3.3 Air Quality and Greenhouse Gases

3.3.1 Introduction

This section describes ambient air quality conditions, including existing pollutant concentrations, meteorology, and locations of sensitive receptors[1] in the San Francisco to San Jose Project Section (Project Section, or project) resource study area (RSA). The section also discusses applicable criteria pollutant and greenhouse gas (GHG) regulations. Critical air quality and GHG issues associated with the project include temporary construction-related emissions, which could exceed local air district and federal General Conformity thresholds designed to achieve regional attainment of federal and state ambient air quality standards. Sensitive receptors adjacent to the project footprint may also be exposed to increased health risks from construction activities. Operation of the project would increase emissions from electrified passenger rail service, as well as attract additional motor vehicles to existing and new transit stations. However, the project would expand transit ridership, which would reduce single-occupancy vehicles in the transportation network and reduce aviation demand. This analysis considers the net effect of the project on air quality and GHG conditions as a result of permanent operations.

Primary Air Quality and Greenhouse Gas Impacts

- Temporary construction emissions in excess of air district and federal *de minimis* thresholds
- Temporary construction emission concentrations in excess of ambient air quality standards
- Temporary conflict with air quality plans associated with construction-generated emissions
- Criteria pollutant and greenhouse gas emissions reduction from removal of passenger vehicle and aircraft trips due to project operations

This analysis is supported by the *San Francisco to San Jose Project Section Air Quality and Greenhouse Gases Technical Report* (California High-Speed Rail Authority [Authority] 2019a, included as Volume 2, Appendix 3.3-A, Air Quality and Greenhouse Gases Technical Report) and, for the San Jose Diridon Station Approach Subsection, the *San Jose to Merced Project Section Air Quality and Greenhouse Gases Technical Report* (Authority 2019b) (Air Quality and Greenhouse Gases Technical Reports).[2] The following appendices in Volume 2 of this Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) provide additional details on air quality and global climate change.

- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for the project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the list of all impact avoidance and minimization features (IAMF) incorporated into the project.
- Appendix 2-I, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 2-J, Policy Consistency Analysis, provides a summary by resource of project inconsistencies and reconciliations with local plans and policies.
- Appendix 3.2-B, Vehicle Miles Traveled Forecasting, summarizes the methodology used to forecast the reduction in vehicle miles traveled (VMT) due to project operations.
- Appendix 3.3-A provides additional technical details on the air quality and GHG analysis.

[1] A receptor is a specific location at which impacts are evaluated.

[2] Technical reports for the project evaluate the portions of the HSR alignment between 4th and King Street Station in San Francisco and Scott Boulevard in Santa Clara, while technical reports for the adjacent San Jose to Merced Project Section evaluate the portions of the HSR alignment south of Scott Boulevard to the Project Section terminus at West Alma Avenue south of the San Jose Diridon Station.

- Appendix 3.3-B, General Conformity Requirements and Process, provides a discussion of the federal General Conformity requirements and the Authority's approach to coordination with the Federal Railroad Administration (FRA).
- Appendix 3.3-C, Changes to Project Benefits Based on 2018 Business Plan, describes how permanent operational benefits of the high-speed rail (HSR) project may change based on the ridership assumptions under the 2018 Business Plan (Authority 2018).

Air quality and GHGs are important considerations for development of the project alternatives because of their effect on human health and global climate change and current regional air quality conditions, which commonly exceed federal and state ambient air quality standards along portions of the project. The following Draft EIR/EIS resource sections provide additional information related to air quality and global climate change:

- Section 3.10, Hazardous Materials and Wastes, describes compliance with asbestos regulations and disposal of lead-based paint (LBP) during construction of the project.
- Section 3.17, Regional Growth, evaluates impacts of building the project alternatives on land consumption and growth-inducing impacts on air quality and global climate change.

3.3.1.1 Definition of Terminology

The following are key definitions for air quality and global climate change analyzed in this Draft EIR/EIS.

- **Air quality**—Describes the amount of air pollution to which the public is exposed.
- **Air pollution**—Refers to one or more chemical substances that degrade the quality of the atmosphere. Air pollutants degrade the atmosphere by reducing visibility, damaging property, and combining to form smog. Air pollutants affect humans by reducing the productivity or vigor of crops or natural vegetation, and by reducing human or animal health. Three general classes of air pollutants are of concern for the project: criteria pollutants, toxic air contaminants (TAC), and GHGs. TACs are equivalent to the federal hazardous air pollutants (HAP). These pollutants are defined in detail in Chapter 4 of the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b), and are as follows:
  - **Criteria pollutants** – Pollutants for which the U.S. Environmental Protection Agency (USEPA) and the State of California have set ambient air quality standards or that are chemical precursors to compounds for which ambient standards have been set. The six criteria pollutants are ozone (O_3), particulate matter (PM) (PM_{10} is PM smaller than or equal to 10 microns in diameter and $PM_{2.5}$ is PM smaller than or equal to 2.5 microns in diameter), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). The statewide standards established for California also incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particles. O_3 is considered a regional pollutant because its precursors (volatile organic compounds [VOC] and nitrogen oxides [NO_X]) affect air quality on a regional scale. Pollutants such as CO, NO_2, SO_2, and Pb are considered local pollutants that tend to accumulate in the air locally. PM is both a local and a regional pollutant. The primary criteria pollutants of concern generated by the project would be O_3 precursors (VOC and NO_X), CO, PM, and SO_2.[3]
  - **TACs** – Nine mobile source air toxics (MSAT), which are a subset of HAPs that USEPA has identified as having significant contributions from mobile (transportation) sources: acetaldehyde, acrolein, benzene, 1,3-butadiene, diesel particulate matter (DPM) and diesel exhaust organic gases, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. These pollutants are known or suspected to cause cancer or other

[3] Pb, sulfates, hydrogen sulfide, vinyl chloride, and visibility-reducing particulates typically are associated with industrial sources, which are not included as part of the project. Accordingly, they are not discussed further within the context of project-generated emissions.

serious health and environmental effects. The California Air Resources Board (CARB) and Bay Area Air Quality Management District (BAAQMD) recognize 21 substances as TACs, including four of the USEPA MSATs: benzene, 1,3-butadiene, DPM, and formaldehyde. The BAAQMD (2017a) considers DPM as the surrogate for total diesel exhaust including organic gases. CARB and BAAQMD have not defined a list of TACs specific to mobile sources, but both agencies recognize DPM as a primary pollutant of concern for mobile sources.

– **GHGs** – Gaseous compounds that limit the transmission of Earth's radiated heat out to space. GHGs include O_3, water vapor, carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and fluorinated gases (e.g., chlorofluorocarbons and hydrochlorofluorocarbons).

- **Global climate change**—Long-term changes in the Earth's climate, usually associated with recent global warming trends, as well as regional changes in weather and precipitation patterns, attributed to increasing concentrations of GHGs in the atmosphere.

3.3.2 Laws, Regulations, and Orders

This section presents federal, state, and regional and local laws, regulations, orders, and plans applicable to air quality and GHGs. The Authority would implement the HSR system, including the project, in compliance with all applicable regulations. Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for more detailed information on laws, regulations, and orders.

3.3.2.1 Federal

Clean Air Act (42 United States Code § 7401) and National Ambient Air Quality Standards

The federal Clean Air Act (CAA), promulgated in 1963 and amended several times thereafter, including the 1990 CAA amendments, establishes the framework for modern air pollution control in the United States. The CAA directs USEPA to establish federal air quality standards, known as national ambient air quality standards (NAAQS), and specifies future dates for achieving compliance. The six major criteria pollutants subject to the NAAQS are O_3, PM (PM_{10} and $PM_{2.5}$), CO, NO_2, SO_2, and Pb. NAAQS are divided into primary and secondary standards; the former are set to protect human health with an adequate margin of safety, the latter to protect environmental values, such as plant and animal life. Table 3.3-1 summarizes NAAQS currently in effect for each criteria pollutant. The table also provides California ambient air quality standards (CAAQS) (Section 3.3.2.2, State) for reference.

Table 3.3-1 State and Federal Ambient Air Quality Standards

Criteria Pollutant	Averaging Time	California Standards	National Standards[1]	
			Primary	Secondary
Ozone (O_3)	1-hour	0.09 ppm	None[2]	None[2]
	8-hour	0.070 ppm	0.070 ppm	0.070 ppm
Particulate matter (PM_{10})	24-hour	50 µg/m³	150 µg/m³	150 µg/m³
	Annual mean	20 µg/m³	None	None
Fine particulate matter ($PM_{2.5}$)	24-hour	None	35 µg/m³	35 µg/m³
	Annual mean	12 µg/m³	12.0 µg/m³	15.0 µg/m³
Carbon monoxide (CO)	8-hour	9.0 ppm	9 ppm	None
	1-hour	20 ppm	35 ppm	None
	8-hour (Lake Tahoe)	6 ppm	None	None

Criteria Pollutant	Averaging Time	California Standards	National Standards[1]	
			Primary	Secondary
Nitrogen dioxide (NO_2)	Annual mean	0.030 ppm	0.053 ppm	0.053 ppm
	1-hour	0.18 ppm	0.100 ppm	None
Sulfur dioxide (SO_2)	Annual mean	None	0.030 ppm[3]	None
	24-hour	0.04 ppm	0.14 ppm[3]	None
	3-hour	None	None	0.5 ppm
	1-hour	0.25 ppm	0.075 ppm	None
Lead (Pb)	30-day average	1.5 µg/m^3	None	None
	Calendar quarter	None	1.5 µg/m^3	1.5 µg/m^3
	3-month average	None	0.15 µg/m^3	0.15 µg/m^3
Sulfates	24-hour	25 µg/m^3	None	None
Visibility-reducing particles	8-hour	–[4]	None	None
Hydrogen sulfide	1-hour	0.03 ppm	None	None
Vinyl chloride	24-hour	0.01 ppm	None	None

Source: CARB 2016a
µg/m^3 = micrograms of pollutant per cubic meter of air
CAAQS = California ambient air quality standards
NAAQS = national ambient air quality standards
ppm = parts per million
SIP = state implementation plan
[1] National standards are divided into primary and secondary standards. Primary standards are intended to protect public health, whereas secondary standards are intended to protect public welfare and the environment.
[2] The federal 1-hour standard of 0.12 ppm was in effect from 1979 through June 15, 2005. The revoked standard is referenced because it was employed for such a long period and is a benchmark for SIPs.
[3] The annual and 24-hour NAAQS for SO_2 apply only for 1 year after designation of the new 1-hour standard to those areas that were previously nonattainment for 24-hour and annual NAAQS.
[4] CAAQS for visibility-reducing particles is defined by a light extinction coefficient of 0.23 per kilometer. The standard is equivalent to visibility of 10 miles where the light extinction is due to particles and the relative humidity is less than 70 percent.

The CAA requires that a state implementation plan (SIP) be prepared for areas that do not meet the NAAQS, referred to as nonattainment areas. The SIP must include pollution control measures that demonstrate how the standards will be met by the dates specified in the CAA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. This process is known as *conformity* and is discussed in the following section. The ultimate goal of the SIP is to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditious attainment of the standards.

Conformity Rule

Pursuant to CAA Section 176(c) requirements, USEPA enacted the federal General Conformity[4] Rule (40 Code of Federal Regulations [C.F.R.] Parts 5, 51, and 93) in 1993. The General Conformity Rule mandates that federal actions should not generate emissions that interfere with state and local agencies' SIPs and emission-reduction strategies to attain the NAAQS.

Pursuant to 23 United States Code (U.S.C.) Section 327 and a memorandum of understanding (MOU) executed by the FRA and the State of California dated July 23, 2019, FRA assigned its

[4] Note that *transportation conformity* is an analytical process required for all federally funded roadway transportation projects, but it does not apply to this project.

federal environmental review responsibilities under the National Environmental Policy Act (NEPA) and related statutes to the Authority under a federal program commonly known as NEPA Assignment. Accordingly, the Authority is the NEPA lead agency for this project. Consistent with 23 U.S.C. Section 327 and the NEPA Assignment MOU, FRA retains its obligations to make General Conformity Determinations under the CAA. The Authority and FRA have agreed to collaborate on the development of General Conformity Determinations. As part of this collaboration, the Authority has developed and provided to FRA a Draft General Conformity Determination and supporting information, as well as the Authority's proposed approach for achieving general conformity. Because the analysis used for this Draft EIR/EIS also generated the information necessary for the Draft General Conformity Determination, specific analysis may be incorporated by reference in the General Conformity Determination. FRA will make the ultimate General Conformity Determination for this project.

The General Conformity Rule (75 *Federal Register* [Fed. Reg.] 17255) applies only to direct and indirect emissions generated by a federal action that are not subject to New Source Review (NSR), for which a federal permitting agency has directly caused or initiated, has continued program responsibility for, or can practically control.[5] The rule does not include stationary industrial sources requiring air quality permits from local air pollution control agencies. Because the project will likely require or receive one or more federal approvals or future federal construction funding, the Authority anticipates FRA will issue a General Conformity Determination in accordance with the implementing regulations of Section 176 of the CAA.

A conformity determination under the General Conformity Rule is required for the project alternatives if it is determined that all of the following criteria apply:

- The action will occur in a nonattainment or maintenance area.
- One or more specific exemptions do not apply to the action.
- The action is not included in the federal agency's "presumed to conform" list.[6]
- The emissions from the proposed action are not within the approved emissions budget for an applicable facility.
- The total direct and indirect emissions of a pollutant (or its precursors) are at or above the *de minimis* levels established in the General Conformity Rule (40 C.F.R. Section 93.153(b)).

The evaluation of direct and indirect emissions is performed by comparing the change in annual emissions due to the project to the applicable *de minimis* emissions level. If the evaluation indicates that emissions are greater than any general conformity *de minimis* thresholds, FRA must perform a conformity determination.

Mobile Source Air Toxics and Hazardous Air Pollutants

While NAAQS or CAAQS do not exist for MSATs or HAPs, USEPA regulates these pollutants through rules and emission control programs. In February 2007, USEPA finalized a rule (Control of Hazardous Air Pollutants from Mobile Sources, February 9, 2007) to limit the benzene content of gasoline and reduce toxic emissions from passenger vehicles and portable fuel containers (e.g., hand-held gas cans). USEPA is also developing programs that would provide additional benefits (further controls) for small off-road gasoline engines, diesel locomotives, and marine engines. These regulatory controls would complement existing USEPA programs that reduce risk

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[5] As defined in the General Conformity Rule (40 C.F.R. § 93.152), "*direct emissions* means those emissions of a criteria pollutant or its precursors that are caused or initiated by the federal action and originate in a nonattainment or maintenance area and occur at the same time and place as the action and are reasonably foreseeable…. *Indirect emissions* means those emissions of a criteria pollutant or its precursors (1) that are caused or initiated by the federal action and originate in the same nonattainment or maintenance area but occur at a different time or place as the action; (2) that are reasonably foreseeable; (3) that the agency can practically control; and (4) for which the agency has continuing program responsibility."

[6] Category of activities designated by a federal agency as having emissions below *de minimis* levels or otherwise do not interfere with the applicable SIP or the attainment and maintenance of the NAAQS.

in local communities, including the Clean School Bus USA, the Voluntary Diesel Retrofit Program, Best Workplaces for Commuters, and the National Clean Diesel Campaign.

Federal Greenhouse Gas Regulations and Guidance

In *Massachusetts v. U.S. Environmental Protection Agency, et al.*, 549 U.S. 497 (2007), the United States Supreme Court ruled that GHGs fit within the CAA's definition of air pollutants and that USEPA has the authority to regulate GHGs. Pursuant to its authority under the CAA, USEPA published a rule on October 30, 2009, requiring mandatory reporting of GHG emissions from facilities that emit 25,000 metric tons or more per year of GHG emissions. The final rule covers the GHGs CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride (SF_6), and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. While the mandatory reporting rule is not a transportation-related regulation, the reporting methodology developed as part of the regulation is helpful in identifying potential GHG emissions from transportation projects.

Federal GHG regulation has continued to evolve since the initial Supreme Court ruling in 2007. Key legislation and regulatory orders applicable to the project alternatives are briefly described in the following list (refer to the Air Quality and Greenhouse Gases Technical Reports [Authority 2019a, 2019b] for additional detail):

- **U.S. Presidential Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance* (October 5, 2009)**—Requires federal agencies to set a 2020 GHG emission-reduction target, increase energy efficiency, conserve resources, support sustainable communities, and leverage federal purchasing power to promote environmentally responsible products and technologies.
- ***Final Endangerment and Cause or Contribute Findings for Greenhouse Gases* (December 7, 2009)**—States that current and projected concentrations of the six key well-mixed GHGs in the atmosphere—CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and SF_6—threaten the public health and welfare of current and future generations.
- **Updated Corporate Average Fuel Economy Standards (October 15, 2012)**—Requires substantial improvements in fuel economy and reductions in GHG emissions for all light-duty vehicles sold in the United States. The updated standards apply to new passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2017 through 2025, and are equivalent to 54.5 miles per gallon. On August 2, 2018, the National Highway Traffic Safety Administration (NHTSA) and USEPA proposed to amend the fuel efficiency standards for passenger cars and light trucks and establish new standards covering model years 2021 through 2026 by maintaining the current model year 2020 standards through 2026 (Safer Affordable Fuel-Efficient Vehicles Rule). On September 19, 2019, USEPA and NHTSA issued a final action on the One National Program Rule, which is considered to be the first part of the Safer Affordable Fuel-Efficient Vehicles Rule and a precursor to the proposed fuel efficiency standards. The One National Program Rule enables USEPA and NHTSA to issue nationwide uniform fuel economy and GHG vehicle standards, specifically by (1) clarifying that federal law preempts state and local tailpipe GHG standards, (2) affirming NHTSA's statutory authority to set nationally applicable fuel economy standards, and (3) withdrawing California's CAA preemption waiver to set state-specific standards.

  USEPA and NHTSA published their decisions to withdraw California's waiver and finalize regulatory text related to the preemption on September 27, 2019 (84 Fed. Reg. 51310). The agencies also announced that they will publish the second part of the Safer Affordable Fuel-Efficient Vehicles Rule (i.e., the standards) in October 2019. California, 22 other states, the District of Columbia, and two cities filed suit against the proposed One National Program Rule on September 20, 2019, in the U.S. District Court for the District of Columbia (*California et al. v. United States Department of Transportation et al.*, Case Number 1:19-cv-02826). The lawsuit requests "permanent injunction prohibiting Defendants from implementing or relying on the Preemption Regulation." The fate of the One National Program Rule and Safer Affordable Fuel-Efficient Vehicles Rule remains uncertain in the face of pending litigation.

- ***Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles* (September 15, 2011, and August 16, 2016)**—Phase I of the standards applies to model years 2014 through 2018 and is tailored to each of three regulatory categories of heavy-duty vehicles—combination tractors, heavy-duty pickup trucks and vans, and vocational vehicles. Phase 2 of the standards apply to model years 2019 through 2027 medium- and heavy-duty vehicles.
- ***Final Guidance on Considering Climate Change in NEPA Reviews and Conducting Programmatic NEPA Reviews* (August 1, 2016) and *Draft National Environmental Policy Act Guidance on Consideration of Greenhouse Gas Emissions* (June 26, 2019)**—The White House Council on Environmental Quality (CEQ) released final guidance regarding the consideration of GHGs in NEPA documents for federal actions in August 2016 (CEQ 2016). On April 25, 2017, CEQ withdrew the final guidance pursuant to U.S. Presidential Executive Order 13783. CEQ released new draft guidance on June 26, 2019, which, if finalized, would replace the withdrawn August 2016 guidance (84 Fed. Reg. 30097). The June 2019 guidance directs federal agencies to analyze the direct and reasonably foreseeable indirect GHG emissions when doing so is practicable and not overly speculative.

3.3.2.2 State

California Clean Air Act and California Ambient Air Quality Standards

In 1988, the state legislature adopted the California Clean Air Act, which established a statewide air pollution control program. The act is administered by the CARB at the state level and by local air quality management districts at the regional level. The air districts are required to develop plans and control programs for attaining the CAAQS by the earliest practicable date. The CAAQS are generally more stringent than NAAQS and incorporate additional standards for sulfates, hydrogen sulfide, visibility-reducing particles, and vinyl chloride. CAAQS and NAAQS are listed together in Table 3.3-1.

The CARB is responsible for implementation of the California Clean Air Act, meeting state requirements of the federal CAA, and establishing the CAAQS. The CARB is responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. The CARB also establishes passenger vehicle fuel specifications.

Mobile Source Air Toxics and Toxic Air Contaminants

California regulates TACs (equivalent to the federal HAPs) primarily through the Toxic Air Contaminant Identification and Control Act (Tanner Act) and the Air Toxics “Hot Spots” Information and Assessment Act of 1987 (Hot Spots Act). The Tanner Act created California’s program to reduce exposure to air toxics. The Hot Spots Act supplements the Tanner Act by requiring a statewide air toxics inventory, notification of people exposed to a significant health risk, and stationary source plans to reduce these risks.

Diesel Particulate Matter Control Measures

In August 1998, the CARB identified DPM from diesel-fueled engines as a TAC. In September 2000, the CARB approved a comprehensive diesel risk reduction plan to reduce DPM from new and existing diesel-fueled engines and vehicles. The CARB has also adopted regulations to reduce emissions from both on-road and off-road heavy-duty diesel vehicles (e.g., equipment used in construction). These regulations, known as airborne toxic control measures, reduce the idling of school buses and other commercial vehicles, control DPM, and limit the emissions of ocean-going vessels in California waters. The regulations also include measures to control emissions of air toxics from stationary sources. The California Toxics Inventory, developed by interpolating from CARB estimates of total organic gases and PM, provides emissions estimates by stationary, area-wide, on-road mobile, off-road mobile, and natural sources (CARB 2015).

Asbestos Control Measures

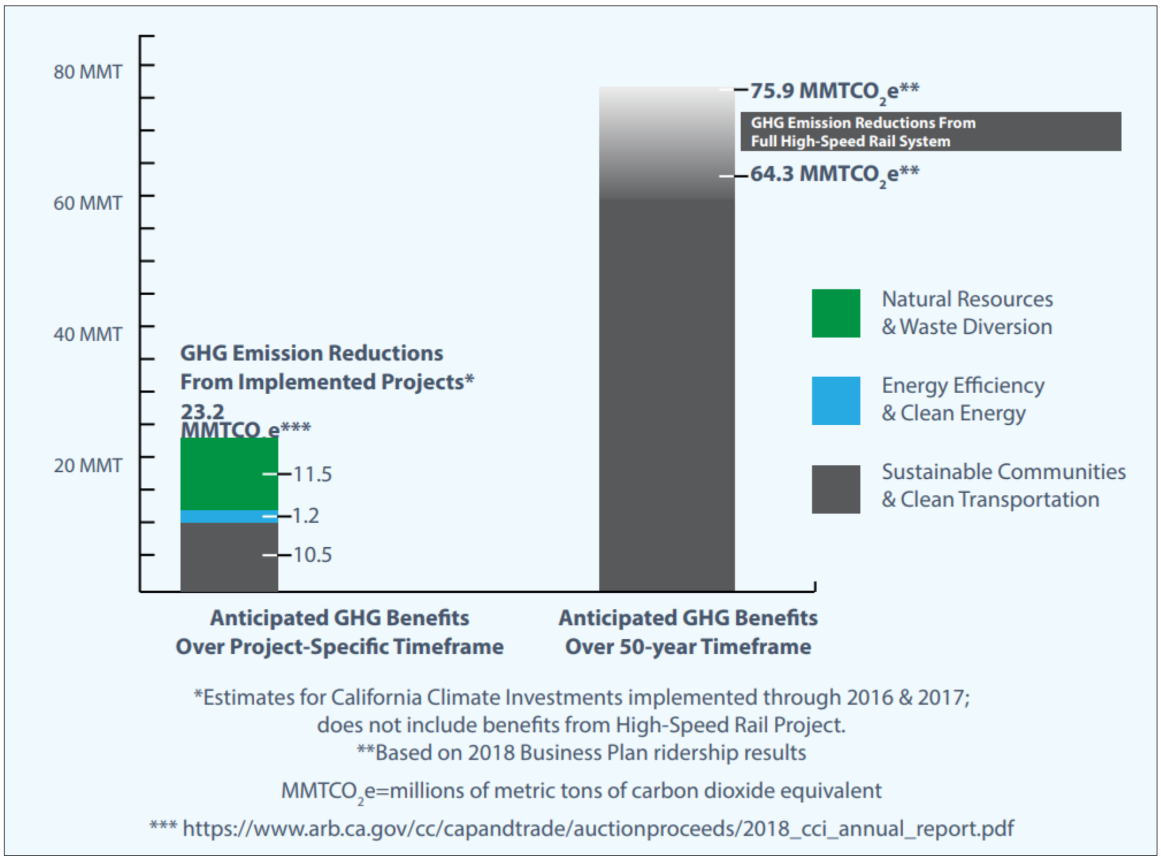
The CARB has adopted two airborne toxic control measures for controlling naturally occurring asbestos (NOA): the *Asbestos Airborne Toxic Control Measure for Surfacing Applications* and the *Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations*. While USEPA is responsible for enforcing regulations relating to asbestos renovations and demolitions, it can delegate this authority to state and local agencies. The CARB and local air districts have been delegated authority to enforce the Federal National Emission Standards for Hazardous Air Pollutants regulations for asbestos.

California Greenhouse Gas Regulations and Guidance

California has taken proactive steps to reduce GHG emissions. This section briefly describes key legislation and regulatory orders applicable to the project alternatives. Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for additional details.

- **Assembly Bill (AB) 1493 (2002)**—Requires the CARB to develop and implement regulations to reduce automobile and light-truck GHG emissions, beginning with model year 2009.
- **California Executive Order (EO) S-03-05 (2005)**—Establishes goals to reduce California's GHG emissions to 2000 levels by 2010, 1990 levels by 2020, and 80 percent below the 1990 levels by 2050.
- **AB 32 (2006)**—Requires the CARB to implement emission limits, regulations, and other feasible and cost-effective measures such that statewide GHG emissions are reduced to 1990 levels by 2020. Pursuant to AB 32, the CARB adopted the Climate Change Scoping Plan (AB 32 Scoping Plan) in December 2008 and updated in 2014 and 2017 (CARB 2017a), which outlines measures for meeting the 2020 GHG emissions reduction limit.
- **California Environmental Quality Act (CEQA) Guidelines Amendments to Address Greenhouse Gas Emissions (2009)**—Requires lead agencies to address GHG emissions in determining the significance of environmental effects caused by a project and to consider feasible means to mitigate the significant effects of GHG emissions.
- **EO B-30-15 (2015)**—Establishes a GHG reduction target of 40 percent below 1990 levels by 2030 in the state. As of July 2016, California was on track to meet or exceed the target of reducing GHG to 1990 levels by 2020, which was previously established in the California Global Warming Solutions Act of 2006 (AB 32). EO B-30-15 supports EO S-3-05 but currently is only binding on state agencies.
- **EO S-01-07 (2007)**—Mandates that a statewide goal be established to reduce the carbon intensity of California's transportation fuels by at least 10 percent by 2020, and that a low-carbon fuel standard for transportation fuels be established in California.
- **Senate Bill (SB) 375 (2008)**—Requires the state's 18 metropolitan planning organizations to incorporate a sustainable communities strategy in their regional transportation plans (RTP) to attain the GHG emissions reduction targets set by the CARB for 2020 and 2035.
- **SB 32 and AB 197 (2016)**—Require the CARB to reduce statewide GHG emissions to at least 40 percent below the 1990 level by 2030. On December 14, 2017, CARB adopted *California's 2017 Climate Change Scoping Plan*, the strategy for achieving California's 2030 GHG emissions target (CARB 2017a). The 2030 midterm target helps to frame the suite of policy measures, regulations, planning efforts, and investments in clean technologies and infrastructure needed to continue lowering emissions. The plan is intended to move the state toward more electric vehicles; cleaner electricity to fuel those cars; denser, more walkable communities with more efficient buildings; and less-polluting agriculture.
- **SB 100 (2018)**—Revises and extends renewable resource targets for electric power generation to 50 percent by December 31, 2026; 60 percent by December 31, 2030; and 100 percent by December 31, 2045.

- **EO B-55-18 (2018)**—Establishes a new state goal to achieve carbon neutrality as soon as possible, and no later than 2045, and to achieve and maintain net negative emissions thereafter.
- **CARB Innovative Clean Transit Regulation (2018)—**Requires public transit agencies to gradually transition to 100 percent zero-emission bus fleets by 2040.
- **California Climate Investments Program—**Allocates billions of cap-and-trade dollars to work toward reducing GHG emissions, strengthening the economy and improving public health and the environment. The cap-and-trade program also creates a financial incentive for industries to invest in clean technologies and to develop innovative ways to reduce pollution. California Climate Investments projects include affordable housing, sustainable agriculture, environmental restoration, waste diversion and recycling, renewable energy, public transportation, and zero-emission vehicles. According to the California Climate Investments program, the California HSR system would generate an aggregate reduction in statewide GHG emissions over a 50-year period. Figure 3.3-1 illustrates the estimated aggregate reductions in GHG emissions that would result from the HSR over a 50-year timeframe.



Source: Authority 2018

Figure 3.3-1 Aggregate GHG Emissions Reductions That Would Result from the California HSR Project

3.3.2.3 Regional and Local

This section describes the air management district and other regional and local planning agencies in the RSA, and provides an overview of regional air quality and climate action plans relevant to the analysis of air quality and GHGs. Volume 2, Appendix 2-I provides a complete list of regional and local plans and policies relevant to air quality and GHGs considered in the preparation of this analysis.

Air Quality Management Districts

The project is located in the San Francisco Bay Area Air Basin (SFBAAB), which is under the jurisdiction of the BAAQMD. The BAAQMD has the following responsibilities:

- Implementing air quality regulations, including developing plans and control measures for stationary sources of air pollution to meet the NAAQS and CAAQS.
- Implementing permit programs for the construction, modification, and operation of sources of air pollution.
- Coordinating with local transportation planning agencies on mobile emissions inventory development, transportation control measure development and implementation, and transportation conformity.
- Enforcing air pollution statutes and regulations governing stationary sources. With CARB oversight, the BAAQMD also administers local regulations.

The BAAQMD has adopted advisory emission thresholds to assist CEQA lead agencies in determining the level of significance of a project's emissions. It has also adopted air quality plans, which are discussed further in the section, to improve air quality, protect public health, and protect the climate. Refer to the San Francisco to San Jose Air Quality and Greenhouse Gases Technical Report (Volume 2, Appendix 3.3-A) for a summary of air district rules applicable to the project.

Metropolitan Planning Organizations

Metropolitan planning organizations are responsible for transportation planning within their local jurisdiction. The Metropolitan Transportation Commission is the federally designated metropolitan planning organization for the San Francisco Bay Area (Bay Area) and is supported by the Association of Bay Area Governments, which is the Bay Area regional planning body.

Air Quality Plans

State Implementation Plan

As discussed in Section 3.3.2.1, Federal, the CAA requires areas with unhealthy levels of O_3, PM, CO, NO_2, and SO_2 to develop SIPs that describe how an area will attain the NAAQS. SIPs are not single documents. They are a compilation of new and previously submitted plans, programs (e.g., monitoring, modeling, permitting), district rules, state regulations, and federal controls. Many of California's SIPs rely on the same core set of control strategies, including emission standards for cars and heavy trucks, fuel regulations, and limits on emissions from consumer products. Section 3.3.5.1, Air Quality, describes SIPs relevant to the RSA.

Transportation Plans and Programs

An RTP is a long-range plan that includes both long- and short-range strategies and actions that lead to the development of an integrated multimodal transportation system to address future transportation demand. RTPs address a region's growth, transportation goals, objectives, and policies for the next 25 years and identify the actions necessary to achieve those goals. Transportation improvement programs provide a comprehensive listing of all surface transportation projects that are to receive federal funding, are subject to a federally required action, or are considered regionally significant for air quality conformity purposes. The relevant RTP and transportation improvement programs in the RSA are described in detail in the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b).

Climate Action Plans

Several cities in the RSA have adopted or are in the process of developing climate action plans, GHG reduction plans, or equivalent documents aimed at reducing local GHG emissions. Jurisdictions with adopted or in-development climate action plans or GHG reduction plans for municipal operations, community activities, or both include the City and County of San Francisco, the Cities of South San Francisco, Burlingame, Millbrae, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, Palo Alto, Mountain View, Sunnyvale, Santa Clara, and San Jose, and San Mateo County and Santa Clara County. These plans all call for reductions in GHG emissions below current levels and actions to reduce VMT and associated transportation emissions. All plans include increased transit service as a key strategy in reducing local GHG emissions.

3.3.3 Consistency with Plans and Laws

As indicated in Section 3.1.5.3, Consistency with Plans and Laws, the CEQA and CEQ regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. Accordingly, this Draft EIR/EIS describes inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

Several federal and state laws and implementing regulations listed in Section 3.3.2.1 and Section 3.3.2.2 protect the air quality and public health at a regional and local level, and aim to curb GHG emissions and the effects of global climate change. The federal and state requirements considered in this analysis are summarized as follows:

- Federal and state laws and regulations that set standards for the ambient air quality in air basins, and establish thresholds of significance for air districts in the state to use in conforming to the required standards.
- State laws and EOs that establish GHG reduction targets to minimize global climate change effects and that require reductions in GHG emissions from on-road vehicles. State plans approved by CARB and prepared by the BAAQMD outline strategies for nonattainment areas to achieve attainment with air quality standards.

The Authority, as the lead agency proposing to build and operate the HSR system, is required to comply with all federal and state laws and regulations and to secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations. The HSR project, including this Project Section, is consistent with state efforts to reduce GHG emissions, and is a central component of the State's strategy for reducing GHG emissions from the transportation sector in the 2017 Scoping Plan (CARB 2017a).

The Authority is a state agency and therefore is not required to comply with local land use and zoning regulations; however, it has endeavored to design and build the HSR system to be compatible with land use and zoning regulations. The CEQA and CEQ regulations require the discussion of inconsistencies or conflicts between a proposed undertaking and regional or local plans and laws.

A total of 30 plans and 176 policies were reviewed. Volume 2, Appendix 2-I presents the plans and policies by resource. The project alternatives are consistent with 175 policies and inconsistent with 1 policy. Volume 2, Appendix 2-J further details the inconsistencies between the project and regional and local plans and policies.

The project alternatives would be inconsistent with certain provisions of the *Plan Bay Area 2040* (Association of Bay Area Governments and Metropolitan Transportation Commission 2017)—Plan Bay Area's Target #3. This target requires a 10 percent reduction in health impacts associated with adverse air quality. During construction, both project alternatives would contribute temporarily to existing violations of the PM_{10} CAAQS and new violations of the $PM_{2.5}$ NAAQS. The NAAQS and CAAQS have been established to protect public health. The existing violations are attributed to emissions from existing sources and would not be caused by the project. The Authority has incorporated all feasible measures for reducing particulate emissions from construction into AQ-IAMF#1: Fugitive Dust Emissions, which minimizes health impacts of particulates to the maximum extent feasible, though existing violations of the CAAQS would remain. As described in Section 3.3.6.2, Air Quality, project operations would reduce air pollution after construction.

3.3.4 Methods for Evaluating Impacts

The evaluation of impacts on air quality and GHGs is a requirement of NEPA and CEQA. The following sections summarize the RSAs and the methods used to analyze air quality and GHGs.

3.3.4.1 Definition of Resource Study Area

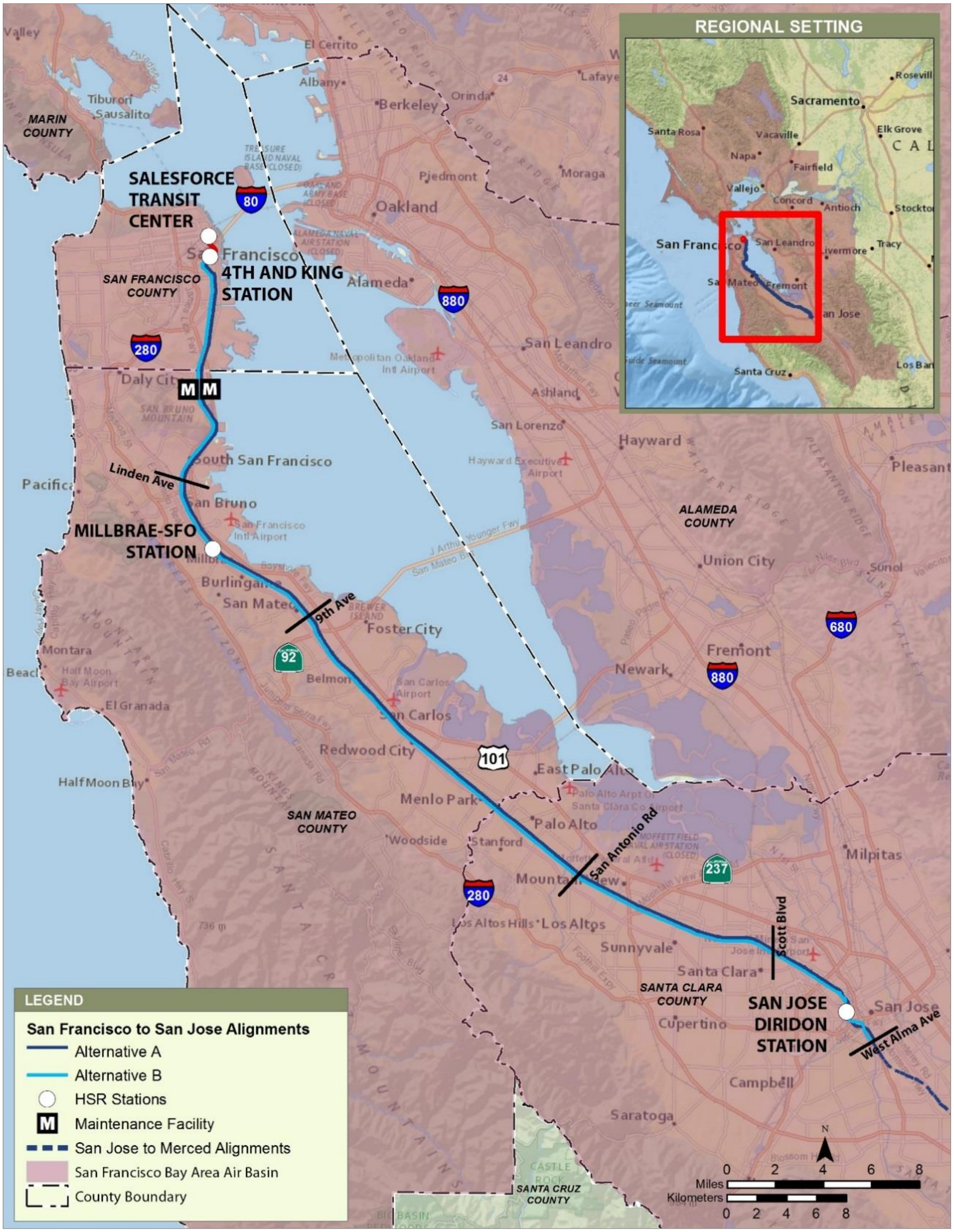
As defined in Section 3.1, Introduction, RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. As shown in Table 3.3-2, the RSA for air quality and GHGs encompasses the areas directly and indirectly affected by construction and operations of the project. The RSAs for air quality and GHGs are distinct because of the nature of criteria pollutants and GHGs mixing into the atmosphere. Three geographic scales define the RSAs:

- **Local**—The project footprint for each project alternative plus areas within 1,000 feet of the temporary features of the project footprint (for localized health risk impacts during construction only).
- **Region**—The affected air basin (i.e., SFBAAB) for regional impacts during construction and operations.
- **State**—The entire state with respect to ambient air quality standards during operations. The RSA for impacts on GHGs also includes the entire state and global atmosphere (during construction and operations) because GHGs mix throughout the atmosphere globally. Figure 3.3-2 illustrates the regional air quality RSA for the project, including the SFBAAB, and the project alternatives.

Table 3.3-2 Definition of Air Quality and Greenhouse Gas Resource Study Areas

Type	General Definition
Air Quality	
Construction	**Local:** Localized air quality impacts from construction, such as health effects associated with certain criteria pollutants and DPM emissions, could occur in areas within 1,000 feet of the project footprint and staging areas.
	Region: Regional air quality impacts from construction, such as health effects from increased O_3 and secondary PM formation, could occur in the SFBAAB.
Operations	**Region and state:** The air quality RSA associated with operations of the project is the affected air basin (SFBAAB) and the entire state. The project could impact on-road emissions throughout the SFBAAB and state and aircraft operations regionally and statewide. Emissions from power plants would occur at power facilities throughout the state. Thus, the resulting change in emissions from these sources from project operations could affect regional and statewide air quality.
Greenhouse Gases	
Construction and Operations	**State:** The RSA associated with global climate change is the entire state for both construction and operations. GHGs, once emitted, are circulated into the atmosphere on a global scale, and the resulting impacts of climate change occur on a global scale as well. California, through AB 32, SB 32, and other approaches, has chosen to reduce its statewide GHG emissions. Thus, GHG emissions from project construction equipment, power plants, and changes in on-road and aircraft operations, could affect statewide climate change.

AB = Assembly Bill
DPM = diesel particulate matter
GHG = greenhouse gas
O_3 = ozone
PM = particulate matter
RSA = resource study area
SB = Senate Bill
SFBAAB = San Francisco Bay Area Air Basin



Source: Authority 2019c, 2019d

MAY 2019

Figure 3.3-2 Regional Air Quality Resource Study Area

3.3.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. The full text of the IAMFs that are applicable to the project is provided in Volume 2, Appendix 2-E. The following IAMFs are applicable to the air quality and GHG analysis:

- AQ-IAMF#1: Fugitive Dust Emissions
- AQ-IAMF#2: Selection of Coatings
- AQ-IAMF#3: Renewable Diesel
- AQ-IAMF#4: Reduce Criteria Exhaust Emissions from Construction Equipment
- AQ-IAMF#5: Reduce Criteria Exhaust Emissions from On-Road Construction Equipment
- GEO-IAMF#5: Hazardous Minerals
- HMW-IAMF#5: Demolition Plans
- HMW-IAMF#10: Hazardous Materials Plans

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.3.6, Environmental Consequences, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts to less than significant under CEQA.

3.3.4.3 Methods for Impact Analysis

Overview of Impact Analysis

This section describes the sources and methods the Authority used to analyze potential project impacts on air quality and climate change. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.5.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. Project inconsistencies and conflicts with regional and local plans and policies that regulate air quality and climate change (Volume 2, Appendix 2-I) also were considered in this analysis.

Methods Used to Analyze Impacts

Construction Impacts

- Mass emissions modeling
- Health risk assessment
- Other localized effects
- Asbestos, lead-based paint, and odors

Operations Impacts

- Mass emissions modeling
- Carbon monoxide hot spots
- Particulate matter hot spots
- Mobile source air toxics
- Operational health risk assessment

As discussed in Section 3.3.1.1, Definition of Terminology, the impact analysis focuses on three types of air pollutants that are of greatest concern for the project—criteria pollutants, TACs, and GHGs. The Authority assessed and quantified the impacts of these pollutants generated by construction and operations of the project alternatives using standard and accepted software tools, techniques, and emission factors. Emissions and impacts under both project alternatives are analyzed at an equal level of detail. This section summarizes the methods used to analyze impacts. The Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) provide additional detail on the analysis, including specific modeling assumptions and outputs.

Construction Impacts

Mass Emissions Modeling

Construction of the project would generate emissions of reactive organic gases (ROG),[7] NO_X, CO, sulfur oxides (SO_X), PM_{10}, $PM_{2.5}$, CO_2, CH_4, and N_2O that could result in temporary air quality and GHG effects. Emissions would originate from off-road equipment exhaust, employee and haul truck vehicle exhaust (on-road vehicles), site grading and earth movement, on-site concrete

[7] ROG is interchangeable with the USEPA term *volatile organic compounds* (VOC).

batching, demolition, paving, architectural coating, and electricity consumption. These emissions would be temporary (i.e., limited to the construction period) and would cease when construction activities are complete.

The Authority estimated combustion exhaust, fugitive dust (PM_{10} and $PM_{2.5}$), and fugitive[8] off-gassing (of VOC) using a combination of emission factors and methods from the California Emissions Estimator Model (CalEEMod), version 2016.3.2; the 2017 CARB emissions factors (EMFAC) model (CARB 2018a); and USEPA's AP-42 Compilation of Air Pollutant Emission Factors based on project-specific construction data (e.g., schedule, equipment, truck volumes) provided by the project engineering team (Scholz 2018). All major design components of the project (at grade, embankment/berm, and viaduct) were quantitatively analyzed and included in the emissions modeling. The analysis also considers emissions generated by heavy-duty trucks used to haul ballast and subballast from regional quarries to the project. All ballast would be hauled from quarries located in the SFBAAB. This project would be a balanced project in terms of earthwork under Alternative A, so fill would not be imported or exported under Alternative A. Fill would be imported under Alternative B. Sources of fill are expected to be local borrow sites within the SFBAAB.

As discussed in Chapter 2, Alternatives, the Authority has incorporated IAMFs into the project that would avoid or minimize potential effects on air quality. The construction impact analysis and emissions modeling accounts for emissions benefits achieved by AQ-IAMF#1 through AQ-IAMF#5.

Construction of the project would occur over multiple phases between 2021 and 2026. The Authority quantified daily criteria pollutant and GHG emissions generated by construction of each phase using the methods described under Mass Emissions Modeling. Daily estimates were converted to annual totals based on the detailed construction schedule for each project alternative, and maximum daily emissions were identified based on concurrent construction activity, consistent with air district requirements (BAAQMD 2017a). The highest daily emissions in each construction year were selected as the peak day for analysis purposes. This approach assesses a conservative scenario based on available information and, therefore, is not necessarily representative of actual daily emissions during the construction period.

Health Risk Assessment

A health risk assessment (HRA) was conducted to assess the potential impacts associated with public exposure to DPM and localized $PM_{2.5}$ exhaust. In accordance with BAAQMD guidance, the HRA used diesel $PM_{2.5}$ as a surrogate for DPM because complete emission factors for DPM are not available. The HRA was conducted using the guidelines provided by the California Office of Environmental Health Hazard Assessment (OEHHA) (2015) for the Air Toxics Hot Spots Program and the HRA guidelines developed by the California Air Pollution Control Officers Association (CAPCOA) (CAPCOA 2009). The HRA was only performed for construction of the alignment, stations, and light maintenance facility (LMF).

The HRA consists of three parts: (1) PM emissions inventory, (2) air dispersion modeling to evaluate off-site concentrations of PM emissions, and (3) assessment of cancer and noncancer risks associated with predicted concentrations. The following subsections provide a brief description of each component.

Particulate Matter Emissions Inventory

The mass emissions analysis includes PM emissions generated by heavy-duty equipment and vehicle exhaust, as well as fugitive dust from site grading and soil movement. The particulate constituent analyzed in the HRA depends on the emission location and associated air district guidance. The BAAQMD (2017a) considers diesel $PM_{2.5}$ to be a surrogate for DPM, with its guidance requiring that diesel $PM_{2.5}$ emissions serve as the basis for the cancer and noncancer risk calculations in the SFBAAB (Kirk 2016). BAAQMD guidance also indicates that localized

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[8] Fugitive means emissions that could not reasonably pass through a vent, stack, or similar opening but are emitted directly to the atmosphere. For example, windblown dust is fugitive PM.

$PM_{2.5}$ risks should be evaluated using total $PM_{2.5}$ exhaust emissions (i.e., emissions from both diesel- and gasoline-powered equipment).

Air Dispersion Modeling

The USEPA's AERMOD dispersion model was used to quantify annual average PM concentrations at nearby receptor locations for each subsection. The modeling approach follows, where applicable, the OEHHA and CAPCOA methods, but is also consistent with BAAQMD methods, as provided in their guidance documents and based on staff consultation (BAAQMD 2012). The Authority used eight representative meteorological datasets in the analysis, which broadly cover the different meteorological conditions in the RSA. Three types of construction work areas—at grade, embankment, and viaduct—were assumed to characterize construction activities and emissions. Receptor spacing was determined based on air district guidance and varies based on the type of construction (e.g., at grade vs. embankment) and location. Receptor heights were all set to 1.2 meters, consistent with OEHHA (2015) guidance.

Risk Calculations

Consistent with USEPA, CARB, and air district regulatory guidance, the HRA examines cancer and noncancer (chronic)[9] exposure to the surrounding community and uses OEHHA's guidance on risk calculations (OEHHA 2015). Cancer risk is defined as the lifetime probability (chance) of developing cancer from exposure to a carcinogen, typically expressed as the increased chance in 1 million. Noncancer chronic effects are defined as the long-term risk associated with health outcomes other than cancer, typically expressed as a ratio. A ratio of 1.0 indicates the level at which adverse noncancer effects are likely to occur. In accordance with OEHHA guidance, inhalation exposure at residences was assumed to occur for 30 years. The parameters used for all exposure scenarios assume exposure begins in the last trimester of pregnancy and progresses through the 30-year period using varying age-specific factors and exposure duration. Consistent with BAAQMD (2017a) guidance, the analysis also considers noncancer health effects from exposure to total $PM_{2.5}$ exhaust from construction.

The risk factors from OEHHA incorporate worst-case, health-protective assumptions. They were established using data from animal and epidemiological exposure studies and represent increased health effects assuming continuous lifetime exposure to a pollutant. The HRA presented in this section is therefore conservative (i.e., tending to overestimate impacts).

Localized Criteria Pollutant Analysis

Criteria pollutants are classified as either regional or localized pollutants. Regional pollutants can be transported over long distances and affect ambient air quality far from the emissions source. Localized pollutants affect ambient air quality near the emissions source. As discussed in Section 3.3.1, Introduction, O_3 is considered a regional criteria pollutant, whereas CO, NO_2, SO_2, and Pb are localized pollutants. PM can be both a local and a regional pollutant, depending on its composition. The primary criteria pollutants of concern generated by the project would be O_3 (including its precursors VOC and NO_X), NO_2, CO, PM, and SO_2.

Potential health effects induced by regional criteria pollutant emissions generated by the project (O_3 precursors and PM) are evaluated using the mass emissions modeling and are discussed further in Section 3.3.6. Localized pollutants (NO_2, CO, PM, and SO_2) generated by a project potentially affect populations near the emissions source. Because these pollutants dissipate with distance, emissions from individual projects can result in direct and material health effects on adjacent sensitive receptors. Accordingly, a quantitative ambient air quality analysis was conducted to assess the potential for construction-generated criteria pollutants to cause new or contribute to existing violations of the NAAQS and CAAQS. The NAAQS and CAAQS are health-protective standards and define the maximum amount of ambient air pollution that can be present without harming public health.

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[9] Note that the OEHHA, CARB, and BAAQMD have not identified acute health effects from diesel exhaust. Therefore, acute health effects are not included in this analysis.

The analysis considers both annual and 1-hour to 24-hour impacts of all criteria pollutants, as applicable based on the established air quality standard. Specifically, the pollutants of concern with established annual standards are NO_2,[10] PM_{10}, and $PM_{2.5}$. The following pollutants of concern have established 1-hour to 24-hour standards:

- CO (1 hour and 8 hours)
- PM_{10} and $PM_{2.5}$ (24 hours)
- NO_2 (1 hour)
- SO_2 (1 hour and 24 hours)

Off-site concentrations of pollutants were modeled using the annual mass emissions inventory and the AERMOD dispersion model. A representative maximum emission scenario for 1-hour to 24-hour impacts was developed for each subsection based on maximum activity levels that could take place concurrently. All major design components of the project (at grade, embankment, and viaduct) were quantitatively analyzed. The combined effect of emissions from geographically proximate construction was also assessed.

Asbestos, Lead-Based Paint, and Odor Impacts

The *San Francisco to San Jose Project Section Geology, Soils, and Seismicity Technical Report* (Authority 2019e) and the *San Jose to Merced Project Section Geology, Soils, and Seismicity Technical Report* (Authority 2019f) were used to determine whether NOA occurs within the local RSA. LBP may have been used during construction of existing structures throughout the RSA. The Authority considered whether demolition would occur and whether the project would comply with applicable standards for appropriate disposal.

Operations Impacts

The following discussion identifies the methods and assumptions used for evaluating operations emissions and impacts on air quality and global climate change. The analysis is based on impact assessment in 2029 (initial Phase 1 operation) and 2040 (Phase 1 operations after initial ridership build-up). Because existing background conditions (e.g., background traffic volumes, trip distribution, vehicle emissions) of 2015 would change over the 25-year project life, the project's air quality operations impacts are evaluated against both existing (2015) conditions and future No Project conditions as they are expected to be in 2029 and 2040. The difference between emissions with the project and without the project represents the net impact of the project.

Criteria pollutant and GHG emissions were calculated under two ridership scenarios: a medium ridership scenario and a high ridership scenario. Both scenarios are based on the level of ridership as presented in the Authority's 2016 Business Plan (Authority 2016a).[11] Two ridership scenarios are shown for the No Project conditions because the scenarios assume different background conditions. For example, forecast trends in demographics and travel costs can influence ridership for any HSR scenario. The medium ridership scenario was developed using the "most likely" values of all inputs to the HSR ridership forecasting model, while the high ridership scenario used inputs that result in ridership at the 75th percentile of the range

[10] NO_X is both a regional and localized pollutant. Regional effects (i.e., O_3 formation) take place over long distances and time scales and are not analyzed through a localized ambient air quality analysis. Likewise, because ROG is a regional pollutant, it is not addressed in the localized analysis. Rather, O_3 impacts (through NO_X and ROG emissions) are addressed through a comparison of project emissions to the air district and federal General Conformity *de minimis* thresholds (Tables 3.3-3 and 3.3-4). Localized effects can occur from the conversion of NO_x to NO_2 in the atmosphere, and these effects are assessed through the localized NO_2 analysis to confirm that emissions would not lead to concentrations that exceed the CAAQS or NAAQS.

[11] As described in Volume 2, Appendix 3.3-A, the Authority Board of Directors adopted the *2018 Business Plan: Connecting California, Expanding Economy, Transforming Travel* (2018 Business Plan) on May 15, 2018 (Authority 2018). The 2018 Business Plan assumes an opening year of 2033 for Phase 1 and presents different ridership forecasts for 2029 and 2040 than were assumed in this EIR/EIS. Under the 2018 Business Plan ridership forecasts, the project would achieve the same benefits described in this section, but they would occur at different times and may be less than presented in Section 3.3.6. Nonetheless, the HSR system would ultimately afford a more energy-efficient choice for personal travel that would help alleviate highway congestion, provide greater capacity for goods movement, and reduce criteria pollutant and GHG emissions.

considered in the ridership risk analysis. The *California High-Speed Rail 2016 Business Plan Ridership and Revenue Forecasting: Technical Supporting Document* (Authority 2016b) provides additional detail on the travel forecasts and risk analysis. The tables in the impact analysis therefore present two values for operations emissions for each pollutant, corresponding to these two scenarios.

Mass Emissions Modeling

The project would affect long-distance, city-to-city travel along freeways and highways throughout the state (on-road vehicles), as well as long-distance, city-to-city aircraft takeoffs and landings (aircraft). The HSR system would also affect electrical demand throughout the state (power plants). Because the project would use electric multiple unit (EMU) trains, operation of the trains would not produce direct emissions from combustion of fossil fuels. However, fugitive dust from the surface surrounding the track would be re-suspended by the trains traveling at high velocities (train movement). The new and expanded stations and LMF would generate local emissions from mobile sources and building operations. Emissions were considered from six sources—on-road vehicles, aircraft, power plants, train movement, stations, and the Brisbane LMF[12]—in the analysis of operations air quality impacts, as described in the following subsections.

Operational Emission Sources

- On-road vehicles—Displaced vehicle trips from mode shift to passenger rail.
- Aircraft—Displaced aircraft trips from mode shift to passenger rail.
- Power plants—Electricity generation and distribution to power electrical multiple unit trains.
- Train movement—Fugitive dust suspended by train movement over the rail track.
- Stations—Area sources (e.g., landscaping equipment), electricity and water consumption, waste generation, emergency generator testing, and vehicle traffic associated with station operation.
- Light maintenance facility—Employee commuting trips, delivery vehicle trips, and off-road maintenance equipment.

On-Road Vehicles

Operations of the project would provide expanded passenger rail service between San Francisco and San Jose that would result in reductions in passenger vehicle usage. Reductions in on-road vehicle emissions were evaluated using average daily displaced VMT estimates and the CARB's EMFAC 2017 model (CARB 2018a). Volume 2, Appendix 3.2-B describes the methodology used to forecast the reduction in VMT due to project operations. Emission reductions from displaced VMT were calculated by multiplying the estimated VMT by the applicable pollutant's emission factors from EMFAC2017, which are based on speed, vehicle mix, and analysis year.

Aircraft

Similar to on-road vehicles, operations of the project would reduce aviation demand throughout the state. Based on the HSR ridership forecasts, the Authority estimated the number of aircraft trips removed attributable to the HSR system. The Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) was used to estimate criteria pollutant benefits from the reduced aircraft activity and the associated ground support equipment activity. AEDT calculates emissions from the aircraft engines for all phases of aircraft ground and airborne operation, and the emissions from the ground support equipment used to service each aircraft.

Aircraft GHG reductions were modeled using fuel consumption and emission factors from the CARB's 2000–2014 Greenhouse Gas Emissions Inventory and the accompanying technical support document (CARB 2016b). The analysis also accounts for criteria pollutant and GHG benefits from reduced use of aircraft ground support equipment, which were calculated using the CARB's OFFROAD model.

[12] The Authority also may use portable electric generators during routine maintenance activities. Emissions from portable generators have not been quantified because information on the number, size, and locations of generators and the amount of use is not available.

Power Plants

Propulsion of the EMUs would consume electricity, which would be generated by power plants throughout the state. Criteria pollutant and GHG emissions were quantified based on the estimated annual electricity demand for the project and emission factors from the CARB and USEPA eGRID 2016 model. The analysis conservatively assumed the HSR system would be powered by the state's current electric grid, which includes renewable and nonrenewable generating units. Because an increasing fraction of future electricity will be generated by renewable resources, as required by state law (60 percent by 2030), the emissions intensity of the statewide electrical grid would be lower when the HSR system would become operational in 2029 and 2040. Accordingly, electricity-related emissions generated by the project are expected to be lower than the emissions estimated for this analysis. Furthermore, under the 2016 Policy Directive POLI-PLAN-03 (Authority 2016c), the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources. This goal also supports the SB 100 policy to require 100 percent renewable energy for supply to electricity end-use customers by 2045.

Train Movement

Re-suspended fugitive dust emissions were estimated using USEPA's (2006a) method for estimating emissions from wind erosion, and using assumptions from San Joaquin Valley Air Pollution Control District (SJVAPCD) (1996).

Stations

The project includes modifications at 4th and King Street, Millbrae, and San Jose Diridon Stations. Emissions associated with the operation of the stations would primarily result from area sources (e.g., landscaping equipment), electricity and water consumption, waste generation, emergency generator testing, and vehicle traffic.

Emissions from these sources were estimated using CalEEMod (version 2016.3.2) and project-specific data, where available. Specifically, electricity and water consumption for each facility was calculated by scaling existing utility rates (e.g., gallons of water per square foot) from the San Jose Diridon Station. The Authority also estimated vehicle emissions associated with passenger access and employee commutes (Volume 2, Appendix 3.3-A).

The 4th and King Street, Millbrae, and San Jose Diridon Stations would have emergency generators that would be used in the event of a power outage. Usage of each of the proposed emergency generators would occur for up to 50 hours per year for periodic testing, consistent with the CARB's Airborne Toxic Control Measure for Stationary Compression Ignition Engines and Section 330.3 of BAAQMD Regulation 9, Rule 8.

Light Maintenance Facility

As discussed in Chapter 2, the project would require an LMF. The LMF would be constructed in Brisbane, either east of the alignment (Alternative A) or west of the alignment (Alternative B).

Building operation and emergency generator emissions were estimated using CalEEMod (version 2016.3.2) and default assumptions for the general light industrial land use category. The Authority also derived emissions from employee commute and delivery trips using CalEEMod and vehicle trip information estimates (Volume 2, Appendix 3.3-A). Emissions from maintenance equipment and vehicle movement at the Brisbane LMF were estimated using a combination of emission factors and methods from CalEEMod and EMFAC2017.

Carbon Monoxide Hot Spots

Traffic around the 4th and King Street, Millbrae, and San Jose Diridon Stations and traffic affected by roadway-rail at-grade crossings may contribute to localized increases in CO, known as CO hot spots. The intersection analysis included all intersections affected by station traffic and near at-grade crossings. As discussed in Section 3.3.4.5, Method for Determining Significance under CEQA, the BAAQMD has adopted screening criteria that provide a conservative indication of whether project-generated traffic would cause a potential CO hot spot. The Authority applied the BAAQMD criteria and California Department of Transportation (Caltrans) guidance (Garza et al. 1997) to select intersections for analysis, based on traffic data provided by Fehr & Peers (Volume 2, Appendix 3.3-A).

A microscale CO hot-spot analysis was performed at the selected locations to verify that station traffic would not cause or contribute to a violation of the CO CAAQS or NAAQS, using the Caltrans CALINE4 model and guidance (Garza et al. 1997). Intersections were selected for analysis by ranking them according to their total peak-hour traffic volumes and delay time. The intersections with the highest total traffic volumes and worst congestion (expressed as delay time) were selected for CO modeling. Analyzing these intersections provides a conservative assessment of potential CO effects because CO concentrations at all other intersections would be lower than those estimated for the selected intersections.

Particulate Matter Hot Spots

PM hot spots may be created by localized increases in vehicle or rail traffic, particularly when that traffic consists of a significant number of diesel-powered vehicles. Redistributing or moving vehicle or rail traffic would also increase PM concentrations at certain locations and result in corresponding decreases in other locations. This section discusses methods for evaluating potential PM hot spots from changes in on-road vehicle and freight rail traffic.

On-Road Vehicles

Although the project is not subject to transportation conformity, portions of the local RSA are classified as either nonattainment or maintenance for the federal PM_{10} or $PM_{2.5}$ standards. Consequently, a hot-spot analysis was conducted following USEPA's 2015 *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (USEPA 2015). The analysis focused on potential air quality concerns under NEPA from the project's effects on roads and followed the recommended practice in USEPA's Final Rule regarding the localized or hot-spot analysis of $PM_{2.5}$ and PM_{10} (40 C.F.R. Part 93, issued March 10, 2006).

Shifting of Tracks Carrying Freight Trains

The existing Caltrain tracks also are used by Union Pacific Railroad (UPRR) freight trains that are pulled by diesel locomotives. Construction of the project would shift existing tracks by up to 63 feet laterally, depending on the location (though not all shifts would occur near sensitive receptors). Neither UPRR service nor associated emissions from locomotive operation would be affected, relative to 2015 existing conditions. Although the sources of PM emissions would shift with the lateral track shift, the amount of emissions, and therefore the potential for the project to result in new or worsened PM hot spots under the USEPA definition of projects of air quality concern, would not change. Accordingly, a PM hot-spot analysis was not conducted for freight trains on the shifted tracks because the project would not change the amount of emissions from freight locomotives, and thus there would be no effect under the USEPA definition of projects of air quality concern. Potential changes in receptor exposure to DPM and $PM_{2.5}$ are analyzed under the Operations Health Risk Assessment subsection.

Mobile Source Air Toxics

The Federal Highway Administration's (FHWA) *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents* (2016) advises on when and how to analyze MSATs in the NEPA process for highway projects. Depending on the specific project circumstances, FHWA has identified the following three categories of analysis:

- **Tier 1**—No analysis for projects without any potential for meaningful MSAT effects
- **Tier 2**—Qualitative analysis for projects with low potential MSAT effects
- **Tier 3**—Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects

Potential MSAT effects associated with the project alternatives were assessed according to FHWA's updated interim guidance and the project analysis tiers. The project would reduce regional VMT and roadway traffic congestion, resulting in a reduction in MSAT emissions. The level of effects from regional MSAT emissions therefore corresponds to FHWA's Tier 1 and no further analysis was conducted. Changes in vehicle activity could result in localized MSAT increases. The potential level of effects from these circumstances corresponds to FHWA's Tier 2; therefore, a qualitative analysis was conducted.

Operations Health Risk Assessment

Shifting of Tracks Carrying Freight Trains

Construction of the project would shift existing tracks used by UPRR freight trains within the railroad right-of-way. The track shifts would change the distances from the freight trains to certain receptor locations, which would result in increased TAC concentrations at certain receptor locations and corresponding decreases at other locations. Because diesel-related exhaust, specifically DPM, is considered a carcinogenic TAC by the CARB, an HRA was conducted to assess the risk (i.e., cancer and noncancer risks) associated with changes in freight activity.

The BAAQMD's existing inventory of health risks from rail sources in the SFBAAB (Winkel 2018) was used to calculate the net effect of health risks associated with moving tracks closer to sensitive receptors. Because the orientation and distance of the shifted track to existing receptors would change throughout the alignment, health risks were estimated at multiple locations to capture the anticipated maximum potential project impacts. The Authority selected locations where the difference in distance to nearby sensitive receptors between the shifted and existing tracks was greatest.

Data from the Peninsula Corridor Joint Powers Board (2015) and USEPA (2009) were used to account for anticipated growth in freight traffic and changes in locomotive emission rates. The analysis assumes the track shifts would be complete by 2022, which represents a conservative assumption of the earliest year that operation on the shifted tracks could occur.

Diesel Buses

The 4th and King Street, Millbrae, and San Jose Diridon Stations would be served by diesel-powered buses, which generate TACs at idle while loading and unloading passengers. Increased bus service to the passenger rail terminals is not part of the project. The Authority assumes that bus service levels are constant into the future given that no operator has a funding plan to deliver more service.

Emergency Generators

The 4th and King Street, Millbrae, and San Jose Diridon Stations and the Brisbane LMF would have emergency generators that would be used in the event of a power outage. These generators would be subject to the permitting requirements specified in BAAQMD Regulation 2, Rule 5, Section 302. Based on these permitting requirements, the generators would not be allowed to operate if they would result in cancer or acute hazard impacts greater than the BAAQMD's health risk thresholds of significance. However, Regulation 2, Rule 5 does not address $PM_{2.5}$ concentrations or permit restrictions for facilities with emissions that would result in concentrations more than the BAAQMD's threshold of 0.3 micrograms per cubic meter ($\mu g/m^3$). Accordingly, $PM_{2.5}$ exhaust concentrations from emergency generator testing were estimated using USEPA's AERMOD dispersion model and emission data from CalEEMod.

3.3.4.4 Method for Evaluating Impacts under NEPA

CEQ NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project effects (Section 3.1.5.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project:

- **Context**—For this analysis, the *context* comprises existing conditions in the SFBAAB, including the regional attainment status, existing ambient air quality monitoring data, and applicable regulations, as established by USEPA and CARB, as well as existing conditions along the project footprint and within 1,000 feet of construction work areas and permanent project features, including the number and location of sensitive receptors.
- **Intensity**—For this analysis, *intensity* is determined by assessing the following conditions: (1) whether the project would conflict with implementation of applicable air quality plans, (2) whether the project would cause or contribute to an existing or projected air quality

violation, and (3) the degree to which the project would affect public health by exposing sensitive receptors to pollutant concentrations.

The Authority used the General Conformity Rule *de minimis* thresholds (Table 3.3-3) to inform the severity of an effect, where emissions in excess of these thresholds indicate that the project would not conform to the appropriate air basin SIPs. It was assumed that General Conformity would apply only to construction of the project, because the analysis demonstrates that project operations would decrease regional emissions of criteria pollutants.

Table 3.3-3 General Conformity *de minimis* Thresholds for the Project

Air Basin	Annual Air Pollutant Emissions in Tons per Year					
	VOC	NO_X	CO	PM_{10}	$PM_{2.5}$	SO_2
SFBAAB[1]	100	100	N/A	N/A	100	100

CO = carbon monoxide
N/A = Not applicable, as the SFBAAB is designated attainment for the federal standards for CO and PM_{10}
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter 2.5 microns in diameter or less
PM_{10} = particulate matter 10 microns in diameter or less
RSA = resource study area
SFBAAB = San Francisco Bay Area Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compounds
[1] The General Conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the RSA in the SFBAAB. Although the RSA is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ General Conformity *de minimis* thresholds are used.

3.3.4.5 Method for Determining Significance under CEQA

For this analysis, the project would result in a significant impact on air quality or climate change if it would:

- Conflict with or obstruct implementation of the applicable air quality plan.
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is nonattainment under an applicable federal or state ambient air quality standard.
- Expose sensitive receptors to substantial pollutant concentrations.
- Result in other emissions (such as those leading to odors) adversely affecting a substantial number of people.
- Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.
- Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

As discussed throughout this section, the significance of air quality impacts is based largely on compliance with state and federal air quality standards, as well as standards and plans developed by local air districts. The primary federal and state standards are the NAAQS and CAAQS, respectively. Both the NAAQS and CAAQS have been established to protect public health and welfare. Local air districts are required to develop plans and control programs for attaining the state standards, which are generally more stringent than the corresponding federal standards and incorporate standards for additional pollutants. The air districts have also developed health-based guidance for assessing the significance of other pollutants, including asbestos. Therefore, the NAAQS and CAAQS, as well as the standards and plans developed by the air districts, provide appropriate thresholds for determining whether project-related emissions would result in a significant impact. The quantitative emissions thresholds developed by BAAQMD to evaluate the significance level of impacts are discussed in the following sections.

The analysis of localized impacts and health risks also relies on standards developed by OEHHA. OEHHA is the lead state agency for the assessment of health risks posed by environmental contaminants, including TACs and other pollutants. The agency's mission is to protect human health and the environment through scientific evaluation of risks posed by hazardous substances. The standards developed by OEHHA are based on extensive scientific evidence and are specifically intended for the protection of human health and the environment.

Impacts related to GHG emissions are evaluated based on consistency with established statewide GHG reduction goals, including the goals set forth in AB 32 and SB 32. AB 32 required California to reduce GHG emissions to 1990 levels by 2020, and SB 32 continues that timeline and requires greater reduction in GHG emissions. The GHG reduction goals are based on scientific consensus on the GHG emissions reduction needed to avert the worst effects of climate change. The CEQA Guidelines provide that a lead agency may consider a project's consistency with the State's long-term climate goals or strategies in determining the significance of impacts. (CEQA Guidelines § 15064.4.)

In December 2018, the California Supreme Court issued its decision in *Sierra Club* v. *County of Fresno* (6 Cal. 5th 502) (hereafter referred to as the Friant Ranch Decision). The case considered a challenge to the long-term, regional air quality analysis in the EIR for the proposed Friant Ranch development. The Friant Ranch project is a 942-acre master-plan development in unincorporated Fresno County within the San Joaquin Valley Air Basin, an air basin currently in nonattainment for the O_3 and $PM_{2.5}$ NAAQS and CAAQS. The Court concluded that the air quality analysis was inadequate because it failed to provide enough detail "for the public to translate the bare [criteria pollutant emissions] numbers provided into adverse health impacts or to understand why such a translation is not possible at this time." The Court's decision clarifies that environmental documents must connect a project's air quality impacts to specific health effects or explain why it is not technically feasible to perform such an analysis.

All criteria pollutants that would be generated by the project are associated with some form of health risk (e.g., asthma). The potential for pollutants to affect public health depends on a multitude of variables, including how they are dispersed and transported in the atmosphere. As discussed in Section 3.3.4.3, Methods for Impact Analysis, both construction and operations of the project would generate regional O_3 precursors (VOC and NO_X) and PM emissions. The project would also result in localized emissions of CO, NO_2, PM, and SO_2. Quantitative emission thresholds can be used to evaluate the significance level of impacts from regional and localized pollutants and are discussed in the following subsections. To the degree feasible, the following discussion characterizes the project's air quality impacts in terms of specific health effects or explains why it is not technically feasible to perform such an analysis in accordance with the Friant Ranch Decision.

Regional Criteria Pollutant Emissions

Adverse health effects induced by regional criteria pollutant emissions generated by the project (O_3 precursors and PM) are highly dependent on a multitude of interconnected variables (e.g., cumulative concentrations, local meteorology and atmospheric conditions, the number and character of exposed individuals [e.g., age, gender]). For these reasons, O_3 precursors (VOC and NO_X) contribute to the formation of ground-borne O_3 on a regional scale, where emissions of VOC and NO_X generated in one area may not equate to a specific O_3 concentration in that same area. Similarly, some types of particulate pollutants may be transported over long distances or formed through atmospheric reactions. As such, the magnitude and locations of specific health effects from exposure to increased O_3 or regional PM concentrations are the product of emissions generated by numerous sources throughout a region, as opposed to a single individual project.

Technical limitations of existing models to correlate project-level regional emissions to specific health consequences are recognized by air quality management districts throughout the state, including the SJVAPCD and the South Coast Air Quality Management District (SCAQMD), who provided *amici curiae* briefs for the Friant Ranch legal proceedings. In its brief, SJVAPCD (2015) acknowledges that while HRAs for localized air toxics, such as DPM, are commonly prepared, "it is not feasible to conduct a similar analysis for criteria air pollutants because currently available computer modeling tools are not equipped for this task." SJVAPCD further notes that "[modeling of] emissions solely from the Friant Ranch project (which equate to less than one-tenth of one percent of the total NO_X and VOC in the Valley) is not likely to yield valid information," and that any such information would not be "accurate when applied at the local level." SCAQMD (2015) presents similar information in their brief, stating that "it takes a large amount of additional precursor emissions to cause a modeled increase in ambient ozone levels."[13] SCAQMD (2015) also acknowledges that a project emitting NO_X or ROG below their threshold of 10 tons per year "is small enough that its regional impact on ambient ozone levels may not be detected in the regional air quality models" and it would "not be feasible to directly correlate project emissions of VOC or NO_X with specific health impacts from ozone."

The BAAQMD's (2017a) CEQA guidelines contain emissions thresholds used to evaluate the significance of a project's emissions (Table 3.3-4). If a project's regional emissions are below the significance thresholds, impacts would be considered less than significant and the project would not be expected to contribute a significant level of air pollution such that air quality in the basin would be degraded. If the construction or operations emissions are greater than these values, impacts for that phase would be considered significant and project-generated emissions may contribute to cumulative and regional health effects. In such cases, all feasible mitigation is applied, and emissions are reduced to the extent possible.

Table 3.3-4 BAAQMD Regional Mass Emission Thresholds

Analysis	BAAQMD[1]
Construction	ROG: 54 lb/day NO_X: 54 lb/day PM_{10}: 82 lb/day (exhaust only) $PM_{2.5}$: 54 lb/day (exhaust only)
Operations	ROG: 54 lb/day or 10 tons/year NO_X: 54 lb/day or 10 tons/year PM_{10}: 82 lb/day or 15 tons/year $PM_{2.5}$: 54 lb/day or 10 tons/year

Source: BAAQMD 2017a
BAAQMD = Bay Area Air Quality Management District
CEQA = California Environmental Quality Act
lb = pounds
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter that is 2.5 microns in diameter and smaller
PM_{10} = particulate matter that is 10 microns in diameter and smaller
ROG = reactive organic gases
[1] BAAQMD's CEQA Guidelines state that the thresholds should be applied to average daily emissions. However, consultation with air district staff indicates that maximum daily emissions should be used to determine project-level impacts. Accordingly, this analysis conservatively applies BAAQMD's thresholds to maximum daily emissions.

The air district thresholds presented in Table 3.3-4 consider existing air quality concentrations and attainment or nonattainment designations under the NAAQS and CAAQS. The NAAQS and CAAQS are informed by a wide range of scientific evidence that demonstrates there are known safe concentrations of criteria pollutants. While recognizing that air quality is a cumulative problem, the air districts consider projects that generate criteria pollutant and O_3 precursor emissions below these thresholds would be minor in nature and would not adversely affect air quality such that the NAAQS or CAAQS would be exceeded. Emissions generated by the project could increase photochemical reactions and the formation of tropospheric O_3 and secondary PM,

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[13] For example, SCAQMD's analysis of their 2012 Air Quality Attainment Plan showed that modeled NO_X and ROG reductions of 432 and 187 tons per day, respectively, only reduced O_3 levels by 9 parts per billion. Analysis of SCAQMD's Rule 1315 showed that emissions of NO_X and ROG of 6,620 pounds (3.46 tons) per day and 89,180 pounds (44.59 tons) per day, respectively, contributed to 20 premature deaths per year and 89,947 school absences (SCAQMD 2015).

which at certain concentrations could lead to increased incidence of specific health consequences. Although these health effects are associated with O_3 and particulate pollution, the effects are a result of cumulative and regional emissions. As such, for projects with relatively small emissions contributions (i.e., emissions below the regional air district thresholds), that project's incremental contribution cannot be traced to specific health outcomes on a regional scale, and a quantitative correlation of project-generated regional criteria pollutant emissions to specific human health impacts is not technically feasible.

Localized Emissions

Localized criteria pollutant emissions generated by a project potentially affect populations near the emissions source. Because these pollutants dissipate with distance, emissions from individual projects can result in direct and material health impacts on adjacent sensitive receptors. The NAAQS and CAAQS are health-protective standards and define the maximum amount of ambient pollution that can be present without harming public health. Epidemiological, controlled human exposure, and toxicology studies evaluate potential health and environmental effects of criteria pollutants, and form the scientific basis for new and revised ambient air quality standards.

For localized emissions of CO, NO_2, and SO_2, the threshold is the ambient air quality standard for each respective pollutant (Table 3.3-1). The increase in pollutant concentration associated with project emissions is added to the existing concentration to estimate the total ambient air pollutant concentration for comparison with the threshold. If concentrations are below the standard, impacts would be considered less than significant and the project would not result in a localized public health concern. If concentrations are greater than the standards, impacts would be considered significant and the project may contribute to localized health effects.

Existing measured concentrations of PM_{10} in most of the RSA already exceed the ambient air quality standards. The potential for the project to worsen these existing violations was determined by comparing the incremental project increase in PM concentrations to the applicable USEPA significant impact levels (SIL) (USEPA 2018f), as recommended by the BAAQMD (Kirk 2016). This analysis uses the fugitive sources SILs because the construction-related PM emissions are principally from fugitive sources. These SILs are 10.4 $\mu g/m^3$ and 1.2 $\mu g/m^3$ for the 24-hour average PM_{10} and $PM_{2.5}$ concentrations, respectively, and 2.08 $\mu g/m^3$ and 1.2 $\mu g/m^3$ for the annual average PM_{10} and $PM_{2.5}$ concentrations, respectively. Where existing measured concentrations of PM_{10} already exceed the ambient air quality standards, BAAQMD considers an incremental increase that does not exceed the SILs not to contribute substantially to further exceedances of the ambient air quality standards or public health effects.

Carbon Monoxide Concentrations from On-Road Vehicles

The BAAQMD has adopted the following screening criteria that provide a conservative indication of whether project-generated traffic would cause a potential CO hot spot:

- Project traffic would not increase traffic volumes at affected intersections to more than 44,000 vehicles per hour.
- Project traffic would not increase traffic volumes at affected intersections to more than 24,000 vehicles per hour where vertical and/or horizontal mixing is substantially limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, below-grade roadway).
- The project is consistent with an applicable congestion management program established by the county congestion management agency for designated roads or highways, RTP, and local congestion management agency plans.

The BAAQMD's screening criteria are used to evaluate whether additional traffic near the 4th and King Street, Millbrae, and San Jose Diridon Stations would result in a CO hot spot. The health-protective CO CAAQS is used as a quantitative concentration threshold for intersections that operate at a level of service (LOS) worse than the screening criteria.

Diesel Particulate Matter and Localized Particulate Matter

The BAAQMD has adopted separate thresholds to evaluate receptor exposure to DPM emissions. The *substantial* DPM threshold defined by the BAAQMD is the probability of contracting cancer for the maximum exposed individual exceeding 10 in 1 million, or the ground-level concentrations of noncarcinogenic TACs resulting in a hazard index greater than 1 for the maximum exposed individual. The BAAQMD has adopted an incremental concentration-based significance threshold to evaluate receptor exposure to localized $PM_{2.5}$, where a *substantial* contribution is defined as $PM_{2.5}$ exhaust (diesel and gasoline) concentrations exceeding 0.3 $\mu g/m^3$. The BAAQMD's cumulative cancer risk threshold is 100 cases per million and its noncancer thresholds are a hazard index of greater than 10.0 and a $PM_{2.5}$ concentration of greater than 0.8 $\mu g/m^3$. Table 3.3-5 summarizes the cancer and noncancer health risk thresholds used in the analysis.

Table 3.3-5 BAAQMD Cancer and Noncancer Health Risk Thresholds

Type	Cancer Risk	Hazard Index	$PM_{2.5}$ Concentration ($\mu g/m^3$)
Project	10 per million	1.0	0.3
Cumulative	100 per million	10.0	0.8

Source: BAAQMD 2017a
$\mu g/m^3$ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter

Asbestos and Lead-Based Paint

There are no quantitative thresholds related to receptor exposure to asbestos and LBP. However, the BAAQMD requires the demolition or renovation of asbestos- or LBP-containing building materials to comply with the requirements of the National Emissions Standards for Hazardous Air Pollutants regulations (40 C.F.R. Parts 61 and 63).

Greenhouse Gas Emissions

GHG emissions and global climate change represent cumulative impacts of human activities and development projects locally, regionally, nationally, and worldwide. GHG emissions cumulatively contribute to the environmental impacts of global climate change. No single project could generate enough GHG emissions to noticeably change the global average temperature; instead, the combination of GHG emissions from past, present, and future projects and activities have and will continue to contribute to global climate change and its associated environmental impacts.

The BAAQMD has not adopted a GHG emission threshold for construction-related emissions. The BAAQMD recommends that GHG emissions from construction be quantified and disclosed, and that a determination regarding the significance of these GHG emissions be made with respect to whether a project is consistent with the AB 32 GHG emission reduction goals. The BAAQMD further recommends incorporation of best management practices to reduce GHG emissions during construction, as feasible and applicable.

The BAAQMD established significance thresholds to evaluate operational emissions, but these are only applicable to land use development and stationary source projects. BAAQMD's thresholds were also established based on statewide emission reduction goals outlined in AB 32 and do not consider the deeper reductions required to meet the long-term goals of SB 32, EO S-03-05, or EO B-55-18.

The project is a transportation project that does not fit into the land use development or stationary source project categories. Accordingly, there are no adopted quantitative GHG thresholds relevant to the project. Therefore, direct and indirect GHG emissions from the project are discussed with respect to larger statewide GHG emission reduction goals, where a significant impact would occur if project emissions would obstruct attainment of the targets outlined under AB 32, SB 32, EO S-03-05, or EO B-55-18.

3.3.5 Affected Environment

This section discusses the affected environment related to air quality and GHGs in the respective RSAs. The affected environment would be identical for both project alternatives, because both project alternatives would be within the same air basin. This information provides the context for the environmental analysis and the evaluation of impacts. Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for more detailed information on the affected environment.

3.3.5.1 Air Quality

Meteorology and Climate

California is divided into 15 air basins based on geographic features that create distinctive regional climates. The Project Section is located in the SFBAAB. Local meteorological conditions vary greatly throughout the Bay Area because of topography and elevation as well as proximity to local waterbodies. The project would traverse two unique and different meteorological zones in the SFBAAB: the San Francisco Peninsula and the Santa Clara Valley. The following sections describe these two areas, based on information provided by BAAQMD (BAAQMD 2017a).

San Francisco Peninsula

The San Francisco Peninsula region extends from the Golden Gate to northwest of San Jose, bounded by the San Francisco Bay on the east, and the Pacific Ocean on the west. The Santa Cruz Mountains run up the center of the peninsula, with elevations exceeding 2,000 feet at the southern end, decreasing to 500 feet in South San Francisco. Coastal towns experience a high incidence of cool, foggy weather in the summer. Cities in the southeastern peninsula experience warmer temperatures and fewer foggy days because the marine air layer is blocked by the ridgeline to the west. San Francisco lies at the northern end of the peninsula. Because most of San Francisco's topography is below 200 feet, marine air flows easily across most of the city, making the climate cool and windy.

At the northern end of the peninsula in San Francisco, pollutant emissions are high, especially from motor vehicle congestion. Localized pollutants, such as CO, can build up in urban canyons. Urban canyons are created when streets divide dense blocks of structures, especially skyscrapers, which can inhibit air circulation at the ground level. In most other areas, winds are generally fast enough to carry the pollutants away before they can accumulate. Air pollution potential is highest along the southeastern portion of the peninsula, where the high winds and fog of the marine layer are obstructed, resulting in accumulated concentrations of pollutants. Pollutant transport from upwind sites is common. In the southeastern portion of the peninsula, air pollutant emissions are relatively high because of motor vehicle traffic as well as stationary sources.

Santa Clara Valley

The Santa Clara Valley is bounded by San Francisco Bay to the north and by mountains to the east, south, and west. Temperatures are warm on summer days and cool on summer nights, and winter temperatures are mild. At the northern end of the valley, mean maximum temperatures are 79 degrees Fahrenheit (°F) to 82°F during the summer and 55°F to 59°F during the winter, and mean minimum temperatures range from 55°F to 59°F in the summer to 39°F to 43°F in the winter. Further inland, where the moderating effect of the bay is not as strong, temperature extremes are greater. For example, in San Martin, 27 miles south of Norman Y. Mineta San Jose International Airport, temperatures can be more than 10°F warmer on summer afternoons and more than 10°F cooler on winter nights.

The air pollution potential of the Santa Clara Valley is high. High summer temperatures, stable air, and mountains surrounding the valley combine to promote O_3 formation. In addition to the many local sources of pollution, O_3 precursors from San Francisco, San Mateo, and Alameda Counties are carried by prevailing winds to the Santa Clara Valley. The valley tends to channel pollutants to the southeast. On summer days with low-level inversions, O_3 can be recirculated by southerly drainage flows in the late evening and early morning and by prevailing northwesterlies in the afternoon. A similar recirculation pattern occurs in the winter, affecting levels of CO and PM. This movement of the air up and down the valley significantly increases the effects of pollutants.

Pollutants of Concern

The federal and state governments have established NAAQS and CAAQS, respectively, for six criteria pollutants. All criteria pollutants can have human health and environmental effects at certain concentrations. The ambient air quality standards for these pollutants (Table 3.3-1) are set to protect public health and the environment within an adequate margin of safety (42 U.S.C. § 7409). The following subsections discuss the principal characteristics and possible health and environmental effects from exposure to the primary criteria pollutants generated by the project. This section also summarizes potential health effects from exposure to TAC.

Ozone and Ozone Precursor Emissions

O_3, or smog, is a photochemical oxidant that is formed when VOC and NO_X (both by-products of the internal combustion engine) react with sunlight. VOC is a compound made up primarily of hydrogen and carbon atoms. Internal combustion associated with motor vehicle usage is the major source of hydrocarbons. Other sources of VOC are emissions associated with the use of paints and solvents, the application of asphalt paving, and the use of household consumer products such as aerosols. The two major forms of NO_X are nitric oxide (NO) and NO_2. NO is a colorless, odorless gas formed from atmospheric nitrogen and oxygen when combustion takes place under high temperature, high pressure, or both. NO_2 is a reddish-brown irritating gas formed by the combination of NO and oxygen during combustion and in the atmosphere. In addition to serving as an integral participant in O_3 formation, NO_X also directly acts as an acute respiratory irritant and increases susceptibility to respiratory pathogens.

O_3 poses a higher risk to those who already suffer from respiratory diseases (e.g., asthma), children, older adults, and people who are active outdoors. Exposure to O_3 at certain concentrations can make breathing more difficult, cause shortness of breath and coughing, inflame and damage the airways, aggregate lung diseases, increase the frequency of asthma attacks, and cause chronic obstructive pulmonary disease. Studies show associations between short-term O_3 exposure and non-accidental mortality, including deaths from respiratory issues. Studies also suggest long-term exposure to O_3 may increase the risk of respiratory-related deaths (USEPA 2018d). The concentration of O_3 at which health effects are observed depends on an individual's sensitivity, level of exertion (i.e., breathing rate), and duration of exposure. Studies show large individual differences in the intensity of symptomatic responses, with one study finding no symptoms to the least responsive individual after a 2-hour exposure to 400 parts per billion of O_3 and a 50 percent decrement in forced airway volume in the most responsive individual. Although the results vary, evidence suggests that sensitive populations (e.g., asthmatics) may be affected on days when the 8-hour maximum O_3 concentration reaches 80 parts per billion (USEPA 2016a). The average background level of O_3 in the Bay Area is approximately 45 parts per billion (BAAQMD 2017b).

In addition to human health effects, O_3 has been tied to crop damage, typically in the form of stunted growth, leaf discoloration, cell damage, and premature death. O_3 can also act as a corrosive and oxidant, resulting in property damage such as the degradation of rubber products and other materials.

Carbon Monoxide

CO is a colorless, odorless, toxic gas produced by incomplete combustion of carbon substances, such as gasoline or diesel fuel. In the RSA, high CO levels are of greatest concern during the winter, when periods of light winds combine with the formation of ground-level temperature inversions from evening through early morning. These conditions trap pollutants near the ground, reducing the dispersion of vehicle emissions. Moreover, motor vehicles exhibit increased CO emission rates at low air temperatures. The primary adverse health effect associated with CO is interference with normal oxygen transfer to the blood, which may result in tissue oxygen deprivation. Exposure to CO at high concentrations can also cause fatigue, headaches, confusion, dizziness, and chest pain. CO at ambient levels has not been associated with ecological effects (CARB 2019a).

Particulate Matter

PM consists of finely divided solids or liquids such as soot, dust, aerosols, fumes, and mists. Two forms of particulates are now generally considered: respirable coarse particles, or PM_{10}, and respirable fine particles, or $PM_{2.5}$. Particulate discharge into the atmosphere results primarily from industrial, agricultural, construction, and transportation activities. However, wind on arid landscapes also contributes substantially to local particulate loading.

Particulate pollution can be transported over long distances and may adversely affect human health, especially for people who are naturally sensitive or susceptible to breathing problems. Numerous studies have linked PM exposure to premature death in people with preexisting heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms. Studies show that every 1 $\mu g/m^3$ reduction in $PM_{2.5}$ results in a 1 percent reduction in mortality rate for individuals over 30 years old (BAAQMD 2017a). Depending on its composition, both PM_{10} and $PM_{2.5}$ also can affect water quality and acidity, deplete soil nutrients, damage sensitive forests and crops, affect ecosystem diversity, and contribute to acid rain (USEPA 2018e).

Nitrogen Dioxide

NO_2 is formed by the combination of NO and oxygen through internal combustion and in the atmosphere. Exposure to high concentrations of NO_2 aggravate respiratory diseases, such as asthma, leading to increased hospital admissions. NO_2 also can reduce visibility and react with water, oxygen, and other chemicals to contribute to acid rain, which can harm sensitive ecosystems (USEPA 2016b).

Sulfur Dioxide

SO_2 is generated by burning of fossil fuels, industrial processes, and natural sources, such as volcanoes. Short-term exposure to SO_2 can harm the respiratory system, making breathing difficult. SO_2 can also affect the environment by damaging foliage and decreasing plant growth (USEPA 2019).

Toxic Air Contaminants

Although NAAQS and CAAQS have been established for criteria pollutants, no ambient standards exist for TACs. A TAC is defined by California law as an air pollutant that “may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.” The primary TACs of concern associated with the project are asbestos and MSAT, including DPM.

Asbestos is the name given to several naturally occurring fibrous silicate minerals. It has been mined for applications requiring thermal insulation, chemical and thermal stability, and high tensile strength. Before the adverse health effects of asbestos were identified, asbestos was widely used as insulation and fireproofing in buildings, and it can still be found in some older buildings. It is also found in its natural state in rock or soil. The inhalation of asbestos fibers into the lungs can result in a variety of adverse health effects, including inflammation of the lungs, respiratory ailments (e.g., asbestosis, which is scarring of lung tissue that results in constricted breathing), and cancer (e.g., lung cancer and mesothelioma, which is cancer of the linings of the lungs and abdomen).

MSATs are a group of 93 compounds emitted from mobile sources that are regulated under USEPA’s 2007 Rule on the Control of Hazardous Air Pollutants from Mobile Sources. USEPA has further identified nine compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers. These are acrolein, benzene, 1,3-butadiene, acetaldehyde, DPM, ethylbenzene, formaldehyde, naphthalene, and polycyclic organic matter. The CARB estimates that DPM emissions are responsible for about 70 percent of the total ambient air toxics risk in California (CARB 2019b). Within the Bay Area, the BAAQMD has found that of all controlled TACs, emissions of DPM are responsible for about 82 percent of the total ambient cancer risk (BAAQMD 2017a). Short-term exposure to DPM can cause acute irritation (e.g., eye, throat, bronchial), neurophysiological symptoms (e.g., lightheadedness, nausea), and respiratory symptoms (e.g., cough, phlegm). The USEPA has determined that diesel exhaust is “likely to be carcinogenic to humans by inhalation” (USEPA 2002).

Ambient Air Quality

The existing air quality conditions in the RSA can be characterized by measurement data. The BAAQMD operates air quality monitoring stations throughout the SFBAAB. For the purposes of this analysis, three stations were selected to represent conditions along the corridor: San Francisco—Arkansas Street, Redwood City—Barron Avenue, and San Jose—Jackson Street.

Table 3.3-6 summarizes the results of ambient monitoring at the three stations, where available, for the most recent 3 years of available data (CARB 2018b; USEPA 2018a). Figure 3.3-3 illustrates the locations of the monitoring stations relative to the project footprint. Between 2015 and 2017, measured CO and NO_2 concentrations did not exceed any federal or state standards at any of the three monitoring locations. However, the federal and state standards for O_3 were exceeded, as were the state standards for PM_{10} and the federal standard for 24-hour $PM_{2.5}$.

The ambient air quality standards define clean air and represent the maximum amount of pollution that can be present in outdoor air without any harmful effects on people and the environment. Existing violations of the O_3 and PM ambient air quality standards indicate that certain individuals exposed to this pollutant may experience certain health effects, including increased incidence of cardiovascular and respiratory ailments.

Attainment Status

Local monitoring data (Table 3.3-6) are used to designate areas as nonattainment, maintenance, attainment, or unclassified for the NAAQS and CAAQS. Table 3.3-7 summarizes the attainment status of the portions of the SFBAAB along the project corridor with regard to the NAAQS and CAAQS.

The four NAAQS/CAAQS designations are defined as follows:

- Nonattainment—Assigned to areas where monitored pollutant concentrations consistently violate the standard in question.
- Maintenance—Assigned to areas where monitored pollutant concentrations exceeded the standard in question in the past, but are no longer in violation of that standard.
- Attainment—Assigned to areas where pollutant concentrations meet the standard in question over a designated period of time.
- Unclassified—Assigned to areas where data are insufficient to determine whether a pollutant is violating the standard in question.

Table 3.3-6 Ambient Criteria Pollutant Concentrations at Air Quality Monitoring Stations along the Project Section

Pollutant and Standards	San Francisco—Arkansas Street			Redwood City—Barron Avenue			San Jose—Jackson Street		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Ozone (O_3)[1]									
Maximum 1-hour concentration (ppm)	0.085	0.070	0.087	0.086	0.075	0.115	0.094	0.087	0.121
Maximum 8-hour concentration (ppm)	0.067	0.057	0.054	0.071	0.060	0.086	0.081	0.066	0.088
Number of days standard exceeded[1]									
CAAQS 1-hour (>0.09 ppm)	0	0	0	0	0	2	0	0	3
NAAQS 8-hour (>0.070 ppm)	0	0	0	1	0	2	2	0	4
CAAQS 8-hour (>0.070 ppm)	0	0	0	1	0	2	2	0	4
Carbon Monoxide (CO)[2]									
Maximum 8-hour concentration (ppm)	1.3	1.1	1.4	1.6	1.1	1.4	1.8	1.4	1.8
Maximum 1-hour concentration (ppm)	1.8	1.7	2.5	3.4	2.2	2.8	2.4	1.9	2.1
Number of days standard exceeded[1]									
NAAQS 8-hour (≥9 ppm)	0	0	0	0	0	0	0	0	0
CAAQS 8-hour (≥9.0 ppm)	0	0	0	0	0	0	0	0	0
NAAQS 1-hour (≥35 ppm)	0	0	0	0	0	0	0	0	0
CAAQS 1-hour (≥20 ppm)	0	0	0	0	0	0	0	0	0
Nitrogen Dioxide (NO_2)[1]									
National maximum 1-hour concentration, 98th percentile (ppm)	0.0532	0.0507	0.0586	0.0403	0.0396	0.0462	0.0493	0.0511	0.0675
State maximum 1-hour concentration (ppm)	0.070	0.058	0.073	0.047	0.045	0.067	0.049	0.051	0.067
State annual average concentration (ppm)	0.012	0.010	0.011	0.010	0.009	0.010	0.012	0.011	N/A
Number of days standard exceeded[1]									
NAAQS 1-hour (98th percentile>0.100 ppm)	0	0	0	0	0	0	0	0	0
CAAQS 1-hour (0.18 ppm)	0	0	0	0	0	0	0	0	0

Pollutant and Standards	San Francisco—Arkansas Street 2015	San Francisco—Arkansas Street 2016	San Francisco—Arkansas Street 2017	Redwood City—Barron Avenue 2015	Redwood City—Barron Avenue 2016	Redwood City—Barron Avenue 2017	San Jose—Jackson Street 2015	San Jose—Jackson Street 2016	San Jose—Jackson Street 2017
Annual standard exceeded?[1]									
NAAQS Annual (>0.053 ppm)	No	No	No	No	No	No	No	No	No
CAAQS Annual (>0.030 ppm)	No	No	No	No	No	No	No	No	No
Particulate Matter (PM_{10})[1, 2]									
National[3] maximum 24-hour concentration (µg/m^3)	44.7	35.7	75.9	N/A	N/A	N/A	58.8	40.0	69.4
National[3] second-highest 24-hour concentration (µg/m^3)	38.2	27.9	52.7	N/A	N/A	N/A	47.2	35.2	67.3
State[4] maximum 24-hour concentration (µg/m^3)	47.0	29.0	77.0	N/A	N/A	N/A	58.0	41.0	69.8
State[4] second-highest 24-hour concentration (µg/m^3)	39.0	28.0	53.0	N/A	N/A	N/A	49.3	37.5	67.6
National annual average concentration (µg/m^3)	9.8	8.8	11.0	N/A	N/A	N/A	21.3	17.5	20.7
State annual average concentration (µg/m^3)[5]	N/A	N/A	22.1	N/A	N/A	N/A	21.9	18.3	21.3
Number of days standard exceeded[1]									
N/AAQS 24-hour (>150 µg/m^3)[6]	0	0	0	N/A	N/A	N/A	0	0	0
CAAQS 24-hour (>50 µg/m^3)[6]	N/A	N/A	2	N/A	N/A	N/A	3	0	19
Annual standard exceeded?[1]									
CAAQS Annual (>20 µg/m^3)	N/A	N/A	Yes	N/A	N/A	N/A	Yes	No	Yes
Particulate Matter ($PM_{2.5}$)[1]									
National[3] maximum 24-hour concentration (µg/m^3)	35.4	19.6	49.9	34.6	19.5	60.8	49.4	22.6	49.7
National[3] second-highest 24-hour concentration (µg/m^3)	34.3	19.3	49.7	26.0	18.4	57.7	37.0	21.8	46.5
State[4] maximum 24-hour concentration (µg/m^3)	35.4	19.6	49.9	34.6	19.5	60.8	49.4	22.7	49.7
State[4] second-highest 24-hour concentration (µg/m^3)	34.3	19.3	49.7	26.0	18.4	57.7	37.0	21.8	46.5
National annual average concentration (µg/m^3)	7.9	7.5	9.7	6.0	8.3	9.0	9.9	8.3	9.5
State annual average concentration (µg/m^3)[5]	7.9	N/A	9.7	6.0	N/A	9.1	10.6	8.4	N/A

Pollutant and Standards	San Francisco—Arkansas Street			Redwood City—Barron Avenue			San Jose—Jackson Street		
	2015	2016	2017	2015	2016	2017	2015	2016	2017
Number of days standard exceeded[1]									
NAAQS 24-hour (>35 µg/m³)	0	0	7	0	0	6	2	0	6
Annual standard exceeded?[1]									
NAAQS Annual (>12.0 µg/m³)	No	No	No	No	No	No	No	No	No
CAAQS Annual (>12 µg/m³)	No	N/A	No	No	N/A	No	No	No	No
Sulfur Dioxide (SO_2)									
No data available	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Sources: CARB 2018b; USEPA 2018a
\> = greater than
µg/m³ = micrograms of pollutant per cubic meter of air
CAAQS = California ambient air quality standards
NAAQS = national ambient air quality standards
ppm = parts per million
[1] An exceedance of a standard is not necessarily a violation because of the regulatory definition of a violation.
[2] National statistics are based on standard conditions data. In addition, national statistics are based on samplers using federal reference or equivalent methods.
[3] State statistics are based on local conditions data.
[4] Measurements usually are collected every 6 days.
[5] State criteria for sufficiently complete data for calculating valid annual averages are more stringent than the national criteria.
[6] Mathematical estimate of how many days' concentrations would have been measured as higher than the level of the standard had each day been monitored. Values have been rounded.

Source: Volume 2, Appendix 3.3-A

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Figure 3.3-3 Monitoring Station Locations

Table 3.3-7 Federal and State Attainment Status in the San Francisco Bay Area Air Basin

Pollutant	Federal	State
Ozone (O_3)	Nonattainment (marginal)	Nonattainment
Particulate matter (PM_{10})	Attainment/unclassified	Nonattainment
Particulate matter ($PM_{2.5}$)	Nonattainment (moderate)	Nonattainment
Carbon monoxide (CO)	Attainment	Attainment
Nitrogen dioxide (NO_2)	Attainment/unclassified	Attainment
Sulfur dioxide (SO_2)	Attainment/unclassified	Attainment

Sources: CARB 2016c; USEPA 2018b

Sensitive Receptors

Sensitive receptors are people who have an increased sensitivity to air pollution or environmental contaminants. Sensitive receptor locations include schools, parks and playgrounds, daycare centers, nursing homes, and hospitals. Residences also are considered sensitive land uses because people can be exposed to pollutants for extended periods. Recreational areas are considered moderately sensitive to poor air quality because vigorous exercise associated with recreation places a high demand on the human respiratory function.

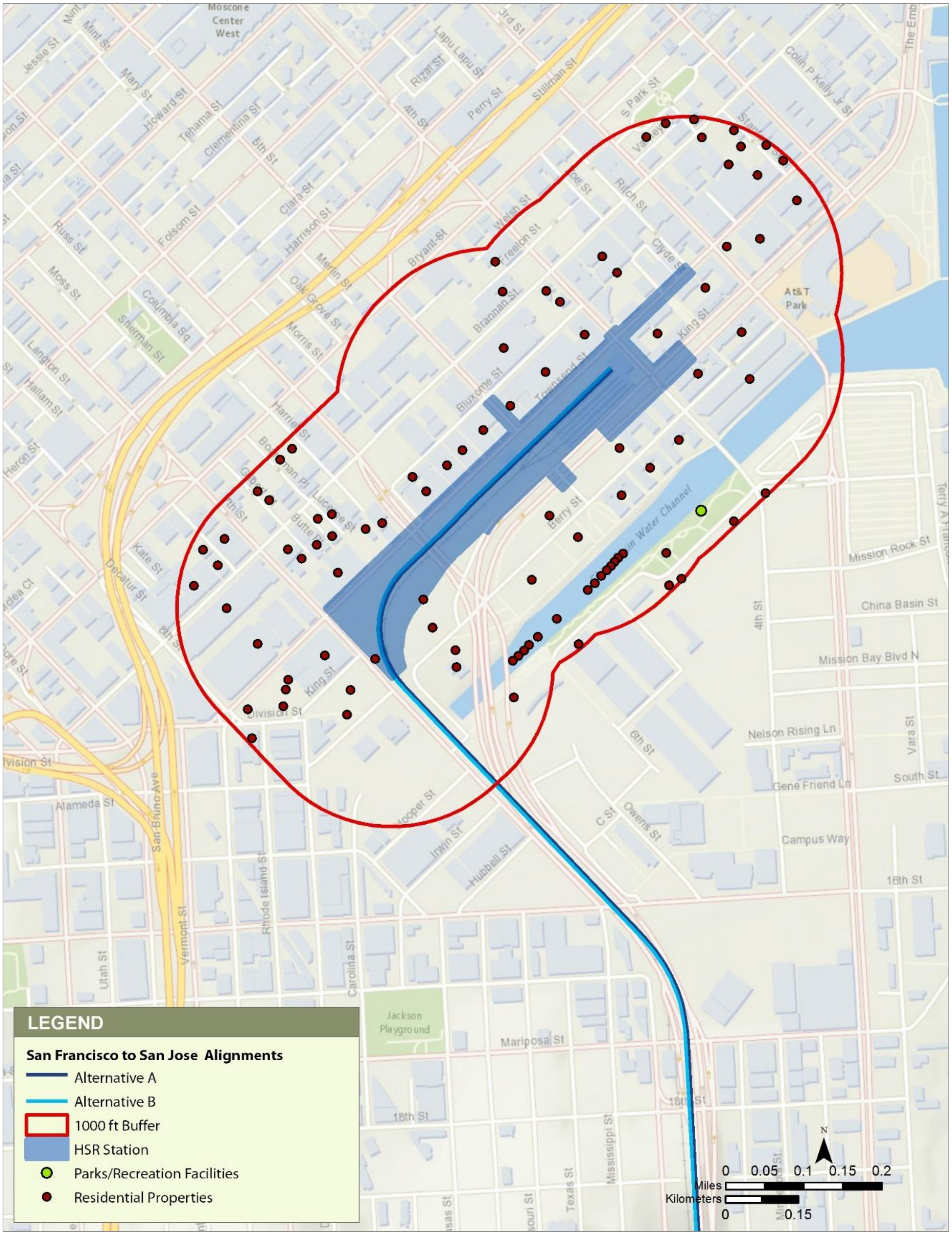
Analyses performed by the CARB indicate that providing a separation of at least 1,000 feet from diesel sources and high-traffic areas would substantially reduce exposure to air contaminants and decrease asthma symptoms in children (California Environmental Protection Agency and CARB 2005). Sensitive receptor locations within 1,000 feet of the 4th and King Street, Millbrae, and San Jose Diridon Stations, the East Brisbane LMF site, and the West Brisbane LMF site, are listed in Table 3.3-8 and illustrated on Figure 3.3-4 through Figure 3.3-8, respectively. Residential land uses are the most common sensitive receptors in the RSA. Other sensitive receptor locations in the RSA include schools, hospitals, convalescent homes, and recreational areas.

Table 3.3-8 Sensitive Receptor Locations within 1,000 Feet of the 4th and King Street, Millbrae, and San Jose Diridon Stations, and the East and West Brisbane LMF

Receptor	Distance from Facility[1,2] (feet)
4th and King Street Station	
Nearest residential receptor	56
San Francisco Tennis Club	234
Mission Creek Park	917
Millbrae Station	
Nearest residential receptor	10
Burlingame Health Care Center	10
Medical offices, 1860 El Camino Real	155
Medical and dental offices, 1840 El Camino Real	191
Mills-Peninsula Medical Center	448
Magnolia of Millbrae	844
Bayside Manor Park	979

Receptor	Distance from Facility[1,2] (feet)
San Jose Diridon Station	
Nearest residential receptor	Alternative A: 36 Alternative B: 33
Arena Green Park	Alternative A: 802 Alternative B: >1,000
Cahill Park	Alternative A: 326 Alternative B: 325
Planned community park	144
Discovery Dog Park	Alternative A: >1,000 Alternative B: 957
Los Gatos Creek Trail	527
Sunol Community Day School play area[3]	745
Brisbane LMF	
Nearest residential receptor	76
Brisbane Community Park	0[4]
Brisbane Lagoon	0
Brisbane Skate Park and Basketball Courts	0
Brisbane City Hall Dog Park	240
Old Quarry Road Park and Trail	374
Little Hollywood Park	590
San Bruno Mountain State and County Park	Alternative A: >1,000 Alternative B: 607
Visitacion Valley Community Center	686

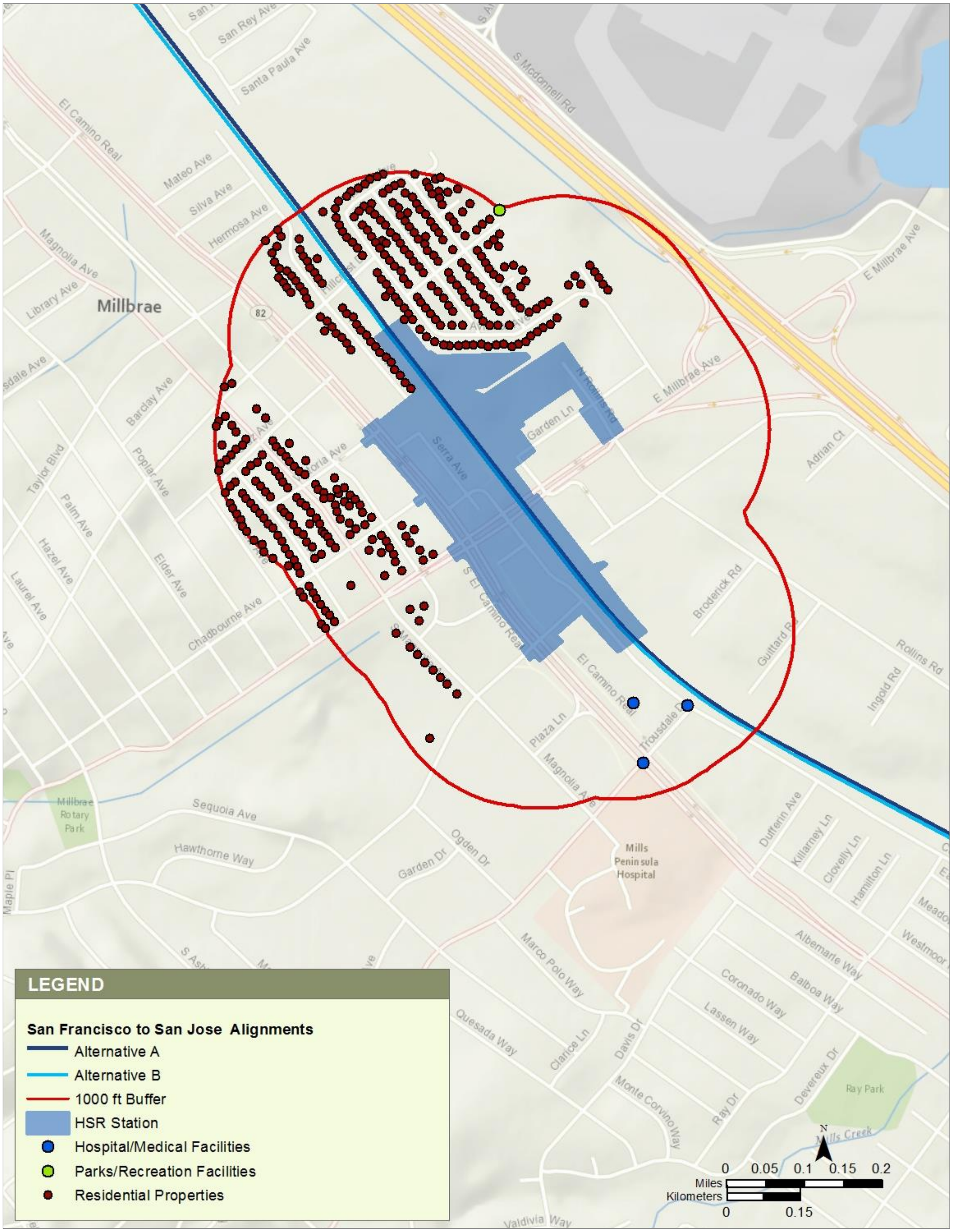
Sources: Volume 2, Appendix 3.3-A; Authority 2019b, 2019c, 2019d; CPAD 2016
> = greater than
LMF = light maintenance facility
[1] Distances are measured from the facility site perimeter. Distances from facility buildings are greater.
[2] Distances apply to both alternatives unless noted otherwise.
[3] The Sunol Community Day School is closed but is considered a parks and recreational facility for the purposes of this analysis, as grassy areas and playfields remain accessible.
[4] Zero values indicate that the receptor abuts the LMF site perimeter.



Sources: Authority 2019c; CPAD 2016

NOVEMBER 2019

Figure 3.3-4 Sensitive Receptors within 1,000 Feet of the 4th and King Street Station



Sources: Authority 2019c; CPAD 2016

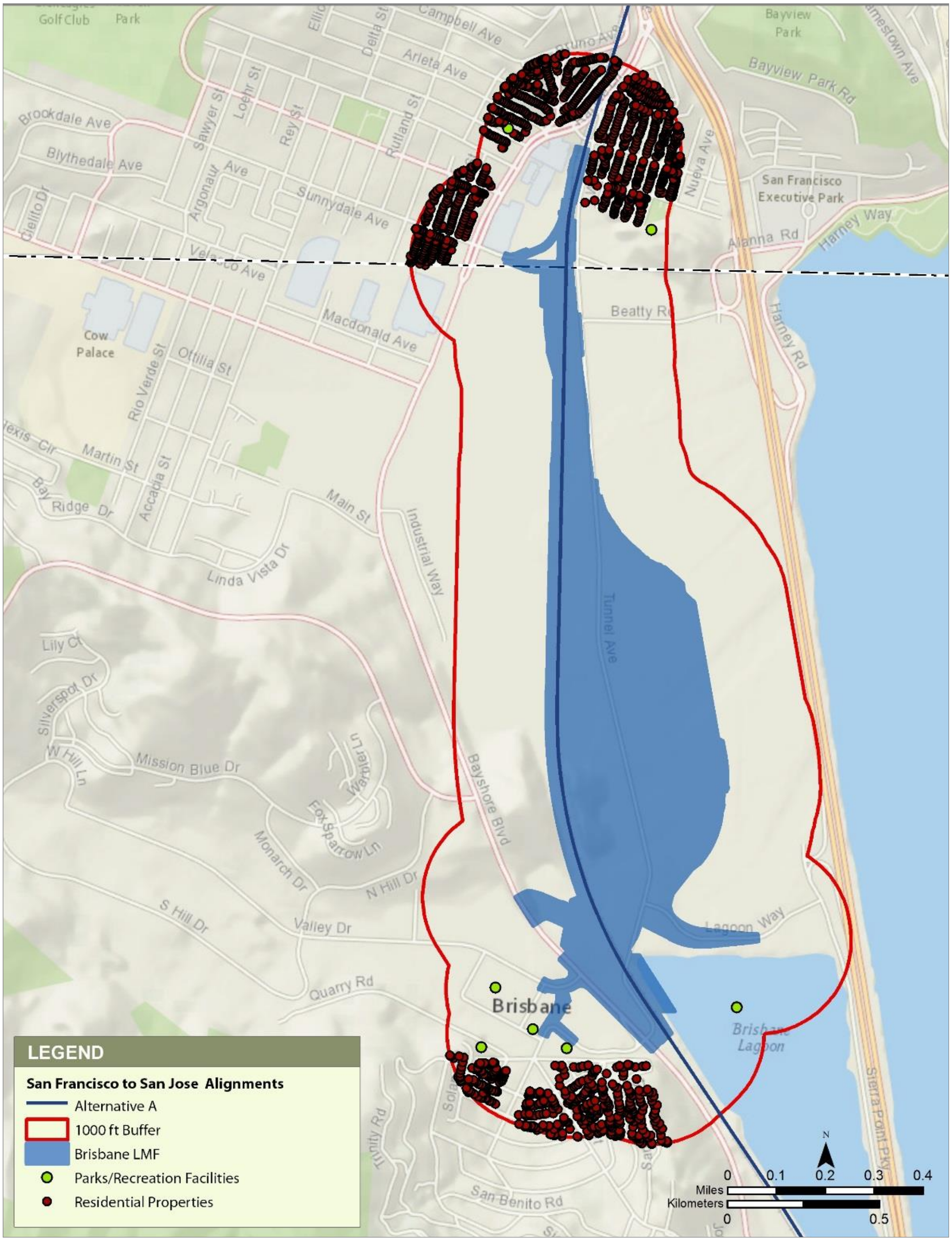
JANUARY 2019

Figure 3.3-5 Sensitive Receptors within 1,000 Feet of the Millbrae Station

Sources: Authority 2019d; CPAD 2016

MARCH 2020

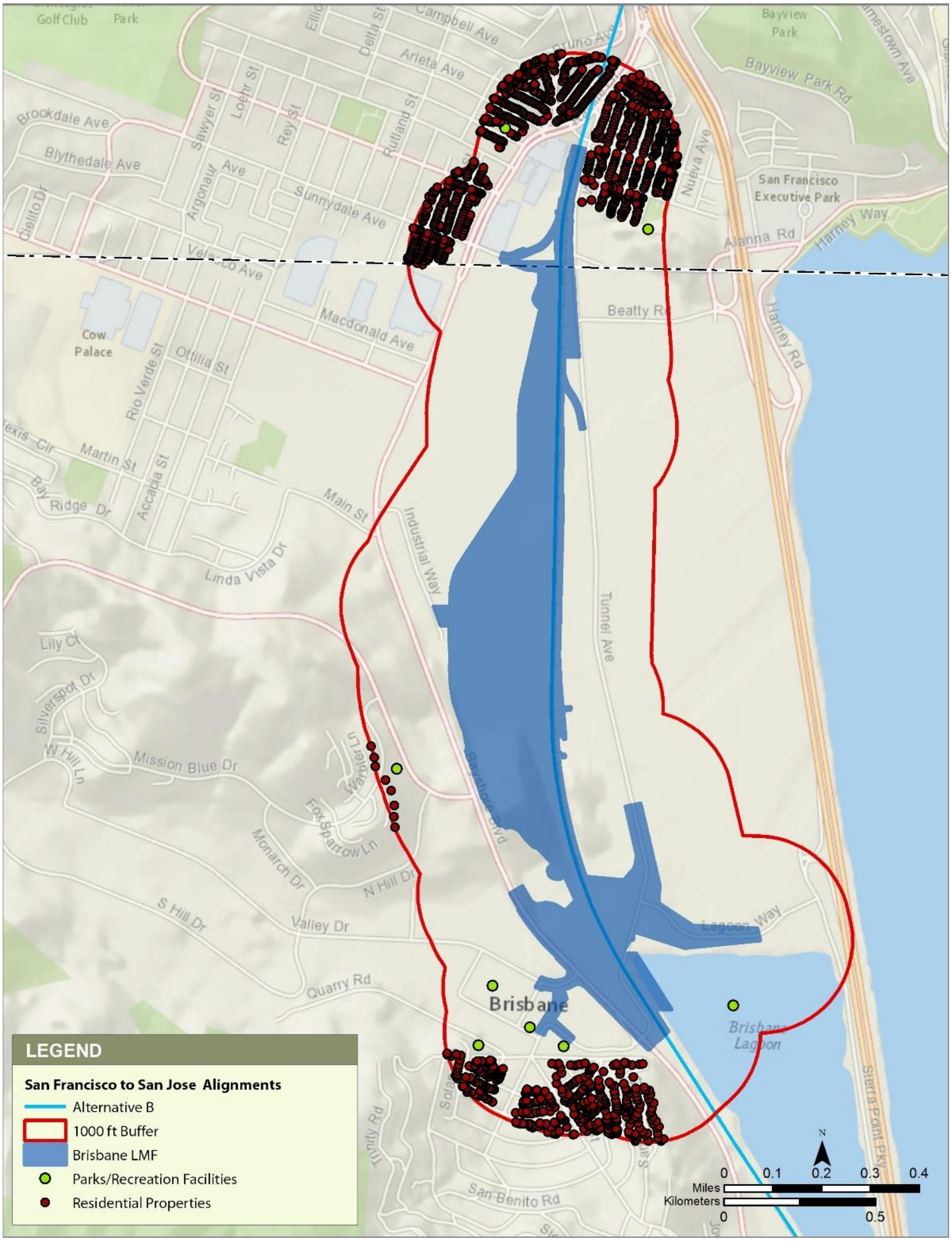
Figure 3.3-6 Sensitive Receptors within 1,000 Feet of the San Jose Diridon Station



Sources: Appendix 3.3-A; CPAD 2016

SEPTEMBER 2019

Figure 3.3-7 Sensitive Receptors within 1,000 Feet of the East Brisbane LMF (Alternative A)



Sources: Volume 2, Appendix 3.3-A; CPAD 2016 SEPTEMBER 2019

Figure 3.3-8 Sensitive Receptors within 1,000 Feet of the West Brisbane LMF (Alternative B)

Air Quality Plans

As discussed in Section 3.3.2.3, Regional and Local, the CARB and BAAQMD have prepared SIPs that describe how areas will attain NAAQS, where applicable. Table 3.3-9 summarizes the status of each SIP relevant to the RSA.

Table 3.3-9 State Implementation Plans

Plan	Status
2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard (BAAQMD 2001)	In a March 30, 2001, *Federal Register* notice (66 Fed. Reg. 17379), USEPA proposed to make a finding that the Bay Area has not attained the national 1-hour O_3 standard. USEPA proposed partial approval and partial disapproval of the 1999 Ozone Attainment Plan. On August 28, 2001, USEPA took final action on its March 2001 notice, triggering a CAA requirement that a new plan be submitted within 1 year of the effective date of USEPA's final action. The revised 2001 Ozone Attainment Plan included the necessary changes to address USEPA's disapproval of the prior plan. In addition, to address the requirements triggered by USEPA's finding of failure to attain, the plan included a new emissions inventory and commitments to adopt and implement additional control measures to attain the standard by 2006, the attainment deadline. It also included additional contingency measures in the event the Bay Area did not attain the standard by 2006.
2017 Clean Air Plan (BAAQMD 2017b)	Although not a federal planning document, the Bay Area 2017 Spare the Air, Cool the Climate (Clean Air Plan) provided a comprehensive plan to improve Bay Area air quality and protect public health. The Clean Air Plan defined a control strategy that the BAAQMD and its partners is implementing to: (1) attain all state and national ambient air quality standards; (2) eliminate disparities among Bay Area communities in cancer health risk from toxic air contaminants; and (3) reduce GHG emissions to protect the climate.

Sources: BAAQMD 2001, 2017b
BAAQMD = Bay Area Air Quality Management District
Bay Area = San Francisco Bay Area
CAA = Clean Air Act
Fed. Reg. = *Federal Register*
GHG = greenhouse gases
O_3 = ozone
USEPA = U.S. Environmental Protection Agency

Emissions Inventory of Criteria Pollutants

An emissions inventory is an accounting of the total emissions from all sources in a particular geographic area over a specified period. Emission inventories are used in air quality planning and can provide a general indication of existing air quality in an area.

The CARB maintains an annual emissions inventory for each county and air basin in the state. The inventory for the SFBAAB consists of data submitted to the CARB by the BAAQMD, plus estimates for certain source categories, which are provided by CARB staff. Based on the 2015 air pollutant inventory data, mobile source emissions account for 85 percent and 79 percent of the basin's CO and NO_X emission inventory, respectively. Area-wide sources account for more than 87 percent and 22 percent of the basin's PM and total organic gas emissions, respectively. Stationary sources account for 89 percent of the basin's SO_X emissions (CARB 2020).

3.3.5.2 Greenhouse Gases

The CARB maintains a statewide emissions inventory of GHGs. In 2016, the largest contributor to GHG emissions was the transportation sector (41 percent). This sector includes emissions from on-road vehicles, interstate aviation, waterborne vessels, and rail operations. The next-largest contributor to emissions was the industrial sector (23 percent), followed by electricity generation (16 percent, including in-state and imports) (CARB 2020).

3.3.6 Environmental Consequences

3.3.6.1 Overview

This section discusses the potential impacts on air quality and climate change (as GHG emissions) that could result from the No Project Alternative and implementing the project alternatives. It is organized by topic: violations of ambient air quality standards and conflicts with air quality attainment plans within SFBAAB, followed by potential exposure of receptors to increased health risks and odors. Construction-related emissions are presented first, followed by emissions during operations.

3.3.6.2 Air Quality

Construction and operations of the project alternatives could result in temporary and permanent impacts on air quality. The types of impacts analyzed in this section include the potential degradation of air quality in the SFBAAB, exposure of sensitive receptors to pollutant concentrations, and elevated health risks.

No Project Impacts

The population of the Bay Area is expected to grow through 2040 (Section 2.6.1.1, Projections Used in Planning). Development in the Bay Area to accommodate the population increase would continue under the No Project conditions and result in associated direct and indirect impacts on air quality and GHGs. The No Project conditions consider the effects of conditions forecasted by current plans for land use and transportation near the project, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon for the environmental analysis if the HSR system is not built. Under the No Project conditions, the regional VMT would be higher, resulting in increased pressure to improve capacity for all transportation modes throughout the area. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be planned and built to achieve equivalent capacity and relieve this increased pressure (Authority 2012). Planned and other reasonably foreseeable projects anticipated to be built by 2040, including residential, commercial, industrial, recreational, and transportation projects, could contribute to regional air quality conditions. A full list of anticipated future development projects is provided in Volume 2 in Appendix 3.18-A, Cumulative Nontransportation Plans and Projects List, and Appendix 3.18-B, Cumulative Transportation Plans and Projects List.

The anticipated improvements in emissions efficiency for on-road vehicles and aircraft in the future have been incorporated into the No Project analysis. Additionally, because of the state requirement that an increasing fraction (60 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, it is likely that future emissions from power plant sources would be lower than the emissions estimated for this analysis, which is based on the state's existing mix of renewable and nonrenewable sources.

Table 3.3-10 and Table 3.3-11 summarize estimated emissions under the No Project conditions in 2015, 2029, and 2040, which correlate with assumptions under the medium and high ridership scenarios, respectively. As shown in the tables, total emissions for some pollutants would decrease from 2015 to 2040 (VOC, CO, and NO_X). For other pollutants (SO_2, PM_{10}, and $PM_{2.5}$), total emissions would increase from 2015 to 2040. The increase in PM would be primarily a result of higher VMT, aircraft, and electricity demand brought about by population and economic growth. The increase in SO_2 would be primarily related to growth in air travel and power plant production. The decrease in other pollutants would result from expected improvements in on-road vehicle engine technology, fuel efficiency, and turnover in older, more heavily polluting vehicles, which would offset emissions increases from higher on-road VMT and aircraft and power plant activity.

Table 3.3-10 Estimated Statewide Emissions, No Project Condition—Medium Ridership Scenario

Emission Source	VOC (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
2015						
On-road vehicles	7,839	324,144	33,370	767	22,981	6,242
Aircraft	338	2,888	2,779	299	84	84
Power plants	1,893	25,767	13,476	1,609	3,189	2,880
Total statewide emissions	**10,070**	**352,800**	**49,624**	**2,675**	**26,254**	**9,206**
2029						
On-road vehicles	1,712	125,365	9,783	577	26,322	6,998
Aircraft	411	3,445	3,391	367	103	102
Power plants	2,310	34,760	14,890	1,936	3,807	3,442
Total statewide emissions	**4,434**	**163,570**	**28,064**	**2,880**	**30,232**	**10,542**
2040						
On-road vehicles	996	86,627	6,312	489	27,540	7,091
Aircraft	474	3,968	3,908	423	118	118
Power plants	2,205	45,146	20,858	3,177	3,921	3,564
Total statewide emissions	**3,675**	**135,741**	**31,077**	**4,089**	**31,580**	**10,773**

Source: Authority 2019g
CO = carbon monoxide
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year
Sum of individual values may not equal total due to rounding.

Table 3.3-11 Estimated Statewide Emissions, No Project Condition—High Ridership Scenario

Emission Source	VOC (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
2015						
On-road vehicles	7,800	322,534	33,204	763	22,867	6,211
Aircraft	315	2,692	2,589	279	78	78
Power plants	1,893	25,767	13,476	1,609	3,189	2,880
Total statewide emissions	**10,008**	**350,993**	**49,269**	**2,651**	**26,134**	**9,170**

Emission Source	VOC (tons/yr)	CO (tons/yr)	NO_X (tons/yr)	SO_2 (tons/yr)	PM_{10} (tons/yr)	$PM_{2.5}$ (tons/yr)
2029						
On-road vehicles	1,725	126,531	9,983	590	26,898	7,147
Aircraft	341	2,856	2,811	304	85	85
Power plants	2,310	34,760	14,890	1,936	3,807	3,442
Total statewide emissions	**4,377**	**164,146**	**27,684**	**2,830**	**30,789**	**10,674**
2040						
On-road vehicles	1,093	94,097	6,907	552	29,185	7,625
Aircraft	520	4,348	4,282	464	129	129
Power plants	2,579	39,173	16,080	2,104	4,082	3,686
Total statewide emissions	**4,192**	**137,618**	**27,269**	**3,120**	**33,397**	**11,440**

Source: Authority 2019g
CO = carbon monoxide
NO_X = nitrogen oxides
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year
Sum of individual values may not equal total due to rounding.

Project Impacts

Construction Impacts

Construction of either project alternative would include earthwork and excavation, station construction, track work, and railway systems construction. Chapter 2 provides descriptions of construction activities.

Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality in the SFBAAB

The predominant pollutants associated with construction of either project alternative are fugitive dust (PM_{10} and $PM_{2.5}$) from earthmoving activities and combustion pollutants, particularly O_3 precursors (NO_X and VOC) and CO from heavy equipment and trucks. VOCs would also be generated from paints and other coatings used during construction activities.

Table 3.3-12 and Table 3.3-13 present construction emissions from Alternatives A and B, respectively, in the SFBAAB in tons per year and pounds per day. Exceedances of General Conformity *de minimis* levels and BAAQMD CEQA thresholds are shown in **bolded underline with an asterisk (*)**. The emissions calculations incorporate the following air quality IAMFs:

- AQ-IAMF#1 would minimize fugitive dust emissions through the implementation of a dust control plan. The fugitive dust control plan would outline measures such as washing vehicles before exiting the construction site, watering unpaved surfaces, limiting vehicle travel speed, and suspending dust-generating activities during high wind events.
- AQ-IAMF#2 would minimize off-gassing emissions of VOCs that would occur from paints and other coatings by requiring the use of low-VOC paint and super-compliant or Clean Air paint, which has a lower VOC content than that required by BAAQMD rules.
- AQ-IAMF#3 would minimize exhaust emissions from off-road equipment with renewable diesel fuel. Renewable diesel is produced from nonpetroleum renewable resources and waste products and generates substantially fewer emissions than traditional diesel per gallon combusted.

Table 3.3-12 Construction-Related Criteria Pollutant Emissions under Alternative A[1]

Activities	Tons per year										Maximum Pounds per day[2]									
					PM_{10}			$PM_{2.5}$							PM_{10}			$PM_{2.5}$		
	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total	Exhaust	Dust	Total[3]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total	Exhaust	Dust	Total[3]
General conformity threshold[4]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-
2021																				
Emissions	2	35	50	0	0	44	44	0	10	10	34	**677***	1,010	4	3	863	866	3	194	198
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2022																				
Emissions	4	82	112	0	0	102	103	1	23	24	36	**694***	944	4	4	837	840	4	188	191
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2023																				
Emissions	4	87	110	0	0	108	109	1	24	25	29	**642***	831	4	3	806	809	3	180	182
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2024																				
Emissions	4	91	120	0	0	119	119	0	26	26	43	**981***	1,399	5	4	1,125	1,129	4	218	222
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2025																				
Emissions	5	**104***	144	1	1	106	106	4	22	26	53	**1,592***	1,375	7	18	1,125	1,129	18	218	222
Exceeds general conformity threshold?	No	Yes	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2026																				
Emissions	0	0	0	0	0	0	0	0	0	0	2	10	55	0	0	13	13	0	3	3
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	No	-	-	No	-	-	No	-	-

Sources: CAPCOA 2017; CARB 2018b; USEPA 1998, 2006b, 2011; Scholz 2018
\- = no threshold
BAAQMD = Bay Area Air Quality Management District
CEQA = California Environmental Quality Act
CO = carbon monoxide
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
NO_X = nitrogen oxides
O_3 = ozone
PM = particulate matter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SFBAAB = San Francisco Bay Area Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compound
Values less than 0.5 are rounded to zero.
Exceedances of thresholds are shown in **bolded underline with an asterisk (*)**.
[1] Emissions results include implementation of air quality IAMFs.
[2] Presents the highest emissions estimate during a single day of construction in each year, based on concurrent construction activities.
[3] Total PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions. Sum of annual values may not equal total due to rounding. Sum of daily values may not equal total because the table presents maximum emissions results for each individual pollutant component. For example, the maximum PM exhaust emissions may not occur on the same day as the maximum total dust emissions.
[4] The general conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the project vicinity in the SFBAAB. The project vicinity is considered a marginal nonattainment area for the O_3 NAAQS and a moderate nonattainment area for the $PM_{2.5}$ NAAQS. Although the project vicinity is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ general conformity *de minimis* thresholds are used.

Table 3.3-13 Construction-Related Criteria Pollutant Emissions under Alternative B[1,2]

Activities	Tons per year										Maximum Pounds per day[3]									
					PM10			PM2.5							PM10			PM2.5		
	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total	Exhaust	Dust	Total[4]	VOC	NO_X	CO	SO_2	Exhaust	Dust	Total	Exhaust	Dust	Total[4]
General conformity threshold[5]	100	100	-	100	-	-	-	-	-	100	-	-	-	-	-	-	-	-	-	-
BAAQMD CEQA threshold	-	-	-	-	-	-	-	-	-	-	54	54	-	-	82	-	-	54	-	-
2021																				
Emissions	2/2	39/39	56/56	0/0	0/0	51/51	52/52	0/0	12/12	12/12	41/41	**812*/812***	1,227/1,227	5/5	4/4	1,135/1,135	1,139/1,139	4/4	250/250	254/254
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2022																				
Emissions	5/5	82/82	112/112	0/0	0/0	102/102	103/103	1/1	23/23	24/24	42/42	**811*/811***	1,147/1,147	5/5	4/4	1,115/1,115	1,118/1,118	4/4	245/245	249/249
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2023																				
Emissions	4/5	**103*/ 105***	137/144	1/1	0/0	133/136	133/136	1/1	30/31	31/31	34/34	**758*/758***	982/982	4/4	3/3	971/971	975/975	3/3	220/220	223/223
Exceeds general conformity threshold?	No	Yes	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2024																				
Emissions	4/5	**106*/ 105***	145/155	1/1	0/0	141/144	141/144	0/0	31/31	31/32	46/46	**1,070*/ 1,070***	1,466/1,466	5/5	5/5	1,187/1,187	1,192/1,192	5/5	232/232	236/236
Exceeds general conformity threshold?	No	Yes	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	Yes	-	-	No	-	-	No	-	-
2025																				
Emissions	5/5	**113*/ 106***	162/154	1/1	1/1	122/116	123/116	4/4	24/23	28/27	**55*/55***	**1,645*/ 1,645***	1,381/1,381	8/8	18/18	1,182/1,182	1,186/1,186	18/18	225/225	229/229
Exceeds general conformity threshold?	No	Yes	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	Yes	Yes	-	-	No	-	-	No	-	-
2026																				
Emissions	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0	0/0
Exceeds general conformity threshold?	No	No	-	No	-	-	-	-	-	No	-	-	-	-	-	-	-	-	-	-
Exceeds CEQA threshold?	-	-	-	-	-	-	-	-	-	-	No	No	-	-	No	-	-	No	-	-

Sources: CAPCOA 2017; CARB 2018b; USEPA 1998, 2006b, 2011; Scholz 2018
- = no threshold
BAAQMD = Bay Area Air Quality Management District
CEQA = California Environmental Quality Act
CO = carbon monoxide
I- = Interstate
IAMF = impact avoidance and minimization feature
NAAQS = national ambient air quality standards
NO_X = nitrogen oxides
O_3 = ozone
PM = particulate matter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SFBAAB = San Francisco Bay Area Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compound
Values less than 0.5 are rounded to zero.
Exceedances of thresholds are shown in **bolded underline with an asterisk (*)**.
[1] Emissions are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).
[2] Emissions results include implementation of air quality IAMFs.
[3] Presents the highest emissions estimate during a single day of construction in each year, based on concurrent construction activities.

[4] Total PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions. Sum of annual values may not equal total due to rounding. Sum of daily values may not equal total because the table presents maximum emissions results for each individual pollutant component. For example, the maximum PM exhaust emissions may not occur on the same day as the maximum total dust emissions.
[5] The general conformity *de minimis* thresholds for criteria pollutants are based on the federal attainment status of the project vicinity in the SFBAAB. The project vicinity is considered a marginal nonattainment area for the O_3 NAAQS and a moderate nonattainment area for the $PM_{2.5}$ NAAQS. Although the project vicinity is in attainment for SO_2, because SO_2 is a precursor for $PM_{2.5}$, the $PM_{2.5}$ general conformity *de minimis* thresholds are used.

- AQ-IAMF#4 would minimize exhaust emissions from off-road equipment by requiring all heavy-duty equipment used during the construction phase to meet Tier 4 engine requirements. Tier 4 engine requirements are currently the strictest emissions standards adopted by the CARB and USEPA.
- AQ-IAMF#5 would minimize exhaust emissions from on-road trucks by requiring all trucks used to haul construction materials to operate a model year 2010 engine or newer.

Even with incorporation of project features (IAMFs), both project alternatives would result in a temporary impact on regional air quality during construction because increased VOC (under Alternative B only) and NO_X emissions (under both alternatives) would exceed the BAAQMD's CEQA thresholds. Construction emissions of NO_X also would exceed the General Conformity *de minimis* threshold for both alternatives. Construction emissions of exhaust PM would not exceed the BAAQMD's CEQA thresholds for either alternative. Construction emissions of CO, PM, SO_2, and VOC would not exceed the General Conformity thresholds for either alternative.

The BAAQMD's thresholds were established to prevent emissions from new projects in the SFBAAB from contributing to CAAQS or NAAQS violations. Because construction emissions of VOC (under Alternative B only) and NO_X would exceed these thresholds, the project would contribute a significant level of regional air pollution within the SFBAAB. Construction of the project may conflict with the *2001 San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard* (BAAQMD 2001) or 2017 Clean Air Plan (BAAQMD 2017b), which were adopted to achieve regional attainment with the ambient air quality standards.

Certain individuals residing in areas that do not meet the CAAQS or NAAQS, including the SFBAAB, could be exposed to pollutant concentrations that would cause or aggravate acute or chronic health outcomes (e.g., asthma, lost work days, premature mortality). The magnitude and locations of any potential changes in ambient air quality, and thus health consequences, from these additional emissions cannot be quantified with a high level of certainty due to the dynamic and complex nature of O_3 formation and distribution (e.g., meteorology, emissions sources, sunlight exposure). Similar limitations exist for precisely modeling project-level health consequences of directly emitted PM. However, it is known that public health would continue to be affected in SFBAAB so long as the region does not attain the CAAQS or NAAQS.

Alternatives A and B would result in comparable levels of total emissions. Construction emissions would be similar for both alternatives for the San Francisco to South San Francisco, San Bruno to San Mateo, and Mountain View to Santa Clara Subsections; the LMF; and the HSR stations. Construction emissions for the northern portion of the San Mateo to Palo Alto Subsection under Alternative B would be somewhat higher than under Alternative A because Alternative B includes construction of the passing tracks and associated modifications to the existing Hayward Park, Hillsdale, Belmont, and San Carlos Stations. Construction emissions for the southern portion of the San Mateo to Palo Alto Subsection would be similar for both alternatives. For the San Jose Diridon Station Approach Subsection, construction emissions would be somewhat higher for Alternative B than for Alternative A because Alternative B includes construction of the viaduct. Emissions would be slightly higher for Alternative B (Viaduct to Scott Boulevard) than for the Alternative B (Viaduct to I-880) because of the greater length of viaduct construction.

The BAAQMD does not have CEQA thresholds for mass emissions of fugitive PM or total (exhaust plus fugitive) PM, CO, or SO_2; localized air quality and public health impacts from these pollutants are evaluated based on the air dispersion modeling of ambient air concentrations. Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos and Lead-Based Paint discusses the conclusions of the modeled ambient air concentrations.

CEQA Conclusion

The impact would be significant under CEQA for both project alternatives because construction could result in temporary exceedance of BAAQMD's ROG (under Alternative B only) and NO_X (under either alternative) thresholds. Project features (AQ-IAMF#1 through AQ-IAMF#5) would minimize air quality impacts through application of all best available on-site controls to reduce construction emissions. However, even with these features, exceedances of BAAQMD's ROG (under Alternative B only) and NO_X thresholds would still occur and the project would contribute a significant level of regional VOC (under Alternative B only) and NO_X pollution within the SFBAAB. A mitigation measure to address this impact is identified in Section 3.3.9, CEQA Significance Conclusions. Section 3.3.7, Mitigation Measures, describes the measure in detail.

Impact AQ#2: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan

Emissions from project construction would be temporary, occurring for approximately 6 years, from 2021 through 2026. Once construction is complete, air quality in the SFBAAB is expected to improve. However, during the construction period, construction activities could cause air quality impacts that exceed BAAQMD thresholds and federal General Conformity thresholds, which support implementation of air quality plans.

As described in Section 3.3.5.1, portions of the RSA in the SFBAAB are in nonattainment areas for the NAAQS. Construction emissions generated within these nonattainment areas are subject to USEPA's General Conformity thresholds. As discussed under Impact AQ#1, for both project alternatives, annual NO_X emissions would exceed the General Conformity *de minimis* thresholds in the SFBAAB, even with implementation of all feasible on-site controls, as required by AQ-IAMF#1 through AQ-IAMF#5. Construction emissions of all other pollutants would be below the applicable General Conformity thresholds.

The BAAQMD has also developed project-level emissions thresholds. These thresholds prevent new projects from contributing to CAAQS or NAAQS violations, which support implementation of regional air quality plans prepared to attain CAAQS and NAAQS. Construction emissions from both project alternatives would exceed the BAAQMD's CEQA threshold for NO_X. Exceedances of adopted thresholds could conflict with applicable air quality plans. These exceedances would occur despite implementation of stringent on-site emissions controls, including implementation of fugitive dust control practices (AQ-IAMF#1), use of low-VOC paints (AQ-IAMF#2), use of renewable diesel (AQ-IAMF#3), use of Tier 4 off-road engines (AQ-IAMF#4), and use of model year 2010 or newer on-road engines (AQ-IAMF#5).

CEQA Conclusion

The impact would be significant under CEQA for both project alternatives because construction could result in emissions that exceed BAAQMD thresholds, as shown in Table 3.3-12 and Table 3.3-13. Exceedances of adopted thresholds could conflict with applicable air quality plans. These exceedances would occur despite stringent on-site emissions controls (project features) that the Authority would require to reduce construction emissions. A mitigation measure to address this impact is identified in Section 3.3.9. Section 3.3.7 describes the measure in detail.

Impact AQ#3: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants

Construction of the project has the potential to cause elevated criteria pollutant concentrations. These elevated concentrations may cause or contribute to exceedances of the NAAQS and CAAQS and affect local air quality and public health. The criteria pollutants of concern with established annual standards are NO_2, PM_{10}, and $PM_{2.5}$. The criteria pollutants of concern with established 1- to 24-hour standards are the following:

- CO (1 hour and 8 hours)
- PM_{10} and $PM_{2.5}$ (24 hours)
- NO_2 (1 hour)
- SO_2 (1 hour and 24 hours)

The increase in pollutant concentrations associated with project construction[14] was added to the background concentration to estimate the ambient air pollutant concentration for comparison to the applicable NAAQS and CAAQS for all pollutants to determine whether construction would cause an ambient air quality violation. The analysis considers both the incremental project-related contribution and the total pollutant concentration; only the total pollutant concentration, which

[14] Pb emissions were not evaluated because equipment and vehicles emit only negligible quantities of Pb.

reflects the incremental project contribution plus the background concentration, is compared to the CAAQS and NAAQS. However, pre-project background concentrations of PM_{10} along portions of the project alignment already exceed the CAAQS. For such cases, the BAAQMD recommends comparing the incremental project-related increase in PM_{10} concentrations to the USEPA SILs to analyze the potential for the project to worsen existing PM_{10} violations.

Table 3.3-14 through Table 3.3-17 show the project's maximum impact, the project's maximum impact plus background, and the 1- to 24-hour criteria pollutant air quality standards, for Alternatives A and B. Similarly, Table 3.3-18 and Table 3.3-19 show the project's maximum impact, the project's maximum impact plus background, and the annual criteria pollutant air quality standards, for Alternatives A and B, respectively. The tables assume implementation of AQ-IAMF#1 through AQ-IAMF#5.

Tables 3.3-14, 3.3-16, 3.3-18, and 3.3-19 show that pollutant concentrations with construction of either project alternative would exceed both the 24-hour and annual CAAQS for PM_{10} because the background values already exceed the PM_{10} CAAQS. Because the background values exceed the standard, the project-related construction PM_{10} contributions were compared to the USEPA SILs. The 1- to 24-hour project construction contributions (Tables 3.3-14 and 3.3-16) would exceed the PM_{10} SIL at locations in all subsections along the alignment except the San Mateo to Palo Alto and Mountain View to Santa Clara Subsections. The annual project construction contributions (Tables 3.3-18 and 3.3-19) would exceed the SIL at all locations along the alignment. The SIL would not be exceeded at the stations or the Brisbane LMF.

Tables 3.3-15 and 3.3-17 show that pollutant concentrations with construction of either project alternative would exceed the 24-hour NAAQS for $PM_{2.5}$ in the San Jose Diridon Station Approach Subsection. Tables 3.3-18 and 3.3-19 show that pollutant concentrations with construction of either project alternative would exceed the 24-hour CAAQS for $PM_{2.5}$ in the San Jose Diridon Station Approach Subsection.

The modeled concentrations presented in Tables 3.3-14 through 3.3-19 include project features AQ-IAMF#1 through AQ-IAMF#5. Criteria pollutant concentrations are estimated for each subsection based on representative local meteorological conditions. Only the modeled maximum pollutant concentration is reported; refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for detailed concentration results by individual construction activity type (e.g., at grade, embankment, and viaduct). Exceedances of CAAQS, SIL (for PM_{10} only), or NAAQS are shown in **bolded underline with an asterisk (*)**.

Table 3.3-14 Criteria Pollutant Concentration Effects from Construction of Alternative A (µg/m³)[1] Compared to 1- to 24-hour California Ambient Air Quality Standards

Construction Area	CO				NO_2		SO_2		PM_{10}		$PM_{2.5}$	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2,7]	Total 24-hour[7,8]	Project 1-hour[2]	Total 1-hour[9]
San Francisco to South San Francisco Subsection												
4th and King Street Station	207	3,071	76	1,680	37	174	0.07	2.97	9.7	**78.7***	0.47	9.9
4th and King Street Station to Chavez Street (at grade)	39	2,903	17	1,621	21	158	0.02	2.92	5.3	**74.3***	0.12	9.5
Chavez Street to Salinas Avenue (at grade)	74	2,938	25	1,629	40	177	0.03	2.93	9.4	**78.4***	0.24	9.6
Salinas Avenue to Linden Avenue (at grade)	47	2,911	37	1,641	25	162	0.02	2.92	9.0	**78.0***	0.15	9.6
Brisbane LMF	150	3,014	60	1,664	32	169	0.05	2.95	**13.8***	**82.8***	0.33	9.7
Combined[10]	246	3,110	97	1,701	58	195	0.09	2.99	**22.8***	**91.8***	0.60	10.0
San Bruno to San Mateo Subsection												
Millbrae Station	181	3,045	51	1,655	29	166	0.05	2.95	6.5	**75.5***	0.37	9.8
Linden Avenue to Peninsula Avenue (at grade)	49	2,913	15	1,619	29	166	0.02	2.92	8.4	**78.4***	0.21	9.6
Linden Avenue to Peninsula Avenue (embankment)	31	2,895	10	1,614	19	156	0.02	2.92	5.7	**74.7***	0.14	9.5
Peninsula Avenue to Ninth Avenue (at grade)	73	2,937	19	1,623	47	184	0.03	2.93	8.3	**77.3***	0.33	9.7
Peninsula Avenue to Ninth Avenue (embankment)	72	2,936	19	1,623	45	182	0.03	2.93	8.5	**77.5***	0.32	9.7
Combined[10]	230	3,094	66	1,670	58	195	0.07	2.97	**14.9***	**83.9***	0.58	10.0

Construction Area	CO				NO_2		SO_2		PM_{10}		$PM_{2.5}$	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2,7]	Total 24-hour[7,8]	Project 1-hour[2]	Total 1-hour[9]
San Mateo to Palo Alto Subsection												
At grade	78	3,973	19	1,852	42	132	0.02	2.92	8.5	**77.5***	0.25	9.7
Embankment	28	3,923	6.9	1,840	16	106	0.01	2.91	3.3	**72.3***	0.12	9.5
Mountain View to Santa Clara Subsection												
San Antonio Road to Lawrence Expressway (at grade)	68	2,817	18	2,080	44	172	021	3.11	8.2	**77.2***	0.34	9.7
Lawrence Expressway to Scott Boulevard (at grade)	18	2,767	11	2,073	11	139	0.02	2.92	5.1	**74.1***	0.09	9.5
San Jose Diridon Station Approach Subsection												
Embankment	173	2,922	92	2,154	68	196	0.1	3	**49.9***	**118.9***	0.4	10
At grade	62	2,812	32	2,095	38	166	0.1	3	**18.1***	**87.1***	0.2	10
Diridon Station	45	2,795	19	2,081	13	141	<0.1	3	3.7	**72.7***	0.1	10
Combined[10]	218	2,967	111	2,173	81	209	0.1	3	**53.7***	**122.7***	1	10
Threshold												
SIL (µg/m³)[7,11]	2,000	-	500	-	N/A	-	-	-	10.4	-	7.8	-
CAAQS (µg/m³)	-	23,000	-	10,000	-	339	-	105	-	50	-	655

Sources: AERMOD version 18081; CARB 2018b; USEPA 2018f
< = less than
- = no threshold
µg/m³ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
CO = carbon monoxide
LMF = light maintenance facility
N/A = not applicableNO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
SO_2 = sulfur dioxide
USEPA = U.S. Environmental Protection Agency

Exceedances of thresholds are shown in **<u>bolded underline with an asterisk (*)</u>**.
[1] Only the highest modeled concentration in the form of the standard is presented for each pollutant.
[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.
[3] A background 1-hour CO concentration of 2,864, 3,895, and 2,749 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[4] A background 8-hour CO concentration of 1,604, 1,833, and 2,062 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[5] A background 1-hour NO_2 concentration of 137.2, 89.9, and 127.8 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[6] A background 24-hour SO_2 concentration in the form of the standard of 2.9, 2.9, 2.9 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[7] Background PM_{10} concentration alone exceeds the CAAQS. Therefore, the incremental project increase in PM_{10} concentrations should be compared to the applicable SIL as recommended by the BAAQMD (Kirk 2016). SILs for pollutants other than PM_{10} are shown for information only.
[8] A background 24-hour PM_{10} concentration of 69.0, 69.0, and 69.0 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[9] A background 1-hour SO_2 concentration of 9.4, 9.4, and 9.4 μg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[10] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.
[11] USEPA SIL guidance (USEPA 2018f).

Table 3.3-15 Criteria Pollutant Concentration Effects from Construction of Alternative A (µg/m³)[1] Compared to 1- to 24-hour National Ambient Air Quality Standards

Construction Area	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2]	Total 24-hour[7]	Project 1-hour[2]	Total 1-hour[8]
San Francisco to South San Francisco Subsection												
4th and King Street Station	186	2,172	74	1,411	21	123	2.2	28	9.6	57	0.32	6.4
4th and King Street Station to Chavez Street (at grade)	39	2,025	17	1,354	18	120	0.96	27	5.3	52	0.11	6.2
Chavez Street to Salinas Avenue (at grade)	74	2,060	25	1,362	29	131	1.6	28	9.4	56	0.17	6.3
Salinas Avenue to Linden Avenue (at grade)	47	2,033	37	1,374	21	123	1.4	28	9.0	56	0.12	6.2
Brisbane LMF	140	2,126	46	1,383	17	119	2.1	28	**10.6***	58	0.23	6.3
Combined[9]	225	2,211	91	1,428	39	141	3.5	30	**19.6***	67	0.43	6.5
San Bruno to San Mateo Subsection												
Millbrae Station	146	2,132	48	1,385	15	117	1.5	28	6.2	53	0.25	6.4
Linden Avenue to Peninsula Avenue (at grade)	49	2,035	15	1,352	22	124	1.5	28	8.4	55	0.16	6.3
Linden Avenue to Peninsula Avenue (embankment)	31	2,017	9.8	1,347	14	116	0.91	27	5.7	53	0.10	6.2
Peninsula Avenue to Ninth Avenue (at grade)	73	2,059	19	1,356	30	132	1.5	28	8.3	55	0.21	6.3
Peninsula Avenue to Ninth Avenue (embankment)	72	2,058	19	1,356	30	132	1.4	28	8.5	56	0.21	6.3
Combined[9]	195	2,181	63	1,400	37	139	3.0	29	**14.6***	62	0.41	6.5

Construction Area	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2]	Total 24-hour[7]	Project 1-hour[2]	Total 1-hour[8]
San Mateo to Palo Alto Subsection												
At grade	78	3,973	19	1,852	26.3	105	1.6	25	8.5	58	0.16	6.3
Embankment	28	3,923	6.9	1,840	10.1	89.1	0.5	24	3.3	53	0.07	6.2
Mountain View to Santa Clara Subsection												
San Antonio Road to Lawrence Expressway (at grade)	68	2,397	18	1,775	33	118	1.5	28	8.2	58	0.25	6.4
Lawrence Expressway to Scott Boulevard (at grade)	18	2,347	11	1,768	9.1	94	0.92	28	5.1	55	0.07	6.2
San Jose Diridon Station Approach Subsection												
Embankment	138	2,467	66	1,822	51	137	19	**50***	**44***	93	<1	6
At grade	62	2,391	28	1,785	26	112	10	**41***	**14***	63	<1	6
Diridon Station	44	2,373	17	1,774	6	91	1	32	3	53	<1	6
Combined[9]	181	2,511	83	1,840	57	143	20	**51***	**47***	97	<1	7
Threshold												
SIL (µg/m³)[10,11]	2,000	-	500	-	N/A	-	1.2	-	10.4	-	7.8	-
NAAQS (µg/m³)	-	40,000	-	10,000	-	188	-	35	-	150	-	196.0

Sources: AERMOD version 18081; USEPA 2018a, 2018f
< = less than
- = no threshold
µg/m³ = micrograms of pollutant per cubic meter of air
CO = carbon monoxide
LMF = light maintenance facility
N/A = not applicable
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
SO_2 = sulfur dioxide
USEPA = U.S. Environmental Protection Agency
Exceedances of NAAQS or PM_{10} SIL are shown in **bolded underline with an asterisk (*)**.
[1] Only the highest modeled concentration in the form of the standard is presented for each pollutant.

[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.
[3] A background 1-hour CO concentration of 1,986, 2,979, and 2,329 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[4] A background 8-hour CO concentration of 1,337, 1,489, and 1,757 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[5] A background 1-hour NO_2 concentration of 101.8, 79.0, and 85.2 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[6] A background 24-hour $PM_{2.5}$ concentration in the form of the standard of 26.2, 23.3, and 26.8 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[7] A background 24-hour PM_{10} concentration of 47.0, 49.7, and 49.7 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[8] A background 1-hour SO_2 concentration of 6.1 µg/m[3] (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St.) was added to the maximum incremental off-site project contribution.
[9] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.
[10] USEPA SIL guidance (USEPA 2018f).
[11] Background concentrations do not exceed the NAAQS. Therefore, USEPA SILs are shown for information only.

Table 3.3-16 Criteria Pollutant Concentration Effects from Construction of Alternative B ($\mu g/m^3$)[1] Compared to 1- to 24-hour California Ambient Air Quality Standards

Construction Area	CO				NO_2		SO_2		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2,7]	Total 24-hour[7,8]	Project 1-hour[2]	Total 1-hour[9]
San Francisco to South San Francisco Subsection												
4th and King Street Station	207	3,071	76	1,680	37	174	0.07	2.97	9.7	**78.7***	0.47	9.9
4th and King Street Station to Chavez Street (at grade)	39	2,903	17	1,621	21	158	0.02	2.92	5.3	**74.3***	0.12	9.5
Chavez Street to Salinas Avenue (at grade)	74	2,938	25	1,629	40	177	0.03	2.93	9.4	**78.4***	0.24	9.6
Salinas Avenue to Linden Avenue (at grade)	47	2,911	37	1,641	25	162	0.02	2.92	9.0	**78.0***	0.15	9.6
Brisbane LMF	124	2,988	54	1,658	26	163	0.05	2.95	**12.4***	**81.4***	0.27	9.7
Combined[10]	246	3,110	93	2,079	58	195	0.09	2.99	**21.4***	**90.4***	0.59	10.0
San Bruno to San Mateo Subsection												
Millbrae Station	181	3,045	51	1,655	29	166	0.05	2.95	6.5	**75.5***	0.37	9.8
Linden Avenue to Peninsula Avenue (at grade)	49	2,913	15	1,619	29	166	0.02	2.92	8.4	**78.4***	0.21	9.6
Linden Avenue to Peninsula Avenue (embankment)	31	2,895	10	1,614	19	156	0.02	2.92	5.7	**74.7***	0.14	9.5
Peninsula Avenue to Ninth Avenue (at grade)	73	2,937	19	1,623	47	184	0.03	2.93	8.3	**77.3***	0.33	9.7
Peninsula Avenue to Ninth Avenue (embankment)	72	2,936	19	1,623	45	182	0.03	2.93	8.5	**77.5***	0.32	9.7
Combined[10]	230	3,094	66	1,670	58	195	0.07	2.97	**14.9***	**83.9***	0.58	10.0

Construction Area	CO				NO_2		SO_2		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2,7]	Total 24-hour[7,8]	Project 1-hour[2]	Total 1-hour[9]
San Mateo to Palo Alto Subsection												
Embankment	42	3,937	10	1,843	27	117	0.02	2.92	5.6	**74.6***	0.21	9.6
At grade	29	3,924	7	1,840	16	106	0.01	2.91	5.8	**74.8***	0.10	9.5
Mountain View to Santa Clara Subsection												
San Antonio Road to Lawrence Expressway (at grade)	68	2,817	18	2,080	44	172	0.21	3.11	8.2	**77.2***	0.34	9.7
Lawrence Expressway to Scott Boulevard (at grade)	18	2,767	11	2,073	11	139	0.02	2.92	5.1	**74.1***	0.09	9.5
San Jose Diridon Station Approach Subsection[11]												
Viaduct	104/80	2,853/ 2,830	50/52	2,112/ 2,114	22/15	150/ 142	0.1/0.1	3/3	**15.5*/ 14.0***	**84.5*/ 83.0***	0.3/0.2	10/10
Embankment	267/272	3,016/ 3,031	128/ 127	2,190/ 2,189	106/ 106	233/ 234	0.3/0.3	3/3	**76.7*/ 76.7***	**145.7*/ 145.7***	1/1	11/11
At grade	78/99	2,828/ 2,849	41/52	2,103/ 2,114	38/47	166/ 175	0.1/0.1	3/3	**24.4*/ 32.1***	**93.4*/ 101.1***	0.3/0.3	10/10
Diridon Station	45/45	2,795/ 2,795	19/19	2,081/ 2,081	13/13	141/ 141	<0.1/ <0.1	3/3	3.7/3.7	**72.7*/ 72.7***	0.1/0.1	10/10
Combined[10]	267/317	3,016/ 3,066	147/ 147	2,209/ 2,209	119/ 119	246/ 247	0.3/0.3	3/3	**80.4*/ 80.4***	**149.4*/ 149.4***	1/1	11/11
Threshold												
SIL (μg/m³)[7,12]	2,000	-	500	-	N/A	-	1.2	-	10.4	-	7.8	-
CAAQS (μg/m³)	-	23,000	-	10,000	-	339	-	-	-	50	-	655

Sources: AERMOD version 18081; CARB 2018b; USEPA 2018f
< = less than
\- = no threshold
μg/m³ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards

CO = carbon monoxide
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
NO_2 = nitrogen dioxide
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
SO_2 = sulfur dioxide
USEPA = U.S. Environment Protection Agency
Exceedances of CAAQS or SIL (for PM_{10} only) are shown in **bolded underline with an asterisk (*)**.
[1] Only the highest modeled concentration in the form of the standard is presented for each pollutant.
[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.
[3] A background 1-hour CO concentration of 2,864, 3,895, and 2,749 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[4] A background 8-hour CO concentration of 1,604, 1,833, and 2,062 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[5] A background 1-hour NO_2 concentration of 137.2, 89.9, and 127.8 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[6] A background 24-hour SO_2 concentration in the form of the standard of 2.9 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St.) was added to the maximum incremental off-site project contribution.
[7] Background PM_{10} concentration alone exceeds the CAAQS. Therefore, the incremental project increase in PM_{10} concentrations should be compared to the applicable USEPA SIL as recommended by the BAAQMD (Kirk 2016). SILs for pollutants other than PM_{10} are shown for information only.
[8] A background 24-hour PM_{10} concentration of 69.0 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St.) was added to the maximum incremental off-site project contribution.
[9] A background 1-hour SO_2 concentration of 9.4 µg/m^3 (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St.) was added to the maximum incremental off-site project contribution.
[10] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.
[11] Concentrations are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).
[12] USEPA SIL guidance (USEPA 2018f).

Table 3.3-17 Criteria Pollutant Concentration Effects from Construction of Alternative B (µg/m³)[1] Compared to 1- to 24-hour National Ambient Air Quality Standards

Construction Area	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2]	Total 24-hour[7]	Project 1-hour[2]	Total 1-hour[8]
San Francisco to South San Francisco Subsection												
4th and King Street Station	186	2,172	74	1,411	21	123	2.2	28.4	9.6	57	0.32	6.4
4th and King Street Station to Chavez Street (at grade)	39	2,025	17	1,354	18	120	0.96	27	5.3	52	0.11	6.2
Chavez Street to Salinas Avenue (at grade)	74	2,060	25	1,362	29	131	1.6	28	9.4	56	0.17	6.3
Salinas Avenue to Linden Avenue (at grade)	47	2,033	37	1,374	21	123	1.4	28	9.0	56	0.12	6.2
Brisbane LMF	119	2,105	39	1,376	15	117	2.0	28	9.6	57	0.19	6.3
Combined[9]	225	2,211	91	1,428	39	141	3.4	30	**18.6***	66	0.43	6.5
San Bruno to San Mateo Subsection												
Millbrae Station	146	2,132	48	1,385	15	117	1.5	28	6.2	53	0.25	6.4
Linden Avenue to Peninsula Avenue (at grade)	49	2,035	15	1,352	22	124	1.5	28	8.4	55	0.16	6.3
Linden Avenue to Peninsula Avenue (embankment)	31	2,017	9.8	1,347	14	116	0.91	27	5.7	53	0.10	6.2
Peninsula Avenue to Ninth Avenue (at grade)	73	2,059	19	1,356	30	132	1.5	28	8.3	55	0.21	6.3
Peninsula Avenue to Ninth Avenue (embankment)	72	2,058	19	1,356	30	132	1.4	28	8.5	56	0.21	6.3
Combined[9]	195	2,181	63	1,400	37	139	3.0	29	**14.6***	62	0.41	6.5
San Mateo to Palo Alto Subsection												
Embankment	42	3,937	10	1843	16	95	1.1	24.4	5.6	55.3	0.12	6.2
At grade	29	3,924	7	1,840	9.8	88.8	1.2	24.5	5.8	55.5	0.06	6.2

Construction Area	CO				NO_2		$PM_{2.5}$		PM_{10}		SO_2	
	Project 1-hour[2]	Total 1-hour[3]	Project 8-hour[2]	Total 8-hour[4]	Project 1-hour[2]	Total 1-hour[5]	Project 24-hour[2]	Total 24-hour[6]	Project 24-hour[2]	Total 24-hour[7]	Project 1-hour[2]	Total 1-hour[8]
Mountain View to Santa Clara Subsection												
San Antonio Road to Lawrence Expressway (at grade)	68	2,397	18	1,775	33	118	1.5	28	8.2	58	0.25	6.4
Lawrence Expressway to Scott Boulevard (at grade)	18	2,347	11	1,768	9.1	94	0.92	28	5.1	55	0.07	6.2
San Jose Diridon Station Approach Subsection[10]												
Viaduct	93/69	2,422/ 2,398	43/33	1,800/ 1,790	15/10	100/96	2/2	33/33	**14*/13***	64/62	0.2/0.2	6/6
Embankment	241/242	2,571/ 2,572	117/118	1,774/ 1,875	75/73	160/158	12/13	**43*/44***	**69*/69***	118/118	1/1	7/7
At grade	76/98	2,406/ 2,427	37/47	1,793/ 1,803	33/42	119/127	3/4	34/**35***	**22*/29***	71/78	0.2/0.3	6/6
Diridon Station	44/44	2,373/ 2,373	17/17	1,774/ 1,774	6/6	91/91	1/1	32/32	3/3	53/53	0.1/0.1	6/6
Combined[9]	286/286	2,617/ 2,626	134/135	1,891/ 1,892	81/79	167/164	13/13	**44*/44***	**72*/72***	122/122	1/1	7/7
Threshold												
SIL (µg/m^3)[11,12]	2,000	-	500	-	N/A	-	1.2	-	10.4	-	7.8	-
NAAQS (µg/m^3)	-	40,000	-	10,000	-	188	-	35	-	150	-	196.0

Sources: AERMOD version 18081; USEPA 2018a, 2018f
\- = no threshold
µg/m^3 = micrograms of pollutant per cubic meter of air
CO = carbon monoxide
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
SO_2 = sulfur dioxide

USEPA = U.S. Environmental Protection Agency

Exceedances of NAAQS or PM_{10} SIL are shown in **bolded underline with an asterisk (*)**.

[1] Only the highest modeled concentration in the form of the standard is presented for each pollutant.

[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.

[3] A background 1-hour CO concentration of 1,986, 2,979, and 2,329 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.

[4] A background 8-hour CO concentration of 1,337, 1,489, and 1,757 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.

[5] A background 1-hour NO_2 concentration of 101.8, 79.0, and 85.2 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.

[6] A background 24-hour $PM_{2.5}$ concentration in the form of the standard of 26.2, 23.3, and 26.8 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.

[7] A background 24-hour PM_{10} concentration of 47.0, 49.7, and 49.7 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.

[8] A background 1-hour SO_2 concentration of 6.1 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St.) was added to the maximum incremental off-site project contribution.

[9] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.

[10] Concentrations are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).

[11] USEPA SIL guidance (USEPA 2018f).

[12] Background concentrations do not exceed the NAAQS. Therefore, USEPA SILs are shown for information only.

Table 3.3-18 Criteria Pollutant Concentration Effects from Construction of Alternative A (µg/m³)[1] Compared to Annual National Ambient Air Quality Standards and California Ambient Air Quality Standards

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project Annual[2]	Project Annual[3]	Project Annual[2]	Total Annual[4]	Project Annual[2]	Total Annual[5]	Project Annual[2]	Total Annual[6]	Project Annual[2,7]	Total Annual[7,8]
San Francisco to South San Francisco Subsection										
4th and King Street Station	0.26	23	0.25	22	0.02	9.7	0.02	8.2	0.16	**22***
At grade	3.9	26	3.7	25	0.59	10.	0.56	8.8	**3.2***	**25***
Brisbane LMF	0.3	23	0.3	22	0.08	9.8	0.07	8.3	0.26	**22***
Combined[9]	4.2	27	4.0	25	0.67	10.	0.63	8.8	**3.5***	**26***
San Bruno to San Mateo Subsection										
Millbrae Station	0.19	23	0.19	22	0.02	9.7	0.01	8.2	0.10	**22***
Embankment	2.3	25	2.2	24	0.57	10	0.54	8.7	**2.7***	**25***
At grade	2.9	26	2.9	24	0.58	10	0.56	8.8	**3.1***	**25***
Combined[9]	3.1	26	3.1	24	0.60	10	0.57	8.8	**3.2***	**25***
San Mateo to Palo Alto Subsection										
Embankment	2.3	21	2.2	20	0.57	9.6	0.54	8.2	**2.8***	**25***
At grade	2.9	22	2.8	21	0.41	9.4	0.40	8.1	**2.5***	**24***
Combined[9]	2.9	22	2.8	21	0.57	9.6	0.54	8.2	**2.8***	**25***
Mountain View to Santa Clara Subsection										
At grade	4.3	28	3.9	27	0.95	11	0.85	10	**5.3***	**27***
Combined[9]	4.3	28	3.9	27	0.95	11	0.85	10	**5.3***	**27***
San Jose Diridon Station Approach Subsection										
Embankment	3	27	3	26	1	11	1	10	**7***	**29***
At grade	0	24	0	23	0	11	0	10	**3***	**25***
Diridon Station	7	31	6	29	2	**12***	2	11	0	**22***
Combined[9]	7	31	6	29	2	**12***	2	11	**7***	**29***

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project Annual[2]	Project Annual[3]	Project Annual[2]	Total Annual[4]	Project Annual[2]	Total Annual[5]	Project Annual[2]	Total Annual[6]	Project Annual[2,7]	Total Annual[7,8]
Threshold										
SIL (µg/m³)[7,10]	1		1		0.2		0.2		2.08	
CAAQS/NAAQS (µg/m³)	-	57	-	100	-	12	-	12	-	20

Sources: AERMOD version 18081; CARB 2018b; USEPA 2018a, 2018f
- = no threshold
µg/m³ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
LMF = light maintenance facility
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
USEPA = U.S. Environmental Protection Agency
Exceedances of CAAQS (for all pollutants) or SIL (for PM_{10} only) are shown in **bolded underline with an asterisk (*)**.
[1] Only the highest modeled concentration in the form of the applicable standard is presented for each pollutant.
[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.
[3] A background annual NO_2 concentration in the form of the (CAAQS) standard of 22.6, 18.8 and 24.1 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[4] A background annual NO_2 concentration in the form of the (NAAQS) standard of 21.3, 18.2, and 22.8 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[5] A background annual $PM_{2.5}$ concentration in the form of the (CAAQS) standard of 9.7, 9.0, and 9.9 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[6] A background annual $PM_{2.5}$ concentration in the form of the (NAAQS) standard of 8.2, 7.7, 9.2 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[7] Background PM_{10} concentration alone exceeds the CAAQS. Therefore, the incremental project increase in PM_{10} concentrations should be compared to the applicable USEPA SIL as recommended by the BAAQMD (Kirk 2016). SILs for pollutants other than PM_{10} are shown for information only.
[8] A background annual PM_{10} concentration in the form of the (CAAQS) standard of 22.1, 21.9, and 21.9 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[9] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.
[10] USEPA SIL guidance (USEPA 2018f).

Table 3.3-19 Criteria Pollutant Concentration Effects from Construction of Alternative B (µg/m³)[1] Compared to Annual National Ambient Air Quality Standards and California Ambient Air Quality Standards

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project Annual[2]	Project Annual[3]	Project Annual[2]	Total Annual[4]	Project Annual[2]	Total Annual[5]	Project Annual[2]	Total Annual[6]	Project Annual[2,7]	Total Annual[7,8]
San Francisco to South San Francisco Subsection										
4th and King Street Station	0.26	23	0.25	22	0.02	9.7	0.02	8.2	0.16	22*
At grade	3.9	26	3.7	25	0.59	10.	0.56	8.8	3.2*	25*
Brisbane LMF	0.31	23	0.30	22	0.08	9.8	0.07	8.3	0.26	22*
Combined[9]	4.2	27	4.0	25	0.67	10	0.63	8.8	3.5*	26*
San Bruno to San Mateo Subsection										
Millbrae Station	0.19	23	0.19	22	0.02	9.7	0.01	8.2	0.10	22*
Embankment	2.3	25	2.2	24	0.57	10	0.54	8.7	2.7*	25*
At grade	2.9	26	2.9	24	0.58	10	0.56	8.8	3.1*	25*
Combined[9]	3.1	26	3.1	24	0.60	1.	0.57	8.8	3.2*	25*
San Mateo to Palo Alto Subsection										
Embankment	4.0	23	3.8	22	1.1	10	1.0	8.7	6.5*	28*
At grade	5.3	24	5.1	23	1.5	11	1.5	9.2	10*	32*
Combined[9]	5.3	24	5.1	23	1.5	11	1.5	9.2	10*	32*
Mountain View to Santa Clara Subsection										
At grade	4.3	28	3.9	27	0.95	11	0.85	10	5.3*	27*
Combined[9]	4.3	28	3.9	27	0.95	11	0.85	10	5.3*	27*
San Jose Diridon Station Approach Subsection[10]										
Viaduct	2/2	26/26	2/2	24/24	0.4/0.3	11/11	0.4/0.3	10/10	3.3*/2.06*	25*/24*
Embankment	2/2	26/26	2/2	25/25	1/1	11/11	1/1	10/10	4.6*/4.8*	27*/27*
At grade	5/5	29/29	5/5	28/28	1/1	11/11	1/1	10/11	5.4*/5.4*	27*/27*
Diridon Station	0.3/0.3	24/24	0.2/0.2	23/23	<0.1/<0.1	11/11	<0.1/<0.1	10/10	0.1/0.1	22*/22*
Combined[9]	6/6	30/30	5/5	30/28	1/1	12/11	1/1	10/10	5.5*/5.5*	27*/27*

Construction Area	NO_2 (CAAQS)		NO_2 (NAAQS)		$PM_{2.5}$ (CAAQS)		$PM_{2.5}$ (NAAQS)		PM_{10} (CAAQS)	
	Project Annual[2]	Project Annual[3]	Project Annual[2]	Total Annual[4]	Project Annual[2]	Total Annual[5]	Project Annual[2]	Total Annual[6]	Project Annual[2,7]	Total Annual[7,8]
Threshold										
SIL (µg/m³)[7,11]	N/A		N/A		N/A		0.2		2.08	
CAAQS/NAAQS (µg/m³)	-	57	-	100	-	12	-	12	-	20

Sources: AERMOD version 18081; USEPA 2018a, 2018f; CARB 2018b
< = less than
- = no threshold
µg/m³ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
NAAQS = national ambient air quality standards
NO_2 = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SIL = significant impact level
USEPA = U.S. Environmental Protection Agency
Exceedances of CAAQS or SIL (for PM_{10} only) are shown in **bolded underline with an asterisk (*)**.
[1] Only the highest modeled concentration in the form of the applicable standard is presented for each pollutant.
[2] Represents the maximum incremental off-site concentration in the form of the standard from project construction.
[3] A background annual NO_2 concentration in the form of the (CAAQS) standard of 22.6, 18.8 and 24.1 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[4] A background annual NO_2 concentration in the form of the (NAAQS) standard of 21.3, 18.2, and 22.8 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[5] A background annual $PM_{2.5}$ concentration in the form of the (CAAQS) standard of 9.7, 9.0, and 9.9 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[6] A background annual $PM_{2.5}$ concentration in the form of the (NAAQS) standard of 8.2, 7.7, 9.2 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[7] Background PM_{10} concentration alone exceeds the CAAQS. Therefore, the incremental project increase in PM_{10} concentrations should be compared to the applicable USEPA SIL as recommended by the BAAQMD (Kirk 2016).
[8] A background annual PM_{10} concentration in the form of the (CAAQS) standard of 22.1, 21.9, and 21.9 µg/m³ (for the locations of San Francisco—Arkansas St., Redwood City—Barron Ave., and San Jose—Jackson St., respectively) was added to the maximum incremental off-site project contribution.
[9] "Combined" conservatively estimates the sum of worst-case concentrations from all features that can occur concurrently at one receptor location.
[10] Concentrations are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).
[11] USEPA SIL guidance (USEPA 2018f).

As shown in Tables 3.3-14 and 3.3-16, construction of either Alternative A or Alternative B (with either viaduct option) would result in localized concentrations that would exceed the 24-hour PM_{10} CAAQS and SIL. Both project alternatives would also contribute to existing exceedances of the CAAQS for PM_{10} where background concentrations already exceed the CAAQS. Within the San Jose Diridon Station Approach Subsection, construction of either Alternative A or Alternative B (with either viaduct option) also would result in localized concentrations that would exceed the 24-hour $PM_{2.5}$ NAAQS, the annual $PM_{2.5}$ CAAQS, the 24-hour PM_{10} CAAQS and SIL, and the annual PM_{10} CAAQS and SIL (see Tables 3.3-17 through 3.3-19). The CAAQS and NAAQS define clean air and represent the maximum amount of pollution that can be present in outdoor air without any harmful impacts on people and the environment. The main health impacts of airborne PM are on the respiratory and cardiovascular system. Certain individuals exposed to PM concentrations above the CAAQS or NAAQS may experience irritation of the airways, decreased lung function, irregular heartbeat, nonfatal heart attacks, and premature death.

CEQA Conclusion

The impact would be significant under CEQA for both project alternatives because construction could result in temporary exceedances of the annual CAAQS for $PM_{2.5}$, and the 24-hour and annual CAAQS for PM_{10}, and contribute to existing exceedances of the PM_{10} standard. Project features (AQ-IAMF#1 through AQ-IAMF#5) would minimize construction emissions through implementation of the best available on-site controls. However, exceedances of the CAAQS still would occur and the project would contribute a significant level of localized PM pollution within the RSA. No feasible mitigation is available to reduce this impact.

Impact AQ#4: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)

Construction of either project alternative, including project features AQ-IAMF#1 through AQ-IAMF#5, has the potential to create inhalation health risks and exposure to $PM_{2.5}$ at receptor locations adjacent to the project footprint. Cancer risk from exposure to diesel exhaust is much higher than the risk associated with any other air toxic from project construction. Construction would result in DPM emissions primarily from diesel-fueled off-road equipment and heavy-duty trucks.

Table 3.3-20 shows estimated construction-related health risks relative to BAAQMD thresholds for both project alternatives. The local topography and meteorology can greatly influence DPM air concentrations and the resulting exposure and health risk. Consequently, health risks for each subsection were estimated based on representative local meteorological conditions. The health risks shown in Table 3.3-20 represent the highest modeled off-site risk, which typically occurs adjacent to or within a few hundred yards of the project footprint.

As shown in Table 3.3-20, maximum health risks in the BAAQMD would be the same under both alternatives, except for slight differences in the San Jose Diridon Station Approach Subsection. In this subsection, Alternative A results in slightly greater potential cancer risk than Alternative B. The receptor locations at which the maximum modeled risks occur are different for each alternative. Although the total construction emissions of DPM in the San Jose Diridon Station Approach Subsection are greater for Alternative B than for Alternative A, site-specific conditions result in the slightly greater potential cancer risk for Alternative A. These conditions include the individual construction activities near each receptor and different orientation of the alignment relative to local wind directions. For the same reasons, the acute Hazard Index (which is derived not from DPM but from the summed concentrations of all modeled TACs) is slightly greater for Alternative B than for Alternative A. While the intensity of health risks would vary by location, neither project alternative would result in increases in cancer risk, health hazards, or $PM_{2.5}$ concentrations in excess of BAAQMD thresholds.

Table 3.3-20 Excess Cancer, Noncancer, and $PM_{2.5}$ Concentration Health Risks Associated with Project Construction in the Bay Area Air Quality Management District[1]

Subsection	Alternative A				Alternative B			
	Cancer (per million)[2]	Chronic HI[3]	Acute HI[3]	$PM_{2.5}$ (μg/m³)	Cancer (per million)[2]	Chronic HI[3]	Acute HI[3]	$PM_{2.5}$ (μg/m³)
San Francisco to South San Francisco	1.1	<0.1	<0.1	<0.1	1.1	<0.1	<0.1	<0.1
San Bruno to San Mateo	2.3	<0.1	0.10	<0.1	2.3	<0.1	0.10	<0.1
San Mateo to Palo Alto	1.8	<0.1	0.10	<0.1	3.3	<0.1	0.10	<0.1
Mountain View to Santa Clara	3.6	<0.1	<0.1	<0.1	3.6	<0.1	<0.1	<0.1
San Jose Diridon Station Approach[4]	5.5	<0.1	0.1	<0.1	3.8/3.9	<0.1/<0.1	0.2/0.2	<0.1/<0.1
BAAQMD Risk Threshold	**10.0**	**1.0**	**1.0**	**0.3**	**10.0**	**1.0**	**1.0**	**0.3**

Sources: AERMOD version 18081; OEHHA 2015; HARP 2 version 18159
< = less than
μg/m3 = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
HI = hazard index
I- = Interstate
LMF = light maintenance facility
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
[1] Only the highest modeled off-site risk is presented for each subsection. The reported risk includes effects from combined construction of all features (e.g., at grade, embankment, station, LMF) in each subsection.
[2] Cancer risk represents the incremental increase in the number of cancers in a population of 1 million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways.
[3] The hazard index (HI) is shown by pollutant contributions to the most affected organ system (respiratory).
[4] Risks and concentrations are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).

The California Public Resources Code, Section 21151.4, sets requirements for construction of any facility within 0.25 mile (1,320 feet) of a school that emits TACs in quantities that pose a health or safety hazard to humans at the school. Table 3.3-20 shows that predicted health risks at the maximally exposed receptor location (within 1,000 feet of the project footprint) would be less than the BAAQMD thresholds. Because DPM and $PM_{2.5}$ concentrations decrease as a function of distance from the emissions source, health risks at schools located beyond 1,000 feet would be lower than reported in Table 3.3-20. Consequently, health risks at schools within 0.25 mile due to project construction activities also would be less than the BAAQMD thresholds, and therefore would not pose a health or safety hazard to humans.

CEQA Conclusion

The impact would be less than significant under CEQA for both project alternatives because the incremental increases in maximum cancer risk and noncancer health hazards would not exceed BAAQMD thresholds. Therefore, CEQA does not require any mitigation.

Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos and Lead-Based Paint

NOA could become airborne as a result of excavating ultramafic and metavolcanic bedrock. NOA may be present in Potrero Point because this hill is mapped as serpentinite, a metamorphosed ultramafic rock. Construction activities near the Potrero Point serpentinite would consist of minor track modifications in the existing Caltrain corridor. No major excavation of serpentinite rock is anticipated; therefore, the risk of exposure of construction workers and the public to airborne

NOA would be limited. If NOA were to be disturbed, the design-build contractor would prepare a construction management plan that outlines practices for avoiding and minimizing NOA (GEO-IAMF#5). Construction contractors would also be required to comply with the BAAQMD's *Asbestos Airborne Toxic Control Measure for Construction and Grading Operations* (BAAQMD 2002), which requires implementation of dust control measures to limit the potential for airborne asbestos.

The demolition of asbestos-containing materials is subject to the *National Emission Standards for Hazardous Air Pollutants* (40 C.F.R. Parts 61 and 63) and would require an asbestos inspection. The Authority would consult with the BAAQMD, as applicable, before demolition activities begin.

Buildings in the air quality RSA might be contaminated with residual Pb, which was used as a pigment and drying agent in oil-based paint until the Lead-Based Paint Poisoning Prevention Act of 1971 prohibited such use. If encountered during demolitions and relocations, LBP and asbestos would be handled and disposed of in accordance with applicable standards.

The Authority would require construction contractors to prepare demolition plans with specific provisions for asbestos and LBP abatement for structures slated for demolition or renovation (HMW-IAMF#5). These plans would minimize the potential exposure of the public and construction workers to these hazardous materials. Implementation of a hazardous materials and waste plan, including procedures for hazardous waste transport, containment, and storage (HMW-IAMF#10), would further minimize potential health impacts on workers and community members during project demolition activities (Section 3.10).

Alternative B (Viaduct to Scott Boulevard) would require about 1,866,000 square feet of demolition, and therefore has greater potential to encounter and expose receptors to impacts from asbestos and LBP, compared to Alternative B (Viaduct to I-880), which would require about 1,678,000 square feet of demolition, or Alternative A, which would require about 817,000 square feet of demolition. Both project alternatives would use the same construction techniques and comply with the same regulations and standards to minimize exposure to these substances.

CEQA Conclusion

The impact would be less than significant under CEQA for both project alternatives because the project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to substantial pollutant concentrations with respect to asbestos and LBP. The project would not expose receptors to substantial public health risks related to asbestos and LBP. Therefore, CEQA does not require any mitigation.

Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors

Sources of odor during project construction would include diesel exhaust from construction equipment and asphalt paving. All odors would be localized and generally confined to the immediate area surrounding the construction site. The project would use standard construction techniques, and the equipment odors would be typical of most construction sites. The equipment odors would be temporary and localized, and they would cease once construction activities have been completed. The BAAQMD has adopted rules that limit the amount of VOC emissions from cutback asphalt, which would also reduce construction-related odors. The potential for impacts would be similar for both project alternatives because both project alternatives would use the same construction techniques and comply with the same air district rules to limit odors.

CEQA Conclusion

The impact would be less than significant under CEQA for both project alternatives because odors generated during construction would not be expected to affect a substantial number of people or result in nuisance complaints. Therefore, CEQA does not require any mitigation.

Operations Impacts

Operations of the project would include HSR train operations, maintenance activities and operation of stations and LMF. Operations and maintenance activities are more fully described in Chapter 2.

Impact AQ#7: Continuous Permanent Direct Impacts on Air Quality in the SFBAAB

Operation of the project has the potential to reduce long-term air pollutant emissions in the Northern California region. The project would improve passenger rail opportunities, and it is anticipated that people would shift trips from on-road vehicles and aircraft to the HSR system, which is less emissions-intensive than other transportation modes. Criteria pollutant emissions and reductions generated by operations of the project were quantified for 2015, 2029, and 2040 to capture changes in ridership and regional emission factors.

Table 3.3-21 through Table 3.3-23 summarize the estimated changes in regional emissions changes due to HSR operations under the medium and high ridership scenarios relative to 2015 existing conditions and 2029 and 2040 No Project conditions, respectively. From an operations perspective, ridership and associated emissions changes from on-road vehicles, aircraft, and power plants (used to generate electricity to power the HSR system) would be identical between the project alternatives. These emissions changes would occur throughout the Northern California region. Emissions from operation of the stations and Brisbane LMF would be the same for both project alternatives. Emissions from the stations and Brisbane LMF would occur locally at and near the building locations. Fugitive dust emissions from train movement would be similar for both project alternatives based on the length of the at-grade and embankment track. Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for detailed emissions results by individual source (e.g., on-road vehicles, stations).

As shown in Tables 3.3-21 through 3.3-23, operations of the project under both ridership scenarios would increase criteria pollutant emissions from additional electricity required to power the HSR system, as well as from operation of the stations and Brisbane LMF, relative to the 2015 existing conditions and 2029 and 2040 No Project conditions. Fugitive dust emissions would also increase because of train movement over the track. Electricity demands and the associated emissions from power plants would be the same for both project alternatives. Station and Brisbane LMF emissions would be the same for both project alternatives.

Although project operations would increase criteria pollutant emissions associated with power plants, train movement, stations, and the Brisbane LMF, it would result in emissions reductions from on-road vehicles and aircraft, relative to the 2015 existing conditions and 2029 and 2040 No Project conditions. These emissions benefits would be achieved by reductions in personal vehicle trips and aircraft activity; with a greater number of people traveling on the HSR system, fewer vehicle and aircraft trips would occur. Increases in gate-down time at grade crossings would increase vehicle idling emissions, but this increase would be more than compensated for by the reduction in regional emissions from on-road vehicles. Because the reductions in on-road vehicles and aircraft activity are directly tied to ridership, there would be no difference in emissions benefits between the project alternatives. The criteria pollutant emissions reductions achieved by changes in on-road vehicle and aircraft activity would more than offset the emissions increase from operations of the project (electricity, train movement, stations, and Brisbane LMF). Long-term operations of the Project Section and the larger HSR system would therefore result in a net reduction in operations emissions from the 2015 existing conditions and 2029 and 2040 No Project conditions.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because project operations are anticipated to result in a net reduction of criteria pollutant emissions. This reduction would be relative to existing conditions if emissions are compared for 2015, and would be relative to the No Project conditions if emissions are compared for 2029 and 2040. Project operations would not create a new violation of any air quality standard or contribute substantially to an existing or projected air quality violation. Reductions in regional O_3 precursors (VOC and NO_X) and PM emissions may contribute to reductions in O_3 and secondary PM formation, which may result in public health benefits, such as reductions in lost work days, hospital admissions, and certain respiratory and cardiovascular symptoms. Therefore, CEQA does not require any mitigation.

Table 3.3-21 Changes in Regional Criteria Pollutant Emissions from Project Operations (under the Medium and High Ridership Scenarios) Relative to the 2015 Existing Conditions

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High
Indirect Emissions Change												
On-road vehicles	-11	-14	-413	-553	-41	-55	-1	-1	-28	-37	-8	-10
Aircraft	-40	-38	-341	-326	-328	-314	-35	-34	-10	-9	-10	-9
Power plants	1	1	13	14	6	7	1	1	2	2	1	2
Direct Emissions Change [1]												
Stations[2,3]	5	5	55	55	5	5	0	0	11	11	3	3
Brisbane LMF[3]	2	2	3	3	1	1	0	0	1	1	0	0
Train movement[4]									15	15	2	2
Total Emissions Change [5]												
Project	-43	-44	-683	-807	-356	-355	-35	-34	-8	-18	-11	-12

Sources: Volume 2, Appendix 3.3-A; Authority 2019g; SJVAPCD 1996; USEPA 2006a; CAPCOA 2017
CO = carbon monoxide
I- = Interstate
LMF = light maintenance facility
NO_X = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year
Values less than 0.5 have been rounded to zero.
[1] Direct emissions do not depend on ridership; emissions are the same for both ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between Existing and Existing Plus Project conditions).
[3] Values for Alternative A and Alternative B (both viaduct options) are the same after rounding.
[4] Train movement would only generate fugitive dust emissions. Emissions for Alternative A would be 15.5 tons/year PM_{10} and 2.3 tons/year $PM_{2.5}$, for Alternative B (Viaduct to I-880) 14.6 tons/year PM_{10} and 2.2 tons/year $PM_{2.5}$, and for Alternative B (Viaduct to Scott Boulevard) 13.9 tons/year PM_{10} and 2.1 tons/year $PM_{2.5}$. Because of the similarity of these values, this table only reports the results for the highest alternative (Alternative A).
[5] Total includes indirect and direct emissions.

Table 3.3-22 Changes in Regional Criteria Pollutant Emissions from Operation of the Project (under the Medium and High Ridership Scenarios) Relative to 2029 No Project Conditions

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High
Indirect Emissions Change												
On-road vehicles	-2	-2	-103	-138	-8	-10	0	-1	-20	-27	-5	-7
Aircraft	-26	-28	-216	-237	-213	-233	-23	-25	-6	-7	-6	-7
Power plants	1	1	11	12	6	6	1	1	1	1	1	1
Direct Emissions Change[1]												
Stations[2,3]	1	1	8	8	1	1	0	0	6	6	2	2
LMF[3]	2	2	2	2	1	1	0	0	1	1	0	0
Train movement[4]									15	15	2	2
Total Emissions Change[5]												
Project	-25	-27	-298	-353	-213	-235	-23	-25	-2	-11	-6	-8

Sources: Volume 2, Appendix 3.3-A; Authority 2019g; SJVAPCD 1996; USEPA 2006a; CAPCOA 2017
CO = carbon monoxide
I- = Interstate
LMF = light maintenance facility
NO_X = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year
Values less than 0.5 have been rounded to zero.
[1] Direct emissions do not depend on ridership; emissions are the same for both ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between No Project and Project conditions).
[3] Values for Alternative A and Alternative B (both viaduct options) are the same after rounding.
[4] Train movement would only generate fugitive dust emissions. Emissions for Alternative A would be 15.5 tons/year PM_{10} and 2.3 tons/year $PM_{2.5}$, for Alternative B (Viaduct to I-880) 14.6 tons/year PM_{10} and 2.2 tons/year $PM_{2.5}$, and for Alternative B (Viaduct to Scott Boulevard) 13.9 tons/year PM_{10} and 2.1 tons/year $PM_{2.5}$. Because of the similarity of these values, this table only reports the results for the highest alternative (Alternative A).
[5] Total includes indirect and direct emissions.

Table 3.3-23 Changes in Regional Criteria Pollutant Emissions from Operation of the Project (under the Medium and High Ridership Scenarios) Relative to the 2040 No Project Conditions

Emission Source	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High	Medium	High
Indirect Emissions Change												
On-road vehicles	-2	-2	-128	-154	-9	-11	-1	-1	-38	-51	-10	-13
Aircraft	-55	-53	-459	-440	-452	-433	-49	-47	-14	-13	-14	-13
Power plants	1	1	12	14	6	7	1	1	1	2	1	2
Direct Emissions Change[1]												
Stations[2,3]	2	2	18	18	2	2	0	0.0	12	12	3	3
LMF[3]	2	2	2	2	1	1	0	0.0	1	1	0	0
Train movement[4]									15	15	2	2
Total Emissions Change[5]												
Project	-52	-49	-556	-560	-452	-434	-49	-47	-21	-34	-16	-18

Sources: Volume 2, Appendix 3.3-A; Authority 2019g; SJVAPCD 1996; USEPA 2006a; CAPCOA 2017
CO = carbon monoxide
I- = Interstate
LMF = light maintenance facility
NO_X = nitrogen dioxide
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
PM_{10} = particulate matter 10 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
yr = year
Values less than 0.5 have been rounded to zero.
[1] Direct emissions do not depend on ridership; emissions are the same for both ridership scenarios.
[2] Represents the net emissions effect of the project (i.e., the difference in station operating emissions between No Project and Project conditions)
[3] Values for Alternative A and Alternative B (both viaduct options) are the same after rounding.
[4] Train movement would only generate fugitive dust emissions. Emissions for Alternative A would be 15.5 tons/year PM_{10} and 2.3 tons/year $PM_{2.5}$, for Alternative B (Viaduct to I-880) 14.6 tons/year PM_{10} and 2.2 tons/year $PM_{2.5}$, and for Alternative B (Viaduct to Scott Boulevard) 13.9 tons/year PM_{10} and 2.1 tons/year $PM_{2.5}$. Because of the similarity of these values, this table only reports the results for the highest alternative (Alternative A).
[5] Total includes indirect and direct emissions.

Impact AQ#8: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan

During operations, either project alternative would result in net decreases in all criteria pollutant emissions (VOC, CO, NO_X, SO_2, PM_{10} and $PM_{2.5}$) when compared to 2015 existing conditions and 2029 and 2040 No Project conditions, as shown in Tables 3.3-21 through 3.3-23. This would be consistent with the BAAQMD's air quality plans, as well as the local RTP. Therefore, project operations would not conflict with or obstruct implementation of applicable air quality plans.

CEQA Conclusion

The impact would be less than significant under CEQA because operations of the project would result in net decreases in all criteria pollutant emissions relative to the 2015 existing conditions. As a result, operations of the project would not conflict with or obstruct implementation of applicable air quality plans. Therefore, CEQA does not require any mitigation.

Impact AQ#9: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)

The Authority performed a CO hot-spot analysis for intersections that could cause a localized CO hot spot. Intersections were screened, selected, and modeled as described in Section 3.3.4.3. Traffic data provided by Fehr & Peers (see Volume 2, Appendix 3.3-A) indicate that no intersections in the local RSA would have volumes of more than the BAAQMD criterion of 24,000 vehicles per hour (the lower of BAAQMD's two screening criteria; see Section 3.3.4.5), but some intersections do not meet the BAAQMD criterion that the project be consistent with an applicable congestion management program. Intersections with an LOS that is better than the established LOS standard in the applicable congestion management program under 2040 Plus Project conditions were considered to be consistent with the congestion management program. Intersections that would have LOS that is equal to or worse than the established LOS standard in the applicable congestion management program under 2040 Plus Project conditions were considered to be potentially not consistent with the congestion management program, and therefore were considered for further analysis.

Thirty-nine intersections along the Caltrain corridor between 4th and King Street Station in San Francisco and West Alma Avenue in San Jose would have existing or predicted LOS in 2040 equal to or worse than the established LOS standards in the congestion management program. The following eight intersections with the highest traffic volumes and worst congestion in 2040 were selected for CO modeling:

- Bayshore Boulevard/Geneva Avenue (Brisbane)
- El Camino Real (State Route [SR] 82)/Millbrae Avenue (Millbrae)
- El Camino Real (SR 82)/Palo Alto Avenue–Sand Hill Road (Palo Alto)
- Central Expressway/Rengstorff Avenue (Mountain View)
- Central Expressway/Moffett Boulevard–Castro Street (Mountain View)
- Coleman Avenue/Interstate (I-) 880 Northbound Ramps (San Jose)
- The Alameda (former SR 82)/Taylor Street–Naglee Avenue (San Jose)
- Autumn Street (former SR 82)/West Santa Clara Street (former SR 82) (San Jose)

A microscale CO hot-spot analysis at five intersections near the 4th and King Street Station was performed separately for 2029 because this station would no longer be in use by 2040. The following five intersections with the highest traffic volumes and worst congestion near the 4th and King Street Station in 2029 were selected for CO modeling:

- Fourth Street/King Street
- Fifth Street/King Street/I-280 Ramps
- Owens Street/16th Street
- Fifth Street/Bryant Street
- Third Street/16th Street

The modeled CO concentrations were combined with CO background concentrations and compared to the air quality standards. Results would be the same for either project alternative because projected traffic volumes would be the same for both. Table 3.3-24 shows the CO hot-spot analysis results and shows that CO concentrations are not anticipated to exceed the 1- or 8-hour NAAQS and CAAQS for either project alternative.

Table 3.3-24 Carbon Monoxide Modeling Concentration Results at Roadway Intersections

Intersection and Year	Receptor ID[1]	1-Hour Concentration[2] (ppm)		8-Hour Concentration[3] (ppm)	
		No Project	Plus Project	No Project	Plus Project
2029					
4th Street/King Street	21	2.9	2.9	1.9	1.9
	22	2.9	2.9	1.9	1.9
	23	2.9	2.9	1.9	1.9
	24	2.9	2.9	1.9	1.9
5th Street/King Street/ I-280 Ramps	25	2.9	2.9	1.9	1.9
	26	2.9	2.9	1.9	1.9
	27	3.0	3.0	2.0	2.0
	28	3.0	3.0	2.0	2.0
Owens Street/16th Street	29	2.7	2.7	1.8	1.8
	30	2.6	2.6	1.7	1.7
	31	2.6	2.6	1.7	1.7
	32	2.6	2.6	1.7	1.7
5th Street/Bryant Street	33	2.6	2.7	1.7	1.8
	34	2.7	2.8	1.8	1.8
	35	2.7	2.7	1.8	1.8
	36	2.7	2.7	1.8	1.8
3rd Street/16th Street	37	2.7	2.7	1.8	1.8
	38	2.8	2.8	1.8	1.8
	39	2.8	2.8	1.8	1.8
	40	2.6	2.6	1.7	1.7
2040					
El Camino Real (SR 82)/ Millbrae Avenue	1	3.8	3.8	2.1	2.1
	2	3.7	3.7	2.0	2.0
	3	3.7	3.7	2.0	2.0
	4	3.7	3.7	2.0	2.0
El Camino Real (SR 82)/Palo Alto Avenue-Sand Hill Road	5	3.6	3.6	1.9	1.9
	6	3.7	3.7	2.0	2.0
	7	3.9	3.9	2.1	2.1
	8	3.8	3.8	2.1	2.1

Intersection and Year	Receptor ID[1]	1-Hour Concentration[2] (ppm)		8-Hour Concentration[3] (ppm)	
		No Project	Plus Project	No Project	Plus Project
Central Expressway/ Rengstorff Avenue	9	3.7	3.7	2.0	2.0
	10	3.8	3.8	2.1	2.1
	11	3.7	3.7	2.0	2.0
	12	3.7	3.7	2.0	2.0
Central Expressway/Moffett Boulevard-Castro Street	13	3.7	3.7	2.0	2.0
	14	3.8	3.8	2.1	2.1
	15	3.8	3.8	2.1	2.1
	16	3.7	3.7	2.0	2.0
Bayshore Boulevard/Geneva Avenue	17	3.5	3.5	1.9	1.9
	18	3.6	3.6	1.9	1.9
	19	3.5	3.5	1.9	1.9
	20	3.8	3.8	2.1	2.1
Coleman Avenue/I-880 Northbound Ramps	21	2.8	2.8	2.2	2.2
	22	2.9	3.0	2.2	2.3
	23	2.9	2.9	2.2	2.2
	24	3.0	3.0	2.3	2.3
The Alameda (former SR 82)/ Taylor Street-Naglee Avenue	25	2.9	2.9	2.2	2.2
	26	2.8	2.9	2.2	2.2
	27	2.9	2.9	2.2	2.2
	28	2.9	2.9	2.2	2.2
Autumn Street (former SR 82)/ West Santa Clara Street (former SR 82)	29	2.8	2.8	2.2	2.2
	30	2.7	2.8	2.1	2.2
	31	2.8	2.9	2.2	2.2
	32	2.8	2.9	2.2	2.2
State standard (ppm)		20	20	9	9
Federal standard (ppm)		35	35	9	9

Sources: Volume 2, Appendix 3.3-A; Garza et al. 1997
Caltrans = California Department of Transportation
I- = Interstate
ID = identifier
ppm = parts per million
SR = State Route
[1] Consistent with Caltrans methods (Garza et al. 1997), receptors are located 3 meters from the intersection at each of the four corners to represent the nearest location in which a receptor could potentially be adjacent to a traveled roadway. The modeled receptors indicated do not necessarily represent actual sensitive receptors. Receptor locations are theoretical and may not reflect actual locations.
[2] An average 1-hour background concentration of 2.00 ppm was assumed for 2029, based on 2015–2017 measured data at the Redwood City—Barron Avenue monitoring site (USEPA 2018a). An average 1-hour background concentration of 2.80 ppm was assumed for 2040, based on 2015–2017 measured data at the San Francisco—Arkansas Street monitoring site (USEPA 2018a).
[3] An average 8-hour background concentration of 1.27 ppm was assumed for 2029, based on 2015-2017 measured data at the Redwood City—Barron Avenue monitoring site (USEPA 2018a). An average 1-hour background concentration of 1.37 ppm was assumed for 2040, based on 2015–2017 measured data at the San Francisco—Arkansas Street monitoring site (USEPA 2018a).

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because the project would not create traffic conditions that would result in localized CO hot spots. As a result, the project would not result in CO concentrations in excess of the health-protective CAAQS or NAAQS, and as such, would not expose sensitive receptors to significant pollutant concentrations or health impacts. Therefore, CEQA does not require any mitigation.

Impact AQ#10: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics

The project would decrease regional VMT and MSAT emissions relative to the 2015 existing and 2029 and 2040 No Project conditions. The HSR system would reduce the number of individual vehicle trips on a regional basis. Because the project would not change the regional traffic mix, the amount of MSATs emitted from highways and other roadways within the RSA would be proportional to the VMT. The regional VMT estimated for the project would be less than the anticipated VMT under the 2015 existing and 2029 and 2040 No Project conditions; therefore, MSAT emissions from regional vehicle traffic would be less for the project. Regionally, the project would be considered a project with “no meaningful MSAT effects” (Tier 1), per FHWA’s (2016) MSAT guidance. Reductions in regional MSAT emissions may result in public health benefits, including reductions in lost work days, hospital admissions, and certain respiratory and cardiovascular symptoms.

Although reductions in regional MSATs are expected because of decreased VMT, localized increases in MSAT emissions could occur near the stations and the LMF because of additional passenger and employee commute trips. These increases would not be considered to have “higher potential MSAT effects” per FHWA guidance because the anticipated change in local average daily traffic would not exceed the FHWA’s (2016) MSAT threshold of 140,000 average daily traffic. Locally, the project would be considered a project with “low MSAT effects” (Tier 2) per FHWA’s (2016) MSAT guidance. Consistent with FHWA’s MSAT guidance, the magnitude and the duration of potential changes in localized MSAT emissions, and thus health consequences, cannot be reliably quantified because of incomplete or unavailable information in forecasting project-specific health impacts. Although there may be differences among the project alternatives with respect to localized MSAT emissions, USEPA’s vehicle and fuel regulations, coupled with fleet turnover, would cause MSAT reductions over time, thereby offsetting the increase in localized traffic associated with the project.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because the project would not result in an increase in MSAT emissions that would expose sensitive receptors to substantial pollutant concentrations. Consistent with FHWA guidance, the project would have no meaningful regional MSAT impacts and would have a low potential for meaningful localized MSAT impacts. Therefore, CEQA does not require any mitigation.

Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)

The BAAQMD is designated nonattainment for $PM_{2.5}$. In accordance with USEPA guidance, if a project meets one of several criteria, it is considered a project of air quality concern, and a quantitative PM_{10}/$PM_{2.5}$ analysis is required. The criteria, along with an evaluation of their applicability to the project alternatives, are as follows:

- **New or expanded highway projects that have a significant number of or significant increase in diesel vehicles**—The project is not a new highway project, nor would it expand an existing highway beyond its current capacity.
- **Projects affecting intersections that are at LOS D, E, or F with a significant number of diesel vehicles or those that would degrade to LOS D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the project**—The traffic volume increases at the affected intersections would be from mostly gasoline-powered passenger cars and transit buses operated by the San Mateo County Transit District

(SamTrans) and San Francisco Municipal Railway (MUNI) that are a mix of diesel, diesel-electric, and electric trolleys. MUNI has plans for an all-electric bus fleet by 2035 (San Francisco Municipal Transit Authority 2018). SamTrans has committed to an all-electric bus fleet by 2033 (SamTrans 2018).

- **New or expanded bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location**—The project would not have new or expanded bus or rail terminals or transfer points that significantly increase the number of diesel vehicles congregating at a single location. Increased bus service to the passenger rail terminals is not part of the project. The Authority assumes that bus service levels are constant into the future because no operator has a funding plan to deliver more service. SamTrans and MUNI have plans to transition to all-electric bus fleets that will also reduce diesel bus emissions over time. The Brisbane LMF may be accessed by diesel vehicles, but the projected volume is only 20 or fewer trucks per day.
- **Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$- or PM_{10}-applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation**—The RSA is not in an area identified as a site of violation or possible violation in the USEPA-approved SIP.

As a result, neither project alternative was determined to be a project of air quality concern, as defined by 40 C.F.R. Section 93.123(b)(1). Neither alternative would violate the PM_{10}/$PM_{2.5}$ health-protective NAAQS or have any localized impact with respect to PM on sensitive receptors during its operations. Thus, CAA 40 C.F.R. Section 93.116 requirements would be met without a quantitative hot-spot analysis.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because the project is not considered to be a project of air quality concern, based on the descriptions in 40 C.F.R. Section 93.123(b)(1). Changes in on-road vehicle operation associated with the project would not contribute to new or worsened violations of the health-protective NAAQS. As such, localized changes in PM emissions from on-road vehicles would not be expected to contribute a significant level of air pollution such that individuals would be exposed to substantial PM concentrations. Therefore, CEQA does not require any mitigation.

Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)

Shifting of tracks carrying freight trains to accommodate higher speeds for existing and new passenger rail has the potential to create increased inhalation health risks and exposure to $PM_{2.5}$, which may exceed local significance thresholds for cancer and noncancer hazards at analyzed receptor locations adjacent to the shifted track. Health risks to the closest receptors along shifted track sections were estimated using the BAAQMD's rail inventory tool and the methods described in Section 3.3.4.3. The analysis assumes conservatively that the track shift would be complete in 2022. Accordingly, emissions exposure under the shifted track scenario and the No Project conditions were assumed to begin in 2022. Existing conditions reflect the risks that would occur if the freight tracks were not shifted and exposure to emissions began in 2015.

Table 3.3-25 shows the incremental change in health risks between the existing, project, and No Project conditions. In Table 3.3-25, the receptor at which the project would have the greatest impact is listed for each subsection. As shown in this table, track shifts would result in both increases and decreases in cancer and noncancer health risks, relative to 2015 existing conditions. The decreases occur primarily because of advancements in locomotive emissions control technology and the retirement of older, higher-emitting engines, which would reduce future DPM emission rates. At locations where risks would decrease compared to 2015 existing conditions, the reduction in future locomotive emission rates is enough to offset the increased risk associated with shifting freight trains closer to existing receptors. At locations where risks would increase, the decrease in distance to receptors due to the track shift is relatively large, leading to a relatively large increase in risk. As a result, the reduction in locomotive emission rates would not be enough to offset the increased risk associated with shifting freight trains closer to existing receptors.

Table 3.3-25 Summary of Changes in Cancer and Noncancer Health Risks from Freight Trains on Shifted Track Relative to Existing Conditions and No Project Conditions

Subsection and Location	Change in Risk in 2022 with the Track Shifts Relative to Risk under Existing (2015) Conditions[1,2]			Change in Risk in 2022 with the Track Shifts Relative to Risk under No Project (2022) Conditions[3,4]		
	Cancer	Chronic HI	$PM_{2.5}$ (µg/m³)	Cancer	Chronic HI	$PM_{2.5}$ (µg/m³)
San Francisco to South San Francisco						
Near San Francisco Avenue and Santa Clara Street	-5.6	<0.01	<0.01	0.8	<0.01	<0.01
San Bruno to San Mateo						
Near Hillcrest Boulevard and Hemlock Avenue	1.4	<0.01	<0.01	8.0	<0.01	<0.01
San Mateo to Palo Alto						
Near El Camino Real and Morse Boulevard	-3.7	<0.01	<0.01	4.3	<0.01	<0.01
Mountain View to Santa Clara						
N/A[5]	N/A	N/A	N/A	N/A	N/A	N/A
San Jose Diridon Station Approach						
Near Chestnut Street and Asbury Street[6]	-17.2	<0.01	-0.03	5.2	<0.01	<0.01
Near Harrison Street and Fuller Ave[6]	-3.9	<0.01	<0.01	5.6	<0.01	0.01
BAAQMD Threshold	**10.0**	**1.0**	**0.3**	**10.0**	**1.0**	**0.3**

Sources: Winkel 2018; Peninsula Corridor Joint Powers Board 2015; OEHHA 2015
< = less than
µg/m³ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
HI = hazard index
HSR = high-speed rail
N/A = not applicable: no locations with both substantial track shifts and nearby receptors were identified in this subsection.
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
Risks apply to both alternatives unless noted otherwise.
[1] Existing conditions reflect the risks that would occur if the tracks were not shifted and exposure to emissions began in 2015.
[2] The change in risk represents the effects of decreased distance from the freight trains to the receptors due to the track shift, decreased emissions from freight trains due to locomotive fleet turnover from 2015 to 2022, and projected increases in freight train volumes from 2015 to 2022.
[3] No Project conditions reflect the risks that would occur if the tracks were not shifted and exposure to emissions began in 2022.
[4] The change in risk represents the effect of decreased distance from the freight trains to the receptors, due to the track shift, in 2022. Though the track shift is associated with the project, there is no change in risk due to the HSR service because the HSR trains are electric and do not produce emissions along the alignment.
[5] No locations with both substantial track shifts and nearby receptors were identified in this subsection.
[6] Risks apply to Alternative A only. No track would be shifted in the San Jose Diridon Station Approach Subsection under Alternative B.

The comparison of project to No Project conditions accounts for changes in locomotive emission rates because both conditions assume exposure begins in 2022. Accordingly, the comparison of risks to the No Project conditions reflects the incremental project impact, exclusive of background trends. As shown in Table 3.3-25, compared to the No Project conditions, the track shifts would result in minor increases in cancer and noncancer health risks at modeled receptor locations. However, these increases would not exceed BAAQMD thresholds. The analysis only evaluates locations where tracks would be moved closer to receptors. In many of these locations, receptors on the other side of the track would experience a corresponding health benefit because freight trains would be moved farther away from these receptors.

The 4th and King Street, Millbrae, and San Jose Diridon Stations currently have emergency generators (one at each station) for use in the event of a power outage. The project includes installation of a second fully permitted generator at Millbrae Station and an additional two fully permitted generators at San Jose Diridon Station. The LMF would also have a generator. The generators would comply with the permitting requirements specified in BAAQMD Regulation 2, Rule 5, which prohibits their operation if cancer or acute hazards exceed air district thresholds. Accordingly, cancer risk and acute hazards from generator testing at the stations and LMF would not exceed BAAQMD thresholds. Regulation 2, Rule 5 does not establish any permit restrictions on $PM_{2.5}$ concentrations in the BAAQMD. $PM_{2.5}$ exhaust concentrations from emergency generator testing were estimated using emissions data from CalEEMod and USEPA's AERMOD dispersion model and compared to BAAQMD's $PM_{2.5}$ threshold. Table 3.3-26 shows the results of the health risk analysis for $PM_{2.5}$ at the stations and LMF. Maximum $PM_{2.5}$ concentrations from testing of the emergency generators would be less than BAAQMD's health risk thresholds of significance for both project alternatives.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because operations-related DPM and $PM_{2.5}$ concentrations would not exceed BAAQMD's cancer and noncancer risk thresholds. Therefore, CEQA does not require any mitigation.

Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors

The HSR trains would be powered from the regional electrical grid and operations would not result in potentially odorous emissions. Some area source emissions would be associated with station and LMF operation, such as natural-gas combustion for space and water heating, landscaping equipment emissions, and solvent and paint use during the periodic reapplication of exterior coatings, which would be the same under both alternatives. The solvent and paint use would have the potential to cause odors at nearby sensitive receptors. However, any potential odor emissions would be similar to those from solvent and paint use at existing land uses in the area and would not represent new or unique odors, relative to those under the No Project conditions.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because odors generated during operations would not be expected to affect a substantial number of people or result in nuisance complaints. Therefore, CEQA does not require any mitigation.

Table 3.3-26 Maximum $PM_{2.5}$ Concentrations from Operation of Emergency Generators at Project Stations and the Light Maintenance Facility

Generator Location/Condition	Maximum $PM_{2.5}$ Concentration ($\mu g/m^3$)
2015 Existing/2029 and 2040 No Project	
4th and King Street Station	<0.1
Millbrae Station	<0.1
San Jose Diridon Station	<0.1

Generator Location/Condition	Maximum $PM_{2.5}$ Concentration ($\mu g/m^3$)
2029/2040 Plus Project	
4th and King Street Station	<0.1
Millbrae Station	<0.1
East Brisbane LMF (Alternative A)	<0.1[1]
West Brisbane LMF (Alternative B)	<0.1[1]
San Jose Diridon Station	<0.1
Project vs. Existing and No Project Conditions[2]	
4th and King Street Station	<0.1
Millbrae Station	<0.1
East Brisbane LMF (Alternative A)	<0.1[1]
West Brisbane LMF (Alternative B)	<0.1[1]
San Jose Diridon Station	<0.1
BAAQMD Threshold	**0.3**

Source: AERMOD version 18081
< = less than
$\mu g/m^3$ = micrograms of pollutant per cubic meter of air
BAAQMD = Bay Area Air Quality Management District
LMF = light maintenance facility
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
Risks apply to both alternatives unless noted otherwise.
[1] No sensitive receptors would be within 1,000 feet of the emergency generators at the Brisbane LMF under either alternative. Accordingly, a health risk assessment is not required, consistent with BAAQMD (2017a) guidance.
[2] Represents the net concentration effect of the project (i.e., the difference in between the existing/No Project and the project condition)

3.3.6.3 Greenhouse Gases

Long-term operations of the project would result in a net reduction of regional and statewide GHG emissions when compared to 2015 existing conditions and the 2029 and 2040 No Project conditions. Construction of the project would result in the temporary generation of GHG emissions. However, net GHG reductions during operations (because of reduced car and aircraft trips in Northern California and statewide) would offset the increase in construction-related GHG emissions in approximately 1 to 7 months. Accordingly, implementation of the project would result in a net decrease in GHG emissions that would be beneficial to the RSA and the state of California and would help meet local and statewide GHG reduction goals.

No Project Impacts

As discussed in Section 3.3.6.2, reasonably foreseeable projects throughout Northern California would result in emissions from on-road vehicles, aircraft, and power plant sources. The emissions intensity of on-road vehicles and aircraft would improve in the future, and these improvements would reduce total GHG emissions under the No Project conditions. Additionally, because of the state requirement that an increasing fraction (60 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, emissions from power plant sources in the future likely would be lower than existing emissions.

Project Impacts

Construction Impacts

Impact AQ#14: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions

Construction of the project would generate GHG emissions impacts from heavy-duty construction equipment, construction worker vehicles, truck hauling, and concrete/cement manufacture and hauling during the construction period. Table 3.3-27 summarizes total estimated GHG emissions associated with project construction. The emissions results assume implementation of AQ-IAMF#2 through AQ-IAMF#5 (AQ-IAMF#1 would not affect GHG emissions). Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for annual emission results. The total GHG construction emissions of the project would be 0.047 to 0.055 percent of the total annual statewide GHG emissions, depending on the alternative.[15]

Table 3.3-27 Carbon Dioxide–Equivalent Construction Emissions

Year	CO_2e Emissions (MT/year)			
	Alternative A		Alternative B[1]	
2021	20,073		22,600/22,600	
2022	44,302		54,465/54,465	
2023	45,947		55,010/56,069	
2024	44,923		53,371/53,773	
2025	45,653		50,009/47,172	
2026	14		17/0	
Construction total	**200,911**		**235,473/234,079**	
Amortized GHG Emissions (averaged over 25 years[2])				
CO_2e per year for total construction	8,036		9,419/9,363	
Payback of GHG Emissions (months)[3]				
Ridership scenario	Medium	High	Medium	High
Payback period (project vs. 2015 existing conditions)	1.8	1.4	2.1/2.1	1.7/1.6
Payback period (project vs. 2029 No Project conditions)	4.3	6.0	5.0/5.0	7.0/7.0
Payback period (project vs. 2040 No Project conditions)	2.5	1.5	2.9/2.9	1.8/1.7

Sources: CAPCOA 2017; CARB 2018a; The Climate Registry 2017; Scholz 2018
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
MT = metric tons
Emission factors for CO_2e do not account for improvements in technology over time that would reduce emissions.
[1] Emissions are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).
[2] Project life is assumed to be 25 years.
[3] Payback periods were estimated by dividing the total GHG emissions during construction years by the annual GHG emission reduction during operations. See Table 3.3-28 for operations GHG emission-reduction data. The range in payback time represents the range of emissions changes based on the medium and high ridership scenarios and the project alternatives.

[15] A GHG emissions inventory for the project vicinity was not available at the time of the release of this document, so the comparison was made to the most recent CARB emissions inventory (2016b), which estimated that the annual CO_2e emissions in California are about 429 million metric tons (CARB 2020).

Long-term operations of the project would result in a net GHG reduction, relative to the 2015 existing conditions and the 2029 and 2040 No Project conditions. To provide a comparison to long-term project operations, construction emissions were amortized over a 25-year project life (although the actual project life would be much longer). Total amortized GHG construction emissions for the project were estimated to be 8,036 metric tons of carbon dioxide equivalent (CO_2e) per year under Alternative A, 9,419 metric tons of CO_2e per year under Alternative B (Viaduct to I-880), and 9,363 metric tons of CO_2e per year under Alternative B (Viaduct to Scott Boulevard). The increase in GHG emissions generated by construction would be offset in about 1 to 7 months of operations (because car and aircraft trips removed in the RSA by the project would reduce emissions relative to the No Project conditions), depending on the ridership scenario and alternative.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because emission reductions during operations from reduced auto and aircraft trips would offset the temporary construction-related contribution to increased GHG emissions. Construction of the project would generate GHG emissions between 2021 and 2026. However, these emissions would be fully offset in about 1 to 7 months of operations (depending on the ridership scenario and alternative). Within a few months of operation, the project would result in annual emissions reductions and a GHG benefit. Additionally, the project is identified in the CARB's AB 32 Scoping Plan and 2017 Scoping Plan as a component of a sustainable transportation system, and would be consistent with the state's plan to achieve GHG emissions reductions in the long term. GHG reductions would occur for each year that the HSR system is operational, resulting in long-term GHG reductions during the post-2020 period. Such reductions in the post-2020 period would be consistent with the statewide goal specified in SB 32. Consequently, the project would not impede the state from meeting the statewide GHG emissions targets. Therefore, CEQA does not require any mitigation.

Operations Impacts

Impact AQ#15: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions

Operations of the project have the potential to create permanent GHG impacts through operation of the stations and Brisbane LMF. The project would improve passenger rail opportunities, and it is anticipated that people would shift trips from on-road vehicles and aircraft to the HSR system, which is less emissions-intensive than other transportation modes. GHG emissions and reductions generated by project operations were quantified for the 2015, 2029, and 2040 analysis scenarios to capture changes in ridership and regional emission factors.

Table 3.3-28 summarizes the estimated net operations emissions under the medium and high ridership scenarios relative to 2015 existing conditions and the 2029 and 2040 No Project conditions (expressed in terms of CO_2e). From an operations perspective, ridership and associated emissions changes from on-road vehicles, aircraft, and power plants (used to generate electricity to power the HSR system) would be the same for both project alternatives. Emissions from operation of the stations and LMF would be the same for both alternatives. Refer to the Air Quality and Greenhouse Gases Technical Reports (Authority 2019a, 2019b) for detailed emissions results by individual source (e.g., on-road vehicles, stations).

As shown in Table 3.3-28, operations of the project under both ridership scenarios would increase indirect GHG emissions from additional electricity required to power the HSR system, as well as direct GHG emissions from operation of the stations and Brisbane LMF, relative to the 2015 existing conditions and the 2029 and 2040 No Project conditions. Electricity demands and the associated emissions from power plants would be the same for both project alternatives. Direct emissions from the stations and Brisbane LMF would also be the same for both project alternatives.

Table 3.3-28 Changes in Statewide Greenhouse Gas Emissions from Project Operations under the Medium and High Ridership Scenarios Compared to Existing, 2029, and 2040 No Project Conditions

Emission Source	Change in CO_2e Emissions from HSR (Million MT/year)	
	Medium	High
Existing Plus Project Emissions Relative to 2015 Existing Conditions		
Indirect Emissions		
On-road vehicles	-1.07	-1.47
Aircraft	-0.70	-0.67
Power plants	0.38	0.41
Direct Emissions[1]		
Stations and Brisbane LMF	0.02	0.02
Total Emissions[2]	-1.37	-1.71
2029 Plus Project Emissions Relative to 2029 No Project Conditions		
Indirect Emissions		
On-road vehicles	-0.45	-0.27
Aircraft	-0.46	-0.50
Power plants	0.32	0.35
Direct Emissions[1]		
Stations and Brisbane LMF	0.02	0.02
Total Emissions[2]	-0.58	-0.42
2040 Plus Project Emissions Relative to 2040 No Project Conditions		
Indirect Emissions		
On-road vehicles	-0.46	-1.11
Aircraft	-0.97	-0.94
Power plants	0.44	0.41
Direct Emissions[1]		
Stations and Brisbane LMF	0.02	0.02
Total Emissions[2]	-0.98	-1.62

Sources: Volume 2, Appendix 3.3-A; Authority 2019g; CAPCOA 2017
CO_2e = carbon dioxide equivalent
HSR = high-speed rail
LMF = light maintenance facility
MT = metric tons
Sum of individual values may not equal total due to rounding.
[1] Sum of station and LMF emissions. Represents the net emissions effect of the project (i.e., the difference in operating emissions between existing or No Project condition and the project condition).
[2] The total includes the indirect and direct emissions.

Although operations of the project would increase GHG emissions associated with power plants, stations, and the Brisbane LMF, it would result in emissions reductions from on-road vehicles and aircraft, relative to the 2015 existing conditions and the 2029 and 2040 No Project conditions. Reductions in single-occupancy vehicle trips and aircraft activity would achieve these emissions benefits; with more people traveling on the HSR system, fewer vehicle and aircraft miles would occur. Because the reductions in on-road vehicle and aircraft activity are directly tied to ridership, there would be no difference in emissions benefits between the alternatives. Increases in gate-down time at at-grade crossings would increase vehicle idling emissions, but this increase would be more than compensated for by the reduction in regional emissions from on-road vehicles. Ultimately, the GHG reductions achieved by changes in on-road vehicles and aircraft activity would more than offset the emissions increase from operations of the project (electricity, stations, and Brisbane LMF). Long-term operations of the project and the larger HSR system therefore would result in a net reduction in operations emissions from the 2015 existing conditions and the 2029 and 2040 No Project conditions. These emissions benefits would begin accumulating after construction emissions are offset, which as noted above, would occur within 1 to 7 months of project operation.

As described in Section 3.3.4.5, for projects to have a less-than-significant impact under CEQA on an individual and cumulative basis, the project must comply with an approved climate change action plan and demonstrate that it would not impede the state from meeting the statewide GHG emissions targets. The project is discussed in CARB's AB 32 Scoping Plan and update as a key strategy to meet California's long-term air quality and climate objectives (CARB 2017a). As indicated in Table 3.3-28, either project alternative would result in a net reduction in GHG emissions relative to the 2015 existing conditions, 2029 No Project conditions, and 2040 No Project conditions, taking into account construction emissions. Therefore, the project would have a beneficial contribution towards meeting California's GHG reduction goals. Because the project is committed to using 100 percent renewable energy for electricity and the system runs on electricity (thus displacing vehicle fossil fuel emissions), the project would also help the state meet the 2045 goal of carbon neutrality in EO B-55-18.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because operations of the project would result in net statewide reductions of GHG emissions as travel modes shift away from on-road vehicles and aircraft trips to the HSR system, which would avoid significant impacts from GHGs on the environment. Additionally, the HSR project is discussed in the CARB's AB 32 Scoping Plan and 2017 Scoping Plan and would help the state attain its GHG reductions goals as identified in AB 32, SB 32, and EO B-55-18. Consequently, the project would not impede the state from meeting the statewide GHG emissions reductions targets. Therefore, CEQA does not require any mitigation.

3.3.7 Mitigation Measures

Construction emissions of NO_X would exceed the BAAQMD threshold under both project alternatives, and would exceed the BAAQMD ROG threshold under Alternative B. Exceedances of adopted thresholds could impede implementation of applicable air quality plans. Accordingly, there would be a significant impact under CEQA associated with project construction in the BAAQMD.

Construction activities under both alternatives would not result in exceedances of applicable local air district health risk thresholds or criteria; however, they would increase existing exceedances of the CAAQS for PM_{10} and result in new exceedances of the annual CAAQS for $PM_{2.5}$.

AQ-MM#1: Offset Project Construction Emissions in the SFBAAB, would be implemented to address impacts on air quality from project construction. As discussed above, there would be no significant impacts under CEQA associated with project operations and therefore no mitigation measures are required for project operations.

AQ-MM#1: Offset Project Construction Emissions in the SFBAAB

Prior to issuance of construction contracts, the Authority would be required to enter into an MOU with the Bay Area Clean Air Foundation (Foundation), a public nonprofit and supporting organization for the BAAQMD to reduce ROG/VOC and NO_X emissions to the required levels. The required levels in the SFBAAB are as follows:

- For emissions in excess of the General Conformity *de minimis* thresholds (NO_X): **net zero**.
- For emissions not in excess of *de minimis* thresholds but above the BAAQMD's daily emission thresholds (ROG/VOC and NO_X): **below the appropriate CEQA threshold levels**.

The mitigation offset fee amount would be determined at the time of mitigation to fund one or more emissions reduction projects in the SFBAAB. The Foundation would require an additional administrative fee of no less than 5 percent. The mitigation offset fee would be determined by the Authority and the Foundation based on the type of projects available at the time of mitigation. When the CEQA threshold is exceeded, these funds may be spent to reduce ROG/VOC and NO_X emissions. When the General Conformity threshold is exceeded, these funds may be spent to reduce emissions of the O_3 precursors that exceed the threshold (in this case, NO_x), provided this is allowed by the federal CAA provisions addressing General Conformity. This fee is intended to fund emissions-reduction projects to achieve reductions, with the estimated tonnage of emissions offsets required starting in 2021. Documentation of payment would be provided to the Authority or its designated representative.

The MOU would include details regarding the annual calculation of required offsets the Authority must achieve, funds to be paid, administrative fee, and the timing of the emissions reductions projects. Acceptance of this fee by the Foundation would serve as an acknowledgment and commitment by the Foundation to undertake the following steps: (1) implement an emissions reduction project(s) within a timeframe to be determined based on the type of project(s) selected after receipt of the mitigation fee designed to achieve the emissions reduction objectives; and (2) provide documentation to the Authority or its designated representative describing the project(s) funded by the mitigation fee, including the amount of emissions reduced (tons per year) in the SFBAAB from the emissions reduction project(s). To qualify under this mitigation measure, the specific emissions reduction project(s) must result in emissions reductions in the SFBAAB that are real, surplus, quantifiable, enforceable, and would not otherwise be achieved through compliance with existing regulatory requirements or any other legal requirement. Pursuant to 40 C.F.R. Section 93.163(a), the necessary reductions must be achieved (contracted and delivered) by the applicable year in question. Funding would need to be received prior to contracting with participants and should allow enough time to receive and process applications to fund and implement off-site reduction projects prior to commencement of project activities being reduced. This would equate roughly to 1 year prior to the required mitigation; additional lead time may be necessary depending on the level of off-site emissions reductions required for a specific year.

This mitigation measure would be effective in offsetting emissions generated during construction of the project through the funding of emissions reduction projects. It is BAAQMD's experience that implementation of an MOU is feasible mitigation that effectively achieves actual emissions reductions. The Authority has conducted coordination with BAAQMD to confirm the feasibility of an MOU. Based on the performance of current incentive programs and reasonably foreseeable future growth, BAAQMD has confirmed that enough emissions reduction credits would be available to offset emissions generated by the project for all years in excess of the BAAQMD's thresholds and General Conformity *de minimis* threshold (refer to Volume 2, Appendix 3.3-B).

The implementation of this mitigation measure would not be expected to affect air quality in the BAAQMD because purchasing emissions offsets would not result in any physical change to the environment, and therefore would not result in other secondary environmental impacts. In addition to VOC and NO_X, the implementation of emissions reduction projects could reduce other criteria pollutants and GHGs. However, this would be a secondary impact of this mitigation measure and is not a required outcome to mitigate any impacts of the project.

3.3.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.5.4, the effects of project actions under NEPA are compared to the No Project condition when evaluating the impact of the project on the resource. The determination of effect was based on the context and intensity of the change that would be generated by construction and operations of the project. Table 3.3-29 compares the impacts of the project alternatives and is followed by a summary of the impacts.

Table 3.3-29 Comparison of Project Alternative Impacts for Air Quality and Greenhouse Gases

Effect	Alternative A	Alternative B
Air Quality		
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality in the SFBAAB	Temporary construction activity would generate emissions of criteria pollutants. Construction-related NO_X emissions would exceed BAAQMD significance threshold and the General Conformity threshold.	Emissions would be greater than Alternative A primarily because of construction of the passing tracks. Construction-related VOC and NO_X emissions would exceed BAAQMD significance thresholds and NO_X emissions would exceed the General Conformity threshold. Alternative B (Viaduct to Scott Boulevard) would have slightly greater emissions (except for NO_X and fugitive PM) than Alternative B (Viaduct to I-880) because of additional construction activity required for the longer viaduct.
Impact AQ#2: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions of NO_X from temporary construction activity in excess of the BAAQMD significance threshold and the General Conformity *de minimis* threshold could impede implementation of O_3 plans in the SFBAAB.	Emissions of VOC and NO_X from temporary construction activity in excess of the BAAQMD significance thresholds, and emissions of NO_X in excess of the General Conformity *de minimis* threshold could impede implementation of O_3 plans in the SFBAAB.
Impact AQ#3: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	Construction-related PM_{10} concentrations would contribute to existing exceedances of the PM_{10} CAAQS. Construction-related criteria pollutant concentrations would lead to new exceedances of the $PM_{2.5}$ CAAQS and NAAQS.	Similar to Alternative A. Emissions would be greater than Alternative A primarily because of construction of the passing tracks. Alternative B (Viaduct to Scott Boulevard) would have slightly greater emissions than Alternative B (Viaduct to I-880) because of additional construction activity required for the longer viaduct.

Effect	Alternative A	Alternative B
Impact AQ#4: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Temporary construction activity would not generate DPM or $PM_{2.5}$ concentrations in excess of BAAQMD health risk thresholds. The maximum increase in potential cancer risk (5.5 per million) and an acute Hazard Index of 0.1 would occur in the San Jose Diridon Station Approach Subsection.	Similar to Alternative A. The maximum increase in potential cancer risk (3.8 per million under Alternative B (Viaduct to I-880) and 3.9 per million under the Alternative B (Viaduct to Scott Boulevard) would occur in the San Jose Diridon Station Approach Subsection and would be less than that under Alternative A. The acute Hazard Index of 0.2 under Alternative B (with either viaduct option) would be slightly greater than Alternative A.
Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos and Lead-Based Paint	Project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to substantial pollutant concentrations. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of approximately 817,000 square feet.	Similar to Alternative A. Greater potential for exposure than Alternative A because of additional demolition associated with construction of passing tracks and aerial viaducts in San Jose. There would be limited potential for exposure of sensitive receptors to asbestos or LBP associated with demolition of approximately 1,678,000 square feet for Alternative B (Viaduct to I-880) and 1,866,000 square feet for Alternative B (Viaduct to Scott Boulevard).
Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors	There would be limited potential for odors generated by construction to affect sensitive receptors or result in nuisance complaints.	Same as Alternative A
Impact AQ#7: Continuous Permanent Direct Impacts on Air Quality in the SFBAAB	Long-term operation of the HSR system would reduce criteria pollutant emissions, relative to the No Project conditions, resulting in a regional and local air quality benefit. Annual reductions in regional emissions would range from 24 to 52 tons of VOC, 298 to 560 tons of CO, 213 to 452 tons of NO_X, 23 to 49 tons of SO_2, 2 to 34 tons of PM_{10}, and 6 to 18 tons of $PM_{2.5}$, depending on the year and ridership scenario.	Same as Alternative A
Impact AQ#8: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan	Emissions reductions from project operations would support implementation of air quality plans and attainment of regional air quality goals.	Same as Alternative A
Impact AQ#9: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)	Increased station traffic would not result in localized CO hot spots or exceedances of the CO NAAQS or CAAQS.	Same as Alternative A

Effect	Alternative A	Alternative B
Impact AQ#10: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics	Operations of the HSR system would result in a regional MSAT reduction and benefit. Increased station traffic would have a low potential for meaningful localized MSAT effects.	Same as Alternative A
Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)	The project is not considered a project of air quality concern, based on the descriptions as indicated in 40 C.F.R. Section 93.123(b)(1).	Same as Alternative A
Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Emissions of DPM and $PM_{2.5}$ from freight trains on shifted tracks, and station and LMF operation, would not expose sensitive receptors to excessive pollutant concentrations because health risks would not exceed BAAQMD's thresholds.	Same as Alternative A
Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors	Emissions-generated odors would be limited and would not be expected to affect a substantial number of people.	Same as Alternative A
Greenhouse Gases		
Impact AQ#14: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	GHG emissions generated during temporary construction of 8,036 MT CO_2e per amortized year would be offset by reductions achieved through project operations within 1 to 6 months (relative to No Project conditions).	GHG emissions generated during temporary construction of 9,419 MT CO_2e per amortized year for Alternative B (Viaduct to I-880) and 9,363 MT CO_2e per amortized year for Alternative B (Viaduct to Scott Boulevard) would be offset by reductions achieved through project operations within 2 to 7 months (relative to No Project conditions).
Impact AQ#15: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Long-term operations of the HSR system would reduce GHG emissions, relative to the No Project conditions, resulting in a statewide and regional GHG benefit. Statewide annual reductions would range from 0.4 million MT CO_2e to 1.7 million MT CO_2e, depending on the year and ridership scenario.	Same as Alternative A

BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
C.F.R. = Code of Federal Regulations
CO = carbon monoxide
CO_2e = carbon dioxide equivalent
DPM = diesel particulate matter
GHG = greenhouse gas
HSR = high-speed rail
I- = Interstate
LBP = lead-based paint
LMF = light maintenance facility
MSAT = mobile source air toxics
MT = metric tons

NAAQS = national ambient air quality standards
NO_X = nitrogen oxides
O_3 = ozone
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
SFBAAB = San Francisco Bay Area Air Basin
SO_2 = sulfur dioxide
VOC = volatile organic compound

Temporary construction activity for either project alternative would generate NO_X emissions in excess of the General Conformity *de minimis* thresholds in the SFBAAB. Construction emissions under Alternative B would be somewhat higher than under Alternative A, primarily because Alternative B includes construction of the passing tracks and aerial viaducts in San Jose.

On-site project features (AQ-IAMF#1 through AQ-IAMF#5) would minimize emissions in the SFBAAB by requiring the cleanest reasonably available equipment and control measures to limit criteria pollutant emissions from construction equipment and vehicles. The MOU (AQ-MM#1) would offset remaining NO_X emissions in excess of the General Conformity *de minimis* thresholds generated in the SFBAAB to net zero. The Authority and FRA have agreed to collaborate on the development of a General Conformity Determination. As a part of this collaboration, the Authority has developed and will provide to FRA a Draft General Conformity Determination and supporting information, as well as the Authority's proposed approach for achieving general conformity (refer to Volume 2, Appendix 3.3-B). The Draft General Conformity Determination encompasses the entire Project Section, from 4th and King Street Station in San Francisco to West Alma Boulevard, south of the San Jose Diridon Station in San Jose. Emissions and concentration results for the San Jose Diridon Station Approach Subsection are included in the Draft General Conformity Determinations for both the San Francisco to San Jose and the San Jose to Merced Project Sections. Each General Conformity Determination includes project features AQ-IAMF#1 through AQ-IAMF#5 and AQ-MM#1. The Authority would implement AQ-MM#1 and comply with other General Conformity requirements only once in the San Jose Diridon Station Approach Subsection. For purposes of accounting for and reporting of emissions and emissions offsets under General Conformity, implementation of AQ-MM#1 in the San Jose Diridon Station Approach Subsection would be assigned to either the San Francisco to San Jose Project Section or the San Jose to Merced Project Section.

Health risks from temporary construction activity for either project alternative would be less than the BAAQMD's cancer risk significance threshold of 10 in 1 million. The hazard index threshold of one would not be exceeded. Under Alternative A, the maximum increase would be a cancer risk of 5.5 per million and hazard index of 0.1. Alternative B (Viaduct to Scott Boulevard) would have a slightly greater maximum increase (cancer risk of 3.9 per million and hazard index of 0.2) than the Alternative B (Viaduct to I-880) (cancer risk of 3.8 per million and hazard index of 0.2) because of additional construction activity required for the longer viaduct. On-site project features (AQ-IAMF#1 through AQ-IAMF#5) that require the cleanest reasonably available equipment and control measures would reduce concentrations below uncontrolled levels.

Demolition activities during construction of the project could encounter asbestos and LBP. Alternative B (Viaduct to Scott Boulevard) would require about 1,866,000 square feet of demolition, and therefore has greater potential to encounter and expose receptors to impacts from asbestos and LBP compared to Alternative B (Viaduct to I-880), which would require about 1,678,000 square feet of demolition, or Alternative A, which would require about 817,000 square feet of demolition. However, project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to pollutant concentrations with respect to asbestos and LBP under both project alternatives. Odors generated during construction are not expected to affect a substantial number of people or to result in nuisance complaints.

During operations, neither project alternative would generate emissions greater than the general conformity *de minimis* thresholds because both project alternatives would reduce criteria pollutant emissions, resulting in a regional air quality benefit. Indirect emissions from electricity consumption to power the trains would be equal for both project alternatives, as would the emissions benefits from reduced on-road vehicle and aircraft activity. Station and LMF operation would generate criteria pollutant emissions from mobile (e.g., employee commuting vehicles) and area (e.g., architectural coatings) sources. Station and LMF emissions would be the same for both project alternatives. Direct emissions of fugitive dust induced by train movement would be similar for both project alternatives. The project alternatives would not conflict with any air quality plans or obstruct attainment of any air quality standards during operations.

Increased station traffic would be similar for both project alternatives and would not worsen traffic conditions to an extent that would result in localized CO or PM hot spots. Consistent with FHWA guidance, changes in local traffic conditions would have a low potential for meaningful MSAT impacts. Freight trains on shifted tracks, and station and LMF operations, would not generate DPM or $PM_{2.5}$ concentrations greater than BAAQMD's cancer and noncancer risk thresholds. Odors generated during operations would be limited and would not be expected to affect a substantial number of people or to result in nuisance complaints.

As with criteria pollutants, construction of either project alternatives would generate GHG emissions. Amortized total GHG construction emissions would be 8,036 metric tons CO_2e per year under Alternative A, 9,419 metric tons CO_2e per year under Alternative B (Viaduct to I-880), and 9,363 metric tons CO_2e per year under Alternative B (Viaduct to Scott Boulevard). Emissions reductions during long-term project operations would offset construction-related GHGs within 1 to 7 months. The overall change in GHG emissions would be approximately the same under both alternatives. As a result, neither project alternative would result in global climate change impacts from GHG emissions.

3.3.9 CEQA Significance Conclusions

As described in Section 3.1.5.4, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less-than-significant impact, or a significant impact. Table 3.3-30 identifies the CEQA significance conclusions for each impact described in Section 3.3.6. A summary of the significant impacts, mitigation measures, and factors supporting the significance conclusions after mitigation follows the table.

Table 3.3-30 CEQA Significance Conclusions and Mitigation Measures for Air Quality and Greenhouse Gases

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Air Quality			
Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality in the SFBAAB	Significant for both alternatives: Construction-related VOC (under Alternative B only) and NO_X emissions would exceed BAAQMD thresholds.	AQ-MM#1: Offset Project Construction Emissions in the SFBAAB	Less than Significant
Impact AQ#2: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan	Significant for both alternatives: Construction-related VOC (under Alternative B only) and NO_X emissions would exceed BAAQMD thresholds.	AQ-MM#1: Offset Project Construction Emissions in the SFBAAB	Less than Significant

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#3: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants	Significant for both alternatives: Construction-related criteria pollutant concentrations would contribute to existing exceedances of the CAAQS for PM_{10} and lead to new exceedances of the CAAQS for $PM_{2.5}$.	None available.	Significant and Unavoidable
Impact AQ#4: Temporary Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Less than significant for both alternatives: Construction-related DPM and $PM_{2.5}$ concentrations would not exceed BAAQMD health risk thresholds.	No mitigation measures are required	N/A
Impact AQ#5: Temporary Direct Impacts on Localized Air Quality—Exposure to Asbestos and Lead-Based Paint	Less than significant for both alternatives: Project design and compliance with existing asbestos and LBP handling and disposal standards would prevent exposure of sensitive receptors to substantial pollutant concentrations.	No mitigation measures are required	N/A
Impact AQ#6: Temporary Direct Impacts on Localized Air Quality—Exposure to Odors	Less than significant for both alternatives: Odors generated during construction would not be expected to affect a substantial number of people or result in nuisance complaints.	No mitigation measures are required	N/A
Impact AQ#7: Continuous Permanent Direct Impacts on Air Quality in the SFBAAB	Less than significant for both alternatives: Long-term operation of the HSR system would reduce criteria pollutant emissions, relative to the No Project conditions, resulting in a regional and local air quality benefit.	No mitigation measures are required	N/A
Impact AQ#8: Continuous Permanent Direct Impacts on Implementation of an Applicable Air Quality Plan	Less than significant for both alternatives: Emissions reductions from project operations would support implementation of air quality plans and attainment of regional air quality goals.	No mitigation measures are required	N/A
Impact AQ#9: Continuous Permanent Direct Impacts on Localized Air Quality—Carbon Monoxide Hot Spots (NAAQS Compliance)	Less than significant for both alternatives: Increased station traffic would not result in localized CO hot spots or exceedances of the CO CAAQS or NAAQS.	No mitigation measures are required	N/A

CEQA Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measure	CEQA Level of Significance after Mitigation
Impact AQ#10: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Mobile Source Air Toxics	Less than significant for both alternatives: Operation of the HSR system would result in a regional MSAT reduction benefit. Increased station traffic would have a low potential for meaningful localized MSAT impacts.	No mitigation measures are required	N/A
Impact AQ#11: Continuous Permanent Direct Impacts on Localized Air Quality—Particulate Matter Hot Spots (NAAQS Compliance)	Less than significant for both alternatives: Changes in on-road vehicle operation would not expose sensitive receptors to substantial concentrations of PM.	No mitigation measures are required	N/A
Impact AQ#12: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Diesel Particulate Matter and $PM_{2.5}$ (Health Risk)	Less than significant for both alternatives: Emissions of DPM and $PM_{2.5}$ from freight trains on shifted tracks, and station and LMF operations, would not expose sensitive receptors to substantial pollutant concentrations because health risks would not exceed BAAQMD thresholds.	No mitigation measures are required	N/A
Impact AQ#13: Continuous Permanent Direct Impacts on Localized Air Quality—Exposure to Odors	Less than significant for both alternatives: Odors generated by operations would not be expected to affect a substantial number of people or result in nuisance complaints.	No mitigation measures are required	N/A
Greenhouse Gases			
Impact AQ#14: Temporary Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Less than significant for both alternatives: GHG emissions generated during construction would be offset by reductions achieved through project operation within 1 to 7 months.	No mitigation measures are required	N/A
Impact AQ#15: Continuous Permanent Direct and Indirect Impacts on Global Climate Change—Greenhouse Gas Emissions	Less than significant for both alternatives: Long-term operation of the HSR system would reduce GHG emissions relative to the No Project conditions, resulting in a statewide and regional GHG benefit.	No mitigation measures are required	N/A

BAAQMD = Bay Area Air Quality Management District
CAAQS = California ambient air quality standards
CEQA = California Environmental Quality Act
CO = carbon monoxide
DPM = diesel particulate matter
GHG = greenhouse gases
HSR = high-speed rail
LBP = lead-based paint
LMF = light maintenance facility
MSAT = mobile source air toxics
N/A = not applicable

NAAQS = national ambient air quality standards
NO_X = nitrogen oxides
PM = particulate matter
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SFBAAB = San Francisco Bay Area Air Basin
VOC = volatile organic compounds

Impact AQ#1: Temporary Direct and Indirect Impacts on Air Quality in the SFBAAB

Both project alternatives would have a significant impact under CEQA because construction would result in regional VOC (under Alternative B only) and NO_X emissions that would exceed the BAAQMD's CEQA thresholds. Impacts associated with fugitive dust emissions would be minimized through implementation of a dust control plan (AQ-IAMF#1). The contractor would use low-VOC paints to limit the emissions of VOCs, which contribute to O_3 formation (AQ-IAMF#2). Exhaust-related pollutants would be reduced through use of renewable diesel fuel, Tier 4 off-road engines, and model year 2010 or newer on-road engines, as required by AQ-IAMF#3 through AQ-IAMF#5, respectively. These project features would minimize air quality impacts and associated public health consequences through application of all best available on-site controls to reduce construction emissions; however, even with these measures, construction of the project would result in exceedances of the BAAQMD's regional VOC (under Alternative B only) and NO_X thresholds.

The Authority would implement mitigation measures to offset the impacts on air quality resources. Specifically, the Authority would implement AQ-MM#1 to offset VOC (under Alternative B only) and NO_X emissions to below BAAQMD's CEQA thresholds. BAAQMD thresholds are based on emissions levels identified under the NSR program (BAAQMD 2017a). The NSR program is a permitting program that was established by Congress as part of the CAA amendments to prevent new sources of emissions degrading air quality. The NSR program requires stationary sources to obtain permits before starting construction or use of the equipment to be permitted. By permitting large stationary sources, the NSR program assures that new emissions would not slow regional progress toward attaining NAAQS. Because BAAQMD's thresholds were established to prevent emissions from new projects in the SFBAAB from contributing to CAAQS or NAAQS violations, offsetting emissions below the threshold levels would avoid potential conflicts with the ambient air quality plans, and would prevent construction of the project contributing a significant level of air pollution such that regional air quality within the SFBAAB would be degraded. Accordingly, with implementation of AQ-MM#1, the impact would be less than significant under both project alternatives.

Impact AQ#2: Temporary Direct Impacts on Implementation of an Applicable Air Quality Plan

Both project alternatives would have a significant impact under CEQA because construction would result in VOC (under Alternative B only) and NO_X emissions that would exceed the BAAQMD's threshold, which could conflict with applicable air quality plans. Project features (AQ IAMF#1 through AQ-IAMF#5) would minimize air quality impacts, although VOC (under Alternative B only) and NO_X emissions still would exceed the BAAQMD's threshold. The Authority would implement AQ-MM#1 to offset the impacts on air quality resources. Construction VOC (under Alternative B only) and NO_X emissions in BAAQMD would be offset to below air district thresholds through implementation of AQ-MM#1. Therefore, the impact would be less than significant.

Impact AQ#3: Temporary Direct Impacts on Localized Air Quality—Criteria Pollutants

Both project alternatives would have a significant impact under CEQA because construction would contribute to existing PM_{10} concentrations that exceed the CAAQS. Project features would minimize air quality impacts (AQ-IAMF#1 through AQ-IAMF#5), although PM_{10} concentrations still would exceed the CAAQS. These project features represent the best available on-site controls to reduce construction emissions, and no additional mitigation is available. Therefore, this impact would be significant and unavoidable.

The NAAQS and CAAQS are set to protect public health and the environment within an adequate margin of safety. Some individuals exposed to pollutant concentrations that exceed the CAAQS or NAAQS may experience certain acute or chronic health conditions, or both. Studies have linked particle pollution to problems such as premature death in people with heart or lung disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, decreased lung function, and increased respiratory symptoms (e.g., coughing) (USEPA 2018e). Studies have linked NO_2 pollution to the aggravation or development of certain respiratory diseases (e.g., asthma), leading to respiratory symptoms (e.g., coughing), hospital admissions, and visits to emergency rooms (USEPA 2016b).

There are no models capable of performing a meaningful project-specific correlation of project-generated NO_2 or PM emissions to specific health consequences (e.g., increased cases of asthma). Models that quantify changes in ambient air pollution and resultant health impacts were developed to support regional planning and policy analysis and have limited sensitivity to small changes in criteria pollutant concentrations induced by individual projects. Accordingly, translating project-generated NO_2 or PM emissions to increases in specific health effects, the locations where specific health impacts could occur, or the number of additional days of nonattainment cannot be estimated with a high degree of accuracy.

Although there is no available tool to model project-level NO_2 or PM health effects individually, USEPA (2018c) has developed an approach for estimating the average human health impacts related to emissions of direct $PM_{2.5}$ and $PM_{2.5}$ precursors (NO_X and SO_2).[16] These “benefit per ton” (BPT) or “incidence-per-ton” factors express the expected number of cases of specific health impacts per ton of emissions. USEPA developed BPT factors for 17 emission sectors (e.g., mobile sources) using nationwide photochemical modeling and demographic input parameters. All estimates are based on a national-scale study and do not account for location-specific meteorology, topography, geographical distribution of receptors, or photochemistry, all of which can affect pollutant dispersion and exposure. The resultant health impacts are therefore reflective of national averages and may not be exact when applied at the project level. Nevertheless, the BPT-based estimates can provide a general order-of-magnitude characterization of potential health consequences associated with project-generated direct PM and precursors to PM (with no secondary formation).

Table 3.3-31 presents the estimated incidence (i.e., number of cases) of health impacts based on the construction emissions inventory for Alternative B (Viaduct to I-880). This alternative and design option would generate the most NO_X and $PM_{2.5}$ (including fugitive) emissions of all project alternatives, and therefore represents the alternative combination with the greatest potential health burden. The estimates were developed by multiplying total project-generated $PM_{2.5}$ and $PM_{2.5}$ precursor (NO_X and SO_2) emissions (in average tons per year) by the relevant incidence per-ton metric from USEPA (2018c).[17] Note that this estimate of regional health risk is different from the estimate of localized health risk, which is based on DPM emissions (see Section 3.3.4.3).

Table 3.3-31 Estimated Incidence of Health Outcomes Based on Total Directly Emitted NO_X, SO_X, and $PM_{2.5}$ Emissions during Construction of Alternative B (Viaduct to I-880)

Health Endpoint	Incidence (cases per year)1
Premature mortality	1.3

[16] Conversion of NO_X to NO_2 occurs in the atmosphere through various chemical reactions. Due to the complex chemistry governing NO_2 and other pollution formation (e.g., O_3), USEPA was not able to derive BPT values for secondary pollutants. USEPA’s BPT estimates are therefore only applicable to direct $PM_{2.5}$ and $PM_{2.5}$ precursors (NO_X and SO_2) (with no secondary formation).

[17] Analysis does not include PM emissions from demolition and earthmoving activities because there are no applicable incidence-per-ton metrics from USEPA for these sources. Demolition and earthmoving activities represent approximately 13 percent of total construction-generated $PM_{2.5}$ emissions.

Health Endpoint	Incidence (cases per year)1
Respiratory emergency room visits	<1
Acute bronchitis	<1
Lower respiratory symptoms	11
Upper respiratory symptoms	16
Minor restricted activity days	473
Work loss days	80
Asthma exacerbation	19
Cardiovascular hospital admissions	<1
Respiratory hospital admissions	<1
Nonfatal heart attacks (Peters et al. 2001)	<1
Nonfatal heart attacks (all studies other than Peters et al. 2001)	<1

Source: USEPA 2018c
< = less than
NO_X = nitrogen oxides
SO_2 = sulfur dioxide
SO_X =sulfur oxides
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
USEPA = U.S. Environmental Protection Agency
[1] Calculated by multiplying total project-generated $PM_{2.5}$ and $PM_{2.5}$ precursor (NO_X and SO_2) emissions (in average tons per year) by the relevant incidence-per-ton metric from USEPA (2018c). USEPA's metrics are based on national data and do not account for any location-specific variables that may influence exposure to project-generated emissions. The results presented above are presented for informational purposes only. Because this is a scaled analysis based on national data, actual changes in health outcomes due to project emissions could be higher or lower than presented because of intervening effects of location of emissions, meteorology, topography, and photochemistry.

Caution should be exercised when reviewing these results because they are based on national averages and do not account for any location-specific variables that may influence exposure to project-generated emissions. This analysis is only presented for informational purposes and has no bearing on the impact determination, which is based on a comparison of pollutant concentrations to the ambient air quality standards. It is also important to consider the magnitude of project-generated emissions and potential health risks relative to ambient conditions. Construction-generated $PM_{2.5}$ emissions represent less than one-tenth of one percent of the SFBAAB's $PM_{2.5}$ emissions inventories (CARB 2017b; BAAQMD 2017b). The SFBAAB does not currently attain the $PM_{2.5}$ NAAQS or CAAQS. Certain individuals residing in areas that do not meet the CAAQS or NAAQS, or in locations adjacent to ambient sources of particle pollution, could be exposed to PM concentrations that cause or aggravate acute or chronic health outcomes (e.g., asthma, lost work days, premature mortality), regardless of project construction.