 1975, unleaded gasoline was introduced for motor vehicles equipped with catalytic converters. The USEPA completed the ban prohibiting the use of leaded gasoline in highway vehicles in December 1995. As a result of the USEPA's regulatory efforts to remove lead from gasoline, atmospheric lead concentrations have declined substantially over the past several decades. The most dramatic reductions in lead emissions occurred prior to 1990 due to the removal of lead from gasoline sold for most highway vehicles. Lead emissions were further reduced substantially between 1990 and 2008, with reductions occurring in the metals industries in part due to national emissions standards for hazardous air pollutants (USEPA 2013). As a result of phasing out leaded gasoline, metal processing is currently the primary source of Pb emissions. The highest level of Pb in the air is generally found near lead smelters. Other stationary sources include waste incinerators, utilities, and lead-acid battery manufacturers. Lead may cause a range of health effects, including anemia, kidney disease, and neuromuscular and neurological dysfunction (in severe cases).

Toxic Air Contaminants

In addition to the criteria pollutants discussed above, Toxic Air Contaminants (TAC) are another group of pollutants of concern. Assembly Bill 1807 (AB 1807) sets forth a procedure for the identification and control of TACs in California. CARB defines a TAC as an air pollutant that may cause or contribute to an increase in mortality or an increase in serious illness, or that may pose a present or potential hazard to human health. TACs may result in long-term health effects such as cancer, birth defects, neurological damage, asthma, or genetic damage, or short-term acute effects such as eye watering, respiratory irritation, runny nose, throat pain, and headaches. Because no safe levels of TACs can be determined, there are no ambient air quality standards for TACs. Instead, TAC impacts are evaluated by calculating the health risks associated with a given exposure. TACs are considered either carcinogenic or non-carcinogenic based on the nature of the health effects associated with exposure. For carcinogenic TACs, potential health impacts are evaluated in terms of overall relative risk expressed as excess cancer cases per one million exposed individuals. Non-carcinogenic TACs differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis.

TACs include both organic and inorganic chemical substances. One of the main sources of TACs in California is diesel engines that emit exhaust containing solid material known as diesel particulate matter (DPM); however, TACs may be emitted from a variety of common sources, including gasoline stations, motor vehicles, dry cleaners, industrial operations, painting operations, and research and teaching facilities.

Diesel Particulate Matter

Diesel engine fuel combustion forms an important fraction of the particulate matter emission inventory, as particulates in diesel emissions are very small and readily respirable. The particles have hundreds of chemicals adsorbed onto their surfaces, including many known or suspected mutagens and carcinogens. The Office of Environmental Health Hazard Assessment (OEHHA) reviewed and evaluated the potential for diesel exhaust to affect human health, and the associated scientific uncertainties. Based on the available scientific evidence, it was determined that a level of DPM exposure has not been identified, below which no carcinogenic effects are anticipated. The Scientific Review Panel that approved the OEHHA report determined that, based on studies to date, 3×10^{-4} micrograms per cubic meter ($\mu g/m^3$) is a reasonable estimate of the unit risk for DPM. This means that a person exposed to a DPM concentration of 1 $\mu g/m^3$ continuously over the course of a lifetime has a 3 per 10,000 chance (or 300 in one million chance) of contracting cancer due to this exposure. In 2000, the statewide estimated average concentration of diesel PM was 1.26 $\mu g/m^3$ for indoor and outdoor ambient air. If DPM concentrations remained the same, about 380 excess cancers per one million population could be expected (CARB 2000). Therefore, these particulate emissions have been determined by CARB to be a TAC.

DPM emissions are estimated to be responsible for about 70 percent of the total ambient Statewide air toxics risk. DPM can also be responsible for elevated localized or near-source exposures (“hot-spots”). Depending on the activity and nearness to receptors, these potential risks are as high as 1,500 per million or more (CARB 2000). CARB staff have conducted risk characterization scenarios to determine the potential excess cancer risks involved when individuals are near various sources of diesel engine emissions, ranging from school buses to high volume freeways. The purpose of the risk characterization was to estimate, through air dispersion modeling, the cancer risk associated with typical diesel-fueled engine or vehicle activities based on modeled PM concentration at the point of maximum impact. The study included various sources of DPM emissions, including idling school buses, truck stops, low- and high-volume freeways, and other sources. High-volume freeways (20,000 or more trucks per day) were estimated to cause 800-1,700 per million potential excess cases of cancers, while low-volume freeways (2,000 or fewer trucks per day) were estimated to cause about 100-200 per million potential excess cases of cancers Statewide (CARB 2000).

Valley Fever

Valley Fever or *coccidioidomycosis* is caused locally by the microscopic fungus *Coccidioides immitis* (C. immitis). The Coccidioides fungus resides in the soil in southwestern United States, northern Mexico, and parts of Central and South America. During drought years, the number of organisms competing with C. immitis decreases, and the C. immitis remains alive but dormant. When rain finally occurs, the fungal spores germinate and multiply more than usual because of fewer other competing organisms. Later, the soil dries out in the summer and fall, and the fungi can become airborne and potentially infectious (Kirkland and Fierey 1996).

Infection occurs when the spores of the fungus become airborne and are inhaled. The fungal spores become airborne when contaminated soil is disturbed by human activities, such as construction and agricultural activities, and natural phenomena, such as windstorms, dust storms, and earthquakes. About 60 percent of infected persons have no symptoms. The remainder develop flu-like symptoms that can last for a month and tiredness that can sometimes last for longer than a few weeks. Common symptoms include fatigue, couth, chest pain, fever, rashes on upper body or legs, headaches, muscle aches, night sweats, and unexplained weight loss (California Department of Public Health 2021a). A small percentage of infected persons (<1 percent) can develop disseminated disease that spreads outside the lungs to the brain, bone, and skin. Without proper treatment, Valley Fever can lead to severe pneumonia, meningitis, and even death. Symptoms may appear between one to four weeks after exposure (Los Angeles County Health Department 2013). Both humans and animals can become infected with Valley Fever, but the infection is not contagious and cannot spread from one person or animal to another (California Department of Public Health 2021a).

Diagnosis of Valley Fever is conducted through a sample of blood, other body fluid, or biopsy of affected tissue. Valley Fever is treatable with anti-fungal medicines. Once recovered from the disease, the individual is protected against further infection. Persons at highest risk from exposure are those with compromised immune systems, such as those with human immunodeficiency virus (HIV) and those with chronic pulmonary disease. Farmers, construction workers, and others who engage in activities that disturb the soil are at highest risk for Valley Fever. Infants, pregnant women, diabetics, people of African, Asian, Latino, or Filipino descent, and the elderly may be at increased risk for disseminated disease. Historically, people at risk for infection are individuals not already immune to the disease and whose jobs involve extensive contact with soil dust, such as construction or agricultural workers and archeologists (Los Angeles County Health Department 2013). Most cases of Valley Fever (over 65 percent) are diagnosed in people living in the Central Valley and Central Coast regions (California department of Public Health 2021a).

There is no vaccine to prevent Valley Fever. However, the California Department of Public Health recommends the following practical tips to reduce exposure (2021a):

- Stay inside and keep windows and doors closed when it is windy outside and the air is dusty, especially during dust storms.
- Consider avoiding outdoor activities that involve close contact to dirt or dust, including yard work, gardening, and digging, especially if you are in one of the groups at higher risk for severe or disseminated Valley fever.
- Cover open dirt areas around your home with grass, plants, or other ground cover to help reduce dusty, open areas.
- While driving in these areas, keep car windows closed and use recirculating air, if available.
- Try to avoid dusty areas, like construction or excavation sites.
- If you cannot avoid these areas, or if you must be outdoors in dusty air, consider wearing an N95 respirator (a type of face mask) to help protect against breathing in dust that can cause Valley fever.

However, if in situations where digging dirt or stirring up dust will happen, then the following tips are recommended:

- Stay upwind of the area where dirt is being disturbed.
- Wet down soil before digging or disturbing dirt to reduce dust.
- Consider wearing an N95 respirator (mask).
- After returning indoors, change out of clothes if covered with dirt.
  - Be careful not to shake out clothing and breathe in the dust before washing. If someone else is washing your clothes, warn the person before they handle the clothes.

In 2020, approximately 246 cases were reported in San Bernardino County (California Department of Public Health 2021b). This is a decrease of 16 cases compared to 2019 (230 cases). In 2019, the incident rate was 10.4 cases per 100,000 people (California Department of Public Health 2020).[3]

2.2 Regulatory Setting

The federal and state governments have authority under the federal and state Clean Air Acts to regulate emissions of airborne pollutants and have established ambient air quality standards (AAQS) for the protection of public health. An air quality standard is defined as "the maximum amount of a pollutant averaged over a specified period of time that can be present in outdoor air without harming public health" (CARB 2021a). USEPA is the federal agency designated to administer air quality regulation, while CARB is the state equivalent in California. Federal and state AAQS have been established for six criteria pollutants: ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, $PM_{10,}$ $PM_{2.5}$, and lead. AAQS are designed to protect those segments of the public most susceptible to respiratory distress, such as children under the age of 14, the elderly (over the age of 65), persons engaged in strenuous work or exercise, and people with cardiovascular and chronic respiratory diseases (USEPA 2016). In addition, the State of California has established health-based ambient air quality standards for these and other pollutants, some of which are more stringent than the federal standards (CARB 2021b). The federal and state Clean Air Acts are described in more detail below.

Federal and State Regulations

The Clean Air Act (CAA) was enacted in 1970 and amended in 1977 and 1990 [42 United States Code (USC) 7401] for the purposes of protecting and enhancing the quality of the nation's air resources to benefit public health, welfare, and productivity. In 1971, to achieve the purposes of Section 109 of the CAA [42 USC 7409], USEPA developed primary and secondary National Ambient Air Quality Standards (NAAQS). NAAQS have been designated for the following criteria pollutants of primary concern: O_3, CO, NO_2, SO_2, $PM_{10,}$ $PM_{2.5}$, and Pb.

The primary NAAQS "in the judgment of the Administrator[4], based on such criteria and allowing an adequate margin of safety, are requisite to protect the public health," and the secondary standards are to "protect the public welfare from any known or anticipated adverse effects associated with the presence of such air pollutant in the ambient air" [42 USC 7409(b)(2)]. USEPA classifies specific geographic areas as either "attainment" or "nonattainment" areas for each pollutant based on the comparison of measured data with the NAAQS. States are required to adopt enforceable plans, known as a State Implementation Plan (SIP), to achieve and maintain air quality meeting the NAAQS. State plans also must control emissions that drift across state lines and harm air quality in downwind states.

The California Clean Air Act (CCAA) was enacted in 1988 (California Health & Safety Code (H&SC) Section 39000 et seq.). Under the CCAA, the State has developed the California Ambient Air Quality Standards (CAAQS), which are generally more stringent than the NAAQS. In addition to the federal criteria pollutants, the CAAQS also specify standards for visibility-reducing particles, sulfates, hydrogen sulfide, and vinyl chloride. Similar to the federal CAA, the CCAA classifies specific geographic areas as either "attainment" or "nonattainment" areas for each pollutant, based on the comparison of measured data within the CAAQS. Table 2 lists the current federal and state standards for regulated pollutants.

[3] The 2020 incident rate is not yet published.
[4] The term "Administrator" means the Administrator of the USEPA.

Table 2 Federal and State Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS	CAAQS
Ozone	1-Hour	–	0.09 ppm
	8-Hour	0.070 ppm	0.070 ppm
Carbon Monoxide	8-Hour	9.0 ppm	9.0 ppm
	1-Hour	35.0 ppm	20.0 ppm
Nitrogen Dioxide	Annual	0.053 ppm	0.030 ppm
	1-Hour	0.100 ppm	0.18 ppm
Sulfur Dioxide	Annual	0.030 ppm	–
	24-Hour	0.14 ppm	0.04 ppm
	1-Hour	0.075 ppm	0.25 ppm
PM_{10}	Annual	–	20 µg/m^3
	24-Hour	150 µg/m^3	50 µg/m^3
PM_{25}	Annual	12 µg/m^3	12 µg/m^3
	24-Hour	35 µg/m^3	–
Lead	30-Day Average	–	1.5 µg/m^3
	3-Month Average	0.15 µg/m^3	–

NAAQS = National Ambient Air Quality Standard; CAAQS = California Ambient Air Quality Standard ppm = parts per million; µg/m^3 = micrograms per cubic meter

Source: CARB 2016

NAAQS and CAAQS Attainment Status

California is divided geographically into 15 air basins for managing the air resources of the state on a regional basis. Areas within each air basin are considered to share the same air masses and, therefore, are expected to have similar ambient air quality. If an air basin is not in either federal or state attainment for a particular pollutant, the basin is classified as a nonattainment area for that pollutant. Under the federal and state Clean Air Acts, once a nonattainment area has achieved the air quality standards for a particular pollutant, it may be redesignated to an attainment area for that pollutant. To be redesignated, the area must meet air quality standards and have a 10-year plan for continuing to meet and maintain air quality standards, as well as satisfy other requirements of the federal CAA. Areas that have been redesignated to attainment are called maintenance areas. As described in Section 2.1 *Environmental Setting,* the Project is within the MDAB.

The portion of the MDAB overseen by the MDAQMD is designated severe nonattainment for the federal eight-hour ozone standard, federal 24-hour PM_{10} standard (San Bernardino County only), state ozone standard, state PM_{10} standard, and state $PM_{2.5}$ standard. The area is classified attainment or unclassified/attainment for all other criteria pollutants (MDAQMD 2020a).

State Implementation Plan

The State Implementation Plan (SIP) is a collection of documents that set forth the state's strategies for achieving the NAAQS. In California, the SIP is a compilation of new and previously submitted plans, programs (such as monitoring, modeling, and permitting), district rules, state regulations, and federal controls. CARB is the lead agency for all purposes related to the SIP under state law. Local air districts and other agencies, such as the Department of Pesticide Regulation and the Bureau of Automotive

Repair, prepare SIP elements and submit them to CARB for review and approval. CARB then forwards SIP revisions to the USEPA for approval and publication in the Federal Register. All of the items included in the California SIP are listed in the Code of Federal Regulations (CFR) at 40 CFR 52.220.

As the regional air quality management district, the MDAQMD is responsible for preparing and implementing the portion of the SIP applicable to the portion of the MDAB within its jurisdiction. The air pollution control district for each county adopts rules, regulations, and programs to attain federal and state air quality standards and appropriates money (including permit fees) to achieve these objectives.

Local Air Quality Regulations

Mojave Desert Air Quality Management District

As the local air quality management agency, MDAQMD is required to monitor air pollutant levels to ensure that state and federal air quality standards are met and, if they are not met, to develop strategies to meet the standards. Depending on whether the standards are met or exceeded, the MDAB is classified as being in "attainment" or "nonattainment." In areas designated as non-attainment for one or more air pollutants, a cumulative air quality impact exists for those air pollutants, and the human health impacts described in Section 2.1, *Environmental Setting,* are already occurring in that area as part of the environmental baseline condition.

Under state law, air districts are required to prepare a plan for air quality improvement for pollutants for which the district is in non-compliance. The SIPs adopted by the MDAQMD that are applicable to the Project are as follows: *Mojave Desert Planning Area Federal Particulate Matter (PM_{10}) Attainment Plan* (1995) and the *MDAQMD 70 ppb Ozone Attainment Plan (Western Mojave Desert Non-Attainment Area)* (2023). The MDAQMD SIP for the PM_{10} NAAQS was adopted on July 31, 1995 and covers San Bernardino County excluding Searles Valley planning area and the South Coast Air Basin. The PM_{10} attainment plan provides specific control measures to reach federal attainment for PM_{10}. Measures to reduce fugitive dust emissions from construction, disturbed areas, travel on unpaved roads, and stationary sources were provided. The plan had the goal of reaching attainment of PM_{10} in 2000. The MDAQMD attainment plan for the 2008 8-hour ozone NAAQS was adopted on January 23, 2023 and covers parts of San Bernardino County and Antelope Valley within the Western Mojave Desert. The plan includes enforceable emission limits, a monitoring program, a permitting program, and contingency measures to attain the federal 2008 8-hour ozone standard. The attainment plan addresses several state and federal planning requirements and incorporates new scientific information, primarily in the form of updated emissions inventories, ambient measurements, and meteorological air quality models. The document also demonstrated conformity with the Southern California Association of Governments' (SCAG) 20202 Regional Transportation Plan/Sustainable Communities Strategy (2020 RTP/SCS) activity data. The document demonstrates that the MDAQMD will meet the 70 ppm 8-hour ozone NAAQS by August 2033.

Project-level significance thresholds established by local air districts set the level at which a project would cause or have a cumulatively considerable contribution to an exceedance of a federal or state ambient air quality standard. Therefore, if a project's air pollutant emissions exceed the significance thresholds, the Project could cause or contribute to the human health impacts.

To minimize potential impacts from Project emissions, MDAQMD implements rules and regulations for emissions that may be generated by various uses and activities. The rules and regulations detail pollution-reduction measures that must be implemented during construction and operation of projects. Rules and regulations relevant to the project include the following:

- **Rule 401 (Visible Emissions).** This rule addresses discharge of visible emissions from any single source into the atmosphere. A violation is a discharge for a period or periods aggregating more than 3 minutes in any one hour which is:
  - As dark or darker in shade designated as No. 1 on the Ringelmann Chart, as published by the United State Bureau of Mines, or
  - Of such opacity as to obscure an observer's view to a degree equal to or greater that does smoke described in Subsection A or 20 percent opacity.
- **Rule 402 (Nuisance).** This rule prohibits the discharge from any source quantities for air containments or other materials which could cause injury, detriment, nuisance, or annoyance to any considerable number of persons or to the public.
- **Rule 403 (Fugitive Dust).** This rule pertains to any project or facility with a disturbance surface area of at least twenty acres; residential construction/demolition activity with a disturbed surface area of at least 10 acres; non-residential construction/demolition activity with a disturbed surface area of at least five acres; moving, depositing, or relocating more than 2,500 cubic yards per day of bulk materials on at least three consecutive days; solar projects; healthily-traveled unpaved roads; and any other project or facility where fugitive dust is visible (MDAQMD 2020b).

In addition, the following California Code of Regulations (CCR) would be applicable to the project:

- **Engine Idling.** In accordance with Section 2485 of CCR Title 13, the idling of all diesel-fueled commercial vehicles (weighing over 10,000 pounds) during construction shall be limited to five minutes at any location.
- **Emission Standards.** In accordance with Section 93115 of CCR Title 17, operation of any stationary, diesel-fueled, compression-ignition engines shall meet specified fuel and fuel additive requirements and emission standards.

San Bernardino County

The San Bernardino County Countywide Plan was adopted on October 27, 2020 and serves as the County's General Plan (County of San Bernardino 2020). Specific air quality policies are addressed in the Natural Resources Element. Applicable policies are as follows:

- **Policy NR-1.3 Coordination on air pollution.** We collaborate with air quality management districts and other local agencies to monitor and reduce major pollutants affecting the county at the emissions source.
- **Policy NR-1.6 Fugitive dust emissions**. We coordinate with air quality management districts on requirements for dust control plans, revegetation, and soil compaction to prevent fugitive dust emissions.
- **Policy NR-1.8 Construction and operations.** We invest in County facilities and fleet vehicles to improve energy efficiency and reduce emissions. We encourage County contractors and other builders and developers to use low-emission construction vehicles and equipment to improve air quality and reduce emissions.

In addition, San Bernardino County has a Development Code for construction of projects and for commercial solar energy facilities in the County. Under Section 83.01.040 *Air Quality*, the following measures for construction are applicable to the project:

(c) Diesel Exhaust Emissions Control Measures. The following emissions control measures shall apply to all discretionary land use projects approved by the County on or after January 15, 2009:

1) *On-Road Diesel Vehicles.* On-road diesel vehicles are regulated by the State of California Air Resources Board.
2) *Off-Road Diesel Vehicle/Equipment Operations.* All business establishments and contractors that use off-road diesel vehicle/equipment as part of their normal business operations shall adhere to the following measures during their operations in order to reduce diesel particulate matter emissions from diesel-fueled engines:

   A. Off-road vehicles/equipment shall not be left idling on site for periods in excess of five minutes. The idling limit does not apply to:

      I. Idling when queuing;
      II. Idling to verify that the vehicle is in safe operating condition;
      III. Idling for testing, servicing, repairing or diagnostic purposes;
      IV. Idling necessary to accomplish work for which the vehicle was designed (such as operating a crane);
      V. Idling required to bring the machine system to operating temperature; and
      VI. Idling necessary to ensure safe operation of the vehicle.

   B. Use reformulated ultra low-sulfur diesel fuel in equipment and use equipment certified by the USEPA or that pre-dates EPA regulations.
   C. Maintain engines in good working order to reduce emissions.
   D. Signs shall be posted requiring vehicle drivers to turn off engines when parked.
   E. Any requirements or standards subsequently adopted by the South Coast Air Quality Management District, the Mojave Desert Air Quality Management District or the California Air Resources Board.
   F. Provide temporary traffic control during all phases of construction.
   G. On-site electrical power connections shall be provided for electric construction tools to eliminate the need for diesel-powered electric generators, where feasible.
   H. Maintain construction equipment engines in good working order to reduce emissions. The developer shall have each contractor certify that all construction equipment is properly serviced and maintained in good operating condition.
   I. Contractors shall use ultra-low sulfur diesel fuel for stationary construction equipment as required by Air Quality Management District (AQMD) Rules 431.1 and 431.2 to reduce the release of undesirable emissions.
   J. Substitute electric and gasoline-powered equipment for diesel-powered equipment, where feasible.

The Project would be subject to all applicable measures from the Development Code Section 84.29.035 *Required Findings for Approval of a Commercial Solar Energy Facility*. The following are the relevant air quality measures for controlling fugitive dust emissions.

(c) The finding of fact shall include the following:

7) The proposed commercial solar energy generation facility will minimize site grading, excavating, and filling activities by being located on land where the existing grade does not exceed an average of five percent across the developed portion of the project site, and by utilizing construction methods that minimize ground disturbance.

20) The proposed commercial solar energy generation facility will be designed, constructed, and operated so as to minimize dust generation, including provision of sufficient watering of excavated or graded soil during construction to prevent excessive dust. Watering will occur at a minimum of three times daily on disturbed soil areas with active operations, unless dust is otherwise controlled by rainfall or use of a dust palliative, or other approved dust control measure.

21) All clearing, grading, earth moving, and excavation activities will cease during period of winds greater than 20 miles per hour (averaged over one hour), or when dust plumes of 20 percent or greater opacity impact public roads, occupied structures, or neighboring property, and in conformance with Air Quality Management District (AQMD) regulations.

22) For sites where the boundary of a new commercial solar energy generation facility will be located within one-quarter mile of a primary residential structure, an adequate wind barrier will be provided to reduce potentially blowing dust in the direction of the residence during construction and ongoing operation of the commercial solar energy generation facility.

23) Any unpaved roads and access ways will be treated and maintained with a dust palliative or graveled or treated by another approved dust control method to prevent excessive dust, and paving requirements will be applied pursuant to Chapter 83.09 of the Development Code.

24) On-site vehicle speed will be limited to 15 miles per hour.

The Project would be subject to all applicable measures from the Development Code Section 84.29.070 *Decommissioning Requirements*. The following are the relevant air quality measures:

a) *Closure Plan*. Following the operational life of the project, the project owner shall perform site closure activities to meet federal, state, and local requirements for the rehabilitation and revegetation of the project site after decommissioning. The project owner shall prepare a Closure, Revegetation, and Rehabilitation Plan and submit it to the Planning Division for review and approval prior to building permit issuance. Under this plan, all aboveground structures and facilities shall be removed to a depth of three feet below grade and removed offsite for recycling or disposal. Concrete, piping, and other materials existing below three feet in depth may be left in place. Areas that had been graded shall be restored to original contours unless it can be shown that there is a community benefit for the grading to remain as altered. Succulent plant species native to the area shall be salvaged prior to construction, transplanted into windrows, and maintained for later transplanting following decommissioning. Shrubs and other plant species shall be revegetated by the collection of seeds and re-seeding following decommissioning.

b) *Compliance with Other Requirements*.

(1) Project decommissioning shall be performed in accordance with all other plans, permits, and mitigation measures that would assure the project conforms to applicable requirements and would avoid significant adverse impacts. These plans include the following as applicable:

(A) Water Quality Management Plan.

(B) Erosion and Sediment Control Plan.

(C) Drainage Report.

(D) Notice of Intent and Stormwater Pollution Prevention Plan.

(E) Air Quality Permits.

(F) Biological Resources Report.

(G) Incidental Take Permit, Section 2081 of the Fish and Game Code.

(H) Cultural Records Report.

(2) The County may require a Phase 1 Environmental Site Assessment be performed at the end of decommissioning to verify site conditions.

2.3 Current Air Quality

Existing Ambient Air Quality

MDAQMD currently operates six active air quality monitoring station in the MDAB (MDAQMD 2020a). The purpose of the monitoring stations is to measure ambient concentrations of pollutants and determine whether ambient air quality meets the California and federal standards. The nearest monitoring station that monitors all the relevant criteria pollutants is the Victorville-14306 Park Avenue monitoring station, which is approximately 31 miles west of the edge of the Project area. This station monitors O_3, $PM_{2.5}$, and NO_2 along with PM_{10}. Table 3 indicates the number of days that each of the standards was exceeded the years 2019, 2020, and 2021. The data collected at the Victorville station indicates that the 8-hour O_3 state and federal standard was exceeded in 2019, 2020, and 2021. In addition the state 1-hour O_3 was exceeded all three years. The PM_{10} federal standard was exceeded in 2019, 2020, and 2021. The federal $PM_{2.5}$ standard was exceeded in 2020 and 2021. No other federal or state standards were exceeded at these monitoring stations.

Table 3 Ambient Air Quality at the Nearest Monitoring Stations

Pollutant	2019	2020	2021
Ozone, O_3			
8 Hour Ozone (ppm), 8-Hr Maximum[1]	0.081	0.094	0.098
Number of Days of State exceedances (>0.070)	34	38	35
Number of days of Federal exceedances (>0.070)	29	35	345
Ozone (ppm), Worst Hour[1]	0.104	0.112	0.112
Number of days above State standard (>0.09 ppm)	3	4	8
Number of days above Federal standard (>0.112 ppm)	0	0	0
Respirable Particulate Matter, PM_{10}			
Particulate Matter 10 microns, $\mu g/m^3$, Worst 24 Hours[1]	170.0	261.4	591.6
Number of days above State standard (>50 $\mu g/m^3$)	*	*	*
Number of days above Federal standard (>150 $\mu g/m^3$)	2	2	1
Fine Particulate Matter, $PM_{2.5}$			
Particulate Matter <2.5 microns, $\mu g/m^3$, Worst 24 Hours[1]	20.0	48.7	87.1
Number of days above Federal standard (>35 $\mu g/m^3$)	0	4	1
Nitrogen Dioxide, NO_2[3]			
Nitrogen Dioxide (ppb), Worst Hour[1]	0.056	0.059	0.057
Number of days above State standard (>180 ppb)	0	0	0
Number of days above Federal standard (>100 ppb)	0	0	0

[1] Measurements from the Victorville-14306 Park Avenue station at 14306 Park Avenue, Victorville.

*Indicates that insufficient data available to determine the value.

Source: CARB 2023

Sensitive Receptors

CARB and OEHHA have identified the following groups of individuals as the most likely to be affected by air pollution: the elderly over 65, children under 14, infants (including in utero in the third trimester of pregnancy), and persons with cardiovascular and chronic respiratory diseases such as asthma, emphysema, and bronchitis (CARB 2005; OEHHA 2015). Some land uses considered more sensitive to air pollution than others due to the types of population groups or activities involved are referred to as sensitive receptors. Examples of these sensitive receptors are residences, schools, hospitals, religious facilities, and daycare centers. MDAQMD CEQA Guidance defines sensitive receptor land uses as residences, schools, daycare centers, playgrounds, and medical facilities (MDAQMD 2020a). The sensitive receptors with the highest potential to be affected by the Project include residences surrounding the Project area. The closet single-family residence is located at the north corner of the Sherman Way and Lincoln Road intersection, immediately east of the Accessor Parcel Number 045-212-142 in the southern portion of the Project area The nearest residential community is Lucerne Valley, which is approximately six miles southwest of the Project area.

3 Air Quality Impact Analysis

3.1 Methodology

Construction and operational emissions were estimated from several emissions models and associated spreadsheet calculations, depending on the source type and data availability.[5] The primary emissions models used included CARB's on-road vehicle emission factor model (EMFAC2017) and the off-road diesel equipment emissions analysis and inventory (OFFROAD2017). Emission factors were obtained from the USEPA AP-42 *Compilation of Air Pollutant Emissions Factors* (USEPA 2006). Short-term and annual emissions were estimated using appropriate emission factors, the number of pieces of equipment, daily operating hours, and the associated schedules. Refer to Appendix A for details on equipment fleet, hours of operation, Project trips, construction schedule, and other assumptions used. The following construction and operational sources and activities were analyzed for emissions:

- **On-site construction equipment exhaust emissions (all criteria pollutants):** Based on EMFAC2017 and OFFROAD2017 emission factors and estimated equipment schedules.
- **On-site construction equipment fugitive dust emissions (PM_{10} and $PM_{2.5}$)**: Based on USEPA AP-42 emission factors, CARB Entrained Road Travel and Paved Road Dust Miscellaneous Process Methodology, and estimated equipment schedules.
- **On-site and off-site haul truck (includes delivery, freight, and dump/water trucks) exhaust emissions (all criteria pollutants):** Based on EMFAC2017 and estimated Project trips from the Traffic Assessment prepared by GHD (2023).
- **On-site and off-site entrained fugitive dust emissions for paved and unpaved road travel**: Based on AP-42 methodology, CARB methodology, and estimated Project trips.
- **Worker vehicle emissions for trips to and from the site**: Based on EMFAC2017 and estimated Project trips.
- **Worker vehicle entrained fugitive dust emissions for paved roads**: Based on AP-42 methodology, CARB methodology, and estimated Project trips.

As previously mentioned in Section 1.3, *Construction Activities*, construction at some of the Project parcels may occur simultaneously, and phases of construction would overlap. Construction emissions associated with the Project are discussed below with the assumption that construction would occur at all sites simultaneously. The lifetime of the Project was assumed to be 30 years and at the end of the solar facility's lifetime it was assumed to be decommissioned.

Trip generation rates for employees and vendors were provided by in the Traffic Assessment (GHD 2023). It was assumed that one-third of vendor vehicles would be medium-heavy duty trucks and two-thirds would be heavy-heavy duty trucks. Similarly, it was assumed that 76 percent of the worker commute vehicles were light-duty automobiles, and the remaining 24 percent were light-duty trucks. Percentages were derived from the distribution of vehicle miles traveled from EMFAC2017.

[5] The Project description was changed subsequent to the original modeling to reduce area size and increase facility size. As discussed in more detail in the Appendix, the analysis was not changed to reflect the changes in the Project size as the analysis as presented represents a more conservative analysis. The operational workers analyzed in the original analysis was 12, the current workers is estimated at 15. The analysis is scaled to update worker trip emissions accordingly.

3.2 Significance Thresholds

MDAQMD Significance Thresholds

Consistency with Air Quality Management Plan

MDAQMD's guidance states that a Project is considered non-conforming if it "…conflicts with or delays the implementation of an applicable attainment or maintenance plans." To demonstrate compliance, the Project must conform to all applicable MDAQMD rules, comply with proposed control measures that are not yet adopted from the applicable plans, and be consistent with the growth forecast from the applicable plans.

Regional Criteria Pollutant Thresholds

MDAQMD recommends quantitative regional significance thresholds for temporary construction activities and long-term Project operation in the MDAB. Projects that exceed the regional emission threshold would be considered to have a cumulatively significant impact to air quality. MDAQMD suggest the use of annual thresholds for projects exceeding one year. The annual thresholds shown in Table 4 are used to evaluate a project's potential air quality impacts.

Table 4 MDAQMD Air Quality Significance Thresholds

Pollutant	Annual Thresholds (tons per year)
CO	100
NO_x	25
VOC	25
SO_x	25
PM_{10}	15
$PM_{2.5}$	12

CO = carbon monoxide; NO_x = nitrogen oxides; VOC = volatile organic compounds; SO_x = sulfur oxide; PM_{10} = particulate matter with a diameter no more than 10 microns; $PM_{2.5}$ = particulate matter with a diameter no more than 2.5 microns

Source: MDAQMD 2020a

Toxic Air Containments Thresholds

MDAQMD has developed significance thresholds for the emissions of TACs based on health risks associated with elevated exposure to such compounds. For carcinogenic compounds, cancer risk is assessed in terms of incremental excess cancer risk. A project would result in a potentially significant impact if it would generate an incremental excess cancer risk greater or equal to 10 in a million or result in a hazard index (HI) or non-cancerous value greater or equal to 1. MDAQMD has listed in their CEQA guidance criteria for when these thresholds should be used for specific land use types and their distance to sensitive receptors (MDAQMD 2020a). The following project types proposed for sites within the specified distance to an existing or planned (zoned) sensitive receptor land use (e.g., residences, schools, daycare centers, playgrounds, and medical facilities) must evaluate the project using the aforementioned MDAQMD TAC thresholds:

- Any industrial project within 1,000 feet;
- A distribution center (40 or more trucks per day) within 1,000 feet;
- A dry cleaner using perchloroethylene within 500 feet;

- A gasoline dispensing facility within 300 feet.

Since the Project is a solar facility and is not categorized as the listed project types, evaluation of the Project's TAC emissions using the MDAQMD thresholds is not required. Therefore, no quantitative health risk assessment is necessary, and TAC emissions generated by the Project are qualitatively assessed.

3.3 Project Impact Analysis

Construction Impacts

Construction of the Project would require approximately 12 months of continuous activity involving several overlapping phases. Refer to Section 1.3, *Construction Activities*, for phasing specifics related to the Project construction schedule. Construction of the Project would generate air pollutant emissions from entrained dust, off-road equipment uses, and vehicle emissions. Off-site emissions would be generated by construction worker daily commute trips and heavy-duty diesel haul and vendor truck trips. Construction emissions would vary substantially from day to day, depending on the level of activity, the specific type of operation, and, for dust and the prevailing weather conditions. Construction of the gen-tie is incorporated into the Project construction schedule and equipment mix. Therefore, emissions associated with the gen-tie are incorporated directly into the impacts associated with construction of the Project. [6]

As shown in Table 5, all construction emissions with no control measures would be below the MDAQMD annual threshold except for PM_{10} emissions. However, the Project would be required to comply with MDAQMD Rule 403 and San Bernardino County Development Code Section 84.29.035 to control fugitive dust along with the San Bernardino County Development Code Section 83.01.040 to reduce exhaust emissions during construction (see Section 2.2, *Regulatory Setting*, for measures associated with the Development Code) . At this time, the exhaust-related reduction cannot be determined since the reduction is dependent on fleet specific information, but adherence to the dust control measures were quantified and applied to the PM_{10} and $PM_{2.5}$ emissions. Table 6 shows the reduced PM_{10} and $PM_{2.5}$ measures accounting for a water control measure. With the water control measures, the PM_{10} emissions do not exceed MDAQMD's threshold of 15 tons per year. Therefore, all construction-related criteria pollutant emissions would not exceed the applicable MDAQMD thresholds.

[6] As indicated in the introduction, the SCE Calcite Substation is not part of this Project and emissions estimates do not include estimates for construction of the Calcite Substation site.

Table 5 Annual Construction Emissions – No Control Measures

Emission Type	Source	Annual Emissions (tons per year)[2] VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$
2023							
Exhaust	Off-Road Construction Equipment	1.6	13.5	<0.1	14.9	0.6	0.6
	On-Road Vehicles	0.6	2.0	<0.1	8.8	0.7	0.3
Fugitive Dust[1]	Off-Road Construction Activity	–	–	–	–	5.7	0.6
	On-Road Vehicles (resuspended)	–	–	–	–	8.6	1.7
Total		**2.2**	**15.5**	**<0.1**	**23.7**	**15.6**	**3.2**
Threshold		25	25	25	100	15	12
Exceed Threshold?		No	No	No	No	**Yes**	No

[1] Fugitive dust describes particulate matter that is emitted into the air due to earth moving activities or that has been re-suspended.

[2] Emissions by construction year are based on an estimated construction schedule and construction starting on January 1, 2023.

VOC = volatile organic compounds; NO_x = nitrogen oxides; SO_x = sulfur oxides; CO = carbon monoxide; PM_{10} = particulate matter with a diameter of 10 or less microns; $PM_{2.5}$ = particulate matter with a diameter of 2.5 or less microns

Rounded values shown; columns may not add up correctly. Subtotal equals the sum of all exhaust and fugitive dust emissions from off-road construction equipment and on-road vehicles. See Appendix A for calculations.

Table 6 Annual Construction Emissions – With Water Control Measures

Emission Type	Source	Annual Emissions (tons per year)[2] VOC	NO_X	SO_X	CO	PM_{10} (with water control)	$PM_{2.5}$ (with water control)
2023							
Exhaust	Off-Road Construction Equipment	1.6	13.5	<0.1	14.9	0.6	0.6
	On-Road Vehicles	0.6	2.0	<0.1	8.8	0.7	0.3
Fugitive Dust[1]	Off-Road Construction Activity	–	–	–	–	3.9	0.4
	On-Road Vehicles (resuspended)	–	–	–	–	7.2	1.6
Total		**2.2**	**15.5**	**0.1**	**23.7**	**12.4**	**2.9**
Threshold		25	25	25	100	15	12
Exceed Threshold?		No	No	No	No	No	No

[1] Fugitive dust describes particulate matter that is emitted into the air due to earth moving activities or that has been re-suspended. Water control measures pursuant to MDAQMD Rule 403 and the San Bernardino County Development Code Section 84.29.035 are accounted for in the PM_{10} and $PM_{2.5}$ emissions.

[2] Emissions by construction year are based on an estimated construction schedule and construction starting on January 1, 2023.

VOC = volatile organic compounds; NO_x = nitrogen oxides; SO_x = sulfur oxides; CO = carbon monoxide; PM_{10} = particulate matter with a diameter of 10 or less microns; $PM_{2.5}$ = particulate matter with a diameter of 2.5 or less microns

Rounded values shown; columns may not add up correctly. Subtotal equals the sum of all exhaust and fugitive dust emissions from off-road construction equipment and on-road vehicles. See Appendix A for calculations.

Project Decommissioning

As stated in Section 1.4, *Operational Activities*, at the end of the Project's useful life (anticipated to be 30 to 40 years), the solar facility would be repowered or decommissioned. For this analysis, the lifetime is based on 30 years. The PV arrays and supporting equipment largely sit on the surface of the land, and removal of the arrays would not require extensive ground-disturbing activities. Any other activities required for deconstruction of the on-site facilities would require similar types and levels of equipment as those used during the construction phase. Therefore, based on the emissions shown in Table 6, decommissioning activities would not generate emissions exceeding established MDAQMD thresholds if decommissioning occurred at all Project parcels simultaneously. If the parcels were to be decommissioned in a subsequent order, then emissions would be lower than those reported in Table 6. Additionally, the Project applicant would be required to develop a Decommissioning Closure Plan for review and approval by the San Bernardino County Planning and Community Development Department. All decommissioning and restoration activities would adhere to the requirements of the appropriate governing authorities and be conducted in accordance with all applicable federal, state, and county regulations. Additionally, recommendations related to the decommissioning of utility sized solar facilities are included as a requirement of all proposed solar projects in San Bernardino County pursuant to development code 84.29.070 to establish safeguards to ensure the maintenance of the health, safety, and welfare of the citizens of the County.

Long-term Regional Impacts

Air Quality Management Plan Consistency

Construction, operation, and decommissioning of the Project would result in emissions of criteria pollutants including ozone precursors, such as ROG and NO_X as well as particulate matter. MDAQMD has prepared air quality management plans (AQMP) to achieve federal ozone standards, the most recent of which is the *MDAQMD 70 ppb Ozone Attainment Plan (Western Mojave Desert Non-Attainment Area)* (2023). In addition, the MDAQMD prepared the *Mojave Desert Planning Area Federal Particulate Matter (PM_{10}) Attainment Plan* (1995) since San Bernardino County is designated nonattainment for the federal PM_{10} standards. To be consistent with the MDAQMD air quality plans, projects must conform to all applicable MDAQMD rules, comply with proposed control measures that are not yet adopted from the applicable plans, and be consistent with the growth forecast from the applicable plans.

The Project would adhere to the MDAQMD Rule 403 (Fugitive Dust Control), in addition to complying with any applicable proposed control measures from the *Mojave Desert Planning Area Federal Particulate Matter (PM_{10}) Attainment Plan* (1995) and the *MDAQMD 70 ppb Ozone Attainment Plan (Western Mojave Desert Non-Attainment Area)* (2023).

The Project would be consistent with the growth forecasts used in the applicable MDAQMD AQMP. The MDAQMD 2023 ozone Attainment Plan used VMT provided by the SCAG's 2020 RTP/SCS, thus the projected number of employees generated by the Project were compared to the SCAG's 2020 RTP/SCS socioeconomic forecast projections of regional population, housing, and employment growth (SCAG 2020).[7] The Project would require fifteen on-site, full-time employees once operational. The employment growth forecasts in SCAG's 2020 RTP/SCS for Apple Valley Town, the nearest major town to the Project area, estimate that the total number of jobs would increase from 18,000 jobs in 2016 to

[7] On September 3, 2020, SCAG's Regional Council formally adopted the 2020-2045 RTP/SCS (titled Connect SoCal). However, the SIP was adopted prior to this date and relies on the demographic and growth forecasts of the 2016-2040 RTP/SCS; therefore, these forecasts are utilized in the analysis of the project's consistency with the air quality attainment plans

30,200 jobs in 2045, for an increase of 12,200 jobs (SCAG 2020). The Project would increase employment by fifteen people (assuming that the Project would require new employees to move to Apple Valley Town). The increase anticipated from the proposed Project would be within the SCAG's projected 2045 employment increase of 12,200 from 2016, and the Project would not cause the Town to exceed official regional employment projections.

Furthermore, as shown in Table 6 and Table 7, the Project would not generate criteria pollutant emissions that would exceed MDAQMD's thresholds for ozone precursors (VOC and NO_X), CO, SO_x, PM_{10}, and $PM_{2.5}$. Thus, the Project would not have a cumulatively considerable air quality impact nor contribute to an exceedance of a federal or state ambient air quality standard. The Project would be consistent with the applicable MDAQMD air quality management plans.

Operational Air Pollutant Emissions

Table 7 summarizes estimated emissions associated with operation of the Project as a whole. As discussed in Section 1.4, *Operational Activities*, the Project would require approximately fifteen full-time employees for operations and maintenance activities. As shown in Table 7, unmitigated operations emissions from the Project would not exceed MDAQMD thresholds for any criteria pollutant. Therefore, the Project would not contribute substantially to an existing or projected air quality violation. In addition, because criteria pollutant emissions and regional thresholds are cumulative in nature, the Project would not result in a cumulatively considerable net increase of criteria pollutants.

Table 7 Estimated Operational Emissions- No Control Measures

Emission Type	Source	Emissions					
		VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$
Exhaust	On Road and On-Site Vehicles	<0.1	0.1	<0.1	0.4	<0.1	<0.1
Fugitive Dust	Maintenance Vehicles	–	–	–	–	1.0	0.1
Total (tons/year)		**<0.1**	**0.1**	**<0.1**	**0.4**	**1.0**	**0.1**
MDAQMD Threshold		25	25	25	100	15	12
Exceed Threshold?		No	No	No	No	No	No

[1] Annualized at 250 working days per year

VOC = volatile organic compounds; NO_x = nitrogen oxides; SO_x = sulfur oxides; CO = carbon monoxide; PM_{10} = particulate matter with a diameter of 10 or less microns; $PM_{2.5}$ = particulate matter with a diameter of 2.5 or less microns

Totals may not add up due to rounding. Subtotal equals the sum of all exhaust and fugitive dust emissions from on-road and on-site vehicles. See Appendix A for calculations.

Emissions Displaced During Operation

The operation of the Project as a renewable energy source could indirectly cause the replacement of fossil fuel energy production facilities and thereby displace criteria pollutants created by existing power generation sources. The Project would generate a maximum of 525 MW of electricity at any given time. Over the 30-year lifespan of the Project, approximately 35,240 gigawatt-hours (GWh) of electricity would be produced, which equates to 1,175 GWh of electricity per year. Table 8 shows the potential criteria pollutant emissions that could be displaced by the Project. It is noted that this estimate only includes emissions generated by the combustion of fossil fuels and does not include operational employee trips or the emissions associated with extracting and transporting those power sources. It is also noted that this estimate only includes the displacement of emissions from the portion of the California electricity market that comes from fossil fuels (approximately 67 percent of the market) and does not include displacement of emissions from the portion of the California electricity market generated by non-combustion sources (i.e., wind, solar, nuclear, hydro-electric) (CEC 2021). These emissions are for informational purposes only and are not used to determine Project significance as it is unknown if active fossil fuel generators would be taken offline directly as a result of this Project. Refer to Appendix A for detailed calculations related to the Project's annual energy generation.

Table 8 Criteria Pollutant Emissions Displaced by the Project

	Emissions					
	VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$
Emissions Displaced Annually (tons per year)	0.4	295.9	11.2	36.0	10.8	4.5
Total Emissions Displaced over Lifetime of Project (tons over 30 years)	12.6	8,877.7	337.0	1,080.2	324.4	135.4

Note: Refer to Appendix A for displacement calculations.

Toxic Air Containments

Construction Impacts

Construction-related activities would result in temporary Project-generated emissions of DPM exhaust emissions from off-road, heavy-duty diesel equipment for site preparation, grading, building construction, and other construction activities. DPM was identified as a TAC by CARB in 1998 (CARB 2021c). Generation of DPM from construction projects typically occurs in a single area for a short period. Construction of the proposed project would occur over approximately 12 months. The dose to which the receptors are exposed is the primary factor used to determine health risk. Dose is a function of the concentration of a substance or substances in the environment and the extent of exposure that person has with the substance. Dose is positively correlated with time, meaning that a longer exposure period would result in a higher exposure level for the Maximally Exposed Individual. The risks estimated for a Maximally Exposed Individual are higher if a fixed exposure occurs over a longer period of time. According to the OEHHA, health risk assessments, which determine the exposure of sensitive receptors to toxic emissions, should be based on a 30-year exposure period (assumed to be the approximate time that a person spends in a household). OEHHA recommends this risk be bracketed with 9-year and 70-year exposure periods. Health risk assessments should be limited to the period/duration of activities associated with the Project.

CARB's Air Quality and Land Use Handbook: A Community Health Perspective (April 2005) recommends against siting sensitive receptors within 500 feet of a freeway, urban roads with 100,000 vehicles/day, or rural roads with 50,000 vehicles/day. While these siting distances are not particular to construction activities, the primary source of TAC emissions from both freeways and construction equipment is DPM. Therefore, for projects within 1,000 feet of sensitive receptors a refined health risk should be conducted. Additionally, OEHHA states that health risk should not be done for projects that are less than 2 months (OEHHA 2015). Based on the size of the site and the scattered residences within the vicinity, there are only approximately 40 to 70 acres of the project site that are within 1,000 feet of the any of the nearest sensitive receptors. If we conservatively round that up to 100 acres, and the construction schedule is 12 months, that means that each 100-acre area would take approximately 1.5 months to complete construction activities from start to finish, assuming a 22-day work month.

Therefore, as most of the site is outside the 1,000-foot radius, and since the receptors within 1,000 feet of the residences would be exposed to construction emissions for less than 2 months, impacts to these nearby receptors from construction activities would be less than significant. Therefore, given the short duration of exposure (less than 2 months) for residences within 1,000 feet of the project site, the low concentration of exhaust PM_{10}, and the fact that the majority of the site is greater than 1,000-feet from the nearest sensitive receptors, DPM generated by Project construction is not expected to create conditions where cancer risk would exceed the 10 in one million threshold or the non-carcinogenic Hazard Index of one for the Maximally Exposed Individual Receptor.

Operation Impacts

Common operational sources of TACs include gasoline stations, dry cleaners, diesel backup generators, truck distribution centers, freeways, and other major roadways (CARB 2005). The Project would not involve construction of gas stations, dry cleaners, highways, or roadways. In addition, the Project would not introduce a new stationary source of emissions. There would be some use of diesel-powered equipment during O&M activities, but the usage would be limited and not a continuous source of DPM. Therefore, the Project would not expose nearby sensitive receivers to substantial pollutant concentrations during operation.

Carbon Monoxide Hot Spots

A carbon monoxide hotspot is a localized concentration of carbon monoxide that is above a carbon monoxide ambient air quality standard. Localized carbon monoxide hotspots can occur at intersections with heavy peak hour traffic. Specifically, hotspots can be created at intersections where traffic levels are sufficiently high such that the local carbon monoxide concentration exceeds the federal one-hour standard of 35.0 ppm or the federal and state eight-hour standard of 9.0 ppm (CARB 2016).

The MDAQMD does not have recommendations to address carbon monoxide hotspots. In lieu of guidance, an analysis completed by the South Coast Air Quality Management District (SCAQMD) was used instead. A detailed carbon monoxide analysis was conducted during the preparation of the SCAQMD's 2003 AQMP. The locations selected for microscale modeling in the 2003 AQMP included high average daily traffic (ADT) intersections in the South Coast Air Basin, those which would be expected to experience the highest CO concentrations. The highest CO concentration observed was at the intersection of Wilshire Boulevard and Veteran Avenue on the west side of Los Angeles near the Interstate-405. The concentration of CO at this intersection was 4.6 ppm, which is well below the state and federal standards. The Wilshire Boulevard/Veteran Avenue intersection has an ADT of approximately 100,000 vehicles per day (SCAQMD 2003).

All the existing roadway segments in proximity to the Project have an ADT of less than 10,000 vehicles. The existing segment with the highest ADT is State Route 18 at the Lucerne Valley and State Route 246 junction with an existing ADT of 8,500 vehicles. With the Project construction traffic, the ADT on the same roadway segment would increase to 9,020 vehicles (GHD 2023). However, this increase would be temporary and cease once construction is complete. During Project operation, the Project would generate approximately 64 total daily trips to account for employee, delivery, and visitor trips (GHD 2023). This quantity of daily vehicle trips could not generate CO hotspot due to the small magnitude of mobile emission sources. Additionally, the Project area is located in a rural flat area where air dispersion is not impeded by buildings or nearby terrain such that exist in metropolitan areas; therefore, CO emissions generated during Project construction and operation would disperse rapidly. Thus, the Project would not cause any nearby intersections to exceed a 100,000 ADT nor result in or substantially contribute to concentrations that exceed the one-hour or eight-hour CO standard.

Valley Fever

Construction activities that include ground disturbance can result in fugitive dust, which can cause fungus *Coccidioides* spores to become airborne if they are present in the soil. These spores can cause Valley Fever. Workers who disturb soil where fungal spores are found, whether by digging, operating earthmoving equipment, driving vehicles, or by working in dusty, wind-blown areas, are more likely to breathe in spores and become infected. It is not a contagious disease and secondary infections are rare. Construction activities associated with the Project would include ground-disturbing activities that could result in an increased potential for exposure of nearby residents and on-site workers to airborne spores, if they are present. Compliance with dust control measured required by MDAQMD Rule 403 and San Bernardino County Development Code Section 84.29.035 would minimize personnel and public exposure to Valley Fever and reduce the potential risk of nearby resident and on-site worker exposure to Valley Fever. However, Recommendation AQ-1 is provided to ensure that personnel and public exposure to Valley Fever is minimized to the greatest extent possible.

Odors

Substantial objectionable odors are normally associated with agriculture, wastewater treatment, industrial uses, or landfills. The Project would involve the construction, operation and maintenance, and decommissioning of a solar energy facility and associated infrastructure that do not produce objectionable odors. For construction activities, odors would be short-term in nature and are subject to MDAQMD Rule 402 *Nuisance* (MDAQMD 1977). Construction activities would be temporary and transitory and associated odors would cease upon construction completion. Accordingly, the proposed Project would not create objectionable odors affecting a substantial number of people during construction. Common sources of operational odor complaints include sewage treatment plants, landfills, recycling facilities, and agricultural uses. Operation of the Project would not emit any odorous compounds.

4 Greenhouse Gases

4.1 Environmental Setting

GHGs and climate change are a cumulative global issue. CARB and USEPA regulate GHG emissions within the State of California and the United States, respectively. While the CARB has the primary regulatory responsibility within California for GHG emissions, local agencies can also adopt policies for GHG emission reduction. CARB has divided California into regional air basins. The Project is in unincorporated San Bernardino County, which is within the MDAB, and under the jurisdiction of the MDAQMD.

Climate Change and Greenhouse Gases

Climate change is the observed increase in the average temperature of the Earth's atmosphere and oceans along with other substantial changes in climate (such as wind patterns, precipitation, and storms) over an extended period. The term "climate change" is often used interchangeably with the term "global warming," but climate change is preferred because it conveys that other changes are happening in addition to rising temperatures. The baseline against which these changes are measured originates in historical records that identify temperature changes that occurred in the past, such as during previous ice ages. The global climate is changing continuously, as evidenced in the geologic record which indicates repeated episodes of substantial warming and cooling. The rate of change has typically been incremental, with warming or cooling trends occurring over the course of thousands of years. The past 10,000 years have been marked by a period of incremental warming, as glaciers have steadily retreated across the globe. However, scientists have observed acceleration in the rate of warming over the past 150 years. The United Nations Intergovernmental Panel on Climate Change (IPCC) expressed that the rise and continued growth of atmospheric CO_2 concentrations is unequivocally due to human activities in the IPCC's Sixth Assessment Report (2021). Human influence has warmed the atmosphere, ocean, and land, which has led the climate to warm at an unprecedented rate in the last 2,000 years. It is estimated that between the period of 1850 through 2019, that a total of 2,390 gigatonnes of anthropogenic CO_2 was emitted. It is likely that anthropogenic activities have increased the global surface temperature by approximately 1.07 degrees Celsius between the years 2010 through 2019 (IPCC 2021).

Gases that absorb and re-emit infrared radiation in the atmosphere are called GHGs. The gases widely seen as the principal contributors to human-induced climate change include carbon dioxide (CO_2), methane (CH_4), nitrous oxides (N_2O), fluorinated gases such as hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs), and sulfur hexafluoride (SF_6). Water vapor is excluded from the list of GHGs because it is short-lived in the atmosphere, and natural processes, such as oceanic evaporation, largely determine its atmospheric concentrations.

GHGs are emitted by natural processes and human activities. Of these gases, CO_2 and CH_4 are emitted in the greatest quantities from human activities. Emissions of CO_2 are usually by-products of fossil fuel combustion, and CH_4 results from off-gassing associated with agricultural practices and landfills. Human-made GHGs, many of which have greater heat-absorption potential than CO_2, include fluorinated gases and SF_6 (USEPA 2021b).

Different types of GHGs have varying global warming potentials (GWP). The GWP of a GHG is the potential of a gas or aerosol to trap heat in the atmosphere over a specified timescale (generally, 100 years). Because GHGs absorb different amounts of heat, a common reference gas (CO_2) is used to relate the amount of heat absorbed to the amount of the gas emitted, referred to as "carbon dioxide equivalent" (CO_2e), which is the amount of GHG emitted multiplied by its GWP. Carbon dioxide has a 100-year GWP of one. By contrast, CH_4 has a GWP of 30, meaning its global warming effect is 30 times greater than CO_2 on a molecule per molecule basis. N_2O has a GWP of 273 (IPCC 2021).

The accumulation of GHGs in the atmosphere regulates the earth's temperature. Without the natural heat-trapping effect of GHGs, the earth's surface would be about 33 degrees Celsius (°C) cooler (World Meteorological Organization 2020). However, since 1750, estimated concentrations of CO_2, CH_4, and N_2O in the atmosphere have increased by 47 percent, 156 percent, and 23 percent, respectively, primarily due to human activity (IPCC 2021). GHG emissions from human activities, particularly the consumption of fossil fuels for electricity production and transportation, are believed to have elevated the concentration of these gases in the atmosphere beyond the level of concentrations that occur naturally.

Greenhouse Gas Emissions Inventory

Global Emissions Inventory

Worldwide anthropogenic emissions of GHGs were approximately 49,000 million metric tons (MMT) of CO_2e in 2010 (IPCC 2014). Carbon dioxide emissions from fossil fuel combustion and industrial processes contributed about 65 percent of total emissions in 2010. Of anthropogenic GHGs, CO_2 was the most abundant, accounting for over 75 percent of total 2010 emissions. Methane emissions accounted for 16 percent of the 2010 total, while N_2O and fluorinated gases accounted for 6 percent and 2 percent respectively (IPCC 2014).[8]

United States Emissions Inventory

Total U.S. GHG emissions were 6,558 MMT of CO_2e in 2019. Emissions decreased by 1.7 percent from 2018 to 2019; since 1990, total U.S. emissions have increased by an average annual rate of 0.06 percent for a total increase of 1.8 percent between 1990 and 2019. The decrease from 2018 to 2019 reflects the combined influences of several long-term trends, including population changes, economic growth, energy market shifts, technological changes such as improvements in energy efficiency, and decrease carbon intensity of energy fuel choices. In 2019, the industrial and transportation end-use sectors accounted for 30 percent and 29 percent, respectively, of nationwide GHG emissions while the commercial and residential end-use sectors accounted for 16 percent and 15 percent of nationwide GHG emissions, respectively, with electricity emissions distributed among the various sectors (USEPA 2021c).

California Emissions Inventory

Based on the CARB California Greenhouse Gas Inventory for 2000-2018, California produced 418.2 MMT of CO_2e in 2019, which is 7.2 MMT of CO_2e lower than 2018 levels. The major source of GHG emissions in California is the transportation sector, which comprises 40 percent of the state's total GHG emissions. The industrial sector is the second largest source, comprising 21 percent of the state's GHG emissions while electric power accounts for approximately 14 percent (CARB 2021b). The magnitude of California's total GHG emissions is due in part to its large size and large population compared to other states. However, a factor that reduces California's per capita fuel use and GHG emissions as compared to other states is its relatively mild climate. In 2016, the State of California

[8] Updated global anthropogenic GHG emissions have not been published yet by the IPCC.

achieved its 2020 GHG emission reduction target of reducing emissions to 1990 levels as emissions fell below 431 MMT of CO_2e (CARB 2021d). The annual 2030 statewide target emissions level is 260 MMT of CO_2e (CARB 2017).

Potential Effects of Climate Change

Globally, climate change has the potential to affect numerous environmental resources though potential impacts related to future air temperatures and precipitation patterns. Scientific modeling predicts that continued GHG emissions at or above current rates would induce more extreme climate changes during the 21st century than were observed during the 20th century. Each of the past three decades has been warmer than all the previous decades in the instrumental record, and the decade from 2000 through 2010 has been the warmest. The observed global mean surface temperature (GMST) from 2015 to 2017 was approximately 1.0°C higher than the average GMST over the period from 1880 to 1900 (National Oceanic and Atmospheric Administration 2020). Furthermore, several independently analyzed data records of global and regional Land-Surface Air Temperature (LSAT) obtained from station observations jointly indicate that LSAT and sea surface temperatures have increased. Due to past and current activities, anthropogenic GHG emissions are increasing global mean surface temperature at a rate of 0.2°C per decade. In addition to these findings, there are identifiable signs that global warming is currently taking place, including substantial ice loss in the Arctic over the past two decades (IPCC 2014 and 2018).

According to *California's Fourth Climate Change Assessment*, statewide temperatures from 1986 to 2016 were approximately 0.6 to 1.1°C higher than those recorded from 1901 to 1960. Potential impacts of climate change in California may include reduced water supply from snowpack, sea level rise, more extreme heat days per year, more large forest fires, and more drought years (State of California 2018). In addition to statewide projections, *California's Fourth Climate Change Assessment* includes regional reports that summarize climate impacts and adaptation solutions for nine regions of the state and regionally specific climate change case studies (State of California 2018). However, while there is growing scientific consensus about the possible effects of climate change at a global and statewide level, current scientific modeling tools are unable to predict what local impacts may occur with a similar degree of accuracy. A summary follows of some of the potential effects that could be experienced in California as a result of climate change.

Air Quality

Scientists project that the annual average maximum daily temperatures in California could rise by 2.4 to 3.2°C in the next 50 years and by 3.1 to 4.9°C in the next century (State of California 2018). Higher temperatures are conducive to air pollution formation, and rising temperatures could therefore result in worsened air quality in California. As a result, climate change may increase the concentration of ground-level ozone, but the magnitude of the effect, and therefore its indirect effects, are uncertain. In addition, as temperatures have increased in recent years, the area burned by wildfires throughout the state has increased, and wildfires have occurred at higher elevations in the Sierra Nevada Mountains (State of California 2018). If higher temperatures continue to be accompanied by an increase in the incidence and extent of large wildfires, air quality could worsen. Severe heat accompanied by drier conditions and poor air quality could increase the number of heat-related deaths, illnesses, and asthma attacks throughout the state. However, if higher temperatures are accompanied by wetter, rather than drier conditions, the rains could tend to temporarily clear the air of particulate pollution, which would effectively reduce the number of large wildfires and thereby ameliorate the pollution associated with them (California Natural Resources Agency 2009).

Water Supply

Analysis of paleoclimatic data (such as tree-ring reconstructions of stream flow and precipitation) indicates a history of naturally and widely varying hydrologic conditions in California and the west, including a pattern of recurring and extended droughts. Uncertainty remains with respect to the overall impact of climate change on future precipitation trends and water supplies in California. Year-to-year variability in statewide precipitation levels has increased since 1980, meaning that wet and dry precipitation extremes have become more common (California Department of Water Resources 2018). This uncertainty regarding future precipitation trends complicates the analysis of future water demand, especially where the relationship between climate change and its potential effect on water demand is not well understood. The average early spring snowpack in the western U.S., including the Sierra Nevada Mountains, decreased by about 10 percent during the last century. During the same period, sea level rose over 0.15 meter along the central and southern California coasts (State of California 2018). The Sierra snowpack provides the majority of California's water supply as snow that accumulates during wet winters is released slowly during the dry months of spring and summer. A warmer climate is predicted to reduce the fraction of precipitation that falls as snow and the amount of snowfall at lower elevations, thereby reducing the total snowpack (State of California 2018). Projections indicate that average spring snowpack in the Sierra Nevada and other mountain catchments in central and northern California will decline by approximately 66 percent from its historical average by 2050 (State of California 2018).

Agriculture

California has an over $50 billion annual agricultural industry that produces over a third of the country’s vegetables and two-thirds of the country’s fruits and nuts (California Department of Food and Agriculture 2020). Higher CO_2 levels can stimulate plant production and increase plant water-use efficiency. However, if temperatures rise and drier conditions prevail, certain regions of agricultural production could experience water shortages of up to 16 percent, which would increase water demand as hotter conditions lead to the loss of soil moisture. In addition, crop yield could be threatened by water-induced stress and extreme heat waves, and plants may be susceptible to new and changing pest and disease outbreaks (State of California 2018). Temperature increases could also change the time of year certain crops, such as wine grapes, bloom or ripen, and thereby affect their quality (California Climate Change Center 2006).

Ecosystems and Wildlife

Climate change and the potential resultant changes in weather patterns could have ecological effects on the global and local scales. Soil moisture is likely to decline in many regions as a result of higher temperatures, and intense rainstorms are likely to become more frequent. Rising temperatures could have four major impacts on plants and animals: timing of ecological events; geographic distribution and range of species; species composition and the incidence of nonnative species within communities; and ecosystem processes, such as carbon cycling and storage (Parmesan 2006; State of California 2018).

4.2 Regulatory Setting

Federal

USEPA "ENDANGERMENT" AND "CAUSE OR CONTRIBUTE" FINDINGS

The U.S. Supreme Court in *Massachusetts et al. v. Environmental Protection Agency et al*. ([2007] 549 U.S. 05-1120) held that USEPA has the authority to regulate motor-vehicle GHG emissions under the federal CAA. The USEPA issued a Final Rule for mandatory reporting of GHG emissions in October 2009. This Final Rule applies to fossil fuel suppliers, industrial gas suppliers, direct GHG emitters, and manufacturers of heavy-duty and off-road vehicles and vehicle engines and requires annual reporting of emissions. In 2012, the USEPA issued a Final Rule that establishes the GHG permitting thresholds that determine when federal CAA permits under the New Source Review Prevention of Significant Deterioration (PSD) and Title V Operating Permit programs are required for new and existing industrial facilities.

In 2014, the U.S. Supreme Court in *Utility Air Regulatory Group v. EPA* (134 S. Ct. 2427 [2014]) held that USEPA may not treat GHGs as an air pollutant for purposes of determining whether a source is a major source required to obtain a PSD or Title V permit. The Court also held that PSD permits otherwise required (based on emissions of other pollutants) may continue to require limitations on GHG emissions based on the application of Best Available Control Technology.

State

The legal framework for GHG emission reduction in California is built upon executive orders, legislation, and regulations. The major components of California's climate change initiative are summarized below.

CALIFORNIA ADVANCED CLEAN CARS PROGRAM

Assembly Bill (AB) 1493 (2002), California's Advanced Clean Cars program (referred to as "Pavley"), requires CARB to develop and adopt regulations to achieve "the maximum feasible and cost-effective reduction of GHG emissions from motor vehicles." On June 30, 2009, USEPA granted the waiver of CAA preemption to California for its GHG emission standards for motor vehicles beginning with the 2009 model year. Pavley I regulates model years from 2009 to 2016 and Pavley II, which is now referred to as "LEV (Low Emission Vehicle) III GHG" regulates model years from 2017 to 2025. The Advanced Clean Cars program coordinates the goals of the Low Emissions Vehicles (LEV), Zero Emissions Vehicles (ZEV), and Clean Fuels Outlet programs, and would provide major reductions in GHG emissions. By 2025, when the rules will be implemented fully, new automobiles will emit 34 percent fewer GHGs and 75 percent fewer smog-forming emissions from their model year 2016 levels (CARB 2011).

EXECUTIVE ORDER N-79-20

On September 23, 2020, the governor issued Executive Order N-79-20, which sets a new statewide goal of phasing out gasoline powered vehicles and equipment. The executive order includes three main goals that CARB will be required to develop regulations for. The order requires that by 2035, all in-states sales of new passenger cars and trucks be 100 percent zero-emissions. By 2045, 100 percent of medium-and-heavy-duty vehicles operating in the State will be zero-emissions where feasible and by 2035 for drayage trucks. Also, by 2035, all off-road vehicles and equipment will be 100 percent zero emissions.

EXECUTIVE ORDER S-3-05

California's major initiative for reducing GHG emissions is outlined in AB 32, the "California Global

Warming Solutions Act of 2006," which was signed into law in 2006. AB 32 codifies the statewide goal of reducing GHG emissions to 1990 levels by 2020 and requires CARB to prepare a Scoping Plan that outlines the main State strategies for reducing GHGs to meet the 2020 deadline. In addition, AB 32 requires CARB to adopt regulations to require reporting and verification of statewide GHG emissions. Based on this guidance, CARB approved a 1990 statewide GHG level and 2020 limit of 427 MMT CO_2e. The Scoping Plan was approved by CARB on December 11, 2008 and included measures to address GHG emission reduction strategies related to energy efficiency, water use, and recycling and solid waste, among other measures. Many of the GHG reduction measures included in the Scoping Plan (e.g., Low Carbon Fuel Standard, Advanced Clean Car standards, and Cap-and-Trade) have been adopted since approval of the Scoping Plan.

In May 2014, CARB approved the first update to the AB 32 Scoping Plan. The 2013 Scoping Plan update defined CARB's climate change priorities for the next five years and set the groundwork to reach post-2020 statewide goals. The update highlighted California's progress toward meeting the "near-term" 2020 GHG emission reduction goals defined in the original Scoping Plan. It also evaluated how to align the State's longer-term GHG reduction strategies with other State policy priorities, including those for water, waste, natural resources, clean energy, transportation, and land use (CARB 2014).

The 2017 Scoping Plan Update was adopted on December 14, 2017. The Scoping Plan Update addresses the 2030 target established by Senate Bill (SB) 32, discussed below, and establishes a proposed framework of action for California to meet a 40 percent reduction in GHG emissions by 2030 compared to 1990 levels. The key programs that the Scoping Plan Update builds on include increasing the use of renewable energy in the state, the Cap-and-Trade Regulation, the Low Carbon Fuel Standard, and reduction of methane emissions from agricultural and other wastes (CARB 2017).

In response to the passage of AB 1279 and the identification of the 2045 GHG reduction target, CARB published the Final 2022 Climate Change Scoping Plan in November 2022 (CARB 2022a). The 2022 Update builds upon the framework established by the 2008 Climate Change Scoping Plan and previous updates while identifying new, technologically feasible, cost-effective, and equity-focused path to achieve California's climate target. The 2022 Update includes policies to achieve a significant reduction in fossil fuel combustion, further reductions in short-lived climate pollutants, support for sustainable development, increased action no NWL to reduce emissions and sequester carbon, and the capture and storage of carbon.

The 2022 Update assesses the progress California is making toward reducing its GHG emissions by at least 40 percent below 1990 levels by 2030, as called for in SB 32 and laid out in the 2017 Scoping Plan, addresses recent legislation and direction from Governor Newsom, extends and expands upon these earlier plans, and implements a target of reducing anthropogenic emissions to 85 percent below 1990 levels by 2045, as well as taking an additional step of adding carbon neutrality as a science-based guide for California's climate work. As stated in the 2022 Update, "The plan outlines how carbon neutrality can be achieved by taking bold steps to reduce GHGs to meet the anthropogenic emissions target and by expanding actions to capture and store carbon through the state's NWL and using a variety of mechanical approaches" (CARB 2022a).

SENATE BILL 97

SB 97, signed in August 2007, acknowledges that climate change is an environmental issue that requires analysis in CEQA documents. In March 2010, the California Resources Agency (Resources Agency) adopted amendments to the *State CEQA Guidelines* for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted guidelines give lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHG and climate change impacts.

SENATE BILL 375

SB 375, signed in August 2008, enhances the state's ability to reach AB 32 goals by directing CARB to develop regional GHG emission reduction targets to be achieved from passenger vehicles by 2020 and 2035. In addition, SB 375 directs each of the state's 18 major Metropolitan Planning Organizations (MPO) to prepare a "sustainable communities strategy" (SCS) that contains a growth strategy to meet these emission targets for inclusion in the Regional Transportation Plan (RTP). On March 22, 2018, CARB adopted updated regional targets for reducing GHG emissions from 2005 levels by 2020 and 2035. The updated GHG emission reduction targets took effect October 1, 2018.

SENATE BILL 32

On September 8, 2016, the governor signed SB 32 into law, extending AB 32 by requiring the state to further reduce GHGs to 40 percent below 1990 levels by 2030 (the other provisions of AB 32 remain unchanged). On December 14, 2017, CARB adopted the 2017 Scoping Plan, which provides a framework for achieving the 2030 target. The 2017 Scoping Plan relies on the continuation and expansion of existing policies and regulations, such as the Cap-and-Trade Program, as well as implementation of recently adopted policies and policies, such as SB 350 and SB 1383 (see below). The 2017 Scoping Plan also puts an increased emphasis on innovation, adoption of existing technology, and strategic investment to support its strategies. As with the 2013 Scoping Plan Update, the 2017 Scoping Plan does not provide project-level thresholds for land use development. Instead, it recommends that local governments adopt policies and locally-appropriate quantitative thresholds consistent with a statewide per capita goal of six metric tons (MT) CO_2e by 2030 and two MT CO_2e by 2050 (CARB 2017). As stated in the 2017 Scoping Plan, these goals may be appropriate for plan-level analyses (regional, sub-regional, county, or city level), but not for specific individual projects because they include all emissions sectors in the state.

SENATE BILL 350

Adopted on October 7, 2015, SB 350 supports the reduction of GHG emissions from the electricity sector through a number of measures, including requiring electricity providers to achieve a 50 percent renewables portfolio standard by 2030, a cumulative doubling of statewide energy efficiency savings in electricity and natural gas by retail customers by 2030.

SENATE BILL 1368

SB 1368 (Chapter 598, Statutes of 2006) is the companion bill of AB 32 and was signed by the Governor in September 2006. SB 1368 requires the California Public Utilities Commission (CPUC) to establish a GHG emission performance standard for baseload generation from investor-owned utilities by February 1, 2007. The California Energy Commission (CEC) also was required to establish a similar standard for local publicly owned utilities by June 30, 2007. These standards cannot exceed the GHG emission rate from a baseload combined-cycle natural gas-fired plant. The legislation further requires that all electricity provided to California, including imported electricity, must be generated from plants that meet the standards set by the CPUC and CEC. The Solar Facility meets the criteria of a renewable energy generation facility as defined in Chapter 8.6 of Division 15 of the Public Resources Code and therefore is determined by rule to comply with the GHG Emission Performance Standards requirements of SB 1368.

SENATE BILL 100

Adopted on September 10, 2018, SB 100 supports the reduction of GHG emissions from the electricity sector by accelerating the state's Renewables Portfolio Standard (RPS) Program, which was last updated by SB 350 in 2015. SB 100 requires electricity providers to increase procurement from eligible renewable energy resources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045. This further supports the reduction of GHG emissions from the electricity sector.

EXECUTIVE ORDER B-55-18

On September 10, 2018, the governor issued Executive Order B-55-18, which established a new statewide goal of achieving carbon neutrality by 2045 and maintaining net negative emissions thereafter. This goal is in addition to the existing statewide GHG reduction targets established by SB 375, SB 32, SB 1383, and SB 100.

CARB RESOLUTION 07-54

CARB Resolution 07-54 establishes 25,000 metric tons of GHG emissions as the threshold for identifying the largest stationary emission sources in California for purposes of requiring the annual reporting of emissions. This threshold was just over 0.005 percent of California's total inventory of GHG emissions for 2004.

17 CALIFORNIA CODE OF REGULATIONS SECTION 95350 ET SEQ.

The purpose of this regulation is to achieve GHG emission reductions by reducing SF_6 emissions from gas-insulated switchgear. Owners of such switchgear must not exceed maximum allowable annual emissions rates, reduced each year until 2020, after which annual emissions must not exceed 1.0 percent. Owners must regularly inventory gas-insulated switchgear equipment, measure quantities of SF_6, and maintain records of these for at least three years. Additionally, by June 1 each year, owners also must submit an annual report to CARB's Executive Officer for emissions that occurred during the previous calendar year.

In September 2020, CARB adopted Resolution 20-28, to amend the current regulation to phase out acquisition of SF_6 in gas-insulated switchgear in stages between 2025 and 2033. Under this resolution, CARB will be developing a timeline for phasing out SF_6 equipment in California and creating incentives to encourage owners to replace SF_6 equipment. The Resolution has not yet been approved by the California Office of Administrative Law.

CALIFORNIA ADVANCED CLEAN TRUCKS PROGRAM

In June 2020, CARB approved the Advanced Clean Trucks regulation, which requires manufacturers who certify Class 2b-8 chassis or complete vehicles with combustion engines to sell zero-emission trucks as an increasing percentage of their annual California sales from 2024 to 2035. In addition, the regulation requires company and fleet reporting for large employers and fleet owners with 50 or more trucks. CARB estimates that implementation of this regulation will reduce GHG emissions by a total of approximately 29 MMT of CO_2e between 2020 and 2040 relative to the business-as-usual baseline. By 2040, emissions are expected to be reduced by approximately four percent annually compared to the business-as-usual forecast (CARB 2020g). By 2045, all new trucks sold in California must be zero-emission.

CALIFORNIA ENVIRONMENTAL QUALITY ACT

Pursuant to the requirements of SB 97, the Resources Agency adopted amendments to the CEQA Guidelines for the feasible mitigation of GHG emissions or the effects of GHG emissions. The adopted

CEQA Guidelines provide general regulatory guidance on the analysis and mitigation of GHG emissions in CEQA documents, while giving lead agencies the discretion to set quantitative or qualitative thresholds for the assessment and mitigation of GHGs and climate change impacts.

Local Regulations

SAN BERNARDINO COUNTY GENERAL PLAN

The San Bernardino County Countywide Plan was adopted on October 27, 2020 and serves as the County's General Plan (County of San Bernardino 2020). Specific air quality policies are addressed in the Natural Resources Element. The applicable policy is as follows:

- **Policy NR-1.7 Greenhouse gas reduction targets**. We strive to meet the 2040 and 2050 greenhouse gas emission reduction targets in accordance with state law.

5 Greenhouse Gas Impact Analysis

5.1 Methodology and Significance Thresholds

Direct GHG Emissions

Construction of the Project would generate temporary GHG emissions primarily from the use of on-site construction equipment, vehicles transporting construction workers to and from the Project area, and heavy-duty trucks used to export earth materials off-site. Site preparation and grading typically generate the greatest emissions from grading equipment and soil hauling. Operational activities of the Project would generate GHG emissions primarily from operation of maintenance equipment on-site and vehicles transporting employees to and from the Project area. Emissions associated with decommissioning of the Project were conservatively assumed to be equivalent to construction of the Project give the type of equipment required for decommissioning. However, equipment and vehicles used at the decommissioning stage would most likely be cleaner. Operational direct GHG emissions accounted for employee vehicle travel and testing of the emergency generator. The analysis relied on CARB's on-road vehicle emission factor model (EMFAC2017), CARB's 2017 Off-Road Equipment Inventory Model (OFFROAD2017), and emission factors obtained from the USEPA AP-42 *Compilation of Air Pollutant Emissions Factors* (2006). The EMFAC2017 model was used to develop CO_2, CH_4, and N_2O emission estimates. These emissions results were used to calculate CO_2e.

Temporary and annual Project emissions were estimated based on equipment and construction schedule assumptions developed from similar solar projects and using appropriate emission factors. The Association of Environmental Professionals (AEP) recommends that total construction GHG emissions resulting from a project be amortized over the project's estimated lifetime and added to GHG emissions (AEP 2016). The construction and decommissioning GHG emissions were summed together and divided over a 30-year lifetime.

Indirect GHG Emissions Associated with Water Use

The use of water in California can involve substantial energy consumption, depending on the source of the water and the use location relative to the source. Major portions of the state rely on imported water from the State Water Project (California Aqueduct), the Central Valley Project, the Colorado River Aqueduct, the All-American Canal, and similar large-scale water distribution systems. Moving water across the state involves considerable energy consumption for pumping and delivering the water to the use location. The use of groundwater can involve substantial energy consumption to pump water from deep aquifers. In addition to the energy consumption associated with wholesale water supply, energy is consumed during local treatment for potable use and for local delivery. Most of the energy associated with water supply is provided by electricity, which is generated from a variety of sources, including fossil-fueled power plants that produce GHGs. Consequentially, the use of water for dust control and grading compaction during construction and photovoltaic panel washing during operations results in indirect GHG emissions. Based on similar solar projects, approximately 400 acre-feet of water would be required over the Project's construction and 50 acre-feet of water would be needed during operation.

As described in Section 1.3, *Construction Activities*, the Project may require water during construction for dust suppression. During operation the Project would require water for solar PV panel washing and facilities at the O&M buildings. Based on the energy factors in CPUC's *Embedded Energy in Water*

Studies (CPUC 2010a) and assuming minimal treatment and delivery, it was estimated that each acre-foot of water requires 649 kilowatt-hours of electricity for Project area delivery. The amount of GHG emissions associated with the 649 kilowatt-hours was conservatively based on the emissions profile for statewide average provided in the California Emissions Estimator Model (CalEEMod) version 2020.4.0 (CAPCOA 2021).

Displaced Emissions

Operation of the Project would create renewable energy over the planned 30-year Project lifetime. This energy could displace GHG emissions that would otherwise be produced by existing power generation resources, including coal and natural gas/other non-renewables.[9] The Project has the capacity to generate approximately 525 MW of electricity at peak sun exposure. Annual energy generation was estimated based on solar radiation at the Project area and annual operational time.[10] The Project could displace a fraction of existing current annual power generated by fossil-fuels. Displaced GHG emissions were estimated assuming that generated solar energy could displace energy generated from fossil fuels in the California market and does not include the approximate 34 percent of the California electricity generated by non-combustion sources (CEC 2021). Refer to Appendix A for detailed calculations related to the Project's annual energy generation. Displaced emissions are provided for informational purposes and are not included in the significance determination.

5.2 Significance Thresholds

Most individual projects do not generate sufficient GHG emissions to directly influence climate change. However, physical changes caused by a project can contribute incrementally to cumulative effects that are significant, even if individual changes resulting from a project are limited. The issue of climate change typically involves an analysis of whether a project's contribution towards an impact would be cumulatively considerable. "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, other current projects, and probable future projects (CEQA Guidelines, Section 15064[h][1]).

For future projects, the significance of GHG emissions may be evaluated based on locally adopted quantitative thresholds, consistency with a regional GHG reduction plan, or consistency with statewide regulations adopted to reduce GHG emissions. A project may not have an impact related to GHG emissions if it complies with an adopted plan that includes specific measures to sufficiently reduce GHG emissions (14 Cal. Code Regs. Section 15064[h][3]).

Section 15064.4 of the *CEQA Guidelines* recommends that lead agencies quantify GHG emissions of projects and consider several other factors that may be used in the determination of significance of GHG emissions from a project, including the extent to which the project may increase or reduce GHG emissions; whether a project exceeds an applicable significance threshold; and the extent to which the project complies with regulations or requirements adopted to implement a plan for the reduction or mitigation of GHG emissions.

---

[9] While the intent is to ultimately replace fossil fuel generation of electricity, until fossil fuel generation systems are ultimately taken offline, the project is adding supply to the existing system. As it is unknown if an existing fossil fuel generating facility will be taken offline as a result of this project, the displaced emissions were not counted as Project benefits for determining project significance.

[10] Photovoltaic cell capacity is rated in terms of mega or kilowatts and indicates the amount of instantaneous power produced when operating at peak sun exposure. Total amount of electricity produced in measured in watt-hours and is dependent on operational time. Operational time of a solar panel is defined by the amount of time that the photovoltaic cells are actively converting solar energy into power, which depends on solar radiation. Solar radiation is the measure of energy emitted from the sun and varies daily depending on the time of day, season, local landscape, and geography.

CEQA Guidelines Section 15064.4 does not establish a threshold of significance. Lead agencies have the discretion to establish significance thresholds for their respective jurisdictions, and in establishing those thresholds, a lead agency may appropriately look to thresholds developed by other public agencies, or suggested by other experts, as long as any threshold chosen is supported by substantial evidence (*CEQA Guidelines* Section 15064.7[c]).

According to *CEQA Guidelines* Section 15183.5, projects can tier off of a qualified GHG reduction plan, which allows for project-level evaluation of GHG emissions through the comparison of the project's consistency with the GHG reduction policies included in a qualified GHG reduction plan. This approach is considered by the Association of Environmental Professionals (AEP) in their white paper, *Beyond Newhall and 2020*, to be the most defensible approach presently available under CEQA to determine the significance of a project's GHG emissions (AEP 2016). However, the County of San Bernardino's *Greenhouse Gas Emissions Reduction Plan* (2011) does not address SB 32 or post-2020 GHG emissions. The project would be operational post-2020. Therefore, for CEQA purposes, this Project cannot tier off the *Greenhouse Gas Emissions Reduction Plan*.

The next best approach would be to use a quantitative threshold from the local air district. Thus, for the purposes of this analysis, thresholds developed by the MDAQMD are considered to determine the significance of GHG emissions. The MDAQMD *CEQA and Federal Conformity Guidelines* provides an annual threshold of 100,000 tons CO_2e and a daily threshold of 548,000 pounds CO_2e for short-term phases (less than one year). The annual threshold of 100,000 tons CO_2e is used in this analysis but converted into the MT CO_{2e} the threshold is 90,718 MT CO_2e.[11]

5.3 Project Impacts

Quantified GHG Emissions

The Project would generate GHG emissions directly and indirectly during construction, routine operational and maintenance activities, and decommissioning activities. Most emissions from the Project would be generated during construction and decommissioning activities. Table 9 presents total estimated emissions from construction activities from on-site and off-site emission sources. As shown therein, the estimated total GHG emissions during Project construction would be approximately 7,144 MT CO_2e over the 12-month construction period. It was conservatively assumed that decommissioning of the Project would use the same type and amount of equipment in a similar schedule to construction; therefore, decommissioning of the Project was estimated to generate an equivalent amount of emissions as construction. This is a conservative estimate because on-road vehicles and off-site equipment would continue to improve in fuel efficiency resulting in reduced emissions over time, as such decommissioning emissions in 30 years[12] would likely be substantially lower than construction emissions. Estimated construction and decommissioning emissions related to the Project amortized over 30 years, the anticipated Project lifetime, would be approximately 476 MT CO_2e per year which his added to the annual operational emissions to determine overall project significance as GHG emissions are cumulative in nature. Additional details on calculations can be found in Appendix A.

[11] 100,000 tons CO_2e *0.907185 MT = 90,718 MT CO_2e

[12] Although the Project would be constructed to last up to 40 years, the project construction-generated emissions were amortized over 30 years to provide a conservative estimate.

Table 9 Estimated Construction Emissions of Greenhouse Gases

Year	Emissions Source (MT CO_2e)				Total (MT CO_2e) per Year
	Off-Road	On-site Mobile	Off-site Mobile	Indirect GHG Emissions from Water Use	
Total Construction	2,822	22	4,254	46	7,144
Total Decommissioning	2,822	22	4,254	46	7,144
Total Construction and Decommissioning	5,643	44	8,509	93	14,289
Amortized Emissions (30-year life)	188	1	284	3	476

MT = metric tons; CO_2e = carbon dioxide equivalent; GHG = greenhouse gases; MDAQMD = Mojave Desert Air Quality Management District

Note: Numbers have been rounded to nearest metric tons

Table 10 summarizes operational emissions associated with the Project. Operation and maintenance of the Project would generate GHG emissions largely through motor vehicle trips to and from the Project area; on-site maintenance activities involving portable equipment and maintenance vehicles; and energy use associated with water consumption. As shown in Table 10, the Project would emit an estimated 150 MT CO_2e per year during operation. The total construction and decommissioning GHG emissions, amortized over 30 years, was added to the annual estimated operational emissions to estimate annual GHG emissions generated by the Project. Accounting for the amortized construction and decommissioning GHG emissions, the Project would emit an average of 627 MT CO_2e per year over the operational life of the Project (assumed 30 years). The total Project GHG emissions do not exceed the MDAQMD threshold of 90,718 MT CO_2e per year with Project emissions being 0.69 percent of the threshold.

Additionally, construction and operation of new renewable energy facilities would offset GHG emissions by replacing energy generated by fossil-fueled power plants. The Project would generate approximately 1,175 gigawatt-hours (GWh) of solar-generated electricity each year that would be added to the power grid and be potentially used in place of electricity generated by fossil-fuel sources. Based on the Project's projected annual electricity generation and the GHG emissions generated due to fossil-fuel combustion to generate the same level of electricity, the Project has the potential to displace 253,319 MT CO_2e per year. Assuming existing fossil fuel electric generation station production is reduced consistent with Project generation, the Project would result in an overall lifetime reduction estimated at 7,599,573 MT CO_2e and therefore could be regionally beneficial.[13] Thus, as the Project would not result in GHG emissions that exceed the MDAQMD threshold and, over its 30-year life could result in a net reduction in regional GHG emissions, the Project would be consistent with state GHG reduction laws, such as SB 32.

Additionally, the proposed on-site substation may feature circuit breakers that contain SF_6 gas, used as an insulator and an arc suppressor in the breakers. SF_6 is inert and non-toxic and is encapsulated in the breaker assembly. SF_6 is a GHG with substantial global warming potential because of its chemical nature and long residency time within the atmosphere. However, under normal conditions, it would be completely contained in the equipment and SF_6 would be released only in the unlikely event of a failure, leak, or crack in the circuit breaker housing. In addition, the equipment would comply with CARB's *Reducing Sulfur Hexafluoride Emissions from Gas Insulated Switchgear* regulations. CARB's current regulations require that switchgear not exceed a maximum allowable annual SF_6 emissions rate of 1.0

[13] 253,319 MT CO_2e * 30 years = 7,599,573 MT CO_2e

percent. All circuit breakers used for this Project would have a manufacturer-guaranteed SF_6 leakage rate of 0.5 percent per year or less per International Electro-technical Commission (IEC) standards. In compliance with CARB regulations, the applicant would be required to regularly inventory gas-insulated switchgear equipment, measure quantities of SF_6 and submit an annual report to CARB. With compliance with existing CARB regulations, the amount of SF_6 that could be released by the solar facility equipment would be insubstantial.

Table 10 Estimated Annual Operational Greenhouse Gas Emissions

	Emissions Source (MT CO_2e)				
Location	**Off-Road**	**On-site Mobile**	**Off-site Mobile**	**Indirect GHG Emissions from Water Use**	**Total (MT CO_2e)**
Operation	<1	15	130	6	150
Amortized Construction and Decommissioning Emissions	188	1	284	3	476
Annual Total	**188**	**8**	**354**	**9**	**627**
MDAQMD Threshold					90,718
Threshold Exceeded?					No
Annual Displaced GHG Emissions (MT CO_2e/year)					253,319
Net Annual GHG Emissions (MT CO_2e /year)					(252,692)

MT = metric tons; CO_2e = carbon dioxide equivalent; GHG = greenhouse gases; MDAQMD = Mojave Desert Air Quality Management District; parenthetical numbers represent negative values

Note: Numbers have been rounded to nearest metric tons

Consistency with GHG Reduction Plans and Policies

The Project would also be consistent with the renewable energy goals under the 2022 Scoping Plan Update and SB 100. The solar facility is consistent with the following specific electricity goals outlined in the 2022 Scoping Plan Update:

- Sector GHG target of 38 million metric tons of carbon dioxide equivalent (MMT of CO2e) in 2030 and 30 MMT of CO2e in 2035 Retail sales load coverage.
- Meet increased demand for electrification without new fossil gas-fired resources.
- Provide availability to support the increase in residential and commercial appliance conversion from current fuel to electric as products are replaced at end of life.

The Statewide goal to reduce GHG emissions to 40 percent below 1990 levels by 2030 has been established in SB 32. The *2022 Climate Change Scoping Plan Update* includes strategies to achieve SB 32 goals as well as further reduce emissions towards the ultimate goal of net zero (85 percent below 1990 emissions) by 2045. The SB 32 Scoping Plan update have included implementation of the RPS as an individual strategy. As discussed in Section 4.2, *Regulatory Setting*, SB 100 accelerated the state's RPS Program by increasing California's procurement of electricity from renewable sources to 33 percent of total retail sales by 2020, 60 percent by 2030, and 100 percent by 2045. The Project would generate approximately 1,175 GWh of electricity each year or approximately 35,240 GWh over the Project's 30-year lifetime. This additional solar-generated energy would be added to the power grid and, thus would directly support energy goals under SB 100 and would be consistent with the 2022 Scoping Plan. Replacement of fossil-fuel sources by 2045 with renewable solar energy would also displace GHG emissions, ultimately off-setting any GHG emissions produced by construction, decommissioning, and operation of the Project. Therefore, the Project would be consistent with state and regional plans to reduce GHG emissions and be consistent with the *2022 Climate Change Scoping Plan Update*.

6 Recommendations

As discussed, a construction and operation of the Project would not generate emissions that would exceed applicable MDAQMD thresholds or conflict with applicable regional plans. Regardless, due to the earthmoving activities associated with construction of the Project there is an increased potential for exposure of nearby residents and on-site workers to Valley Fever airborne spores, if they are present. Recommendation AQ-1 would reduce health risks associated with the potential exposure to Valley Fever spores.

AQ-1 Minimize Personnel and Public Exposure to Valley Fever

A Fugitive Dust Control Plan shall be prepared to minimize personnel and public exposure to Valley Fever. The Plan shall include the following requirements:

- All heavy-duty earth-moving vehicles shall be closed-cab and equipped with a High Efficiency Particulate Arrestance (HEPA) filtered air system.
- N95 respirators shall be provided to on-site workers for the duration of the construction period and workers shall wear the respirators during any ground-disturbance activities.
- Workers shall receive training to recognize the symptoms of Valley Fever and shall be instructed to promptly report suspected symptoms of work-related Valley Fever to a supervisor. Evidence of training shall be provided to the San Bernardino County Planning Department within 24 hours of the training session.
- A Valley Fever informational handout shall be provided to all on-site construction personnel. The handout shall provide, at a minimum, information regarding the symptoms, health effects, preventative measures, and treatment.

7 Conclusions

7.1 Air Quality

As discussed in Section 3, *Air Quality Impact Analysis*, simultaneous construction and decommissioning of the Project parcels would not exceed the significance thresholds established by MDAQMD. If construction activities occurred subsequently at Project parcels, the Project would also not generate emissions during construction or decommissioning that would exceed the MDAQMD significance threshold. As previously discussed, construction would be subject to MDAQMD Rule 403 and the San Bernardino County Development Code Section 84.29.035 to control fugitive dust along with the San Bernardino County Development Code Section 83.01.040 to reduce exhaust emissions during construction. Compliance with these existing requirements would further reduce emissions. In addition, the Project construction and decommissioning would not result in health risk impacts that would exceed the MDAQMD carcinogenic and non-carcinogenic risk thresholds. The analyses further documented that Project operation would not result in adverse long-term regional impacts. Lastly, the Project would not result in excessive exposure to CO hotspots. Therefore, since the Project's emissions do not exceed the MDAQMD applicable thresholds, the Project construction and decommissioning, and operations and maintenance, would not result in a cumulatively considerable increase in emissions of nonattainment pollutants. Moreover, the Project would not expose sensitive receptors to excessive concentrations of DPM or generate CO hotspots.

Exposure to Valley Fever and the resulting health impacts to surrounding communities and on-site workers would be reduced with Recommendation AQ-1. Valley Fever spores are naturally occurring in the soil of San Bernardino County and fungal spores can become airborne during ground disturbances, such as construction work. Reduction of dust disturbance or stabilization of dust will reduce the number of fungal spores becoming airborne and thus reduce the incidences of individuals becoming infected.

7.2 Greenhouse Gases

As discussed in Section 5, *Greenhouse Gas Impact Analysis*, the Project would not generate GHG emissions that would exceed local and regional significance thresholds and is consistent with applicable GHG reduction plans. Further, due to being a renewable solar energy project, the Project would reduce the local, regional, and statewide cumulative GHG emissions and offset a portion of the incremental cumulative GHG impacts of other projects. The Project, as a solar development, would reduce dependency on fossil fuels for electricity generation and would be regionally beneficial to air quality. Therefore, the Project would support attainment of the state's GHG reduction goals and the Project-specific incremental impact on GHG emissions would not be cumulatively considerable.

8 References

Association of Environmental Professionals (AEP). 2016. Final White Paper Beyond 2020 and Newhall: A Field Guide to New CEQA Greenhouse Gas Threshold and Climate Action Plan Targets for California. October. https://califaep.org/docs/AEP-2016_Final_White_Paper.pdf (accessed August 2021).

California Air Pollution Control Officers Association (CAPCOA). 2021. California Emissions Estimator Model User Guide: Version 2020.4.0. Prepared by BREEZE Software, A Division of Trinity Consultants in collaboration with South Coast Air Quality Management District and the California Air Districts. http://www.aqmd.gov/docs/default-source/caleemod/user-guide-2021/01_user-39-s-guide2020-4-0.pdf?sfvrsn=6 (accessed August 2021).

California Air Resources Board (CARB). 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. Available at https://www.arb.ca.gov/diesel/documents/rrpFinal.pdf (accessed August 2021).

______. 2005. Air Quality and Land Use Handbook: A Community Health Perspective. https://www.arb.ca.gov/ch/handbook.pdf (accessed August 2021).

______. 2011. Staff Report: Initial Statement of Reasons for Proposed Rulemaking, Public Hearing to Consider the “LEV III” Amendments to the California Greenhouse Gas and Criteria Pollutant Exhaust and Evaporative Emission Standards and Test Procedures and to the On-Board Diagnostic System Requirements for Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles, and to the Evaporative Emission Requirements for Heavy-Duty Vehicles. Sacramento, CA. December 7, 2011 (accessed August 2021).

______. 2014. First Update to the Climate Change Scoping Plan. May. https://ww2.arb.ca.gov/sites/default/files/classic/cc/scopingplan/2013_update/first_update_climate_change_scoping_plan.pdf (accessed August 2021).

______. 2016. Ambient Air Quality Standards. Last modified: May 4, 2016. https://ww2.arb.ca.gov/sites/default/files/2020-07/aaqs2.pdf (accessed August 2021).

______. 2017. California’s 2017 Climate Change Scoping Plan. December 14, 2017. https://www.arb.ca.gov/cc/scopingplan/scoping_plan_2017.pdf (accessed August 2021).

______. 2021a. “California Ambient Air Quality Standards.” https://ww2.arb.ca.gov/resources/california-ambient-air-quality-standards (accessed August 2021).

______. 2021b. “Air Quality Standards.” https://ww2.arb.ca.gov/resources/background-air-quality-standards (accessed August 2021).

______. 2021c. Summary: Diesel Particulate Matter Health Impacts. https://ww2.arb.ca.gov/resources/summary-diesel-particulate-matter-health-impacts (accessed September 2021).

______. 2021d California Greenhouse Gas Emissions for 2000 to 2019 Trends of Emissions and Other Indicators. July. https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2019/ghg_inventory_trends_00-19.pdf (accessed August 2021).

______. 2022 Scoping plan Documents. https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan/2022-scoping-plan-documents (accessed March 2023).

______. 2023. iADAM: Air Quality Data Statistics Top 4 Summary. N.d. https://www.arb.ca.gov/adam/topfour/topfour1.php (accessed March 2023).

California Climate Change Center (CCCC). 2006. Climate Scenarios for California.

California Department of Public Health. 2020. Epidemiologic Summary of Valley Fever (Coccidioidomycosis) in California, 2019. September. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciEpiSummary2019.pdf (accessed August 2021).

______. 2021a. Valley Fever Fact Sheet. Last Updated June 2021. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/ValleyFeverFactSheet.pdf (accessed August 2021).

______. 2021b. Coccidioidomycosis in California Provisional Monthly Report January-July 2021. July. https://www.cdph.ca.gov/Programs/CID/DCDC/CDPH%20Document%20Library/CocciinCAProvisionalMonthlyReport.pdf (accessed August 2021).

California Department of Water Resources. 2018. Indicators of Climate Change in California. May 2018. https://oehha.ca.gov/media/downloads/climate-change/report/2018caindicatorsreportmay2018.pdf (accessed August 2021).

California Department of Food and Agriculture. 2020. "California Agricultural Production Statistics." https://www.cdfa.ca.gov/statistics/ (accessed August 2021).

California Energy Commission (CEC). 2021. 2020 Total System Electric Generation. N.d. https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2020-total-system-electric-generation (accessed August 2021).

California Natural Resources Agency. 2009. 2009 California Climate Adaptation Strategy. March 2009. http://resources.ca.gov/docs/climate/Statewide_Adaptation_Strategy.pdf (accessed July 2021).

California Public Utilities Commission (CPUC). 2010. Embedded Energy in Water Studies Study 2: Water Agency and Function Component Study and Embedded Energy-Water Load Profiles. August. https://waterenergyinnovations.com/wp-content/uploads/2020/03/Embedded-Energy-in-Water-Studies-Study-2-FINAL.pdf (accessed August 2021).

GHD. 2023. Sienna Solar Project Final Traffic Assessment Memorandum. July 6.

Intergovernmental Panel on Climate Change (IPCC). 2014. Climate Change 2014 Synthesis Report. Contribution of Working Groups I, II and III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Core Writing Team, R.K. Pachauri and L.A. Meyer (eds.)]. IPCC, Geneva, Switzerland. https://www.ipcc.ch/site/assets/uploads/2018/02/SYR_AR5_FINAL_full.pdf (accessed August 2021).

______. 2018. Summary for Policymakers. In: Global warming of 1.5°C. An IPCC Special Report on the impacts of global warming of 1.5°C above pre-industrial levels and related global greenhouse gas emission pathways, in the context of strengthening the global response to the threat of climate change, sustainable development, and efforts to eradicate poverty. https://www.ipcc.ch/sr15/ (accessed August 2021).

______. 2021. Climate Change 2021 The Physical Science Basis. August. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.pdf (accessed August 2021).

Kirkland and Fierey. 1996. Coccidioidomycosis: A Reemerging Infectious Disease. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2626789/ (accessed August 2021).

Los Angeles County Health Department. 2013. Preventing Work-Related Coccidioidomycosis (Valley Fever). June. http://publichealth.lacounty.gov/acd/docs/ValleyFeverPreventionforWorkFlyer.pdf (accessed August 2021).

Mojave Desert Air Quality Management District (MDAQMD). 1977. Rule 402 Nuisance. July. https://www.mdaqmd.ca.gov/home/showpublisheddocument/290/636305704801500000 (accessed August 2021).

______. 1995. Mojave Desert Planning Area Federal Particulate Matter (PM_{10}) Attainment Plan. July 31. https://www.mdaqmd.ca.gov/home/showpublisheddocument/176/636305689057870000 (accessed August 2021).

______. 2017. MDAQMD Federal 75 ppb Ozone Attainment Plan (Western Mojave Desert Nonattainment Area). Adopted on February 27, 2017. https://ww3.arb.ca.gov/planning/sip/planarea/wmdaqmp/2016sip_mdplan.pdf (accessed August 2021).

______. 2020a. California Environmental Quality Act (CEQA) and Federal Conformity Guidelines. February. https://www.mdaqmd.ca.gov/home/showpublisheddocument?id=8510 (accessed August 2021).

______. 2020b. Rule 403 Fugitive Dust Control. Amended October 28. https://www.mdaqmd.ca.gov/home/showpublisheddocument/8482/637393282546170000 (accessed August 2021).

______. 2023. Federal 70 PPB Ozone Attainment Plan (Western Mojave Desert Nonattainment Area). Adopted January 23, 2023. https://www.mdaqmd.ca.gov/home/showpublisheddocument/9693/638131029372000000 (accessed March 2023).

Office of Environmental Health Hazard Assessment (OEHHA), 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines - The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. February. https://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf (accessed August 2021).

Parmesan, C. August 2006. Ecological and Evolutionary Responses to Recent Climate Change.

San Bernardino, County of. 2011. County of San Bernardino Greenhouse Gas Emissions Reduction Plan. September. http://www.sbcounty.gov/Uploads/lus/GreenhouseGas/FinalGHGFull.pdf (accessed September 2021).

______. 2020. San Bernardino County Plan – County Policy Plan. October. http://countywideplan.com/wp-content/uploads/2021/01/CWP_PolicyPlan_HardCopy_MainText_Tables_20201027_adopted.pdf (accessed August 2021).

South Coast Air Quality Management District. 2003. Final 2003 AQMP Appendix V Modeling and Attainment Demonstrations. August. http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2003-air-quality-management-plan/2003-aqmp-appendix-v.pdf (accessed August 2021).

Southern California Association of Governments (SCAG). 2020. Connect SoCal (2020 - 2045 Regional Transportation Plan/Sustainable Communities Strategy). https://www.connectsocal.org/Pages/Connect-SoCal-Final-Plan.aspx (accessed August 2021).

State of California. 2018. California’s Fourth Climate Change Assessment Statewide Summary Report. August 27, 2018. http://www.climateassessment.ca.gov/state/ (accessed August 2021).

United States Environmental Protection Agency (USEPA). 2006. *Chapter 13: Miscellaneous Sources*, AP-42 Fifth Edition Compilation of Air Pollutant Emission Factors. November. https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-13-miscellaneous-0 (accessed August 2021).

______. 2013. Policy Assessment for the Review of the Lead National Ambient Air Quality Standards, External Review Draft. https://www3.epa.gov/ttn/naaqs/stan2000dards/pb/data/010913_pb-draft-pa.pdf (accessed August 2021).

______. 2016. “NAAQS Table.” https://www.epa.gov/criteria-air-pollutants/naaqs-table (accessed August 2021).

______. 2021a. “Criteria Air Pollutants.” https://www.epa.gov/criteria-air-pollutants (accessed August 2021).

______. 2021b. “Overview of Greenhouse Gases”. N.d. https://www.epa.gov/ghgemissions/overview-greenhouse-gases (accessed August 2021).

______. 2021c. Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2018. U. S. EPA #430-R-20-002. April 2020. https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2018 (accessed August 2021).

World Meteorological Organization. 2020. “Greenhouse Gases.” https://public.wmo.int/en/our-mandate/focus-areas/environment/greenhouse%20gases (accessed August 2021).

Appendix A

Bulk Emissions Calculations

Sienna Solar
Assumptions Updates

Apr-23

The project description was updated after the initial analysis was conducted. The analysis was not revised as the analysis provided is more conservative than what the revised project would be. The following changes to the original analysis are made textually in the report but are not revised in the Appendix calculations.

- The system size is increased from a 500-megawatt facility to a 525-megawatt facility. This will not change the construction time or average daily trips to the site. It would increase the potential GHG offset emissions quantified by approximately 342,000 MT over the 30 years of operation.

- The site size was reduced from 2,007 acres to 1,854 acres. This would reduce the number of days needed for site preparation and grading activities or the daily acres graded but would not reduce the equipment needed. No change was made to construction emissions based on reduced acreage.

- The total miles of collector lines to be developed will be up to 39 miles as opposed to the 28.10 as identified in the original report. The number of miles would not increase the daily emissions estimates. And although 39 miles is analyzed, not all routes will be developed.

Employment

	2016	2045	Growth
SCAG	18,000	30,200	12,200

SCAG 2020. Current Context Demographics and Growht Forecast. Technical Report adopted on September 3. 2020. https://scag.ca.gov/sites/main/files/file-attachments/0903fconnectsocal_demographics-and-growth-forecast.pdf?1606001579

Sienna Solar
Analysis Updates

Worker Commute Emissions

			Emissions						
			lbs/day						MT/yr
	Workers	Worker Trips	VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
		Original (5 worker, 2 visitor)							
Passenger Vehicle (LDA)			0.03554	0.041222	0.00247	0.611563	0.045042	0.01846	0.1141469
Light-duty Truck (LDT2)			0.02272	0.031566	0.00108	0.309462	0.015719	0.00645	0.0497806
Total	5	24	0.05826	0.07279	0.00355	0.92102	0.06076	0.0249	0.163927
Emissions/trip			0.00243	0.00303	0.00015	0.03838	0.00253	0.001	0.00683
		2023 Revisions (15 worker, 2 visitor)							
Worker (Updated)	15	64	0.15537	0.1941	0.00947	2.45606	0.16203	0.0664	0.43714
Service Vehicles (LHDT2)			0.00662	0.17793	0.00067	0.05028	0.01234	0.0058	0.032426
Equipment/Material Delivery (T6)			0.00231	0.06902	0.00105	0.03883	0.01648	0.0072	0.050525
Total			0.16429	0.44104	0.01119	2.54517	0.19085	0.0795	0.520091
		Days/year	tons/year						
		250	0.02	0.06	0.00	0.32	0.02	0.01	130

Worker Onsite Emissions

			Emissions						
			lbs/year						MT/yr
	Workers	Worker Trips	VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
		Original (5 worker, 2 visitor)							
Light-duty Truck (LDT2)	3		0.49028	0.91638	0.04194	11.3348	0.33856	0.1566	1.934171
Emissions/trip		12	0.04086	0.07637	0.0035	0.94457	0.02821	0.013	0.161181
		2023 Revisions (15 worker, 2 visitor)							
Worker (Updated)	4	16	2.6148	4.88736	0.22369	60.4524	1.80564	0.8351	10.31558
Utility/Service Vehicle			0.17202	8.55818	0.0468	1.99286	0.32532	0.1407	1.507633
Water Truck			0.18148	23.8963	0.06533	2.96211	0.24131	0.1031	3.271216
Total			2.9683	37.3418	0.33582	65.4074	2.37227	1.0789	15.09443
			tons/year						
			0.001	0.019	0.0002	0.033	0.001	0.001	15

Worker Fugitive Emissions

	Worker Trips	On-Road (lbs/day)		Worker Trips	On-Site (lbs/day)	
		PM_{10}	$PM_{2.5}$		PM_{10}	$PM_{2.5}$
		Original (5 worker, 2 visitor)				
Passenger Vehicle (LDA)		108.47	26.62			
Light-duty Truck (LDT2)		37.81	9.28		763.12	76.67
Emissions/trip	24.00	6.09	1.50	12.00	63.59	6.39
		2023 Revisions (15 worker, 2 visitor)				
Worker (Updated)	64.00	390.07	95.75	16.00	1,017.49	102.23
Service Vehicles (LHDT2)		12.19	2.99		254.37	25.56
Equipment/Material Delivery (T6)		12.19	2.99			
Water Truck					254.37	25.56
Total		414.45	101.73		1,526.24	153.34
Total (tons/yr)		0.21	0.05		0.76	0.08

Sienna Solar
Analysis Updates

Operational Criteria Emissions By Year

	tons/year					
	VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$
On Road and On-Site Vehicles (Exhaust)	0.022	0.074	0.002	0.351	0.025	0.010
Vehicles (Fugitive)					0.97	0.13
Total	0.022	0.074	0.002	0.351	0.995	0.138
Total (For Report)	<0.1	0.1	<0.1	0.4	1.0	0.1

Operational GHG Emissions

	MT/yr CO_2e		
	Original	2023	
Off-Road	0.00	0.00	
Onsite-Mobile	6.71	15	
Off-Site Mobile	61.72	130	
Water	5.79	5.79	
Total Operational	**74.22**	**150.90**	
Amortized Con. & Decom.	476	476	
Total Annual	550	627	0.69%

Emissions Displaced During Operations

Original	2023 Analysis	
500	525	MW system
33,562	35,240	gigawatt hours produced
1,119	1,175	gigawatt hour of electricity per year

	Emissions						
	Annual - Tons/yr; 30 year total - Tons						MT/yr; MT
	VOC	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$	CO_2e
Original							
Emissions Displaced Annually	0.4	281.9	10.7	34.3	10.3	4.3	241,911
Total Emissions Displaced over 30 years	11.5	8,455.80	320.6	1,028.60	308.4	129.7	7,257,330
2023 Revisions							
Emissions Displaced Annually	0.4	295.9	11.2	36.0	10.8	4.5	253,946
Total Emissions Displaced over 30 years	12.6	8,877.7	337.0	1,080.2	324.4	135.4	7,618,381
Net Displaced Annually (Displaced - Project)							253,319
Net Displaced 30 years (Displaced - Project)							7,599,573
Increase from Original							11,408
							252,692

Sienna Solar PV (2,084 Acres, 500 MW)

Emissions Factors Used in Analysis

1		2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Exhaust Emissions Factors for Equipment in		**Mojave Desert Air Basin**														
Equipment [1, 2, 3]	**Fuel Type**	**Consumption (gallons/hr)**	**Actual HP**	**Modeled HP**	**HC lbs/hr**	**ROG lbs/hr**	**TOG lbs/hr**	**CO lbs/hr**	**NOx lbs/hr**	**CO_2 lbs/hr**	**PM_{10} lbs/hr**	**$PM_{2.5}$ lbs/hr**	**otal PM lbs/h**	**SO_X lbs/hr**	**NH_3 lbs/hr**	
Air Compressor	diesel	1.02	78	50	2.11E-02	2.51E-02	3.03E-02	1.94E-01	1.56E-01	2.22E+01	6.28E-03	5.77E-03	1.21E-02	2.87E-04	1.87E-04	
Crane	diesel	2.73	231	238	3.44E-02	4.16E-02	4.96E-02	2.86E-01	4.37E-01	6.14E+01	2.06E-02	1.89E-02	3.95E-02	5.67E-04	5.01E-04	
Crawler Tractor	diesel	3.93	212	238	4.64E-02	5.62E-02	6.68E-02	4.14E-01	5.93E-01	8.84E+01	2.79E-02	2.57E-02	5.36E-02	8.16E-04	7.22E-04	
Drum Roller Compactor	diesel	2.24	134	138	1.56E-02	1.88E-02	2.24E-02	2.96E-01	1.93E-01	5.04E+01	9.74E-03	8.96E-03	1.87E-02	4.66E-04	4.12E-04	
Excavator	diesel	3.60	212	238	2.01E-02	2.43E-02	2.90E-02	2.91E-01	2.04E-01	8.11E+01	8.15E-03	7.50E-03	1.56E-02	7.49E-04	6.62E-04	
Generator Set	diesel	1.23	84	88	1.47E-02	1.78E-02	2.12E-02	2.09E-01	1.51E-01	2.77E+01	8.65E-03	7.95E-03	1.66E-02	2.56E-04	2.26E-04	
Grader	diesel	3.16	187	175	4.26E-02	5.16E-02	6.14E-02	4.58E-01	4.70E-01	7.10E+01	2.58E-02	2.38E-02	4.96E-02	6.55E-04	5.79E-04	
Off-highway Truck	diesel	5.79	402	450	3.96E-02	4.79E-02	5.71E-02	3.06E-01	3.40E-01	1.30E+02	1.29E-02	1.18E-02	2.47E-02	1.20E-03	1.06E-03	
Other Construction Equipment	diesel	3.26	172	175	3.17E-02	3.84E-02	4.57E-02	4.39E-01	3.78E-01	7.33E+01	1.97E-02	1.82E-02	3.79E-02	6.77E-04	5.98E-04	
Rough-terrain Forklift	diesel	2.00	100	100	1.64E-02	1.98E-02	2.36E-02	2.47E-01	2.10E-01	3.81E+01	1.14E-02	1.05E-02	2.20E-02	3.52E-04	3.11E-04	
Rubber-tired Loader	diesel	3.34	203	238	2.77E-02	3.35E-02	3.99E-02	2.97E-01	3.01E-01	7.52E+01	1.27E-02	1.17E-02	2.45E-02	6.95E-04	6.14E-04	
Skid Steer	diesel	1.35	75	75	7.24E-03	8.76E-03	1.04E-02	1.87E-01	1.17E-01	3.03E+01	3.93E-03	3.62E-03	7.55E-03	2.80E-04	2.47E-04	
Trencher (big)	diesel	5.87	300	300	6.46E-02	7.82E-02	9.30E-02	3.96E-01	8.83E-01	1.32E+02	3.69E-02	3.40E-02	7.09E-02	1.22E-03	1.08E-03	
Trencher (small)	diesel	1.82	78	75	5.73E-02	6.93E-02	8.25E-02	3.43E-01	5.75E-01	4.10E+01	3.98E-02	3.66E-02	7.65E-02	3.77E-04	3.35E-04	
Vibratory Post Driver	diesel	3.26	158	175	3.17E-02	3.84E-02	4.57E-02	4.39E-01	3.78E-01	7.33E+01	1.97E-02	1.82E-02	3.79E-02	6.77E-04	5.98E-04	

1. Emissions factors for diesel and gasoline equip developed from the CARB 2017 Off-Road Inventory Model for year 2023. Emissions based on the equipment within the model horsepower bin nearest the applicant provided horsepower rating; emissions between bins were averaged if actual horsepower was equally between two model horsepower bins. Note that emission factors from the 2017 Inventory Model are substantially lower than in the previous OFFROAD2011 model because of changed assumptions by CARB regarding load factors, hours of use, fuel consumption, and equipment population.

2. "Other Construction Equipment" used for vibratory post driver.

On-Road Mobile Vehicle Emission Factors Used in Analysis

Source: San Bernardino (MD), EMFAC 2017 Annual Average, Year 2023

Running Emissions, grams/mile

							PM_{10} (g/mile)			$PM_{2.5}$ * (g/mile)					
Vehicle Type	Speed	ROG	TOG	CO	NO_X	SO_X	Exhaust	Tire Wear	Brake	Exhaust	Tire Wear	Brake	CO_2	CH_4	N_2O
LDA	10	0.039073725	0.056571727	1.152663143	0.058929129	0.005085617	0.006141824	0.008000002	0.036750011	0.005654128	0.002	0.015750005	514.105061	0.0101732	0.007546882
LDA	55	0.006612772	0.009616013	0.535324688	0.034691371	0.002500786	0.001088287	0.008000002	0.036750011	0.001002888	0.002	0.015750005	252.79091	0.00174031	0.00432666
LDT2	10	0.072736507	0.105677788	1.702486955	0.137341515	0.006338669	0.006430896	0.008000002	0.036750011	0.005916233	0.002	0.015750005	640.718936	0.01758122	0.011539515
LDT2	55	0.012788296	0.018636738	0.791867681	0.080178156	0.003123955	0.001136121	0.008000002	0.036750011	0.001045764	0.002	0.015750005	315.75953	0.00309599	0.006661599
LHD2	10	0.400150418	0.464248163	1.947081411	1.300912116	0.013027206	0.036893217	0.010644025	0.089180026	0.035237922	0.00266101	0.038220011	1350.30116	0.02366708	0.125972382
LHD2	55	0.049204727	0.057645641	0.438102934	1.608088606	0.006094553	0.012011418	0.010721276	0.089180026	0.011481981	0.00268032	0.038220011	631.679194	0.00319742	0.059525688
MHDT	10	0.077277336	0.103483406	0.899890201	3.875340234	0.021227558	0.005219915	0.012000003	0.130340037	0.004952537	0.003	0.055860016	1445.51141	0.00134365	0.227214264
MHDT	55	0.014141809	0.019221595	0.311630219	0.560320016	0.009484452	0.007141328	0.012000003	0.130340037	0.006824437	0.003	0.055860016	984.096743	0.00227706	0.09399804
MDV	10	0.100792296	0.145741628	2.086892755	0.182873921	0.007933741	0.006740715	0.008000002	0.036750011	0.006212666	0.002	0.015750005	802.550391	0.02352798	0.016820503
MDV	55	0.01790118	0.025998704	0.950179934	0.109256351	0.003909301	0.001249921	0.008000002	0.036750011	0.001154191	0.002	0.015750005	395.412811	0.00419751	0.00953958
HHDT	10	0.082315376	0.093713629	1.343580537	10.83006655	0.029632034	0.011908318	0.035929861	0.061619857	0.011393168	0.00898247	0.02640851	3136.49243	0.00382503	0.493010826
HHDT	55	0.013749524	0.015687578	0.103353466	1.204377318	0.010277922	0.023408701	0.020003274	0.061739993	0.022396039	0.00500082	0.026459997	1087.88032	0.00065289	0.170965238

Start Emissions, grams/trip

Vehicle Type	ROG	TOG	CO	NO_X	SO_X	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
LDA	0.220096143	0.240976868	2.200773324	0.183143967	0.000529067	0.001814672	0.001668561	53.46373613	0.05026596	0.025681144
LDT2	0.347631167	0.380611802	2.825381348	0.30303508	0.000689389	0.001934108	0.001778396	69.66470718	0.073493451	0.033103701
LHD2	0.033550831	0.036733937	0.447772491	0.141545188	5.54882E-05	9.38615E-05	8.63022E-05	5.607240725	0.006813508	0.010983259
MHDT	0.04626588	0.050655315	1.013325893	1.641031137	8.66587E-05	0.000105159	9.66897E-05	8.757111402	0.009130818	0.007099773
MDV	0.434955479	0.476216291	3.284695342	0.368175784	0.000841869	0.001989053	0.001829132	85.07331067	0.088026639	0.036081623
HHDT	4.00565E-07	4.38568E-07	0.000707851	2.263815753	7.22654E-08	2.36089E-07	2.17075E-07	0.007302625	7.79928E-08	4.41824E-06

	Additional ROG Emissions				**Additional TOG Emissions**			
Vehicle Type	Diurnal (g/vehicle/day)	Hot Soak (g/trip)[1]	Resting Losses (g/vehicle/day)[2]	Running Losses (g/trip)	Diurnal (g/vehicle/day)	Hot Soak (g/trip)[1]	Resting Losses (g/vehicle/day)[2]	Running Losses (g/trip)
LDA	0.277471607	0.101462018	0.215429112	0.214460887	0.277471607	0.101462018	0.215429112	0.214460887
LDT2	0.499803435	0.153513381	0.394967228	0.513175249	0.499803435	0.153513381	0.394967228	0.513175249
LHD2	0.016803541	0.033711009	0.008088999	0.207056003	0.016803541	0.033711009	0.008088999	0.207056003
MHDT	0.01163704	0.019228227	0.005578239	0.104891362	0.01163704	0.019228227	0.005578239	0.104891362
MDV	0.550298038	0.174147873	0.460825203	0.535921832	0.550298038	0.174147873	0.460825203	0.535921832
HHDT	2.22116E-05	3.25924E-05	1.15678E-05	0.000171434	2.22116E-05	3.25924E-05	1.15678E-05	0.000171434

[1]Hotsoak emissions occur during the first hour the vehilce is parked after normal operation

[2] Diurnal/resting losses have to do with the vehicle population on site as it "rests".

Note: Mobile emission factors are weighted averages based on the vehicle population per fuel type, vehicle class and speed obtained from EMFAC2017.

Additional Greenhouse Gas Emissions Factors

GHG Global Warming Potential [1,2]

CO_2:	1	GWP
CH_4:	30	GWP
N_2O:	273	GWP

Note: 1 ton (short, US) = 0.90718474 metric ton.

1. Based on 100 Yr GWP from IPCC Sixth Assessment, 2021

2. No climate-carbon feedbacks (CC fb) included

Indirect Water Supply GHG Emissions

State Water Project/ Central Valley Proj	428	kwh/acre foot [1]
Local Supply (Groundwater)	906-1,990	kwh/million gallons [2]
Local Treatment	44	kwh/millions gallons [3]
Local Delivery	45-956	kwh/million gallons [4]
Factor used:	***1993***	***kwh/MG [5]***
	649	***kwh/AF***

Note: 1 million gallons (MG) = 3.07 acre feet (AF)

1. Embedded Energy in Water Studies, 2010a: Study 1, Figure 3.4: Dos Amigos Pumping Plant. (p.62-63)

2. Embedded Energy in Water Studies, 2010b:Study 2, Table 4-6: Central Valley energy intensity range for groundwater (main water supply)

3. Embedded Energy in Water Studies, 2010b:Study 2, Table 4-6: Lowest Statewide energy intensity value used because no Central Valley specific values, but minimal treatment of water observed in Central Valley agencies

4. Embedded Energy in Water Studies, 2010b:Study 2, Table 4-6: Statewide energy intensity values assuming booster pump use on moderate terrain

5 Energy intensity (EI) value used for analysis = the average supply EI + minimal water treatment EI + average local delivery EI

Southern California Edison Electricity Generation [1]

CO_2:	391.000	lbs/MWH
CH_4:	0.033	lbs/MWH
N_2O:	0.004	lbs/MWH
	0.0001783	MT/kwh

Indirect GHG Factor:

0.116 MT/Acre Foot

Note: 1 Metric Tons (MT) = 2204.62 lbs

1. California Emissions Estimator Model User Guide, Appendix D, CAPCOA 2021

Paved roads - Emission Factor Derivation Table

$$E_{ext} = [\ k\ (sL)^{0.91} \times (W)^{1.02}\ ]\ (1 - P/4N)$$

where:
E=particulate emissions factor (lb/VMT)
k = particle size multiplier
sL = road surface silt loading (g/m^2)
W = average vehicle weight class (tons)
P = # of "wet" days with at least 0.01 inch of precipitation
N = # of days in averaging period (default 365 for annual)

				On-Site Vehicles[6]	
Parameter	**Unit**	**PM10**	**PM2.5**	**PM10**	**PM2.5**
Mean Vehicle Weight[1]	tons	2.4	2.4	10	10
k factor[2]	lb/VMT	0.0022	0.00054	0.0022	0.00054
Silt Loading, sL[3]	g/m^2	0.156	0.156	0.135	0.135
precipitation, P[4]	days	23	23	23	23
Averaging period, N[5]	days	365	365	365	365
Uncontrolled Emission factor, E	**lb/VMT**	**0.00097518**	**0.00024**	**0.00367**	**0.00090**

NOTES

1. Assumption based on the mix of <u>all</u> vehicles (not just project vehicles) driving on paved roads to site. Eland EIR used 2.2 tons versus CA Statewide MVW = 2.4 tons (CARB 7.9, November 2018).
2. AP-42 Table 13.2.1-1 recommends 0.0022 lb/VMT for PM10 and 0.00054 lb/VMT for PM2.5. PM2.5 factor is estimated to be 15% of PM10 per CARB's Miscellanous Process Methodology 7.9 Entrained Road Travel, Paved Road Dust (March 2018).
3. Consistent with the Project Description, a majority of construction vehicles would access the site from State Route 18 and 247 with some use of county roads. Therefore the silt loading factor was weighted assuming 90% travel on SR-18 and SR-247 considered a major road and 10% travel on county roads considered local rural. The San Bernardino County specific silt loading values were used. Source: CARB 7.9, March
4. CARB 7.9, Nov 2018: Table 8. San Bernardino County in the Mojave Desert receives 23 days of percipitation
5. AP-42 13.2 eqn 2 (EPA, January 2011)

6. Assumption based on onsite fleet mix of heavy, medium and light duty trucks (https://www.epa.gov/emission-standards-reference-guide/vehicle-weight-classifications-emission-standards-reference-guide) and silt loading for "Local" roadway category (CARB 7.9, Nov 2016: Table 3)

Unpaved roads - Emission Factor Derivation Table

$$E.F._{\cdot dust,i} = \left(\frac{k(s/12)^{1}(S/30)^{0.5}}{(M/0.5)^{0.2}} - C \right)(1 - \frac{P}{365})$$

where:
E=particulate emissions factor (lb/VMT)
k = particle size multiplier for particle size range and units of interest
s = surface material silt content (%)
M= surface material mositure content (%)
S = mean vehicle speed (mph)
C = emission factor for 1980s vehicle fleet exhust, brake wear and tire wear
P = # of "wet" days with at least 0.01 inch of precipitation

Parameter	**Unit**	**PM10**	**PM2.5**
Particle size, k[1]	lbs/VMT	1.8	0.18
Silt content, s[2]	%	8.5	8.5
Surface moisture content, M[3]	%	6.515	6.515
Mead vehicle speed, S[4]	mph	15	15
Exhaust emission factor, C[5]	lbs/VMT	0.00047	0.00036
precipitation, P[6]	days	23	23
Uncontrolled Emission factor, E	**lb/VMT**	**0.51**	**0.05**
Control efficiency for watering[7]	%	0.55	0.55
Controlled Emission factor, E	**lb/VMT**	**0.23**	**0.023**
Control efficiency for dust palliative[8]	%	0.84	0.84
Controlled Emission factor, E	**lb/VMT**	**0.08**	**0.01**

NOTES

1. Consistent assumption obtained for Public Roads from AP-42 Table 13.2.2-2 and CARB 7.9, March 2018: Table 7
2. Silt content was obtained from the most recet AP-42 recommendation (Table 13.2.2-1) for "construction sites". The AP-42 guidance provides a range of 0.56-23 with the average as 8.5%.
3. AP-42 recommends range from 0.03-13 % for public roads (Table 13.2.2-3), therefore average mositure content was applied.
4.MDAQMD-recommended measure for dust control is for vehicles not to exceed 15 mph on any unpaved surface on the construction site. Also consistent with San Bernardino County Development Code Section 84.29.035. Note that AP-42 recommends range from 10-55 mph for public roads (Table 13.2.2-3).
5. AP-42 recommended emission factor for 1980's vehicles fleet exhaust, brake wear and tire wear for unpaved roads (Table 13.2.2.-4.)
6. CARB 7.9, Nov 2018: Table 8. San Bernardino County in the Mojave Desert receives 23 days of percipitation
7. MRI, April 2001. Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031.
8. Per CARB certification for Soil Sement®

CARB Source: https://ww3.arb.ca.gov/ei/areasrc/fullpdf/full7-9_2018.pdf
USEPA Source: https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-fifth-edition-volume-i-chapter-13-miscellaneous-0

Sienna Solar PV (2,084 Acres, 500 MW)

On-Site Equipment Combustion Emissions [1]

Phase 1 - Site Prep and Grading	# of Days in Phase :	66														
Equipment	HP Estimate	Number of Units	Daily Hours	Days in Use	Total Hourly Usage (units*hours per day*days)	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO_2e
Crawler Tractor	212	1	5	66	330	15.31	18.53	22.05	136.68	195.48	29,178.61	9.21	8.47	0.24	0.27	13.2
Grader	187	3	8	66	1,584	67.49	81.67	97.19	725.50	743.83	112,431.36	40.91	37.63	0.92	1.04	51.0
Off-highway Truck	402	5	4	66	1,320	52.28	63.26	75.29	404.15	449.21	171,897.82	16.98	15.62	1.40	1.59	78.0
Drum Roller Compactor	134	2	8	66	1,056	16.43	19.88	23.66	312.92	203.93	53,231.47	10.28	9.46	0.43	0.49	24.1
Rubber-tired Loader	203	2	8	66	1,056	29.24	35.38	42.10	313.16	317.41	79,434.11	13.46	12.38	0.65	0.73	36.0
Rough-terrain Forklift	130	3	8	66	1,584	25.98	31.43	37.41	391.27	332.67	60,359.66	18.12	16.67	0.49	0.56	27.4
Skid Steer	75	3	8	66	1,584	11.47	13.88	16.51	296.37	184.63	47,986.78	6.23	5.73	0.39	0.44	21.8
					AVG EXHAUST EMISSIONS PER DAY	**3.31**	**4.00**	**4.76**	**39.10**	**36.78**	**8,403.83**	**1.75**	**1.61**	**0.07**	**0.08**	**3.81**
					TOTAL	**218.20**	**264.02**	**314.21**	**2,580.06**	**2,427.16**	**554,519.81**	**115.18**	**105.97**	**4.53**	**5.12**	**251.53**

Phase 2 - Tracker Foundations	# of Days in Phase :	125														
Equipment	HP Estimate	Number of Units	Daily Hours	Days in Use	Total Hourly Usage (units*hours per day*days)	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO_2e
Air Compressor	78	1	8	125	1,000	21.07	25.07	30.34	193.64	155.92	22,238.61	6.28	5.77	0.19	0.29	10.1
Generator Set	84	3	8	125	3,000	44.12	53.38	63.53	627.98	452.58	83,197.84	25.94	23.86	0.68	0.77	37.7
Off-highway Truck	402	5	4	125	2,500	99.05	119.85	142.63	765.63	850.99	325,642.10	32.16	29.59	2.66	3.01	147.7
Other Construction Equipment	172	1	2	125	250	7.93	9.60	11.43	109.72	94.59	18,324.59	4.94	4.54	0.15	0.17	8.3
Rough-terrain Forklift	100	5	8	125	5,000	82.01	99.24	118.10	1,235.37	1,050.34	190,574.91	57.21	52.63	1.56	1.76	86.4
Rubber-tired Loader	203	1	8	125	1,000	27.70	33.51	39.88	296.63	300.65	75,239.72	12.75	11.73	0.61	0.69	34.1
Vibratory Post Driver	158	7	8	125	7,000	222.16	268.82	319.92	3,072.05	2,648.51	513,088.38	138.20	127.15	4.19	4.74	232.7
Skid Steer	75	7	8	125	7,000	50.69	61.34	73.00	1,310.01	816.12	212,113.63	27.54	25.34	1.73	1.96	96.2
					AVG EXHAUST EMISSIONS PER DAY	**4.44**	**5.37**	**6.39**	**60.89**	**50.96**	**11,523.36**	**2.44**	**2.24**	**0.09**	**0.11**	**5.23**
					TOTAL	**554.74**	**670.81**	**798.82**	**7,611.03**	**6,369.69**	**1,440,419.78**	**305.02**	**280.62**	**11.76**	**13.38**	**653.36**

Phase 3 - Underground Cabling	# of Days in Phase :	125														
Equipment	HP Estimate	Number of Units	Daily Hours	Days in Use	Total Hourly Usage (units*hours per day*days)	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO_2e
Excavator	212	3	8	125	3,000	60.32	72.98	86.85	874.09	613.13	243,204.60	24.44	22.49	1.99	2.25	110.3
Trencher (big)	300	1	8	125	1,000	64.60	78.16	93.02	395.76	883.00	132,009.95	36.93	33.98	1.08	1.22	59.9
Off-highway Truck	402	5	4	125	2,500	99.05	119.85	142.63	765.63	850.99	325,642.10	32.16	29.59	2.66	3.01	147.7
Drum Roller Compactor	134	2	8	125	2,000	31.12	37.66	44.82	592.79	386.32	100,841.34	19.48	17.92	0.82	0.93	45.7
Rubber-tired Loader	203	1	8	125	1,000	27.70	33.51	39.88	296.63	300.65	75,239.72	12.75	11.73	0.61	0.69	34.1
Skid Steer	75	3	8	125	3,000	21.73	26.29	31.29	561.43	349.76	90,905.84	11.80	10.86	0.74	0.84	41.2
					AVG EXHAUST EMISSIONS PER DAY	**2.44**	**2.95**	**3.51**	**27.89**	**27.07**	**7,742.75**	**1.10**	**1.01**	**0.06**	**0.07**	**3.51**
					TOTAL	**304.51**	**368.45**	**438.49**	**3,486.33**	**3,383.86**	**967,843.54**	**137.57**	**126.56**	**7.90**	**8.94**	**439.01**

Phase 4 -Mechanical Installation	# of Days in Phase :	146														
Equipment	HP Estimate	Number of Units	Daily Hours	Days in Use	Total Hourly Usage (units*hours per day*days)	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO_2e
Air Compressor	78	15	8	146	17,520	369.10	439.26	531.51	3,392.64	2,731.71	389,620.49	109.96	101.17	3.28	5.04	176.7
Generator Set	84	8	8	146	9,344	137.41	166.27	197.87	1,955.95	1,409.64	259,133.54	80.79	74.32	2.12	2.39	117.5
Off-highway Truck	402	6	4	146	3,504	138.82	167.98	199.91	1,073.10	1,192.75	456,419.96	45.08	41.47	3.73	4.22	207.0
Other Construction Equipment	172	1	2	146	292	9.27	11.21	13.35	128.15	110.48	21,403.12	5.77	5.30	0.17	0.20	9.7
Rough-terrain Forklift	100	7	8	146	8,176	134.11	162.27	193.12	2,020.08	1,717.51	311,628.09	93.55	86.07	2.54	2.88	141.4
Rubber-tired Loader	203	3	8	146	3,504	97.05	117.42	139.75	1,039.38	1,053.48	263,639.99	44.66	41.09	2.15	2.43	119.6
Skid Steer	75	1	8	146	1,168	8.46	10.24	12.18	218.58	136.18	35,392.67	4.60	4.23	0.29	0.33	16.1
					AVG EXHAUST EMISSIONS PER DAY	**6.12**	**7.36**	**8.82**	**67.31**	**57.20**	**11,898.89**	**2.63**	**2.42**	**0.10**	**0.12**	**5.40**
					TOTAL	**894.22**	**1,074.65**	**1,287.68**	**9,827.89**	**8,351.74**	**1,737,237.87**	**384.41**	**353.65**	**14.28**	**17.48**	**788.00**

Phase 5- Electrical Installation	# of Days in Phase :	167														
Equipment	HP Estimate	Number of Units	Daily Hours	Days in Use	Total Hourly Usage (units*hours per day*days)	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO_2e
Air Compressors	78	2	8	167	2,672	56.29	66.99	81.06	517.42	416.62	59,421.57	16.77	15.43	0.50	0.77	27.0
Off-highway Truck	402	7	4	167	4,676	185.26	224.16	266.77	1,432.03	1,591.69	609,080.98	60.16	55.35	4.97	5.63	276.3
Rubber-tired Loader	203	3	8	167	4,008	111.00	134.31	159.85	1,188.88	1,205.01	301,560.81	51.08	47.00	2.46	2.78	136.8
Rough-terrain Forklift	100	4	8	167	5,344	87.66	106.07	126.23	1,320.37	1,122.60	203,686.46	61.15	56.26	1.66	1.88	92.4
Trencher (small)	78	2	8	167	2,672	153.13	185.29	220.51	917.43	1,536.83	109,581.66	106.44	97.92	0.89	1.01	49.7
Crane	231	1	2	167	334	11.50	13.91	16.56	95.46	146.07	20,507.79	6.87	6.32	0.17	0.19	9.3
Excavator	212	2	8	167	2,672	53.72	65.00	77.36	778.52	546.09	216,614.23	21.77	20.03	1.77	2.00	98.3
					AVG EXHAUST EMISSIONS PER DAY	**3.94**	**4.76**	**5.68**	**37.43**	**39.31**	**9,104.51**	**1.94**	**1.79**	**0.07**	**0.09**	**4.13**
					TOTAL	**658.56**	**795.73**	**948.32**	**6,250.11**	**6,564.91**	**1,520,453.50**	**324.24**	**298.30**	**12.43**	**14.26**	**689.67**

Annual

Year	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO2e
2023	2,630.22	3,173.68	3,787.52	29,755.42	27,097.36	6,220,474.50	1,266.42	1,165.10	50.89	59.18	2,821.56
Total	2,630.22	3,173.68	3,787.52	29,755.42	27,097.36	6,220,474.50	1,266.42	1,165.10	50.89	59.18	2,821.56

Max Daily

Year	HC lbs	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	NH_3 lbs	SO_X lbs	MT of CO2e
2023	16.94	20.44	24.40	195.19	174.54	40,269.51	8.12	7.47	0.33	0.38	18.27
Total Max Daily	16.94	20.44	24.40	195.19	174.54	40,269.51	8.12	7.47	0.33	0.38	18.27

NOTES

MT = Metric Tons

1. Equipment list assumptions were prepared using Eland 1 Solar EIR as recommended by the Applicant
2. Off-high Truck additional emissions during transit operations calculated with onsite mobile emissions
3. Emissions for 2023 calculated using following asssumptions related to construction days/schedule: 66 days of Phase 1, 125 days of Phase 2, 125 days of Phase 3, 146 days of Phase 4 & 167 days of Phase 5

Sienna Solar PV (2,084 Acres, 500 MW)

Fugitive Dust Emissions During Construction On-site (excludes vehicular traffic from vendor vehicles)

				Natural Soil					
Phase 1 - Site Prep and Grading		**Number of Days**	**66**	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
Vehicle Type	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor [4]**	**$PM_{2.5}$ lbs/mile factor [4]**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Mobile Construction Equipment (0.5 mph) [1]	0.74	0.51	0.050	0.37	0.04	0.2	0.0	0.1	0.0
Stationary Construction Equipment (0.25 mpd) [2]	0	0.51	0.050	0.00	0.00	0.0	0.0	0.0	0.0
Off-highway Truck[3]	3,299	0.25	0.026	839.23	84.32	749.9	74.6	266.6	26.5
Total Pounds Per day				**12.72**	**1.28**	**11.37**	**1.13**	**4.04**	**0.40**
Total	**3,300**			**839.60**	**84.36**	**750.03**	**74.57**	**266.68**	**26.51**

				Natural Soil					
Phase 2 - Tracker Foundations		**Number of Days**	**125**	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
Vehicle Type	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor [4]**	**$PM_{2.5}$ lbs/mile factor [4]**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Mobile Construction Equipment (0.5 mph) [1]	1.1	0.51	0.050	0.57	0.06	0.3	0.0	0.1	0.0
Stationary Construction Equipment (0.25 mpd) [2]	0	0.51	0.050	0.00	0.00	0.0	0.0	0.0	0.0
Off-highway Truck[3]	6,250	0.25	0.026	1,589.83	159.73	1420.5	141.2	505.1	50.2
Total Pounds Per day				**12.72**	**1.28**	**11.37**	**1.13**	**4.04**	**0.40**
Total	**6,251**			**1,590.40**	**159.79**	**1,420.80**	**141.25**	**505.17**	**50.22**

				Natural Soil					
Phase 3 - Underground Cabling		**Number of Days**	**125**	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
Vehicle Type	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor [4]**	**$PM_{2.5}$ lbs/mile factor [4]**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Mobile Construction Equipment (0.5 mph) [1]	0.8	0.51	0.050	0.39	0.04	0.2	0.0	0.1	0.0
Stationary Construction Equipment (0.25 mpd) [2]	0	0.51	0.050	0.00	0.00	0.0	0.0	0.0	0.0
Off-highway Truck[3]	6,250	0.25	0.026	1,589.83	159.73	1420.5	141.2	505.1	50.2
Total Pounds Per day				**12.72**	**1.28**	**11.37**	**1.13**	**4.04**	**0.40**
Total	**6,251**			**1,590.22**	**159.77**	**1,420.71**	**141.25**	**505.14**	**50.22**

				Natural Soil					
Phase 4 -Mechanical Installation		**Number of Days**	**146**	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
Vehicle Type	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor [4]**	**$PM_{2.5}$ lbs/mile factor [4]**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Mobile Construction Equipment (0.5 mph) [1]	1.1	0.51	0.050	0.57	0.06	0.3	0.0	0.1	0.0
Stationary Construction Equipment (0.25 mpd) [2]	0	0.51	0.050	0.00	0.00	0.0	0.0	0.0	0.0
Off-highway Truck[3]	8,760	0.25	0.026	2,228.31	223.88	1991.0	197.9	707.9	70.4
Total Pounds Per day				**15.27**	**1.53**	**13.64**	**1.36**	**4.85**	**0.48**
Total	**8,761**			**2,228.88**	**223.94**	**1,991.28**	**197.97**	**708.01**	**70.39**

				Natural Soil					
Phase 5- Electrical Installation		**Number of Days**	**167**	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
Vehicle Type	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor [4]**	**$PM_{2.5}$ lbs/mile factor [4]**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Mobile Construction Equipment (0.5 mph) [1]	0.96	0.51	0.050	0.48	0.05	0.2	0.0	0.1	0.0
Stationary Construction Equipment (0.25 mpd) [2]	0	0.51	0.050	0.00	0.00	0.0	0.0	0.0	0.0
Off-highway Truck[3]	11,690	0.25	0.026	2,973.62	298.76	1349.9	137.3	493.8	52.2
Total Pounds Per day				**17.81**	**1.79**	**8.08**	**0.82**	**2.96**	**0.31**
Total	**11,691**			**2,974.11**	**298.81**	**1,350.13**	**137.36**	**493.85**	**52.23**

Annual

Year	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
	PM_{10} lbs	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
2023	9,223.21	926.67	6,932.96	692.40	2,478.86	249.58
Total	**9,223.21**	**926.67**	**6,932.96**	**692.40**	**2,478.86**	**249.58**

Max Daily

Year	**No Additional Control[4]**		**With Water Control [5]**		**With Palliative Control[6]**	
	PM_{10} lbs	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
2023	58.52	5.88	47.74	4.75	16.97	1.69
Max Daily	**58.52**	**5.88**	**47.74**	**4.75**	**16.97**	**1.69**

Notes:

1. Crawler tractor, loader, skid-steer, drum roller compactor, and forklifts assumed to transit an average of 0.5 acres/8hr day. VMT is estimated based on the hours of operation and conversion of acreage to square miles to miles. Mobile equipment that is considered earth moving (i.e. grader) are accounted for seperately due to a specific operations.
2. Trencher, pile driver, excavator, and crane work primarily in place and are not considered mobile in this analysis.
3. Off-highway trucks are assumed to travel 5 miles per day on site and is consistent with Rexford 1 assumptions.
4. Uncontrolled emission factors based on silt content of local soil, onsite fleet mix, and and typical construction activites frpm AP-42, Table 13.2.2-2
5. Emission factors are reduced via water control by 55% efficiency per MRI, April 2001. Particulate Emission Measurements from Controlled Construction Activities, EPA/600/R-01/031.
6. Emission factors are reduced via palliative control by 84% efficiency per CARB certification for Soil Sement®
7. Emissions based on assumption of % of activity occuring on compacted/scraper road where base uncontrolled emission factors are 2.27 and 0.227 for PM_{10} and $PM_{2.5}$, respectively.
8. Emissions based on assumption of % of activity occuring on gravel road where base uncontrolled emission factors are 1.76 and 0.176 for PM_{10} and $PM_{2.5}$, respectively.

Particulates from Grading [1]

		Grader Parameters	
Travel Speed (S):		7.1	mph
Hours Operating:		8	
Acres/ 8hr-day:		0.5	
Width of Grading Blade (ft)[2]:		12	**Water Controlled[3]**
PM-10 Emissions Factor (lbs/ VMT)	E = 0.6 * 0.051 * (S)^(2.0)	*1.54255*	*0.6*
PM-2.5 Emissions Factor (lbs/VMT)	E = 0.031*0.04*(S)^(2.5)	*0.2*	*0.1*

Location	Acreage	VMT[4]	Fugitive Dust From Grading		Mitigated Fugitive Dust From Grading[3]	
			PM 10 (lbs)	PM2.5 (lbs)	PM 10 (lbs)	PM2.5 (lbs)
Site	2084	1432.75	2210.082782	238.6371063	861.9322848	93.06847144
TOTAL	2084	1432.75	2210.082782	238.6371063	861.9322848	93.06847144

Year	Fugitive Dust From Grading		Mitigated Fugitive Dust From Grading[3]	
	PM_{10} lbs	$PM_{2.5}$ lbs	PM_{10} lbs	$PM_{2.5}$ lbs
2023	2,210.08	238.64	861.93	93.07
2024	0.00	0.00	0.00	0.00
Total	**2,210.08**	**238.64**	**861.93**	**93.07**

Year	Fugitive Dust From Grading		Mitigated Fugitive Dust From Grading[3]	
	PM_{10} lbs	$PM_{2.5}$ lbs	PM_{10} lbs	$PM_{2.5}$ lbs
2023	17.68	1.91	6.90	0.74
2024	0.00	0.00	0.00	0.00
Max Daily	**17.68**	**1.91**	**6.90**	**0.74**

Notes

1. Fugitive dust emissions from grading the project site were estimated using the methodology described in Section 11., Western Surface Coal Mining of the USEPA AP-42 and used in CalEEMod 2020.4.0 (CAPCOA 2021).
2. Blade width of grading equipment is default width of 12 feet based on Caterpillar's 140 Motor Grader. (CalEEMod Appendix A, 2017)
3. Assumes use of water to control dust reduces dust by 61% based on per 3.2 hour watering interval of general construction; test series 701 reproted in WRAP Fugitive Dust Handbook, September 2006
4. VMT is estimated based on grading area and blade width where VMT = Acres graded/Blade Width * (43560 sqft/acre)/(5280 ft/mile)

Sienna Solar PV (2,084 Acres, 500 MW)

On-Road Mobile Emissions (55 mph)[1]

Activity 1 - Site Preparation

Vehicle Type[2,3]	Daily Trips To Site[4]	Daily Trips from Site	No. of Trips (one-way)	Average Miles per Trip (one-way)[5,6]	Daily Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
Within MDAQMD																
Vendors (Trucks)	25															
T6 (MHDT)	8	8	16	25	400	0.01	0.02	0.27	0.49	868.02	0.13	0.06	0.01	0.00	0.08	0
T7 (HHDT)	17	17	34	25	850	0.03	0.03	0.19	2.26	2,039.07	0.20	0.10	0.02	0.00	0.32	1
Employee Commute	100															
Passenger Vehicle (LDA)	76	76	153	25	3,815	0.30	0.33	5.24	0.35	2,144.70	0.39	0.16	0.02	0.03	0.05	1
Light-duty Truck (LDT2)	24	24	47	25	1,185	0.18	0.20	2.36	0.24	832.26	0.12	0.05	0.01	0.02	0.02	0
					Daily Emissions[7]	**0.52**	**0.58**	**8.08**	**3.35**	**5,884.05**	**0.84**	**0.37**	**0.06**	**0.05**	**0.47**	**2.73**
	No. of Days:	66			*Total Activity 1 Emissions:*	*34.20*	*38.10*	*532.95*	*220.80*	*388,254.37*	*55.11*	*24.18*	*3.77*	*3.34*	*30.96*	*179.99*
		1650														

Activity 2 - Grading and Earthwork

Vehicle Type[2,3]	Daily Trips To Site[4]	Daily Trips from Site	No. of Trips (one-way)	Average Miles per Trip (one-way)[5,6]	Daily Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
Within MDAQMD																
Vendors (Trucks)	25															
T6 (MHDT)	8	8	16	25	400	0.01	0.02	0.27	0.49	868.02	0.13	0.06	0.01	0.00	0.08	0
T7 (HHDT)	17	17	34	25	850	0.03	0.03	0.19	2.26	2,039.07	0.20	0.10	0.02	0.00	0.32	1
Employee Commute	400															
Passenger Vehicle (LDA)	305	305	610	25	15,261	1.21	1.34	20.98	1.41	8,578.81	1.54	0.63	0.08	0.13	0.18	4
Light-duty Truck (LDT2)	95	95	190	25	4,739	0.71	0.79	9.46	0.96	3,329.03	0.48	0.20	0.03	0.06	0.08	2
					Daily Emissions[7]	**1.96**	**2.17**	**30.90**	**5.13**	**14,814.93**	**2.35**	**0.99**	**0.15**	**0.19**	**0.67**	**6.81**
	No. of Days:	66			*Total Activity 2 Emissions:*	*129.22*	*143.22*	*2,039.06*	*338.51*	*977,551.29*	*155.34*	*65.28*	*9.60*	*12.70*	*44.01*	*449.03*
		1650														

Activity 3, 4, 5 - Concrete Foundations, Structural Steel Work and Electrical/Instrumentation Work

Vehicle Type[2,3]	Daily Trips To Site[4]	Daily Trips from Site	No. of Trips (one-way)	Average Miles per Trip (one-way)[5,6]	Daily Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
Within MDAQMD																
Vendors (Trucks)	55															
T6 (MHDT)	18	18	36	35	1,260	0.04	0.05	0.87	1.56	2,734.27	0.42	0.18	0.03	0.01	0.26	1
T7 (HHDT)	37	37	74	35	2,590	0.08	0.09	0.59	6.88	6,213.17	0.60	0.31	0.06	0.00	0.98	3
Employee Commute	800															
Passenger Vehicle (LDA)	610	610	1,221	25	30,521	2.42	2.67	41.95	2.83	17,157.62	3.09	1.27	0.17	0.25	0.36	8
Light-duty Truck (LDT2)	190	190	379	25	9,479	1.43	1.58	18.91	1.93	6,658.07	0.96	0.39	0.07	0.13	0.17	3
					Daily Emissions[7]	**3.96**	**4.39**	**62.32**	**13.19**	**32,763.12**	**5.07**	**2.15**	**0.32**	**0.39**	**1.76**	**15.08**
	No. of Days:	237			*Total Activity 3, 4, 5 Emissions:*	*936.07*	*1,038.55*	*14,739.49*	*3,120.01*	*7,748,477.35*	*1,198.24*	*508.73*	*75.84*	*91.92*	*417.39*	*3,567.59*
		13,008														

Activity 6 - Collector Line Installation

Vehicle Type[2,3]	Daily Trips To Site[4]	Daily Trips from Site	No. of Trips (one-way)	Average Miles per Trip (one-way)[5,6]	Daily Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
Within MDAQMD																
Vendors (Trucks)	15															
T6 (MHDT)	5	5	10	25	250	0.01	0.01	0.17	0.31	542.51	0.08	0.04	0.01	0.00	0.05	0
T7 (HHDT)	10	10	20	25	500	0.02	0.02	0.11	1.33	1,199.45	0.12	0.06	0.01	0.00	0.19	1
Employee Commute	75															
Passenger Vehicle (LDA)	57	57	114	25	2,861	0.23	0.25	3.93	0.27	1,608.53	0.29	0.12	0.02	0.02	0.03	1
Light-duty Truck (LDT2)	18	18	36	25	889	0.13	0.15	1.77	0.18	624.19	0.09	0.04	0.01	0.01	0.02	0
					Daily Emissions[7]	**0.38**	**0.43**	**5.99**	**2.08**	**3,974.69**	**0.58**	**0.25**	**0.04**	**0.04**	**0.29**	**1.84**
	No. of Days:	31			*Total Activity 6 Emissions:*	*12.03*	*13.39*	*188.28*	*65.44*	*124,888.79*	*18.16*	*7.90*	*1.21*	*1.18*	*9.10*	*57.79*
		471														

Annual

Year	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
2023	1,111.52	1,233.27	17,499.78	3,744.77	9,239,171.81	1,426.86	606.09	90.41	109.14	501.46	4,254.40
Total	**1,111.52**	**1,233.27**	**17,499.78**	**3,744.77**	**9,239,171.81**	**1,426.86**	**606.09**	**90.41**	**109.14**	**501.46**	**4,254.40**

Daily

Year	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
2023	6.43	7.14	101.30	21.67	53,462.10	8.26	3.51	0.52	0.63	2.90	24.62
Total Max Daily	**6.43**	**7.14**	**101.30**	**21.67**	**53,462.10**	**8.26**	**3.51**	**0.52**	**0.63**	**2.90**	**24.62**

Operation[8] **No. Work days in Year:** **250**

Vehicle Type	Trips to Site (Daily)	Trips from Site (Daily)	No. of Daily Trips (one-way)	Average Miles per Trip (one-way)[3,4,5]	Daily Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_X lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_X lbs	CH_4 lbs	N_2O lbs	MT of CO_2e
Employee Commute	12	12														
Passenger Vehicle (LDA)	9	9	18	25	445	0.04	0.04	0.61	0.04	250.11	0.05	0.02	0.00	0.00	0.01	0
Light-duty Truck (LDT2)	3	3	6	25	155	0.02	0.03	0.31	0.03	108.94	0.02	0.01	0.00	0.00	0.00	0
Service Vehicles (LHDT2)	1	1	2	25	50	0.01	0.01	0.05	0.18	69.67	0.01	0.01	0.00	0.00	0.01	0
Equipment/Material Delivery (T6)	1	1	2	25	50	0.00	0.00	0.04	0.07	108.54	0.02	0.01	0.00	0.00	0.01	0
					Daily Operational On-road Emissions	**0.07**	**0.07**	**1.01**	**0.32**	**537.26**	**0.09**	**0.04**	**0.01**	**0.01**	**0.02**	**0.25**
					Annual Operational On-road Emissions	**16.80**	**18.73**	**252.53**	**79.93**	**134,314.69**	**22.40**	**9.48**	**1.32**	**1.60**	**6.25**	**61.72**

NOTES

Note: 1 lb = 453.59 grams; MT = metric tons

1. On-road emissions use mileage to determine running emissions from associated with vendor vehicles coming to the site. Starting and additional emissions for vendor vehicles are not included here, and are included with on-site emissions. Emissions from employee commute vehicles assume only one trip to the site per day occur. On-road emissions for employee commute acount for running and start emissions for all pollutants, as well as hotsoak, running losses, diurnal, and resting loss ROG and TOG emissions.
2. It is assumed that 1/3 of the vendor trips are done by T6 trucks (MHDT) and 2/3 by T7 trucks (HHDT); assumption is the same as used in Eland 1 Solar Project
3. To more accurately represent the type of vehicles used by employees for commuting it is assumed that 76% of the vehicles are light-duty automobiles (LDA) and 24% is light-duty trucks (LDT2). Percentages were derived from the distribution of gasoline powered LDA and LDT2 VMT from EMFAC2017.
4. Trip data is based the GHD Traffic Assessment
5. Assumed that vendors are coming from Victorville, which is approximately 25 miles west of the project site
6. Assumed that employees are coming from Victorville, which is approximatley 25 miles west of the project site
7. On-road emissions are calculated using emission factors that weighted based on the type of fuel used per vehicle class indicated in EMFAC2017 by sub-area.
8. There would be 5 full-time employees and vendor/delivery trips

Sienna Solar PV (2,084 Acres, 500 MW)

On-site Mobile Emissions (max 10 mph)

Activity 1 - Site Preparation			No. Days in Phase:	66												Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Vehicle Type	No. Units/Trips per Day	Days Operating	Miles Traveled per Unit per Day [1]	Total Onsite Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
Worker (Truck)																					
Light-duty Truck (LDT2)	10	66	4	2,639	3.20	3.44	14.02	1.24	3,830	0.30	0.14	0.04	0.21	0.12	1.75	671.38	67.46	304.78	31.01	111.48	11.79
Vendors (Trucks)	25																				
T6 (MHDT)	8	66	0.25	132	0.24	0.25	1.44	3.04	431	0.04	0.02	0.01	0.01	0.07	0.205	33.57	3.37	15.24	1.55	5.57	0.59
T7 (HHDT)	17	66	0.25	280	0.05	0.06	0.83	12.29	1,939	0.07	0.03	0.02	0.00	0.30	0.917	71.33	7.17	32.38	3.29	11.85	1.25
AVG EMISSIONS PER DAY					**0.05**	**0.06**	**0.25**	**0.25**	**94**	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**	**0.04**	**11.76**	**1.18**	**5.34**	**0.54**	**1.95**	**0.21**
TOTAL				**412**	**3.49**	**3.75**	**16.29**	**16.57**	**6,199**	**0.41**	**0.19**	**0.06**	**0.22**	**0.49**	**2.88**	**776.29**	**77.99**	**352.41**	**35.85**	**128.90**	**13.63**

Activity 2 - Grading and Earthwork			No. Days in Phase:	66												Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Vehicle Type	No. Units/Trips per Day	Days Operating	Miles Traveled per Unit per Day [1]	Total Onsite Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
Worker (Truck)																					
Light-duty Truck (LDT2)	10	66	4	2,639	3.20	3.44	14.02	1.24	3,830	0.30	0.14	0.04	0.21	0.12	1.75	671.38	67.46	304.78	31.01	111.48	11.79
Vendors (Trucks)	25																				
T6 (MHDT)	8	66	0.25	132	0.24	0.25	1.44	3.04	431	0.04	0.02	0.01	0.01	0.07	0.205	33.57	3.37	15.24	1.55	5.57	0.59
T7 (HHDT)	17	66	0.25	280	0.05	0.06	0.83	12.29	1,939	0.07	0.03	0.02	0.00	0.30	0.917	71.33	7.17	32.38	3.29	11.85	1.25
AVG EMISSIONS PER DAY					**0.05**	**0.06**	**0.25**	**0.25**	**94**	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**	**0.04**	**11.76**	**1.18**	**5.34**	**0.54**	**1.95**	**0.21**
TOTAL				**412**	**3.49**	**3.75**	**16.29**	**16.57**	**6,199**	**0.41**	**0.19**	**0.06**	**0.22**	**0.49**	**2.88**	**776.29**	**77.99**	**352.41**	**35.85**	**128.90**	**13.63**

Activity 3, 4, 5 - Concrete Foundations, Structural Steel Work and Electrical/Instrumentation Work			No. Days in Phase:	237												Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Vehicle Type	No. Units/Trips per Day	Days Operating	Miles Traveled per Unit per Day [1]	Total Onsite Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
Worker (Truck)																					
Light-duty Truck (LDT2)	10	237	4	9,460	11.47	12.33	50.24	4.44	13,726	1.08	0.50	0.14	0.75	0.41	6.29	2406.37	241.77	1092.40	111.14	399.58	42.26
Vendors (Trucks)	55																				
T6 (MHDT)	18	237	0.25	1,064	1.94	2.04	11.62	24.49	3,474	0.35	0.15	0.05	0.09	0.60	1.651	270.72	27.20	122.90	12.50	44.95	4.75
T7 (HHDT)	37	237	0.25	2,188	0.40	0.46	6.49	95.91	15,127	0.53	0.23	0.14	0.02	2.38	7.156	556.47	55.91	252.62	25.70	92.40	9.77
AVG EMISSIONS PER DAY					**0.06**	**0.06**	**0.29**	**0.53**	**137**	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**	**0.06**	**13.67**	**1.37**	**6.21**	**0.63**	**2.27**	**0.24**
TOTAL				**3,252**	**13.81**	**14.83**	**68.35**	**124.84**	**32,327**	**1.95**	**0.88**	**0.33**	**0.86**	**3.39**	**15.09**	**3,233.56**	**324.88**	**1,467.92**	**149.34**	**536.94**	**56.78**

Activity 6 - Collector Line Installation			No. Days in Phase:	31												Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Vehicle Type	No. Units/Trips per Day	Days Operating	Miles Traveled per Unit per Day [1]	Total Onsite Vehicle Miles Traveled	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
Worker (Truck)																					
Light-duty Truck (LDT2)	10	31	4	1,257	1.52	1.64	6.67	0.59	1,824	0.14	0.07	0.02	0.10	0.05	0.84	319.71	32.12	145.13	14.77	53.09	5.61
Vendors (Trucks)	15																				
T6 (MHDT)	5	31	0.25	39	0.07	0.08	0.43	0.90	128	0.01	0.01	0.00	0.00	0.02	0.061	9.99	1.00	4.54	0.46	1.66	0.18
T7 (HHDT)	10	31	0.25	79	0.01	0.02	0.23	3.44	543	0.02	0.01	0.01	0.00	0.09	0.257	19.98	2.01	9.07	0.92	3.32	0.35
AVG EMISSIONS PER DAY					**0.05**	**0.06**	**0.23**	**0.16**	**79**	**0.01**	**0.00**	**0.00**	**0.00**	**0.01**	**0.04**	**11.13**	**1.12**	**5.05**	**0.51**	**1.85**	**0.20**
TOTAL				**118**	**1.61**	**1.73**	**7.34**	**4.94**	**2,495**	**0.17**	**0.08**	**0.03**	**0.10**	**0.16**	**1.15**	**349.68**	**35.13**	**158.74**	**16.15**	**58.07**	**6.14**

Annual

											Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Year	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
2023	22.41	24.07	108.27	162.92	47,220.87	2.95	1.34	0.48	1.41	4.54	22.00	5,135.82	516.00	2,331.47	237.20	852.81	90.19
Total	**22.41**	**24.07**	**108.27**	**162.92**	**47,220.87**	**2.95**	**1.34**	**0.48**	**1.41**	**4.54**	**22.00**	**5,135.82**	**516.00**	**2,331.47**	**237.20**	**852.81**	**90.19**

Max daily

											Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Year	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
2023	0.16	0.18	0.78	1.03	324.60	0.02	0.01	0.00	0.01	0.03	0.15	37.20	3.74	16.89	1.72	6.18	0.65
Total Max Daily	**0.16**	**0.18**	**0.78**	**1.03**	**324.60**	**0.02**	**0.01**	**0.00**	**0.01**	**0.03**	**0.15**	**37.20**	**3.74**	**16.89**	**1.72**	**6.18**	**0.65**

Operational			No. Work days in Year:	250			No. Workers:	5								Un-mitigated		Mitigated-Watering		Mitigated-Palliatives	
Vehicle Type	Trips per Day	Round Trip (miles)	Daily VMT	Annual VMT	ROG lbs	TOG lbs	CO lbs	NO_x lbs	CO_2 lbs	PM_{10} lbs	$PM_{2.5}$ lbs	SO_x lbs	CH_4 lbs	N_2O lbs	MT of CO_2e	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs	Fugitive Dust (PM_{10}) lbs	Fugitive Dust ($PM_{2.5}$) lbs
Pickup Trucks (LDT2)	3	4	12	3,000	0.49	0.71	11.33	0.92	4,239.50	0.34	0.16	0.04	0.12	0.08	1.934	763.12	76.67	346.43	35.24	126.72	13.40
Utility/Service Vehicle (T6)	1	4	4	1,000	0.17	0.23	1.99	8.56	3,186.90	0.33	0.14	0.05	0.00	0.50	1.508	254.37	25.56	115.48	11.75	42.24	4.47
Water Truck(T7)	1	4	4	1,000	0.18	0.21	2.96	23.90	6,914.82	0.24	0.10	0.07	0.01	1.09	3.271	254.37	25.56	115.48	11.75	42.24	4.47
Avg Daily Emissions					**0.00**	**0.00**	**0.07**	**0.13**	**57.36**	**0.00**	**0.00**	**0.00**	**0.00**	**0.01**	**0.03**	**5.09**	**0.51**	**2.31**	**0.23**	**0.84**	**0.09**
Annual Total Emissions					**0.84**	**1.15**	**16.29**	**33.37**	**14,341.21**	**0.91**	**0.40**	**0.15**	**0.13**	**1.67**	**6.71**	**1,271.87**	**127.79**	**577.38**	**58.74**	**211.20**	**22.34**

NOTES

1 lb = 453.59 grams; MT = metric tons

1. Distance traveled on-site is based on the assumption that vendors vehicles will deliver equipment and materials to staging areas near the access roads and therefore minimal on-site driving would occur. Workers passenger vehicles are assumed to not be driven on the project site accept for accessing the on-site parking lots will be at or near the main access site for the project. For the on-site trucks, it is assumed that the trucks would travel a total of 4 miles per day
2. Emission calculations include running emissions; start emissions, hotsoak, and running losses for a single trip; diurnal, and resting loss emissions per vehicle.
3. Emissions for 2023 calculated using following asssumptions related to construction days/schedule: 79 days from Activity 1, 79 days from Activity 2, 237 days from Activity 3,4,5, 37 days from Activity 6
4. Operational onsite trip information was not available therefore assumptions were made assuming that daily onsite operations would consist of the five workers with 1 trip for the utility/water truck travel and 3 for pickup trucks.

Sienna Solar PV (2,084 Acres, 500 MW)

Fugitive Dust Emissions on Paved Roads in San Bernardino County [1]

Activity 1 - Site Preparation					**Number of Days**	**66**
Vehicle Type	**Daily Vehicle Miles Traveled**	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor**	**$PM_{2.5}$ lbs/mile factor**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Vendors (Trucks)						
T6 (MHDT)	400	26,394	0.001	0.0002	25.74	6.32
T7 (HHDT)	850	56,087	0.001	0.0002	54.69	13.43
Employee Commute						
Passenger Vehicle (LDA)	3,815	251,741	0.001	0.0002	245.49	60.26
Light-duty Truck (LDT2)	1,185	78,180	0.001	0.0002	76.24	18.71
Total Pounds Per Day					**6.09**	**1.50**
Total	**6,250**				**402.17**	**98.71**

Activity 2 - Grading and Earthwork					**Number of Days**	**66**
Vehicle Type	**Daily Vehicle Miles Traveled**	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor**	**$PM_{2.5}$ lbs/mile factor**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Vendors (Trucks)						
T6 (MHDT)	400	26,394	0.001	0.0002	25.74	6.32
T7 (HHDT)	850	56,087	0.001	0.0002	54.69	13.43
Employee Commute						
Passenger Vehicle (LDA)	15,261	1,006,965	0.001	0.0002	981.97	241.03
Light-duty Truck (LDT2)	4,739	312,718	0.001	0.0002	304.96	74.85
Total Pounds Per Day					**20.72**	**5.09**
Total	**20,000**				**1,367.36**	**335.63**

Activity 3, 4, 5 - Concrete Foundations, Structural Steel Work and Electrical/Instrumentation Work					**Number of Days**	**237**
Vehicle Type	**Daily Vehicle Miles Traveled**	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor**	**$PM_{2.5}$ lbs/mile factor**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Vendors (Trucks)						
T6 (MHDT)	1,260	297,990	0.001	0.0002	290.59	71.33
T7 (HHDT)	2,590	612,535	0.001	0.0002	597.33	146.62
Employee Commute						
Passenger Vehicle (LDA)	30,521	7,218,314	0.001	0.0002	7,039.17	1,727.80
Light-duty Truck (LDT2)	9,479	2,241,686	0.001	0.0002	2,186.05	536.58
Total Pounds Per Day					**42.76**	**10.50**
Total	**40,000**				**10,113.14**	**2,482.32**

Activity 6 - Collector Line Installation					**Number of Days**	**31**
Vehicle Type	**Daily Vehicle Miles Traveled**	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor**	**$PM_{2.5}$ lbs/mile factor**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Vendors (Trucks)						
T6 (MHDT)	250	7,855	0.001	0.0002	7.66	1.88
T7 (HHDT)	500	15,711	0.001	0.0002	15.32	3.76
Employee Commute						
Passenger Vehicle (LDA)	2,861	89,908	0.001	0.0002	87.68	21.52
Light-duty Truck (LDT2)	889	27,921	0.001	0.0002	27.23	6.68
Total Pounds Per Day					**4.39**	**1.08**
Total	**3,750**				**137.89**	**33.84**

Annual

Year	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
2023	12,020.56	2,950.50
Total	**12,020.56**	**2,950.50**

Year	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
2023	69.58	17.08
Max Daily	**69.58**	**17.08**

Operational Phase Fugitive Dust Emissions on Paved Roads					**Number of Days:**	**250**
Vehicle Type	**Daily Vehicle Miles Traveled**	**Total Vehicle Miles Traveled**	**PM_{10} lbs/mile factor**	**$PM_{2.5}$ lbs/mile factor**	**PM_{10} lbs**	**$PM_{2.5}$ lbs**
Employee Commute						
Passenger Vehicle (LDA)	445	111227.6514	0.001	0.0002	108.47	26.62
Light-duty Truck (LDT2)	155	38772.3486	0.001	0.0002	37.81	9.28
Service Vehicles (LHDT2)	50	12500	0.001	0.0002	12.19	2.99
Equipment/Material Delivery (T6)	50	12500	0.001	0.0002	12.19	2.99
				Total Pounds Per Day	**0.68**	**0.17**
				Annual Pounds	**170.66**	**41.89**

Notes:

1. Emission factor calculation presented in "Emission Factors" tab
3. Emissions for 2023 calculated using following asssumptions related to construction days/schedule: 66 days of Phase 1, 125 days of Phase 2, 125 days of Phase 3, 146 days of Phase 4 & 167 days of Phase 5

Sienna Solar PV (2,084 Acres, 500 MW)

Displaced Energy Production during 30-year Project life

Annual Energy Production		Annual Average Solar Radiation Hours/Day/Year
Grid Size (MW)	500	
Total hrs/year	8,760	
% Operational time [1]	*26%*	6.13
Operational hours/year	2,237	
KWh produced per year	1,118,725,000	
GWh produced per year	1,119	
GWh produced over 30 years	33,562	
Assumed Heat Rate (Btu/KWh)	10,000	
Annual Fuel Equivalent (MMBtu)[2]	11,187,250	

California Power Mix[3]		Annual Fuel Displacement (MMBtu)
Coal[4]	2.74%	306,531
Large Hydro	12.21%	1,365,963
Natural Gas[4]	37.06%	4,145,995
Nuclear	9.33%	1,043,770
Oil	0.01%	1,119
Other (petroleum coke/waste heat)	0.19%	21,256
Renewables	33.09%	3,701,861
Unspecified sources of Power	5.36%	599,637
Total	**100.0%**	**11,186,131**

Annual Pollutant Displacement[4]

Natural Gas Turbine Emissions					
Pollutant	**AP-42 Emission Factor (lb/MMBtu)[5]**	**Controlled Emission Factor (lb/MMBtu)**	**Controlled Emissions (lb)**	**Controlled Emissions (ton)**	**AP-42 Emission Factor Source Notes[5]**
NO_2	0.099	0.099	410,453	205.23	Table 3.1-1, lean premix; Assume SCR Control Efficiency
CO	0.015	0.015	62,190	31.09	Table 3.1-1, lean premix; Assume Ox. Cat. Control Efficiency
PM_{10}	0.0047	0.0047	19,486	9.74	Table 3.1-2a, PM (condensible)
$PM_{2.5}$	0.0019	0.0019	7,877	3.94	Table 3.1-2a, PM (filterable)
SO_2	0.0034	0.0034	14,096	7.05	Table 3.1-2a
CO_2	110	110	456,059,434	228,029.72	Table 3.1-2a

Coal Combustion Emissions					
Pollutant	**AP-42 Emission Factor (lb/ton)[6]**	**Controlled Emission Factor (lb/ton)**	**Emissions (lb)[7]**	**Emissions (ton)**	**AP-42 Emission Factor Source Notes[6]**
NOx	12	12	153265	76.63	Table 1.1-3 pulverized coal, wall fired, bituminous coal NSPS
CO	0.5	0.5	6386	3.19	Table 1.1-3 pulverized coal, wall fired, bituminous coal NSPS
PM_{10}[8]	0.46	0.084	1073	0.54	Table 1.1-4, PC-fired dry bottom wall-fired, scrubber control
$PM_{2.5}$[8]	0.12	0.06	766	0.38	Table 1.1-4, PC-fired dry bottom wall-fired, scrubber control
SO_2[9]	2.85	0.57	7280	3.64	Table 1.1-3 pulverized coal, wall fired, bituminous coal NSPS
CO_2	6040	6040	77143547	38,571.77	Table 1.1-20
Total NMHC	0.06	0.06	766	0.38	Table 1.1-19; assumed all hydrocarbons are reactive
CH_4	0.04	0.04	511	0.26	Table 1.1-19
N_2O	0.03	0.03	383	0.19	Table 1.1-19

Total Displaced Emissions Associated With Direct Combustion		
Pollutant	**tons/year[8]**	**tons/lifetime (30 years)**
ROG (NMHC)	0.4	11.5
NO_X	281.9	8,455.8
CO	34.3	1,028.6
PM_{10}	10.3	308.4
$PM_{2.5}$	4.3	129.7
SO_X	10.7	320.6
CO_2E (Metric Ton)	241,911	7,257,336

Notes:

1. Operational time is based on annual average solar radiation hours per day per year (6.13) for the project area. Source: National Renewable Energy Laboratories, U.S. Department of Energy (https://pvwatts.nrel.gov/pvwatts.php)
2. The Project is assumed to displace existing power generation equivalent to the current power mix(each year of operation.
3. California Power Mix assumptions are based on data from the 2019 Total California Electrical System Power https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/2020-total-system-electric-generation/2019
4. Combustion of natural gas and coal for power are of the greatest concern related to the generation of criteria pollutants and GHG emissions, therefore only fuel displacement of natural gas and coal due to electricty production from the Solar Scarlet facility are considered in this assessment.
5. EPA Air Pollution Emission Factors AP-42 Section 3.1, Stationary Gas Turbines
6. EPA Air Pollution Emission Factors AP-42 Section 1.1, Bituminous and Subbituminous Coal Combustion
7. Coal characteristics used for conversion: Assumed coal heat content = 24 MMBtu/ton
8. Total particulate matter (CPM-TOT) is expressed in terms of coal ash content therefore emission factor is determined by multiplying % ash content of coal (assumed to be 20% herein) by value listed in Table 1.1-4. Organic fraction of particulate matter is 20% of total CPM-TOT (Table 1.1-5) and listed as controlled emission factor.
9. SO_x emission factor calculated by multiplying the weight percent of sulfur (assumed to be 7.5%) by the value listed in Table 1.1-3
10. CO_2E volumes are in metric tons rather than short (US) tons

Sienna Solar PV (2,084 Acres, 500 MW)

Construction Criteria Emissions by Year

Emission Type	Source	ROG	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$	With Water Control PM_{10} (tons)	With Water Control $PM_{2.5}$ (tons)	With Palliative PM_{10} (tons)	With Palliative $PM_{2.5}$ (tons)
2023											
Exhaust	Off Road Construction Equipment	1.6	13.5	0.0	14.9	0.6	0.6	0.6	0.6	0.6	0.6
	On-Road Vehicles	0.6	2.0	0.0	8.8	0.7	0.3	0.7	0.3	0.7	0.3
Fugitive Dust	Off Road Construction Activity	-	-	-	-	5.7	0.6	3.9	0.4	1.7	0.2
	On-Road Vehicles (resuspended)	-	-	-	-	8.6	1.7	7.2	1.6	6.4	1.5
	Subtotal	**2.2**	**15.5**	**0.1**	**23.7**	**15.6**	**3.2**	**12.4**	**2.9**	**9.5**	**2.6**
MDAQMD Tons/Year Threshold		**25**	**25**	**25**	**100**	**15**	**12**	**15**	**12**	**15**	**12**
Exceed Threshold?		No	No	No	No	Yes	No	No	No	No	No

Notes:

1. Operational emissions were estimated assuming that operationas for Rexford II would be similar to Eland Solar Project.
2. Assumes maintenance vehicles are traveling on 50% paved roads and 50% unpaved roads/ untreated soil

Operational Criteria Emissions by Year

Emission Type	Source	ROG	NO_X	SO_X	CO	PM_{10}	$PM_{2.5}$
Operational							
Exhaust	On Road and On-Site Vehicles	0.0	0.1	0.0	0.1	0.0	0.0
Fugitive Dust	Maintenance Vehicles	-	-	-	-	0.6	0.1
	Subtotal	**0.0**	**0.1**	**0.0**	**0.1**	**0.6**	**0.1**
MDAQMD Tons/Year Threshold		**25**	**25**	**25**	**100**	**15**	**12**
Exceed Threshold?		No	No	No	N/A	No	N/A

Emissions (tons per year)

GHG Emissions from Construction

Year	Off-Road	On-site Mobile	Off-site Mobile	Indirect GHG Emissions from Water Use	Total (MT of CO_2e)
Construction	2,822	22	4,254	46	7,144
Decommissioning	2,822	22	4,254	46	7,144
Construction and Deomminssioning	5,643	44	8,509	93	14,289
Amortized Emissions (30-year life)	*188*	*1*	*284*	*3*	*476*
MDAQMD Threshold					**90,718**
Exceed Threshold?					No

Emissions Source (MT of CO2e): Off-Road, On-site Mobile, Off-site Mobile, Indirect GHG Emissions from Water Use

Notes:

1. Numbers have been rounded to the nearest metric ton (MT).
2. The approxiamte volue of water needed during the construction period is unknown. Assuming approximately 400AF of water would be required over the projects construction period based on similar solar projects

GHG Emissions from Operation

Location	Off-Road	On-site Mobile	Off-site Mobile	Indirect GHG Emissions from Water Use	Total (MT of CO_2e)
Total	0	7	62	6	74
Amortized Construction Emissions	188	1	284	3	476
Total	**188**	**8**	**345**	**9**	**551**
MDAQMD Threshold					**90,718**
Exceed Threshold?					No

Emissions Source (MT of CO2e): Off-Road, On-site Mobile, Off-site Mobile, Indirect GHG Emissions from Water Use

Notes:

Numbers have been rounded to the nearest metric ton (MT).

1. The approxiamte volue of water needed during the construction period is unknown. Assuming approximately 50AF of water would be required during project operation based on similar solar projects