K. AIR QUALITY

1. Introduction

This section describes the air quality setting and existing conditions as they relate to the BART to Livermore Extension Project, discusses the applicable regulations, and assesses the potential impacts to air quality from construction and operation of the Proposed Project and Alternatives.

Projects such as the BART to Livermore Extension Project that result in transit service improvements typically provide regional air quality benefits by reducing the amount of vehicles on the roads. However, transit projects can also result in elevated emissions and localized air pollutant concentrations due to increased local automobile congestion around stations and other project operations such as feeder bus service, emergency generators, architectural coating application, and cleaning and maintenance of transport vehicles.

This air quality analysis is conducted to (1) quantify the regional and localized air pollutant emission changes associated with the BART to Livermore Extension Project; and (2) compare those changes to air quality standards established by local, State of California (State), and federal air quality regulatory agencies as well as to significance thresholds recommended by those agencies. Where applicable, mitigation measures that would reduce impacts are also discussed. The assessment methods used in this section are consistent with the current recommendations of the Bay Area Air Quality Management District (BAAQMD) and the California Air Resources Board (CARB).

For the purpose of this air quality analysis, the study area is defined as the area within an approximately 3,280-foot radius (1,000 meters) around the collective footprint, which is the combined footprints of the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative. Construction of the bus infrastructure improvements for the Enhanced Bus Alternative, as well as for the feeder buses for the Proposed Project and other Build Alternatives (which are anticipated to be within existing street rights-of-way) is addressed programmatically in this analysis, as described in Chapter 2, Project Description. For the bus service operations under the Enhanced Bus Alternative, as well as under the Proposed Project and other Build Alternatives, mass emissions are quantified based on anticipated routes (in and beyond the collective footprint).[1] The health risks and concentrations of particulate matter (PM) with an aerodynamic diameter of less than 2.5 microns ($PM_{2.5}$) from

[1] Arup, 2017a. BART to Livermore Extension Bus and Overall Operations and Maintenance Cost Technical Memorandum. July.

bus service are assessed for bus operations near the Dublin/Pleasanton BART Station (Dublin/Pleasanton Station) and the proposed Isabel BART Station (Isabel Station); these locations were chosen for the assessment because they are expected to have the highest occurrence of impacts due to the multiple bus lines accessing the stations for passenger pick-up and drop-off. Local concentrations of criteria pollutants are not estimated, as criteria pollutants (with the exception of $PM_{2.5}$) tend to have a potential impact on a regional rather than local level.

Comments pertaining to air quality were received in response to the Notice of Preparation for this EIR and during the public scoping meeting held for the EIR. These comments included a request for an analysis of the impacts on sensitive receptors in the city of Pleasanton near the Proposed Project and Alternatives and an analysis of the effects of ozone, particulates, and carbon monoxide (CO) on residents, particularly near the proposed Isabel Station.

2. Existing Conditions

The BART to Livermore Extension Project would be located in Alameda County, which is part of the nine-county San Francisco Bay Area Air Basin (SFBAAB). While overall air quality in the SFBAAB is generally good, it does not achieve either the State or federal standards for certain pollutants, as described in the analysis below.

This subsection describes the existing conditions for air quality in the SFBAAB, as well as local air quality conditions; the environmental setting; climate and meteorology; air pollutants and local air quality; existing sources of air pollution; and sensitive receptors.

a. Climate and Meteorology

Ambient concentrations of air pollutants are determined by the amount of emissions released by sources and the atmosphere's ability to transport and dilute those emissions. Natural factors that affect transport, pollutant transformation, and dilution include terrain, wind, atmospheric stability, and sunlight. Existing air quality conditions within the project corridor are determined by such natural factors as topography, meteorology, and climate, as well as the amount of emissions released by existing sources.

The environmental factors that affect ambient air pollutant concentrations are discussed below.

(1) Temperature Inversions

Temperature inversion layers, also called thermal inversions, are areas in which the normal decrease in air temperature with increasing altitude is reversed, i.e., air at higher altitudes is warmer than the air directly below it. The thickness of inversion layers varies considerably, from less than 100 feet to several thousands of feet. Thermal inversions limit the vertical dispersion of air pollutants and can trap pollutants close to the ground. These inversions occur most often when a warmer, less dense air mass flows over a colder, denser air mass close to the ground. The highest air pollutant concentrations in the San Francisco Bay Area (Bay Area) generally result from two types of such inversions:

- Subsidence inversions, a regional phenomenon that most commonly occurs in the Bay Area during summer and fall, when descending warmer air from the subtropical high-pressure cell centered over the Pacific Ocean caps the cooler marine air layer nearer the surface
- Radiation inversions, which are more localized and more typical of winter nights in interior parts of the Bay Area where air in contact with the ground cools more rapidly than the layer of air above it

(2) Topography and Its Effect on Wind Speeds and Patterns

Low-wind-speed conditions limit horizontal air dispersion and can result in the buildup of air pollutants. Poor air quality under low-wind-speed conditions can be especially pronounced in interior valleys, where the topography also contributes to the restriction of air movement and pollutant dispersion.

(3) Solar Radiation and Its Impact on Photochemical Pollutants

The higher intensity and longer duration of solar radiation during the Bay Area's summer months provide ultraviolet light and warm temperatures that promote the formation of secondary photochemical pollutants (e.g., ozone). Because sunlight intensity and summer temperatures are much higher in many of the Bay Area's inland valleys than in coastal areas, the inland areas are especially prone to photochemical air pollution. In contrast, photochemical pollutants do not usually reach significant levels anywhere in the Bay Area during the winter, when temperatures are lower and daylight hours are shorter.

Consequently, the inland areas of the Bay Area, which experience higher temperatures in the summer and lower temperatures in the winter, and which are sheltered from the higher winds and frequent fog that affect the coastal areas, tend to have the highest air pollution potential. Furthermore, because air pollutant levels depend on the amount of pollutants emitted locally or from upwind sources, ambient air pollution levels in inland areas tend to be higher where they are subject to emissions transported by the prevailing winds from populous upwind areas.

(4) Bay Area Climate

The Bay Area has a Mediterranean-type climate, which is influenced by a zone of high atmospheric pressure centered over the northeastern Pacific Ocean that lasts throughout much of the year. This high-pressure zone keeps storms from affecting the Bay Area in the summer, then weakens and shifts southward in the winter, allowing the passage of winter storm systems. For most of the year, prevailing winds in the Bay Area are from the west.

(5) Local Topography and Meteorology

The Livermore Valley is a sheltered inland valley near the eastern border of the SFBAAB. The western side is bordered by foothills (1,000 to 1,500 feet high) with two gaps—Hayward Pass and Niles Canyon—connecting the valley to the central SFBAAB. The eastern side of the valley is also bordered by foothills with one major passage to the San Joaquin Valley, Altamont Pass, and several secondary passages. The Black Hills and Mount Diablo lie to the north. A northwest-to-southeast channel connects the Diablo Valley to the Livermore Valley. The southern side of the Livermore Valley is bordered by mountains approximately 3,000 to 3,500 feet high.

As mentioned above, during the summer months, temperature inversions allow pollutants to become trapped and concentrated. Average summer temperatures in the Livermore Valley range from the high 80s to the low 90s, with extremes in the 100s. At other times in the summer, strong Pacific high-pressure cells from the west coupled with hot inland temperatures cause a strong onshore pressure gradient (a significant change in air pressure over a relatively short distance) that produces a strong afternoon wind. With a weak temperature inversion, air moves over the hills around Altamont Pass with ease, dispersing pollutants.

In the winter, with the exception of regional storms moving through the area, air movement is often dictated by local conditions. At night and early morning, especially under clear, calm, and cold conditions, gravity drives cold air downward. The cold air drains off the hills and moves into the gaps and passes. On the eastern side of the valley, the prevailing winds blow from north, northeast, and east out of Altamont Pass. Winds are light during the late night and early morning hours. Winter daytime winds sometimes flow from the south through Altamont Pass to the San Joaquin Valley. Average winter temperatures range from the high 50s to the low 60s, while lows are from the mid to high 30s, with extremes in the high teens and low 20s.

Air pollution potential is high in the Livermore Valley, especially for photochemical pollutants in the summer and fall, with high temperatures increasing the potential for the buildup of ozone The valley not only traps locally generated pollutants, but receives ozone and ozone precursors carried on winds from San Francisco, Alameda, Contra Costa, and Santa Clara counties. In early fall, winds commonly flow toward the northeast, carrying ozone west from the San Joaquin Valley to the Livermore Valley.

During the winter, the sheltering effect of the valley, its distance from moderating water bodies, and the presence of a strong high-pressure system contribute to the development of strong, surface-based temperature inversions. Pollutants such as CO and PM—

generated by motor vehicles, fireplaces, and agricultural burning—can become concentrated.[2]

Based on 2011 to 2015 meteorological data, prevailing winds at the Livermore Airport are westerly and west-north-westerly, with secondary winds (less than 15 percent) from the east-northeast.[3, 4] The Livermore Airport station is the closest station to the study area, and 2011 to 2015 is the most recent 5-year period for which meteorological data from that station are available.

b. Air Pollutants and Local Air Quality

(1) Federal and State Ambient Air Quality Standards

The United States Environmental Protection Agency (EPA) and the CARB have established health-based ambient air quality standards for several different pollutants. The EPA sets National Ambient Air Quality Standards (NAAQS) for the following seven pollutants, known as criteria pollutants: ozone, CO, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), PM with an aerodynamic diameter of less than 10 microns (PM_{10}), $PM_{2.5}$, and lead.

In addition, the CARB has established California Ambient Air Quality Standards (CAAQS) standards for the criteria pollutants, as well as for sulfate, visibility reducing particles, hydrogen sulfide, and vinyl chloride. The CAAQS are generally stricter than the NAAQS.

Areas can be designated as (1) attainment, where criteria pollutant concentrations are below the standards; (2) nonattainment, where criteria pollutant levels exceed the standards; (3) marginal nonattainment, where pollutant concentrations exceed the standards by a small amount; and (4) unclassified or unclassified/attainment, where insufficient data have been collected to determine classification. The attainment statuses of the SFBAAB are presented in Table 3.K-1 below.

[2] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

[3] National Climatic Data Center (NCDC), 2016a. TD-3505 Hourly Dataset. ASOS Station KLVK (Livermore Airport, WMO 724927, WBAN 23285). National Oceanic and Atmospheric Administration, National Centers for Environmental Information. Available at: ftp://ftp.ncdc.noaa.gov/pub/data/noaa/, accessed March 9, 2016. [Subset used: January 2011–December 2015.]

[4] National Climatic Data Center (NCDC), 2016b. DS-6405 1-Minute Dataset. ASOS Station KLVK (Livermore Airport, WBAN 23285). National Oceanic and Atmospheric Administration, National Centers for Environmental Information. Available at: ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/, accessed March 9, 2016. [Subset used: January 2011–December 2015.]

TABLE 3.K-1 NATIONAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS, EFFECTS, AND SOURCES

		State Standard[a]		National Standard[b]			
Pollutant	**Averaging Time**	**Concen-tration**	**Attainment Status**	**Concen-tration**	**Attainment Status**	**Pollutant Health and Atmospheric Effects**	**Major Pollutant Sources**
Ozone (O_3)	1-Hour 8-Hour	0.09 ppm 0.070 ppm	N N	[c] 0.070 ppm	[c] MN	High concentrations can directly affect lungs, causing irritation. Long-term exposure may cause damage to lung tissue.	Formed when ROGs and NO_X react in the presence of sunlight. Major sources include on-road motor vehicles, solvent evaporation, and commercial industrial mobile equipment.
Carbon Monoxide (CO)	1-Hour 8-Hour	20 ppm 9.0 ppm	A A	35 ppm 9 ppm	A A	Classified as a chemical asphyxiate, CO interferes with the transfer of fresh oxygen to the blood and deprives sensitive tissues of oxygen.	Internal combustion engines, primarily gasoline-powered motor vehicles.
Nitrogen Dioxide (NO_2)	1-Hour Annual	0.18 ppm 0.030 ppm	A -	0.10 ppm 0.053 ppm	U A	Irritating to eyes and respiratory tract. Colors atmosphere reddish-brown.	Motor vehicles, petroleum-refining operations, industrial sources, aircraft, ships, and railroads.
Sulfur Dioxide (SO_2)	1-Hour 3-Hour 24-Hour Annual	0.25 ppm – 0.04 ppm –	A - A -	0.075 ppm [d] 0.14 ppm [e] 0.030 ppm [e]	A - A [e] A [e]	Irritates upper respiratory tract; injurious to lung tissue. Can yellow the leaves of plants, destructive to marble, iron, and steel. Limits visibility and reduces sunlight.	Fuel combustion, chemical plants, sulfur recovery plants, and metal processing.
Respirable Particulate Matter (PM_{10})	24-Hour Annual	50 μg/m³ 20 μg/m³	N N	150 μg/m³ [f]	U [f]	May irritate eyes and respiratory tract, and cause decreases in lung capacity, increases in certain cancers, and increased mortality. Produces haze and limits visibility.	Dust and fume-producing industrial and agricultural operations, combustion, atmospheric photochemical reactions, and natural activities (e.g., wind-raised dust and ocean sprays).

TABLE 3.K-1 NATIONAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS, EFFECTS, AND SOURCES

		State Standard[a]		National Standard[b]			
Pollutant	**Averaging Time**	**Concen-tration**	**Attainment Status**	**Concen-tration**	**Attainment Status**	**Pollutant Health and Atmospheric Effects**	**Major Pollutant Sources**
Fine Particulate Matter ($PM_{2.5}$)	24-Hour Annual	– 12 μg/m³	– N	35 μg/m³ 12 μg/m³	N U/A	Increases respiratory disease, lung damage, cancer, and premature death. Reduces visibility and results in surface soiling.	Fuel combustion in motor vehicles, equipment, and industrial sources; residential and agricultural burning. Also formed from photochemical reactions of other pollutants, including NO_x, SO_2, and organics.
Lead	30-day Average Calendar Quarter Rolling 3-Month Average	1.5 μg/m³ – –	A – –	– 1.5 μg/m3 h 0.15 μg/m³	– A[h] U/A	Disturbs gastrointestinal system and causes anemia, kidney disease, and neuromuscular and neurological dysfunction.	Present source: lead smelters, battery manufacturing and recycling facilities. Past source: combustion of leaded gasoline.
Sulfates	24-Hour	25 μg/m³	A	–	–	Decrease in ventilator function, aggravation of asthmatic symptoms, and increased risk of cardio-pulmonary disease. Degrades visibility and can harm ecosystems and damage materials due to acidity.	Combustion of petroleum-derived fuels that contain sulfur.
Hydrogen Sulfide	1-Hour	0.03 ppm (42 μg/m³)	U	–	–	Disagreeable odor.	Bacterial decomposition of sulfur-containing organic substances.
Vinyl Chloride	24-Hour	0.010 ppm (26 μg/m³)	-	–	–	Central nervous system effects such as dizziness, drowsiness, and headaches. Long-term exposure to vinyl chloride through inhalation and oral exposure causes liver damage, can increase risk of cancer.	Used to make polyvinyl chloride plastic and vinyl products. Has been detected near landfills, sewage plants, and hazardous waste sites due to microbial breakdown of chlorinated solvents.

TABLE 3.K-1 NATIONAL AND CALIFORNIA AMBIENT AIR QUALITY STANDARDS, EFFECTS, AND SOURCES

		State Standard[a]		National Standard[b]			
Pollutant	**Averaging Time**	**Concen-tration**	**Attainment Status**	**Concen-tration**	**Attainment Status**	**Pollutant Health and Atmospheric Effects**	**Major Pollutant Sources**
Visibility Reducing Particles	8-Hour	[i]	U	–	–	Visibility impairment.	Consists of suspended PM, a complex mixture of tiny particles that consists of dry solid fragments, solid cores with liquid coatings, and small droplets of liquid.

Notes: -- = not applicable; ROG = reactive organic gas; NO_x = oxides of nitrogen; SOx = oxides of sulfur; ppm = parts per million; μg/m³ = micrograms per cubic meter. A = Attainment; N = Nonattainment; MN = Marginal Nonattainment; U = Unclassified; U/A = Unclassified/Attainment (insufficient data collected to determine classification; generally indicates low concern for the pollutant levels).

[a] California standards for ozone, CO (except Lake Tahoe), SO_2 (1-hour and 24-hour), NO_2, and PM_{10} are values not to be exceeded. The standards for Lake Tahoe CO and lead are not to be equaled or exceeded. If the standard is for a 1-hour, 8-hour, or 24-hour average (i.e., all standards except for lead and the PM_{10} annual standard), some measurements may be excluded; in particular, measurements determined by the CARB to occur less than once a year on average are excluded. The Lake Tahoe CO standard is 6.0 ppm, which is two-thirds of the national and State standard.

[b] National standards shown are the primary standards designed to protect public health. The national primary standards reflect the level of air quality necessary, with an adequate margin of safety, to protect the public health. National standards other than for ozone, particulates, and those based on annual averages are not to be exceeded more than once a year. The 1-hour ozone standard is attained if, during the most recent 3-year period, the average number of days per year with maximum hourly concentrations above the standard is equal to or less than 1. The 8-hour ozone standard is attained when the 3-year average of the fourth highest daily concentrations is 0.075 ppm or less. The 24-hour PM_{10} standard is attained when the 3-year average of the 99th percentile of monitored concentrations is less than 150 μg/m³. The 24-hour $PM_{2.5}$ standard is attained when the 3-year average of the 98th percentile is less than 35 μg/m³.

[c] The national 1-hour ozone standard was revoked on June 15, 2005.

[d] The national secondary 3-hour SO_2 standard is 0.5 ppm.

[e] On June 2, 2010, the 1971 national annual and 24-hr SO_2 standards were revoked. However, these standards remain in effect until 1 year after an area is designated for the 2010 standard, except in areas designated nonattainment for the 1971 standards, where the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standard are approved.

[f] The national annual PM_{10} standard was revoked in 2006.

[g] The national secondary annual $PM_{2.5}$ standard is 15 μg/m³. On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 μg/m³ to 12.0 μg/m³.

[h] On October 15, 2008, the national rolling 3-month average lead standard was established. The 1978 national quarterly lead standard remains in effect until 1 year after an area is designated for the 2008 standard, except in areas designated nonattainment for the 1978, where the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[i] In 1989, the CARB converted both the general statewide 10-mile visibility standard and the Lake Tahoe 30-mile visibility standard to instrumental equivalents, which are "extinction of 0.23 per kilometer" and "extinction of 0.07 per kilometer" for the statewide and Lake Tahoe Air Basin standards, respectively.

Sources:

Bay Area Air Quality Management District (BAAQMD), 2016a; California Air Resources Board (CARB), 2016a; California Air Resources Board (CARB), 2016b; California Air Resources Board (CARB), 2016c; United States Environmental Protection Agency (EPA), 2016a; United States Environmental Protection Agency (EPA), 2016b.

(2) Ambient Air Quality

Existing air quality conditions in the study area are characterized by regional monitoring data. The BAAQMD maintains one pollutant monitoring station in Livermore as well as several additional monitoring stations throughout Alameda County—i.e., in Fremont, East Oakland, West Oakland, and Berkeley. Local ambient air quality data from the county for 2013 to 2015 are summarized in Table 3.K-2. The Livermore station is the closest station to the study area; however, recent data are not consistently available for the Livermore station.[5] Therefore, when data from the Livermore station were not available, data from the next closest station within the county are shown. Details of the data selected for each given year and pollutant are provided in the table footnotes. As seen from these data, some violations of the State ozone, $PM_{2.5}$, and PM_{10} and federal ozone and $PM_{2.5}$ standards in the study area occurred during the past 3 years.

(3) Criteria Air Pollutants of Concern and Health Effects

The pollutants of greatest concern in the study area are ozone, PM_{10}, $PM_{2.5}$, and CO. The SFBAAB does not meet the State ozone, PM_{10}, and $PM_{2.5}$ standards or the federal ozone and $PM_{2.5}$ standards.

[5] The Livermore Rincon station is not equipped with an SO_2 sensor; therefore, SO_2 data were taken from the next closest monitoring station with available data in Alameda County (West Oakland). Similarly, CO and PM_{10} were not monitored at the Livermore Rincon station in 2010–2012; therefore, CO and PM_{10} data were taken from the next closest monitoring station with available data in Alameda County (East Oakland and Berkeley, respectively).

TABLE 3.K-2 AMBIENT AIR QUALITY IN ALAMEDA COUNTY

	Alameda County[a]		
	2013	2014	2015
Ozone (O_3)			
Maximum 1-hour Concentration (ppm)	**0.096**	**0.093**	**0.105**
No. Days > CAAQS (1-hour) of 0.09 ppm	3	0	1
Maximum 8-hour Concentration (National/State)[b] (ppm)	**0.077/0.077**	**0.080/0.080**	**0.081/0.082**
No. Days > CAAQS (8-hour) of 0.07 ppm	2	7	7
No. Days > NAAQS (8-hour) of 0.070 ppm	1	4	1
Carbon Monoxide (CO)			
Maximum 1-hour Concentration (ppm)	3.6	2.8	2.4
No. Days > CAAQS (1-hour) of 20 ppm	0	0	0
Maximum 8-hour Concentration (ppm)	1.8	1.5	1.4
No. Days > NAAQS and CAAQS (8-hour) of 9.0 ppm	0	0	0
Nitrogen Dioxide (NO_2)			
Maximum 1-hour Concentration (ppm)	0.051	0.049	0.050
No. Days > CAAQS (1-hour) of 0.18 ppm	0	0	0
No. Days > NAAQS (1-hour) of 0.1 ppm	0	0	0
Annual Average Concentration (ppm)	0.012	0.010	0.010
Sulfur Dioxide (SO_2)			
Maximum 1-hour concentration (ppm)	0.050	0.016	0.022
No. Days > CAAQS (1-hour) of 0.25 ppm	0	0	0
No. Days > NAAQS (1-hour) of 0.075 ppm	0	0	0
Annual Average Concentration (ppm)	0.0004	0.0004	0.0007

TABLE 3.K-2 AMBIENT AIR QUALITY IN ALAMEDA COUNTY

	Alameda County[a]		
	2013	**2014**	**2015**
Respirable Particulate Matter (PM_{10})			
Maximum 24-hour Concentration (National/State)[b] (μg/m³)	(-)/(-)	(-)/(-)	(-)/(-)
No. Days > NAAQS (24-hour) of 150 μg/m³	(-)	(-)	(-)
No. Days > CAAQS (24-hour) of 50 μg/m³	(-)	(-)	(-)
Annual Average Concentration (National/State)[b] (μg/m³)	(-)/(-)	(-)/(-)	(-)/(-)
Fine Particulate Matter ($PM_{2.5}$)			
Maximum 24-hour Concentration (National/State)[b] (μg/m³)	40.1/40.1	42.9/42.9	31.1/31.1
No. Days > NAAQS (24-hour) of 35 μg/m³	4	1.2	0
Annual Average Concentration (National/State)[b] (μg/m³)	8.4/10.3	7.6/8.5	8.8/8.8

Notes: CAAQS = California Ambient Air Quality Standards; NAAQS = National Ambient Air Quality Standards; ppm = parts per million; μg/m³ = micrograms per cubic meter; – = data not available in Alameda County. **Bold**/gray shading indicates segments that operate at unacceptable levels.
[a] Data were taken from the Livermore air monitoring station (793 Rincon Avenue) when available. When data from the Livermore station were not available, data from the next closest Alameda County air monitoring station were used. 2013–2015 CO data are from the East Oakland station (9925 International Boulevard), and 2013–2015 SO_2 data are from the West Oakland station (1100 21st Street). PM_{10} data were not monitored at any stations within Alameda County in 2013–2015.
[b] State and national statistics may differ for the following reasons: State statistics are based on California-approved samplers, whereas national statistics are based on samplers using federal reference or equivalent methods. State and national statistics may therefore be based on different samplers. State criteria for ensuring that data are sufficiently complete for calculating valid annual averages are more stringent than the national criteria.
Sources: California Air Resources Board (CARB), 2016d; Bay Area Air Quality Management District (BAAQMD), 2016b.

While the Bay Area has long met the NO_2 standards, oxides of nitrogen (NO_x) emissions are nevertheless a concern because they are precursors to ozone. Although reactive organic gases (ROGs) are not criteria pollutants, their emissions are consequential because they are also precursors to ozone.[6]

The SFBAAB is in attainment for both State and federal CO standards. CO can be a pollutant of concern if the number of motor vehicles and vehicle miles traveled (VMT) in the area continues to grow. However, due to substantial reductions in CO emissions from mobile sources since the introduction of catalytic converters in 1975, it is only under very unusual circumstances that the potential for elevated levels of CO remains.

SO_2 is no longer considered a pollutant of concern in the State because ambient levels are fairly low and the State has been in attainment for this standard for some time. SO_2 emissions have decreased substantially over the past 30 years due to improved industrial source controls and the use of natural gas instead of fuel oil for electricity generation. In addition, SO_2 emissions from mobile sources have decreased due to lower sulfur content in fuels.

(a) Oxides of Nitrogen

NO_x is a precursor to ozone and is primarily emitted through the combustion of fuel by mobile sources (e.g., passenger vehicles, buses, off-road equipment) and industrial sources (e.g., power plants). When inhaled at high concentrations, NO_2, one of the types of NO_x, can cause irritation in the respiratory system. Per the EPA, acute exposure can aggravate existing respiratory conditions (e.g., asthma) while long-term exposure may

[6] To address organic chemicals that have photochemical reactivity, the BAAQMD has defined ROGs in its CEQA Air Quality Guidelines as "classes of organic compounds, especially olefins, substituted aromatics and aldehydes, that react rapidly in the atmosphere to form photochemical smog or ozone." The EPA and BAAQMD have also defined ozone precursor gases under the term volatile organic compounds (VOCs). The EPA formally defines VOCs in 40 CFR 51.100(s) as "any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions." The BAAQMD defines VOCs in Regulation 1 as "any organic compound, as described in Section 1-233, which would be emitted during use, processing, application, curing, or drying of a solvent, surface coating, or other material." Organic compound is defined in Section 1-233 of Regulation 1 as "any compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides, or carbonates, and ammonium carbonate." Thus, the BAAQMD's definition of VOCs is more inclusive in that it does not require gases to participate in atmospheric photochemical reactions to be defined as a VOC.

In practical terms, the BAAQMD's definition of ROGs is almost equivalent to the EPA's definition of VOCs. For purposes of this section, with certain exceptions, ROGs will be referred to in the impact analysis because the BAAQMD CEQA thresholds are based on ROGs.

contribute to the development of asthma and potentially increase susceptibility to respiratory infections.[7]

(b) Reactive Organic Gases

ROGs are primarily emitted by industrial facilities, combustion of fuel by mobile and stationary sources, and use of chemical solvents and are a precursor to ozone formation. Per the EPA, exposure to ROG emissions can cause irritation of the eyes, nose, and throat; headaches; loss of coordination; nausea; and damage to the liver, kidney, and central nervous system. Some ROGs are known to cause cancer.[8]

(c) Ozone

Ozone, or smog, is not emitted directly; rather, it is formed in the atmosphere through complex chemical reactions between ROG and NO_x in the presence of sunlight. Ozone formation is greatest on warm, windless, sunny days. The main sources of NO_x and ROG, often referred to as ozone precursors, are (1) combustion processes (including motor vehicle engines); (2) the evaporation of solvents, paints, and fuels; and (3) biogenic sources. Automobiles are the single largest source of ozone precursors in the SFBAAB.

Ozone levels usually build up during the day and peak in the afternoon. Short-term exposure can cause eye irritation and airway constriction. In addition to causing shortness of breath, ozone can aggravate existing respiratory diseases such as asthma, bronchitis, and emphysema. Chronic exposure to high ozone levels can permanently damage lung tissue. Ozone can also damage plants, trees, and materials such as rubber and fabrics.

(d) Particulate Matter

PM encompasses a wide range of solid and liquid particles in the atmosphere, including smoke, dust, aerosols, and metallic oxides. In the SFBAAB, most PM stems from combustion, factories, construction, grading, demolition, agricultural activities, and motor vehicles. Motor vehicles are currently responsible for about half of all particulates in the SFBAAB. Wood burning in fireplaces and stoves is another large source of fine particulates. Some PM, such as pollen, is naturally occurring.

[7] United States Environmental Protection Agency (EPA), 2017a. Basic Information about NO2. Available at: https://www.epa.gov/no2-pollution/basic-information-about-no2#What is NO2, accessed April 24, 2017.

[8] United States Environmental Protection Agency (EPA), 2017b. Volatile Organic Compounds' Impact on Indoor Air Quality. https://www.epa.gov/indoor-air-quality-iaq/volatile-organic-compounds-impact-indoor-air-quality, accessed April 24, 2017.

The EPA currently regulates two types of PM emissions: PM_{10} and $PM_{2.5}$. PM_{10} (with particles less than or equal to 10 microns in diameter) is also referred to as respirable particulate matter. $PM_{2.5}$ (with particles less than or equal to 2.5 microns in diameter) is also referred to as fine particulate matter.

PM_{10} is of concern because it bypasses the body's natural filtration system more easily than larger particles and can lodge deeply into the lungs. PM_{10} can be emitted directly or formed in the atmosphere through complex chemical reactions from precursor pollutants such as NO_x, oxides of sulfur (SO_x), ROGs, and ammonia. $PM_{2.5}$ poses an increased health risk relative to PM_{10} because the particles can deposit more deeply in the lungs and they contain substances that are particularly harmful to human health. Exposure to PM can increase the risk of chronic respiratory disease, nonfatal heart attacks, irregular heartbeat, aggravated asthma, and decreased lung function.

(e) Carbon Monoxide

CO is an odorless, colorless gas that is formed by the incomplete combustion of fuels. The single largest source of CO in the SFBAAB is motor vehicles. Emissions are highest during cold starts, hard acceleration, low speeds, and stop-and-go driving.

When inhaled at high concentrations, CO combines with hemoglobin in the blood and lowers its oxygen-carrying capacity, resulting in reduced oxygen reaching the brain, heart, and other body tissues. This condition is especially critical for people with cardiovascular diseases, chronic lung disease, or anemia, as well as for fetuses. Even healthy people exposed to high CO concentrations can experience headaches, dizziness, fatigue, unconsciousness, and even death.

(4) Criteria Pollutant Emissions in Alameda County

Table 3.K-3 summarizes the emissions inventory for criteria air pollutants within Alameda County and within the entire SFBAAB for various source categories. According to the emissions inventory for the county, total mobile sources (both on-road and off-road) are the largest contributor to the estimated annual average air pollutant levels of reactive organic gases (ROG),[9] CO, NO_x, and SO_x, accounting for approximately 40 percent, 90 percent, 87 percent, and 57 percent, respectively, of the total inventory. Areawide sources include solvent evaporation from equipment cleaning operations; on-site fuel combustion

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[9] The California Air Resources Board (CARB) considers ROG to be a separate, distinct category from VOC. The definition of ROG can be found at:
https://www.arb.ca.gov/ei/speciate/voc_rog_dfn_11_04.pdf

In practical terms, the CARB's definition of ROGs is almost equivalent to the EPA's definition of VOCs and the BAAQMD's definition of ROGs. The term ROG is used here because the Alameda County inventory is from the CARB.

for space and water heating (such as in boilers); and landscape maintenance equipment (such as lawnmowers and leaf blowers); they account for approximately 83 percent of the PM_{10} emissions and 64 percent of the $PM_{2.5}$ emissions within Alameda County.[10]

TABLE 3.K-3 2015 ESTIMATED CRITERIA POLLUTANT EMISSIONS INVENTORIES BY SOURCE (COUNTY AND AIR BASIN)

	Tons per Day Based on Annual Average					
Source	**ROG**	**CO**	**NO_X**	**SO_X**	**PM_{10}**	**$PM_{2.5}$**
Alameda County						
Mobile	26.3	238.0	62.5	2.1	3.9	3.0
Stationary	20.4	4.8	5.7	1.6	3.7	2.1
Area	18.5	21.9	3.4	0.1	37.8	9.1
TOTAL	65.2	264.7	71.6	3.7	45.3	14.2
San Francisco Bay Area Air Basin						
Mobile	129.0	1123.4	263.6	15.0	18.1	13.9
Stationary	109.7	47.5	53.4	50.2	17.4	13.0
Area	91.9	169.0	17.6	0.6	189.7	56.2
TOTAL	330.6	1339.9	334.6	65.8	225.2	83.1

Note: Table totals may not be exact due to rounding.
Source: California Air Resources Board (CARB), 2016e.

Although mobile source emissions constitute the majority of the 2015 ROG, CO, NO_x, and SO_x inventory, in both Alameda County and the SFBAAB as a whole, corresponding emissions from this category have decreased greatly since the 1970s due to more stringent federal and State emissions controls on mobile sources and fuels. Examples of vehicle emissions standards include the CARB's low-emission vehicle standards,[11] the CARB's heavy-duty engine standards,[12] and the EPA's corporate average fuel economy

[10] California Air Resources Board (CARB), 2016e. Almanac Emission Projection Data. Available at: http://www.arb.ca.gov/app/emsinv/emssumcat.php, accessed August 19 and September 2, 2016.

[11] California Air Resources Board (CARB), 2016f. Low-Emission Vehicle Program. Available at: http://www.arb.ca.gov/msprog/levprog/levprog.htm, accessed September 2, 2016.

[12] California Air Resources Board (CARB), 2016g. Truck and Bus Regulation: On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation. Available at: http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm, accessed August 31 and September 2, 2016.

standards for passenger car and light duty trucks.[13] Examples of cleaner fuel standards include the elimination of lead from gasoline and the lowering of sulfur content in fuels.[14]

(5) Toxic Air Contaminants

In California, toxic air contaminants (TACs) are defined by the CARB as air pollutants that "may cause or contribute to an increase in deaths or in serious illness, or which may pose a present or potential hazard to human health."[15] To date, the CARB has identified more than 21 TACs and adopted the EPA's list of hazardous air pollutants (HAPs) as TACs.[16] The EPA defines HAPs as "pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects." Currently, there are 187 identified HAPs.[17]

The nature and magnitude of the potential health effects of TACs depends on the substance, concentration, and period of exposure. Some TACs cause effects in response to short-term (acute) exposure, while others cause effects only after sustained exposures over weeks, months, or years. The effects of acute exposure may be minor, such as watery eyes or respiratory irritation, or they may involve major damage, e.g., to the reproductive or nervous system. If exposure to a sufficient concentration occurs for a sufficient period, individuals may have an increased risk of developing cancer or a greater likelihood of experiencing non-carcinogenic chronic adverse effects. Chronic non-carcinogenic health effects may be minor, e.g., nasal rhinitis or respiratory irritation, or they may be serious, involving long-term damage to the immune, neurological, reproductive, respiratory, or other systems.[18]

Significant sources of TACs in the environment include industrial processes such as petroleum refining, chemical manufacturing, electric utilities, metal mining/refining, and chrome plating; commercial operations such as gasoline stations and dry cleaners; and transportation activities, particularly diesel-powered vehicles, including trains, buses, and trucks. In 1998, the CARB identified PM from diesel-powered engines as a TAC. Diesel particulate matter (DPM) emissions are estimated to be responsible for about 70 percent

[13] United States Environmental Protection Agency (EPA), 2016c. Fuel Economy and Emissions Program. Available at: http://www.epa.gov/fueleconomy/, accessed September 2, 2016.
[14] United States Environmental Protection Agency (EPA), 2016d. Fuel and Fuel Additives. Available at: http://www.epa.gov/otaq/fuels/index.htm, accessed September 2, 2016.
[15] California Air Resources Board (CARB), 2013. Glossary of Air Pollution Terms. Available at: http://www.arb.ca.gov/html/gloss.htm#T, accessed August 24, 2013.
[16] California Air Resources Board (CARB), 2011a. Toxic Air Contaminant Identification List. Available at: http://www.arb.ca.gov/toxics/id/taclist.htm, accessed August 24, 2013.
[17] United States Environmental Protection Agency (EPA), 2013. Toxic Air Pollutants. Available at: http://www.epa.gov/oar/toxicair/newtoxics.html, accessed August 24, 2013.
[18] Ibid.

of the total ambient air toxics risk. Statewide, the average potential cancer risk associated with these emissions is 500+ potential cases per million.[19]

Unlike criteria pollutants, the concentrations of individual TACs are not regulated directly; however, concentrations of TACs may be regulated indirectly based on results from a health risk assessment (HRA). An HRA is a scientifically based tool used to determine if exposure to chemical(s) pose a significant risk to human health. Table 3.K-4 summarizes the monitored concentrations of carcinogenic TACs at the BAAQMD Livermore monitoring station in 2010, the most recent year for which data are available. The concentration of TACs indicates the potential for adverse health impacts resulting from breathing ambient air and represents baseline conditions related to TACs.

According to the California Almanac of Emissions and Air Quality,[20] most of the estimated health risk from TACs in ambient air are attributed to relatively few compounds, predominantly PM exhaust from diesel-fueled engines.

DPM is a complex mixture of hydrocarbons, particulates, gases, and other compounds. DPM is emitted by diesel-fueled internal combustion engines, the composition of which varies depending on engine type, operating conditions, fuel composition, lubricating oil, and presence/absence of an emission control system. Both the California Office of Environmental Health Hazard Assessment (OEHHA) and the EPA consider DPM to be a carcinogen. The cancer potency factor derived by the California Environmental Protection Agency (Cal/EPA) for DPM is highly uncertain in both the estimation of response and the dose. In the past, due to inadequate animal test data and epidemiology data on diesel exhaust, the International Agency for Research on Cancer (IARC), a branch of the World Health Organization, had classified DPM as Probably Carcinogenic to Humans (Group 2); the EPA had also concluded that the existing data did not provide an adequate basis for

[19] California Air Resources Board (CARB), 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. Stationary Source Division and Mobile Source Division. October.

[20] California Air Resources Board (CARB), 2009a. The California Almanac of Emissions and Air Quality, Chapter 4: Air Basin Trends and Forecasts – Criteria Air Pollutants. Available at: https://www.arb.ca.gov/aqd/almanac/almanac09/chap409.htm, accessed July 2017.

TABLE 3.K-4 ANNUAL AVERAGE AMBIENT CONCENTRATIONS OF VOLATILE ORGANIC COMPOUND CARCINOGENIC TACS IN LIVERMORE

	Concentration	
Compound	**(ppb)**	**(μg/m³)**
1,3-Butadiene	0.0363	0.0803
Benzene	0.212	0.677
Carbon Tetrachloride	0.113	0.710
Chloroform	0.0188	0.0919
Ethylbenzene	0.0757	0. 328
Ethylene Dibromide[a]	ND (0.005)	ND (0.04)
Ethylene Dichloride[a]	ND (0.05)	ND (0.2)
Methylene Chloride	0.142	0.493
Perchloroethylene	0.0143	0.0969
Trichloroethylene	0.00767	0.0412
Vinyl Chloride[a]	ND (0.05)	ND (0.1)

Notes:
ND = non-detect; ppb = parts per billion; μg/m³ = micrograms per cubic meter.
Data are taken from the BAAQMD Livermore monitoring station for 2010. Concentrations in μg/m³ are calculated assuming a temperature of 25°C. and a pressure of 1 atmosphere.
All data are based on averages of 30 samples. Samples with concentrations below the method detection limit were assigned a value equal to one-half of the detection limit.
[a] Ethylene dibromide, ethylene dichloride, and vinyl chloride were not detected above the method detection limit in any of the samples; they are therefore designated as ND with one-half the detection limit in parenthesis.
Source: Bay Area Air Quality Management District (BAAQMD), 2010a.

quantitative risk assessment.[21] However, based on two more recent scientific studies,[22, 23] the IARC has reclassified DPM as Carcinogenic to Humans, placing it in Group 1.[24] This classification means that the IARC has determined that there is "sufficient evidence of carcinogenicity" of a substance in humans; it represents the strongest weight-of-evidence rating in the IARC's carcinogen classification scheme. The EPA, OEHHA, and IARC also recognize that exposure to DPM may cause non-cancer effects such as changes in lung function and airway inflammation.[25, 26, 27] DPM is a component of PM, and recent scientific data have linked prolonged exposure to PM to premature mortality, respiratory effects, and cardiovascular disease.

In 2003, the BAAQMD estimated that the carcinogenic health risks from exposure to DPM in the Bay Area was about 500-in-1-million to 700-in-1-million.[28] More recently, as part of the effort to identify and update Community Air Risk Evaluation (CARE) communities, the BAAQMD prepared projected emissions and health risk estimates for 2015, which showed resulting cancer risks in the Dublin/Pleasanton/Livermore area of 150-in-1-million to 200-in-1-million,[29] with DPM contributing more than 85 percent of the total carcinogenic potential of emissions.

Diesel trucks and buses are sources of DPM emissions within the Bay Area. Specifically, the California Department of Transportation estimated that, in 2014, approximately 9 percent of the vehicles on Interstate Highway (I-) 580 in Livermore were trucks with two

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[21] United States Environmental Protection Agency (EPA), 2002. Health Assessment Document for Diesel Engine Exhaust. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. EPA/600/8-90/057F. May.

[22] Silverman D.T., C.M. Samanic, J.H. Lubin, A.E. Blair, P.A. Stewart, R. Vermeulen, J.B. Coble, N. Rothman, P.L. Schleiff, W.D. Travis, R.G. Ziegler, S. Wacholder, M.D. Attfield, 2012. The Diesel Exhaust in Miners Study: A Nested Case-Control Study of Lung Cancer and Diesel Exhaust. J Natl Cancer Inst. October.

[23] Attfield, M.D., P.L. Schleiff, J.H. Lubin, A. Blair, P.A. Stewart, R. Vermeulen, J.B. Coble, and D.T. Silverman, 2011. The Diesel Exhaust in Miners Study: A Cohort Mortality Study With Emphasis on Lung Cancer. J Natl Cancer Inst. October 21.

[24] International Agency for Research on Cancer (IARC), 2012. Press Release No. 213. IARC: Diesel Engine Exhaust Carcinogenic. June 12.

[25] Office of Environmental Health Hazard Assessment (OEHHA), 1998. Findings of the Scientific Review Panel on The Report on Diesel Exhaust, as adopted at the Panel's April 22, 1998, meeting. April 22.

[26] Office of Environmental Health Hazard Assessment (OEHHA), 2002. Air Toxics Hot Spots Program Risk Assessment Guidelines: Part II Technical Support Document for Describing Available Cancer Potency Factors. California Environmental Protection Agency. December.

[27] United States Environmental Protection Agency (EPA), 2011. Integrated Risk Information System (IRIS). Available at: http://www.epa.gov/iris/.

[28] Bay Area Air Quality Management District (BAAQMD), 2007. Toxic Air Contaminants 2003 Annual Report. August.

[29] Bay Area Air Quality Management District (BAAQMD), 2014. Improving Air Quality and Health in Bay Area Communities. Community Air Risk Evaluation Program Retrospective & Path Forward (2004–2013). April.

or more axles.[30] Many of these trucks are diesel powered and thus contribute to DPM risks.

Based on available data, the other 10 TACs that pose the greatest risk from breathing ambient air in California are benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, ethylbenzene, chloroform, formaldehyde, methylene chloride, and perchloroethylene.[31]

(6) Odors

Odors are not generally regarded as a physical health risk. However, manifestations of a person's reaction to strong odors can range from irritation, anger, or anxiety to circulatory and respiratory system effects, nausea, vomiting, and headache.

The ability to detect odors varies considerably among the population. Some individuals are able to smell very minute quantities of specific substances; others may not have the same sensitivity, but may have sensitivities to odors of other substances. In addition, people may have different reactions to the same odor; an odor that is offensive to one person may be acceptable to another (e.g., a fast food restaurant). It is important to also note that an unfamiliar odor is more easily detected and a transient odor is more likely to result in complaints than a constant one. This is caused by a phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor and recognition only occurs with an alteration in the intensity.

Odor intensity depends on the odorant concentration in the air. When an odorous sample is progressively diluted, the odorant concentration decreases. As this occurs, the odor intensity weakens and eventually becomes so low that the detection or recognition of the odor is quite difficult. At some point during dilution, the concentration of the odorant reaches a detection threshold. An odorant concentration below the detection threshold means that the concentration in the air is not detectable by the average human.

Land uses that constitute odor sources include industrial facilities, such as asphalt batch plants, wastewater treatment facilities, and solid waste transfer facilities. Other examples of minor sources of odors include restaurants and auto body/paint shops. In general, odor dispersal occurs relatively quickly, with noticeable effects diminishing substantially with increasing distance from the source.

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[30] California Department of Transportation (Caltrans), 2014. Annual Average Daily Truck Traffic on the California State Highway System. Available at: http://www.dot.ca.gov/trafficops/census/, accessed August 31, 2016.

[31] California Air Resources Board (CARB), 2009a. The California Almanac of Emissions and Air Quality, Chapter 4: Air Basin Trends and Forecasts – Criteria Air Pollutants. Available at: https://www.arb.ca.gov/aqd/almanac/almanac09/chap409.htm, accessed July 2017.

c. Existing Sources

A number of existing air pollutant sources are located within and around the study area. Using the BAAQMD Stationary Source Screening Tool for Alameda County,[32] existing stationary sources within 1,000 feet of the collective footprint were identified, as shown in Figure 3.K-1. Per the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards, a 1,000-foot radius is generally recommended around the project property boundary to identify existing sources that may individually or cumulatively impact new receptors or contribute to the cumulative impact of new sources.[33] This 1,000-foot radius is referred to as the zone of influence, as sources located more than 1,000 feet from a receptor generally do not significantly influence the receptor. Existing stationary sources within 1,000 feet of the collective footprint include diesel-fired emergency generators, printing operations, gas stations, surface coating operations, and wipe cleaning operations.

d. Existing Sensitive Receptors

Sensitive receptors are locations where individuals with increased sensitivity to the health effects of air pollutants, such as children, hospital patients, and the elderly are usually present. Typical sensitive receptors include schools, daycare centers, parks, playgrounds, nursing homes, hospitals, and residential communities. Table 3.K-5 lists the daycare centers, hospitals, parks, playgrounds, and schools in the study area that are evaluated for health-related impacts. Other sensitive receptors also evaluated for health-related impacts include residential homes and small licensed daycare facilities operated out of private homes.

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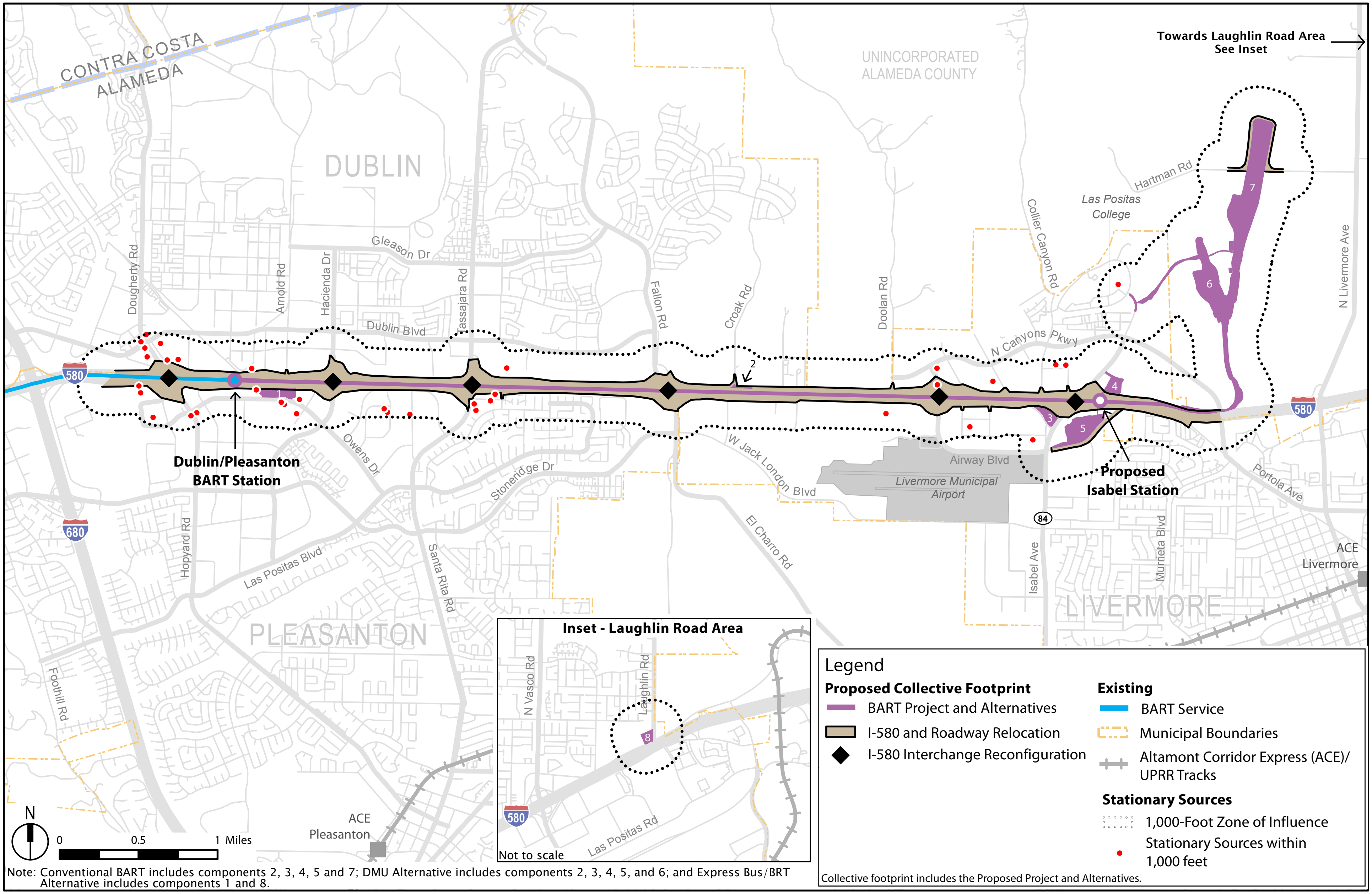
[32] Bay Area Air Quality Management District (BAAQMD), 2012a. Stationary Source Screening Tool. Available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools, accessed August 31, 2016.

[33] Bay Area Air Quality Management District (BAAQMD), 2012b. Recommended Methods for Screening and Modeling Local Risks and Hazards. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en, accessed February 2017.



Source: Arup, 2017b; BAAQMD, 2012a.

BART to Livermore Extension Project EIR

Figure 3.K-1
Air Quality
Stationary Air Pollutant Sources

TABLE 3.K-5 SENSITIVE RECEPTORS FOR HEALTH RISK ASSESSMENT

Name	Address
Daycare[a]	
Extended Day Child Care Center, Inc. - Dougherty	5301 Hibernia Street, Dublin
Kindercare Learning Center	3760 Brockton Drive, Pleasanton
La Petite Academy - Syber Kids	3 Sybase Drive, Dublin
Larpd Extended Student Service - Rancho	401 Jack London Boulevard, Livermore
New Horizons Preschool And Day Care	405 East Jack London Boulevard, Livermore
YMCA of the East Bay Y-Kids Fairlands	4151 West Las Positas, Pleasanton
YMCA of the East Bay Y-Kids Mohr	3300 Dennis Drive, Pleasanton
Hospital	
Hope Hospice Inc.	6500 Dublin Boulevard Suite. 100, Dublin
Las Positas College Student Health Center	3033 Collier Canyon Road, Livermore
Recreational	
Bray Commons	3300 Finninan Way, Dublin
Emerald Glen Park	4201 Central Parkway, Dublin
Fairlands Park	4100 Churchill Drive, Pleasanton
Las Positas Golf Course	917 Clubhouse Drive, Livermore
Los Positas College – Sports Fields	3000 Campus Hill Drive, Livermore
Meadows Park	3301 West Las Positas Boulevard, Pleasanton
Stoneridge Creek Neighborhood Park	3200 Stoneridge Creek Way, Pleasanton
Devany Square	4405 Chancery Lane, Dublin
Tri-Valley Golf Center	2600 Kitty Hawk Road 117, Livermore
YMCA	4151 West Las Positas, Pleasanton
School	
Fairlands Elementary	4151 West Las Positas Boulevard, Pleasanton
Hacienda Child Development Center	4671 Chabot Drive, Pleasanton
Hacienda School	3800 Stoneridge Drive, Pleasanton
Henry P. Mohr Elementary	3300 Dennis Drive, Pleasanton
James Dougherty Elementary	5301 Hibernia Drive, Dublin
Livermore Valley Charter School	543 Sonoma Avenue, Livermore
Rancho Las Positas Elementary	401 East Jack London Boulevard, Livermore
Tri-Valley Rop	2600 Kitty Hawk Road 117, Livermore

Note:
[a] Many licensed daycare facilities do not have formal names and may be operated out of private homes. These daycare facilities are not listed in this table for privacy reasons, but are evaluated as sensitive receptors for the health risk assessment.
Sources: Environmental Data Resources, 2017a; Environmental Data Resources, 2017b; Google Earth, 2017.

3. Regulatory Framework

This subsection describes the federal, State, and local environmental laws and policies relevant to the air quality.

a. Federal Clean Air Act

The federal Clean Air Act (CAA), as amended in 1990, establishes the framework for federal air pollution control. The CAA directed the EPA to establish the NAAQS described in Table 3.K-1. For federal nonattainment areas, the federal CAA requires the states to develop and adopt State Implementation Plans (SIPs) describing how the NAAQS will be attained. SIPs are prepared and adopted by the local or regional air districts (the BAAQMD for the Bay Area), and then reviewed and submitted to the EPA by the CARB and must be periodically modified to reflect the latest emissions inventories, planning documents, and rules and regulations of the air basins as reported by their jurisdictional agencies.

b. Federal Transportation Air Conformity

The federal CAA and EPA regulations ensure that federal transportation plans, programs, and projects conform to a SIP's purpose of eliminating or reducing the number/severity of violations of the NAAQS. Thus, transportation plans, programs, or projects cannot be approved unless projected emissions are within the limits allowed under the SIP and they do not violate local air quality standards. Regional Transportation Plans (RTPs) and Transportation Improvement Programs (TIPs) include highway or transit improvement projects that require funding or approval from the Federal Highway Administration or Federal Transit Administration. The emissions of nonattainment pollutants and precursors are calculated for all projects in RTPs and TIPs, and total emissions levels are compared to the transportation emissions limits in an SIP. The selected project must come from a conforming RTP and TIP, be included in the air quality analysis for the current conforming RTP and TIP even if not included in the RTP and TIP, or be included in a new air quality analysis showing that the current RTP and TIP would still conform if the project is implemented.

The BART to Livermore Extension Project is currently listed in both the Metropolitan Transportation Commission's RTP, known as Plan Bay Area, and its proposed updated version, the (final) draft Plan Bay Area 2040, issued in July 2017.[34] However, because BART

[34] Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC), 2013. Plan Bay Area 2013. Available at: http://files.mtc.ca.gov/pdf/Plan_Bay_Area_FINAL/Plan_Bay_Area.pdf.

(continued)

has not yet adopted the Proposed Project or one of the alternatives, the BART to Livermore Extension Project was not included in the Plan Bay Area transportation conformity modeling.

The Federal Transit Administration or Federal Highway Administration must make a project-level conformity determination prior to project approval and/or funding. As discussed in Chapter 1, Introduction, the Proposed Project, the DMU Alternative, or Express Bus/BRT Alternative would be expected to require National Environmental Policy Act (NEPA) review subsequent to completion of the CEQA process. Conformity analysis and findings would be completed by the federal lead agency in conjunction with NEPA review.

c. California Clean Air Act

The California Clean Air Act of 1988 (California CAA) focuses on attainment of the CAAQS, which, for certain pollutants and averaging periods, are more stringent than the corresponding federal standards. The CARB and local air pollution control districts are responsible for achieving the CAAQS through district-level air quality management plans. The California CAA requires the designation of attainment and nonattainment areas with respect to the CAAQS. The California CAA also requires local and regional air districts to expeditiously prepare and adopt an air quality attainment plan if the district violates the CAAQS for CO, SO_2, NO_2, or ozone. No locally prepared attainment plans are in place for areas that violate the State PM_{10} standards because attainment plans are not required for those areas. This is discussed further below.

The California CAA requires the CAAQS to be met as expeditiously as practicable, but, unlike the federal CAA, does not set precise attainment deadlines. Instead, the California CAA establishes increasingly stringent requirements for areas that require more time to attain the standards. The CARB is primarily responsible for statewide pollution sources; as such, it develops and implements air pollution control plans to achieve and maintain the NAAQS, and produces a major part of the SIP for California, incorporating local air district strategies for reducing emissions from sources under their jurisdiction. Other CARB duties include monitoring air quality; determining and updating area designations and maps; and setting emissions standards for new mobile sources, consumer products, small utility engines, and off-road vehicles.

Association of Bay Area Governments (ABAG) and Metropolitan Transportation Commission (MTC), 2017. Draft Plan Bay Area 2040 Released; Public Invited to Comment Online or at Open Houses. Available: http://www.planbayarea.org/news/news-story/draft-plan-bay-area-2040-released-public-invited-comment-online-or-open-houses, accessed April 13, 2017.

d. Local Air Quality Management Programs

The BAAQMD has jurisdiction over air quality issues within the SFAAB. The BAAQMD's responsibilities include attaining and maintaining air quality standards in the SFBAAB through air quality planning, adoption of rules and regulations, enforcement, technical innovation, issuing permits for stationary sources of air pollution, and promoting the understanding of air quality issues.

The BAAQMD prepares air quality plans with control measures to attain the NAAQS in the SFBAAB. For example, the 1994 Carbon Monoxide Maintenance Plan was developed in coordination with the Association of Bay Area Governments to ensure continued attainment of the national CO standard.

The BAAQMD has prepared both federal and State air quality plans to bring the SFBAAB into attainment with the State and federal ozone standards; the Bay Area is currently nonattainment for ozone (both State and federal). Three air quality plans exist for the Bay Area, as follows:

- 2001 Ozone Attainment Plan, which describes the Bay Area's strategy for compliance with the federal 1-hour ozone standard. Although the EPA revoked the federal 1-hour ozone standard on June 15, 2005, the emissions reduction commitments in the plan are still being carried out by the BAAQMD.[35]
- 2005 Bay Area Ozone Strategy, which reviews the region's progress reducing ozone levels. This plan describes current conditions and charts a course for future actions to further reduce ozone and ozone precursor levels in the Bay Area and to achieve compliance with the State 1-hour ozone standard.[36]
- 2010 Clean Air Plan, which provides control strategies to reduce ozone, PM, air toxins, and greenhouse gases (GHGs) from stationary and mobile sources, specifically addresses nonattainment of the State ozone standards in the SFBAAB.[37]

On April 19, 2017 the BAAQMD adopted the 2017 Clean Air Plan, which provides control strategies for ozone, PM, TACs, and GHGs, and is aimed at reducing air pollution,

[35] Bay Area Air Quality Management District (BAAQMD), 2001. Revised San Francisco Bay Area Ozone Attainment Plan for the 1-Hour National Ozone Standard. October 24. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2001-ozone-attainment-plan/oap_2001.pdf, accessed July 25, 2017.

[36] Bay Area Air Quality Management District (BAAQMD), 2006. Bay Area 2005 Ozone Strategy. January 4. Available at http://www.baaqmd.gov/~/media/files/planning-and-research/plans/2005-ozone-strategy/adoptedfinal_vol1.pdf, accessed July 24, 2017.

[37] Bay Area Air Quality Management District (BAAQMD), 2010b. Bay Area 2010 Clean Air Plan. Available at: http://www.baaqmd.gov/plans-and-climate/air-quality-plans/current-plans, accessed April 5, 2016.

protecting public health, and protecting the global climate. The 2017 Clean Air Plan includes the first ever Regional Climate Protection Strategy and has a total of 85 control measures, categorized among nine economic sectors.

In addition to the 2010 and 2017 Clean Air Plans, in 2004, the BAAQMD initiated the CARE program. This program has helped identify communities in the Bay Area that are disproportionately impacted by local emission sources. The CARE program serves as a foundation for the BAAQMD's efforts to reduce population exposure to TACs, including DPM, in communities that experience higher than average pollution levels. These communities are generally located near sources of pollution (e.g., freeways, industrial facilities), and thus have higher levels of risk from TAC exposure. The CARE program goals are as follows: (1) identify areas where air pollution contributes most to health impacts and where populations are most vulnerable to air pollution; (2) apply sound scientific methods and strategies to reduce health impacts in these areas; and (3) engage community groups and other agencies to develop additional actions to reduce local health impacts.[38]

e. Toxic Air Contaminants

Air quality regulations also focus on TACs. In general, air toxics that may cause cancer have no threshold concentration below which risks do not occur. However, standards for carcinogenic air toxics are established to reflect increased risks of 1-in-1-million to 1-in-10,000, which are the values identified as de minimis by regulatory agencies. Both the EPA's and CARB's regulation of HAPs and TACs typically reflect the de minimis risk levels noted above, while also generally requiring the use of either the maximum available control technology or best available control technology (BACT) to limit emissions. (Note: When BACT is applied to TACs, it is known as T-BACT.) These statutes and regulations, in conjunction with additional rules set forth by the BAAQMD, establish the regulatory framework for air toxics.[39]

(1) Federal

Title III of the CAA amendments requires the EPA to promulgate National Emissions Standards For Hazardous Air Pollutants (NESHAPs) for the regulation of HAPs from stationary sources. Currently, there are over 125 different types of stationary sources regulated under NESHAPs.

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[38] Bay Area Air Quality Management District (BAAQMD), 2014. Improving Air Quality and Health in Bay Area Communities. Community Air Risk Evaluation Program Retrospective & Path Forward (2004–2013). April.

[39] HAPs include 187 pollutants as defined by the EPA. TACs may include additional pollutants identified by Cal/EPA and the BAAQMD beyond those specifically defined as HAPs.

The CAA amendments also required the EPA to issue vehicle or fuel standards containing reasonable requirements to control HAP emissions, applying at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile source emissions of HAPs, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 of the CAA amendments also required the use of reformulated gasoline in selected U.S. cities (those with the most severe ozone nonattainment conditions) to further reduce mobile-source emissions, including the emissions of air toxics.[40]

(2) State

TACs in California are primarily regulated through the Tanner Air Toxics Act and the Air Toxics Hot Spots Information and Assessment Act of 1987, also known as the Hot Spots Act. The Tanner Act sets forth a formal procedure for CARB to designate substances as TACs. To date, the CARB has adopted the EPA's list of HAPs as TACs, as well as identified more than 21 additional TACs.[41]

Once a TAC is identified, the CARB adopts an Airborne Toxic Control Measure (ATCM) for sources that emit that particular TAC. If there is a concentration below which health effects are not likely to occur, the ATCM must reduce exposure below that threshold. If there is no safe concentration below which adverse health effects are not likely to occur, the measure must incorporate T-BACT to minimize emissions.

The Hot Spots Act requires existing facilities that emit toxic substances above a specified level to prepare a toxic emissions inventory; conduct a risk assessment if emissions are significant; notify the public of significant risk levels; and prepare and implement risk reduction measures.

The CARB adopted a comprehensive Risk Reduction Plan in 2000 after identifying DPM as a TAC.[42] Pursuant to this plan, the CARB adopted diesel-exhaust control measures and stringent emissions standards for various on-road and off-road sources of diesel emissions. Rules include the Public Transit Bus Fleet Rule and Emissions Standards for New Urban Buses, the California Diesel Fuel Regulations, On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation, and the In-Use Off-Road Diesel Vehicle Regulation.

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[40] United States Code. Title 42. Chapter 85. Section 7554. Urban Bus Standards.

[41] California Air Resources Board (CARB), 2011a. Toxic Air Contaminant Identification List. Available at: http://www.arb.ca.gov/toxics/id/taclist.htm, accessed August 24, 2013.

[42] California Air Resources Board (CARB), 2000. Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles. Stationary Source Division and Mobile Source Division. October.

(3) Local

At the local level, air pollution control or management districts may adopt and enforce the CARB's control measures and adopt their own TAC regulations. The BAAQMD limits emissions and public exposure to TACs primarily through Regulation 2-5 (New Source Review of Toxic Air Contaminants) and other rules, which are described by source category below.

(a) Planning Healthy Places

The purpose of the BAAQMD's Planning Healthy Places guidelines is to promote efficient and sustainable land use development while ensuring clean and healthy air for residents. Planning Healthy Places was developed on the premise that regional ambient air emissions and health risk control programs do not account for localized impacts to communities located near busy roadways, factories, airports, and other sources of air pollution.

The BAAQMD prepared these guidelines outside the CEQA context to assist developers and land use planners in addressing potential land use compatibility issues associated with locating people close to localized sources of air pollution, specifically PM and TACs. The BAAQMD identifies a list of best practices to reduce emissions or exposure to sensitive receptors located near development projects. Through Planning Healthy Places, the BAAQMD denotes regions in the Bay Area near highways and busy roadways where best practices are recommended to reduce exposure and emissions, as well as regions situated close to large and complex emissions sources (e.g., ports, refineries, and gas stations) where further study is required to assess air pollution levels.

Based on the interactive map for Planning Healthy Places, there are several discrete areas within the study area where BAAQMD recommends further study.[43] Additionally, best practices are recommended for areas adjacent to I-580 and other major roadways within the study area. These recommendations are intended for development projects that will place future residential receptors near existing sources of PM and TAC emissions.

f. Source-Specific Standards

The EPA, the CARB, and the BAAQMD administer regulations that limit criteria air pollutant, HAP, and TAC emissions (including DPM) from specific sources. The following

[43] Bay Area Air Quality Management District (BAAQMD), 2016c. Planning Healthy Places. Interactive Map of Location of Communities and Places Estimated to Have Elevated Levels of Fine Particulates and/or Toxic Air Contaminants. Available at: https://www.arcgis.com/home/webmap/viewer.html?webmap=9b240e706e6545e0996be9df227a5b8c&extent=-122.5158,37.5806,-122.0087,37.8427, accessed July 19, 2017.

subsections describe the regulations applicable to emissions sources for both the construction and operations activities of the Proposed Project and Alternatives.

(1) Mobile Off-Road Engines (Construction Phase)

Construction emissions generated from off-road construction equipment such as loaders, graders, and cranes are subject to federal and State regulations, as described below.

(a) Federal Emission Standards for Nonroad Diesel Engines

This program applies to nonroad diesel-powered engines, such as found in construction, general industrial, and port terminal equipment. The EPA established a series of emissions standards, called Tiers, for new nonroad diesel engines, culminating in the 2004 Nonroad Tier 4 Final Rule.[44, 45] The tiers require progressively more stringent emissions limits over time in which each tier is phased in over several years by engine power category—Tier 1: 1996-2005; Tier 2: 2001-2006; Tier 3: 2006-2008; Tier 4: 2008-2015.

(b) CARB Off-Road Emissions Regulation for Compression-Ignition Engines and Equipment

Similar to the EPA Nonroad Diesel Rule, the CARB Off-Road Emissions Regulation for Compression-Ignition Engines and Equipment applies to diesel engines such as those found in construction, general industrial, and port terminal equipment.[46, 47] Initially adopted in 2000 and amended in 2004, the regulation establishes Tier emissions standards, test procedures, and warranty and certification requirements. For some model years and engine sizes, the CARB Tier emissions standards are more stringent than the EPA standards.

[44] United States Environmental Protection Agency (EPA), 1998. Control of Emissions of Air Pollution from Nonroad Diesel Engines, Final Rule. Title 40 Code of Federal Regulations, Parts 9, 86, and 89. October.

[45] United States Environmental Protection Agency (EPA), 2004. Control of Emissions of Air Pollution from Nonroad Diesel Engines and Fuel, Final Rule. Title 40 Code of Federal Regulations, Parts 9, 69, 80, 86, 89, 94, 1039, 1048, 1051, 1065, and 1068. June.

[46] California Air Resources Board (CARB), 2004a. Off-Road Compression-Ignition Engines and Equipment. 13 CCR Section 2420 & Section 2425.1. December.

[47] California Air Resources Board (CARB), 2016h. New Off-Road Compression-Ignition (Diesel) Engines and Equipment. Available at: http://arb.ca.gov/msprog/offroad/orcomp/orcomp.htm, accessed August 29, 2016.

(c) State In-Use Off-Road Diesel Vehicle Regulation

In July 2007, the CARB adopted the In-Use Off-Road Diesel Vehicle Regulation and amended it in December 2011.[48, 49] The regulation requires owners of off-road mobile equipment powered by diesel engines 25 horsepower or larger to meet the fleet average or BACT requirements for NO_x and PM emissions by January 1 of each year. The regulation also establishes idling restrictions, limitations on buying/selling of older off-road diesel vehicles (Tier 0), reporting requirements, and retrofit and replacement requirements. The requirements and compliance dates vary by fleet size, with performance requirements for large fleets beginning in 2014, medium fleets in 2017, and small fleets in 2019.

(2) Mobile On-Road Engines

Construction can generate air emissions from on-road heavy-duty trucks such as haul trucks and vendor trucks. The operation of buses, maintenance trucks, and the shuttle van also generate air emissions. These sources are subject to federal and State regulations.

(a) Federal Emissions Standards for Heavy-Duty Engines and Vehicles

The EPA established a series of increasingly strict emissions standards for new engines, starting in 1988, culminating with the 2001 Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements Rule, more commonly known as the 2007 Highway Rule.[50] This rule integrated engine and fuel controls to gain emission reductions and established a PM emissions standard of 0.01 gram per horsepower-hour (g/hp-hr) for new vehicles beginning with model year 2007. NO_x and non-methane hydrocarbon standards of 0.20 g/hp-hr and 0.14 g/hp-hr, respectively, were phased in between 2007 and 2010 on a percent-of-sales basis: 50 percent from 2007 to 2009 and 100 percent in 2010.

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[48] California Air Resources Board (CARB), 2011b. Regulation for In-Use Off-Road Diesel-Fueled Fleets. Title 13, California Code of Regulations, Section 2449.

[49] California Air Resources Board (CARB), 2012. In-Use Off-Road Diesel Vehicle Regulation. Available at: http://www.arb.ca.gov/msprog/ordiesel/ordiesel.htm, accessed August 29, 2016.

[50] United States Environmental Protection Agency (EPA), 2001. Control of Air Pollution from New Motor Vehicles: Heavy-Duty Engine and Vehicle Standards and Highway Diesel Fuel Sulfur Control Requirements, Final Rule ("2007 Highway Rule"). Title 40 Code of Federal Regulations, Parts 80 and 86. January 18.

(b) State Heavy-Duty Diesel Truck Idling Regulation

The CARB adopted the in-use heavy-duty diesel truck idling ATCM in July 2004. The CARB approved the Heavy-Duty Diesel Truck Idling regulation in February 2005.[51, 52] The regulation requires in-state and out-of-state registered sleeper-berth-equipped trucks to shut down their engines if idling for longer than 5 minutes, except in the case of queuing (if the queue is located more than 100 feet from any homes or schools). Under the regulation, 2008 and newer model year heavy-duty diesel engines need to be equipped with a non-programmable engine shutdown system that automatically shuts down the engine after 5 minutes of idling or optionally meet a stringent oxides of nitrogen idling emission standard. Trucks with engines of model year 2006 or older may use any California or federally certified diesel-fueled auxiliary power system or fuel-fired heaters.

(c) Statewide Bus Truck and Bus Regulation

In addition to the 2007 Highway Rule described above, diesel buses are also subject to the CARB Statewide Truck and Bus Regulation adopted in December 2008 and amended in September 2011 and November 2014.[53, 54, 55] The regulation requires heavy-duty vehicles to be retrofitted with PM filters beginning on January 1, 2012, and requires older vehicles to be replaced starting on January 1, 2015. By January 1, 2023, nearly all trucks and buses are required to have 2010-model-year engines or the equivalent. The 2014 amendment extended the timeline to retrofit PM filters for certain categories.

(3) Emergency Generators

Diesel-fueled emergency generators are subject to a number of federal and State regulations applicable to stationary engines.

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[51] California Air Resources Board (CARB), 2004b. Airborne Toxic Control Measure to Limit Diesel-Fueled Commercial Motor Vehicle Idling. Title 13 California Code of Regulations, Chapter 10, Section 2485. July.

[52] California Air Resources Board (CARB), 2016i. Heavy-Duty Vehicle Idling Emission Reduction Program. Available at: http://www.arb.ca.gov/msprog/truck-idling/truck-idling.htm, accessed August 29, 2016.

[53] California Air Resources Board (CARB), 2016g. Truck and Bus Regulation: On-Road Heavy-Duty Diesel Vehicles (In-Use) Regulation. Available at: http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm, accessed August 31 and September 2, 2016.

[54] California Air Resources Board (CARB), 2011c. Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from in-Use On-Road Diesel-Fueled Vehicles. Title 13 California Code of Regulations, Chapter 1, Section 2025. September.

[55] California Air Resources Board (CARB), 2014. Amendments to the Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from in-Use On-Road Diesel-Fueled Vehicles. Title 13 California Code of Regulations, Chapter 1, Section 2025. November.

(a) New Source Performance Standards Subpart IIII (Stationary Compression Ignition Internal Combustion Engines)

The EPA promulgated New Source Performance Standards (NSPS) for major and minor sources on a category-by-category basis. The NSPS imposes uniform requirements on new and modified sources based on the best demonstrated technology, i.e., the best system of continuous emissions reduction that has been demonstrated to work in a given industry, considering economic costs and other factors, such as energy use. The NSPS program is implemented by the BAAQMD.

NSPS Subpart IIII applies to stationary compression ignition internal compression engines for which construction, modification, or reconstruction commenced after July 11, 2005. The requirements include emissions standards based on model year, maximum engine power, and emergency or non-emergency engine status; fuel requirements; monitoring requirements; compliance requirements; testing requirements; notification, reporting, and recordkeeping requirements; and emissions standards for special fuels.

(b) National Emission Standards for Hazardous Air Pollutants Subpart ZZZZ (Reciprocating Internal Combustion Engines)

Diesel-fueled emergency generators, as reciprocating internal combustion engines, are subject to NESHAPs Subpart ZZZZ. This regulation requires that new reciprocating internal combustion engines (defined as constructed or reconstructed on or after June 12, 2006) at an area source of HAPs meet the emission limits and work practices under NSPS Subpart IIII.[56] No other requirements under NESHAPs Subpart ZZZZ apply to new engines.

(c) State Airborne Toxic Control Measure for Stationary Internal Combustion Engines

The CARB ATCM for Stationary Compression Ignition Engines was adopted in 2004 and amended in May 2011 with the goal of reducing criteria pollutant and DPM emissions from diesel-fueled stationary compression ignition engines. The ATCM outlines emissions standards, fuel use requirements, and operational hour limitations for prime and emergency backup engines. The 2011 amendments harmonized many of the ATCM requirements with 2006 EPA Standards of Performance for Stationary Compression-Ignition Internal Combustion Engines (NSPS Subpart IIII); however, some ATCM emissions standards and other requirements are more stringent than the NSPS.

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[56] An area source of HAPs is defined as a source that is not a major source. A major source emits 10 tons/yr or more of a single HAP or 25 tons/yr or more of a combination of HAPs. As HAP emissions from the BART facility will be much lower than the 10-tons/yr threshold, it is considered an area source.

(d) BAAQMD Regulation 2-5 (New Source Review of Toxic Air Contaminants)

BAAQMD regulates stationary sources of TACs through Regulation 2-5. Sources that have the potential to emit TACs greater than trigger levels defined in Regulation 2-5 are required to obtain permits from the BAAQMD, unless specifically exempted from permitting. Permits may be granted if the sources are constructed and operated in accordance with applicable regulations, including New Source Review Standards (BAAQMD Regulation 2-2) and ATCMs. The BAAQMD evaluates TAC-emitting stationary sources based on the quantity and toxicity of the TAC emissions, as well as the proximity of the facilities to sensitive receptors.

Emergency generators are a source of DPM, a TAC, and are therefore subject to Regulation 2-5. An exemption from the requirements of Regulation 2-5 exist for emergency generators smaller than 50 horsepower. However, the emergency generators proposed under the Proposed Project and the DMU Alternative are larger than 50 horsepower. If it is determined that the emergency generators will result in an increased cancer risk greater than 1-in-1-million and/or a chronic hazard index greater than 0.20, the emergency generators must implement T-BACT to reduce emissions.[57] If all sources subject to permitting, as part of the same project, cannot reduce the risk below the project threshold (cancer risk of 10-in-1-million, chronic hazard index of 1.0, or acute hazard index of 1.0) even after implementing T-BACT, the BAAQMD will deny the permit. The BAAQMD permit requirements help limit emissions from new sources and reduce emissions from existing sources by requiring them to apply new technology when retrofitting.

(e) BAAQMD Regulation 9-8 (Internal Combustion Engines)

Regulation 9-8 provides standards for the control of NO_x and CO from internal combustion engines. The regulation's emissions standards do not apply to emergency generators; however, emergency generators are limited to up to 50 hours of reliability-related activities within a calendar year. The regulation also requires recordkeeping.

(4) Diesel Multiple Units

(a) Federal Off-Road Diesel Engine Emissions Control Program (40 CFR Part 89)

This program applies to off-road diesel-powered engines, including passenger locomotives with total rated power equal to or less than 750 kilowatts. This is a tiered approach established by the EPA to lower the emissions standards for several categories

[57] T-BACT for emergency generators is being below the PM_{10} emission standard of 0.15 grams per brake horsepower-hour. This is achieved by all new emergency generators per the California ATCM for Stationary Internal Combustion Engines.

of off-road engines, such as diesel-powered trains, in which each tier is phased in over several years by engine power category—Tier 1: 1996–2005; Tier 2: 2001–2010; Tier 3: 2006–2010; and Tier 4: 2008–2015.

(b) State Heavy-Duty Off-Road Compression Ignition Engine Program (13 CCR 1956.1–1956.4; 13 CCR 1956.8)

This State rule established exhaust emissions standards for off-road heavy-duty diesel engines that have become increasingly more stringent based on the horsepower and model year, and complements the EPA program described above.

(c) State Diesel Requirements (13 CCR 2281, 13 CCR 2282, 13 CCR 2456[e]2)

All diesel fuel sold or supplied in California for motor vehicle use was required to meet or exceed formulation requirements, including a sulfur content no greater than 15 parts per million (ppm) by weight, as of September 1, 2006.

(5) Maintenance/Storage Facilities

(a) BAAQMD Regulation 8-1 (General Provisions)

Regulation 8-1 provides general requirements for organic compounds. The storage or disposal of cloth or paper impregnated with organic compounds used for surface preparation or cleanup, or for coating, ink, or paint removal, must be in closed containers.

(b) BAAQMD Regulation 8-16 (Solvent Cleaning Operations)

Regulation 8-16 requires monthly recordkeeping, indicating the type and quantity of solvent used in wipe cleaning. Records must be retained and available for inspection by the BAAQMD for the previous 24-month period.

(6) Diesel Fuel Requirements

In addition to the source-specific standards that are typically met through emissions control technologies, the EPA and the CARB also directly regulate the diesel fuel used in many project emission sources.

(a) Federal Highway Diesel Fuel Sulfur Requirements

The 2007 Highway Rule also required refineries to begin producing highway diesel fuel that meets a maximum sulfur standard of 15 ppm, known as ultra-low-sulfur diesel, by June 2006. All 2007 and later model year diesel-fueled vehicles must be refueled with ultra-low-sulfur diesel.

(b) Federal Nonroad Diesel Fuel Sulfur Requirements

This rule required low-sulfur (500 ppm) diesel fuel to be phased in starting in 2007, and required ultra-low-sulfur diesel (15 ppm) to be phased in over the 2010–2012 period for nonroad, locomotive, and marine engines.[58] The California Diesel Fuel Regulations (described below) generally preempt this rule for other sources such as construction equipment and require ultra-low-sulfur diesel at an earlier date.

(c) California Diesel Fuel Regulations

In 1988, the CARB proposed an initial diesel fuel regulation limiting the sulfur content and aromatic hydrocarbon content of diesel fuel for motor vehicles and identified particulate emissions from diesel-fueled engines as a TAC. The 1988 initial diesel fuel regulation was subsequently amended and additional regulations regarding diesel fuel were passed. Current standards for the sale of diesel fuel in California require a sulfur limit of 15 ppm,[59] an aromatic hydrocarbon limit of 10 percent by volume,[60] and a minimum lubricity level of a maximum wear scar diameter of 520 microns based on ASTM International test method D6079-02, Standard Test Method for Evaluating Lubricity of Diesel Fuels by the High Frequency Reciprocating Rig.[61, 62]

These State regulations establish the same fuel sulfur content limits as the federal diesel fuel regulations described above (15 ppm or 0.0015 percent); however, the State fuel regulations accelerate the effective dates of the requirements for non-highway applications within California by 3 to 5 years.

g. Odors

Because odors are typically considered a local air quality problem, the EPA has not established any odor regulations. Instead, the BAAQMD enforces rules that pertain to odors in the SFBAAB. Although offensive odors rarely cause physical harm, they can be unpleasant and generate citizen complaints. The BAAQMD's Regulation 7 (Odorous Substances) places general limitations on odorous substances and specific emission limitations on certain odorous compounds. This regulation does not apply until the air pollution control officer receives, within a 90-day period, 10 or more odor complaints

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[58] This applies only to diesel fuel, as opposed to marine residual fuel, which is more typically used for very large ocean-going vessels.

[59] California Air Resources Board (CARB), 2004c. Amendments to the California Diesel Fuel Regulations, Sulfur Content of Diesel Fuel. 13 CCR §2281. August.

[60] California Air Resources Board (CARB), 2004d. Amendments to the California Diesel Fuel Regulations, Aromatic Hydrocarbon Content of Diesel Fuel. 13 CCR Section 2282. August.

[61] California Air Resources Board (CARB), 2004e. Amendments to the California Diesel Fuel Regulations, Lubricity of Diesel Fuel. 13 CCR §2284. August.

[62] California Code of Regulations, Title 13, Sections 2281, 2282, and 2284.

alleging that a person or entity has caused odors, at or beyond the source's property line, that are perceived to be objectionable by the complainants in the normal course of their work, travel, or residence. At this point, the limits in the regulation become effective until such time as no complaints have been received by the air pollution control officer for 1 year. The limits in the regulation become applicable again if the air pollution control officer receives odor complaints from five or more complainants within a 90-day period.

4. Impacts and Mitigation Measures

This subsection lists the standards of significance used to assess impacts, discusses the methodology used in the analysis, describes the analysis scenarios, summarizes the impacts, and then provides an in-depth analysis of the impacts with mitigation measures identified as appropriate.

a. Standards of Significance

For the purposes of this EIR, impacts on air quality are considered significant if the Proposed Project or one of the Alternatives would result in any of the following:

- Conflict with or obstruct implementation of the applicable air quality plan
- Violate any air quality standard or contribute substantially to an existing or projected air quality violation
- Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in nonattainment under an applicable NAAQS or CAAQS, specifically by exceeding quantitative thresholds for ozone precursors
- Expose sensitive receptors to substantial pollutant concentrations
- Create objectionable odors affecting a substantial number of people[63]

In 2017, the BAAQMD released the most recent update to its CEQA Air Quality Guidelines.[64] This is an advisory document that provides the lead agency, consultants, and project applicants with uniform procedures for addressing air quality in environmental documents. To assist in identifying projects with significant impact, the guidelines recommend CEQA numerical thresholds of significance for certain criteria air pollutants, TACs, and $PM_{2.5}$ for use by lead agencies.[65] These thresholds of significance are for

[63] BAAQMD thresholds list five confirmed complaints per year averaged over 3 years.
[64] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.
[65] Ibid.

individual project emission levels that would be cumulatively considerable. There are no separate cumulative thresholds of significance for criteria air pollutant emissions.

(1) Criteria Pollutants (Construction)

The following quantifiable criteria are used in this Draft EIR to define construction significance for criteria pollutants:

- Emissions of ROG, NO_x, or $PM_{2.5}$ (exhaust) exceeding 10 tons per year (tons/yr) or 54 pounds per day (lbs/day)
- Emissions of PM_{10} (exhaust) exceeding 15 tons/yr or 82 lbs/day
- Increase in the annual average $PM_{2.5}$ concentration greater than 0.3 microgram per cubic meter ($\mu g/m^3$)
- Cumulative annual average $PM_{2.5}$ concentration greater than 0.8 $\mu g/m^3$

(2) Criteria Pollutants (Operational)

The following quantifiable criteria are used in this Draft EIR to define operational significance:

- Emissions of ROG, NO_x, or $PM_{2.5}$ (exhaust) exceeding 10 tons/yr or 54 lbs/day
- Emissions of PM_{10} (exhaust) exceeding 15 tons/yr or 82 lbs/day
- Contribution to ambient CO concentration leading to an exceedance of the CAAQS of 9 ppm averaged over 8 hours or 20 ppm averaged over 1 hour, or the NAAQS of 9 ppm averaged over 8 hours or 35 ppm averaged over 1 hour
- Increase in the annual average $PM_{2.5}$ concentration greater than 0.3 $\mu g/m^3$
- Cumulative annual average $PM_{2.5}$ concentration greater than 0.8 $\mu g/m^3$

(3) Toxic Air Contaminants

To assist in identifying projects with significant impacts, the BAAQMD has recommended numerical significance criteria for TAC impacts for use by lead agencies.[66] If the project does not comply with a qualified Community Risk Reduction Plan, the following quantifiable criteria are used in this Draft EIR to define construction and operational significance:

- Expose the public to carcinogenic TACs that would increase the probability of contracting cancer for the maximally exposed individual that exceeds 10-in-1-million (100-in-1-million for cumulative impacts)

[66] Ibid.

- Expose the public to non-carcinogenic TACs that would result in an acute or chronic hazard index greater than 1 (10 for cumulative impacts).

b. Impact Methodology

The methodology used to evaluate the significance of impacts is described below. The EMU Option would generally result in the same impacts as the DMU Alternative; therefore, the analysis and conclusions for the DMU Alternative also apply to the EMU Option, except where specifically noted in the analysis below. In these cases, the impacts associated with the EMU Option are described immediately following the analysis of the DMU Alternative.

Emissions of criteria pollutants are compared with mass emissions thresholds. Local concentrations of these criteria pollutants are not estimated because their potential impacts, with the exception of $PM_{2.5}$, are at the regional rather than local level.

By contrast, emissions of TACs and $PM_{2.5}$ and their associated health impacts are evaluated at the local level because of their potential to impact individuals near project emission sources. In accordance with the BAAQMD's 2017 CEQA Air Quality Guidelines,[67] the zone of influence of an emissions source is 1,000 feet. Beyond this 1,000-foot radius, it is not expected that the non-project sources of TACs would have a cumulative health risk impact on sensitive receptors. As described in the Introduction subsection above, the study area for impacts of TACs and $PM_{2.5}$ is conservatively defined as the area within 3,280 feet (1,000 meters) of the collective footprint.

The impacts analysis for mass emission thresholds, $PM_{2.5}$ concentration thresholds, and health risk are evaluated for two separate years: 2025 (corresponding to the project opening year) and 2040 (corresponding to the horizon year). For each of these two years, the impacts are evaluated against the No Project Conditions. For example, the change between the 2025 No Project Conditions and the 2025 Project Conditions represents the net emissions increase or decrease attributed to the Proposed Project or an alternative in 2025. Similarly, the change between the 2025 No Project Conditions and the 2025 Cumulative Conditions represents the net emissions increase or decrease attributed to the Proposed Project or an alternative under Cumulative Conditions.

(1) Criteria Pollutants

Criteria pollutant emissions were calculated for the Proposed Project and Alternatives. The analysis is consistent with the California Emission Estimator Model version 2013.2.2

[67] Ibid.

(CalEEMod®).[68] The analysis is based on the CalEEMod® methodology described in Appendix A of the CalEEMod® User's Guide and the default data tables in Appendix D of the CalEEMod® User's Guide, with certain modifications to methodologies as described below for construction and operations. Tables 1 through 10 of Appendix H provide specific details on the calculation of construction emissions, and Tables 11 through 30 of Appendix H provide details on the calculation of operational emissions.

The subsections below describe calculation methodologies for operational emissions followed by construction-related emissions.

(a) Calculation Methodologies for Construction Emission Sources

Project construction would generate criteria air pollutant emissions through the use of heavy-duty construction equipment, off-gassing from architectural coatings and asphalt paving, and truck haul trips, and from construction workers and vendors traveling to and from the project site. Mobile source emissions would be generated from the use of construction equipment, including but not limited to excavators, bulldozers, compactors, forklifts, and cranes, and would include emissions of NO_x, ROG, PM_{10}, and $PM_{2.5}$. The assessment of construction air quality impacts considers each of these sources and recognizes that construction emissions can vary substantially from day to day, depending on the level of activity; the specific type of operation; and, for dust, the prevailing weather conditions.

Criteria pollutant emissions from on-road and off-road diesel vehicles were calculated using EMFAC2014 emissions factors.[69] Project-specific construction schedule, equipment lists, and vehicle trip data were used where known. In cases where project-specific data were not available, default data provided by CalEEMod® were used. Default data (such as emissions factors, trip lengths, and vehicle fleet mix) have been provided by the various air districts throughout California to account for local requirements and conditions.

Construction of the Proposed Project or the DMU Alternative was assumed to occur over an approximately 48-month period beginning in 2020.[70] Construction of the Express Bus/BRT Alternative was assumed to occur over a 52-month period beginning in 2020. Construction off-road equipment operating schedules were provided by BART. The model default fleet mix was used to compute construction equipment exhaust emissions rates.

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[68] California Air Pollution Control Officers Association (CAPCOA), 2013. California Emissions Estimator Model. Available at: http://www.caleemod.com, accessed February 2017.

[69] Emission factors for 2020 were conservatively used for all years of construction.

[70] As described in Chapter 2, Project Description, construction is expected to begin in 2021; however, this analysis assumes a construction start date of 2020. Because construction equipment fleets are expected to become cleaner over time due to fleet turnover and air quality regulations for diesel equipment, a conservative emissions estimate is provided.

In addition, ROG emissions from architectural coatings were calculated assuming 150 grams per liter for exterior coating and 100 grams per liter for interior coating to account for the BAAQMD's Regulation 8, Rule 3, which applies to the volatile organic compound (VOC) content of paints and solvents sold and used in the region.[71] ROG emissions from asphalt paving off-gassing were calculated using an emissions factor from the South Coast Air Quality Management District study as reported in Appendix A of the CalEEMod® User's Guide.

Construction activities for the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would occur along the project corridor. For the purpose of this analysis, the corridor was divided into segments. The equipment usage and construction schedule were provided by segment, and emissions were therefore calculated for each segment. Daily emissions (in lbs/day) were calculated based on the sum of construction emissions from all segments divided by the construction duration for each alternative, assuming 365 days of construction per year.

In addition to the bus-related facilities that would be installed for the proposed Isabel Station (included in the discussion of the methodology above), other bus infrastructure improvements, such as bus shelters, bus bulbs, and transit signal priority, would be installed under the Proposed Project and Build Alternatives. Because specific details on construction equipment and schedule for these activities are unknown at this time, the construction emissions from bus improvements were conservatively calculated by scaling the total construction emissions from the Proposed Project (not including the storage and maintenance facility) using the ratio of assumed construction duration for bus improvements (2 months) to the total construction duration for the Proposed Project (48 months). These emissions were then added to the construction emissions calculated for the Proposed Project and each alternative.

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[71] The BAAQMD regulations for paint are specifically for VOCs. However, the BAAQMD CEQA thresholds for mass emissions of ozone precursors addresses ROGs, not VOCs. BAAQMD Regulation 1 defines VOCs as "any organic compound, as described in Section 1-233, which would be emitted during use, processing, application, curing, or drying of a solvent, surface coating, or other material." Organic compound is defined in Section 1-233 of Regulation 1 as "any compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides, or carbonates, and ammonium carbonate." (Note the difference between the BAAQMD and EPA definitions of VOCs. The EPA's definition requires that the organic compounds be photochemically reactive, while the BAAQMD's definition does not, and is therefore more encompassing.)

The BAAQMD CEQA Air Quality Guidelines define ROGs as "classes of organic compounds, especially olefins, substituted aromatics and aldehydes, that react rapidly in the atmosphere to form photochemical smog or ozone."

In practical terms, ROGs are a subset of VOCs (as defined by the BAAQMD) as not all organic compounds will react rapidly in the atmosphere to form photochemical smog or ozone. Depending on the source, the percentage of VOCs that are ROGs is typically very high (i.e., close to 100 percent). Thus, for purposes of this section, ROG emissions are conservatively assumed to be equivalent to VOC (as defined by BAAQMD) emissions.

(b) Calculation Methodologies for Operational Emission Sources

Operations of the Proposed Project and Alternatives would result in emissions of criteria air pollutants and ozone precursors, including ROG, NO_x, PM_{10}, and $PM_{2.5}$, from a variety of sources, including mobile on-road sources and sources on BART property. Operational emissions calculation methodologies address the following emission sources, for the Proposed Project or Build Alternatives, as indicated below.

- For on-road vehicles:
  - Net changes in passenger vehicle traffic (Proposed Project and Build Alternatives)
  - Net changes in bus miles (Proposed Project and Build Alternatives)
- For diesel combustion:
  - Emergency generators (Proposed Project and DMU Alternative)
  - Diesel combustion by DMU vehicles (DMU Alternative)
  - Diesel-fueled maintenance trucks at the DMU storage and maintenance facility (DMU Alternative)
  - Diesel-fueled shuttle van for transporting train operators between the BART storage and maintenance facility and the Isabel Station (Proposed Project)
- For area sources of emissions:
  - Architectural coatings (Proposed Project, DMU Alternative, and Express Bus/BRT Alternative)
  - Solvent usage at the BART and DMU maintenance facilities (Proposed Project and DMU Alternative)

Passenger Vehicle Traffic (Proposed Project and Build Alternatives)

The implementation of the Proposed Project or any of the alternatives would change passenger vehicle traffic as people could decide to use public transportation or otherwise change their transportation patterns due to the Proposed Project or Build Alternatives.

As described in Section 3.B, Transportation, the change in annual VMT and annual trips between the 2025 No Project Conditions and 2025 Project Conditions was used to quantify the change in emissions. In this analysis, the change is referred to as the Proposed Project in 2025 or 2025 Alternative (DMU Alternative, Express Bus/BRT Alternative, or Enhanced Bus Alternative). Similarly, the change between the 2040 No Project Conditions and 2040 Project Conditions was quantified and is referred to as the 2040 Proposed Project or 2040 Alternative (DMU Alternative, Express Bus/BRT Alternative, or Enhanced Bus Alternative).

The net change in overall VMT from the No Project Condition for each alternative is shown in Table 3.K-6. Emissions were calculated using EMFAC2014 emission factors for 2025 and 2040. Traffic activity was annualized by applying a conversion factor of 300 to average weekday VMT and trips, to account for lower weekend traffic activity, consistent with the methodology used in the Plan Bay Area 2040 Draft EIR.

TABLE 3.K-6 CHANGE IN ANNUAL NET PASSENGER VMT

	Net New Annual VMT	
	2025	**2040**
Project Conditions		
Conventional BART Project	-38,250,574	-73,770,403
DMU Alternative	-28,578,215	-42,745,966
Express Bus/BRT Alternative	-13,357,023	-28,586,697
Enhanced Bus Alternative	-75,668	-2,722,388
Cumulative Conditions		
Conventional BART Project	-32,649,225	-82,390,212
DMU Alternative	-21,858,079	-49,924,896
Express Bus/BRT Alternative	-19,509,613	-34,691,838
Enhanced Bus Alternative	-8,705,948	-8,834,264

Notes: VMT = vehicle miles traveled
Net new annual VMT is the net change in VMT between the Proposed Project (or Alternative) and No Project Condition for the specified year (2025 or 2040). A net negative VMT indicates that the Proposed Project or the Alternative would result in a net reduction in VMT.
Source: Cambridge Systematics, 2017.

Buses (Proposed Project and Build Alternatives)

Emissions from buses are calculated based on distance traveled (in miles) and emissions factors. The distance traveled is calculated based on the roundtrip distance (in miles) for each new and modified bus route. Emission factors for buses operated by Central Contra Costa Transit Authority, San Joaquin Regional Transit District, Modesto Area Express, and Amtrak California are from EMFAC2014 for 2025 and 2040 operational years. EMFAC2014 provides estimated county-specific average emissions factors for future years, and is a suitable source of data for when agency specific emissions factors are not available.

Emissions factors specific to buses operated by Livermore-Amador Valley Transit Authority (LAVTA) were available and are used in this analysis. Buses operated by LAVTA are subject to the Fleet Rule for Transit Agencies – Urban Bus Requirements, and are required to reduce DPM emissions to 0.01 grams per brake horsepower-hour (g/bhp-hr) and NO_x

emissions to 4.8 g/bhp-hr.[72] Therefore, PM and NO_x emissions from buses for 2025 and 2040 that would be operated on LAVTA routes were calculated based on emissions of 0.01 g/bhp-hr and 4.8 g/bhp-hr, respectively. Idling emissions for all buses are based on EMFAC2014 emissions factors. Anticipated schedules, including hours of operation and bus frequency, are described in Chapter 2, Project Description. Buses were assumed to idle at the proposed Isabel Station for the Proposed Project and DMU Alternative or at the Dublin/Pleasanton Station for the Express Bus/BRT Alternative and Enhanced Bus Alternative. The duration of idling was assumed to be 5 minutes (between each trip), as transit bus idling is limited to 5 minutes per the CARB's ATCM to Limit Diesel-Fueled Commercial Motor Vehicle Idling.

Maintenance Facility Vehicles and Equipment (Conventional BART Project and DMU Alternative)

Equipment at the BART and DMU maintenance facilities would consist of electric-powered forklifts and two diesel-fueled maintenance trucks. Because the forklifts would be electric, there would be no associated criteria air pollutant emissions. Additionally, the BART storage and maintenance facility would include a diesel-fueled shuttle van for transporting train operators between the storage and maintenance facility and the Isabel Station. Emissions from the maintenance trucks and shuttle van were calculated based on EMFAC2014 emissions factors for light heavy-duty trucks[73] for 2025 and 2040. Each truck was assumed to travel approximately 11 miles per day and idle for 10 minutes per day.[74] The shuttle van was assumed to travel 20 miles per day and idle for 40 minutes per day.

Emergency Generators (Conventional BART Project and DMU Alternative)

A single diesel-fired emergency generator would be installed at both the North Isabel touchdown structure and at the storage and maintenance facility to provide backup power during emergency situations. Because the make and model of the generator have not yet been determined, emissions for the generator at the North Isabel touchdown structure were calculated based on the size typical of diesel generators installed at other BART stations (2,500 kilowatts) and emissions factors for Tier 2 engines. Generator operation

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[72] In accordance with Title 13 of the California Code of Regulations, Section 2023.1, transit agencies are required to comply with the Fleet Rule for Transit Agencies – Urban Bus Requirements by following one of two paths: alternative fuel or diesel. LAVTA elected to comply with the diesel path, which requires that DPM emissions be reduced to either 15 percent of the 2002 baseline or 0.01 g/bhp-hr, whichever is greater, by January 1, 2007. LAVTA was required to meet a reduction of target of 0.01 g/bhp-hr.

[73] EMFAC2014 vehicle class.

[74] Daily vehicle miles were provided by the project sponsor. Idling is assumed to occur for up to 10 minutes per day. Source: Dean, Donald, Environmental Coordinator, Bay Area Rapid Transit District, 2016. Email communication with Ramboll Environ, Inc. September 20.

would be limited to 2 hours of testing each month. Emissions for the storage and maintenance facility generator (500-kilowatt) were calculated based on Tier 3 emission factors and 50 hours per year for non-emergency maintenance and readiness testing.

DMU Vehicles (DMU Alternative)

DMU emissions were calculated based on annual rail car miles and trips, as described in Section 3.B, Transportation. Emissions factors for criteria air pollutants were obtained from the CARB and EPA Off-Road Compression-Ignition (Diesel) Engine standards for a Tier 4 Final diesel engine. As the exact make and model of the DMU have not been determined, emissions were determined based on the size and operating parameters typical of the DMU model planned for use in the East Contra Costa BART Extension (eBART) passenger rail service.[75]

Architectural Coating (Conventional BART Project, DMU Alternative, Express Bus/BRT Alternative)

ROG off-gassing emissions from architectural coating are calculated based on the square footage of the new buildings, an assumed VOC content of the paint based on BAAQMD regulations, and a reapplication rate of 10 percent, consistent with CalEEMod®.[76]

Solvent Use (Conventional BART Project and DMU Alternative)

Solvent and brake cleaner would be used at the BART and DMU maintenance facilities, although the specific materials have not yet been identified. For the purposes of evaluation, it is assumed that ROG emissions from use of solvent and brake cleaner would

[75] LTK Engineering Services, 2008. eBART Phase I Project to Hillcrest Terminal: DMU and LRV Comparison. May 14.

[76] The BAAQMD regulations for paint are specifically for VOCs. However, the BAAQMD CEQA thresholds for mass emissions of ozone precursors addresses ROGs, not VOCs. BAAQMD Regulation 1 defines VOCs as "any organic compound, as described in Section 1-233, which would be emitted during use, processing, application, curing, or drying of a solvent, surface coating, or other material." Organic compound is defined in Section 1-233 of Regulation 1 as "any compound of carbon, excluding methane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides, or carbonates, and ammonium carbonate." (Note the difference between the BAAQMD and EPA definitions of VOCs. The EPA's definition requires that the organic compounds be photochemically reactive, while the BAAQMD's definition does not, and is therefore more encompassing.)

The BAAQMD CEQA Air Quality Guidelines define ROGs as "classes of organic compounds, especially olefins, substituted aromatics and aldehydes, that react rapidly in the atmosphere to form photochemical smog or ozone."

In practical terms, ROGs are a subset of VOCs (as defined by BAAQMD), as not all organic compounds will react rapidly in the atmosphere to form photochemical smog or ozone. Depending on the source, the percentage of VOCs that are ROGs is typically very high (i.e., close to 100 percent). Thus, for purposes of this section, ROG emissions are conservatively assumed to be equivalent to VOC (as defined by BAAQMD) emissions.

be less than the BAAQMD permitting exemption threshold of 150 pounds per year in BAAQMD Regulation 2-1-118-9.1.[77]

(2) Carbon Monoxide

CO impacts are evaluated by using the BAAQMD's screening thresholds for hotspots. The screening methodology is based on peak hourly traffic volumes at affected intersections. If a project would contribute 44,000 vehicles per hour to an intersection, or 24,000 vehicles per hour for intersections where vertical or horizontal air mixing would be limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, or below-grade roadway), it could violate or contribute to a violation of NAAQS or CAAQS for CO.[78] Peak hourly traffic volumes from Section 3.B, Transportation are used to evaluate against screening thresholds.

The BAAQMD does not have separate cumulative thresholds of significance for local CO impacts; therefore, no separate cumulative analysis is performed for CO.

(3) Toxic Air Contaminants

TACs would be emitted during the operation and construction of the Proposed Project and Build Alternatives. The emissions and health risk calculation methodologies are described below.

(a) Construction

During construction of the BART to Livermore Extension Project, diesel-powered off-road construction equipment such as cranes, forklifts, and backhoes would generate TACs. The following three steps were performed for analysis of TACs: (1) an emissions estimation; (2) air dispersion modeling; and (3) an HRA.

For sources of diesel exhaust, such as construction equipment and haul trucks, the primary health impact is cancer risk. The DPM concentration at which the cancer risk significance threshold is exceeded is lower than the concentration for exceeding the chronic health index. Thus, non-cancer hazard indices from diesel exhaust were not explicitly estimated in this report.

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[77] The 150-pound threshold for BAAQMD Regulation 2-1-118-9.1 is specifically for VOCs. However, the BAAQMD CEQA thresholds for mass emissions of ozone precursors includes ROG, not VOC. Similarly, as for architectural costing, for purposes of this section, we conservatively assume the ROG emissions are equivalent to VOC (as defined by BAAQMD) emissions.

[78] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

An HRA was conducted to assess both increased cancer risk and localized $PM_{2.5}$ concentrations from construction sources for sensitive receptors located within the study area. Based on a sensitive receptor search within the 3,280-foot (1,000-meter) study area, the following five sensitive receptor types were identified and evaluated in the HRA: residents, school children, daycare children, patients in hospitals, and recreational users. Known future developments with potential sensitive receptors were also considered in this analysis. Table 3.K-5 is a listing of the daycare centers, hospitals, parks, playgrounds, and schools in the study area and evaluated in the HRA. Other sensitive receptors also evaluated in the HRA include residential homes and small licensed daycare facilities operated out of private homes.

Localized $PM_{2.5}$ concentrations are assessed based on annual average concentrations. Conversely, cancer risk is assessed based on the probability of contracting cancer over a 30-year period. Sources considered in the HRA include unmitigated and mitigated emissions from construction equipment and trucks and from employee vehicle transport.

To evaluate DPM and $PM_{2.5}$ impacts from the construction of the Proposed Project and Build Alternatives, near-field air dispersion modeling of project operation emissions sources was conducted using the American Meteorological Society/EPA Regulatory Model (AERMOD), version 15181, as recommended by the 2017 BAAQMD CEQA Air Quality Guidelines (referred to herein as BAAQMD CEQA Guidelines).[79] Air dispersion modeling applications used surface meteorological data from the Livermore Airport (located 0.5 mile south of the project corridor near the proposed Isabel Station) and upper air data from the Metropolitan Oakland International Airport (closest upper air station to the project) to provide the most representative data set for this analysis.

The ambient concentrations obtained through dispersion modeling were subsequently used in the risk assessment to quantify cancer health risk impacts and to evaluate $PM_{2.5}$ impacts. Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological data, topographical information, and receptor parameters, which are discussed below.

Emissions

Emissions of DPM and $PM_{2.5}$ from construction activities were quantified using the emissions estimation methodologies previously described above for criteria pollutants. DPM emissions were conservatively assumed to be equal to PM_{10} emissions for all diesel combustion sources.

[79] Ibid.

Meteorological Data

Air dispersion modeling requires the use of meteorological data that, ideally, are spatially and temporally representative of conditions in the immediate vicinity of the site under consideration. For the HRA, National Weather Service surface meteorological data for 2011 through 2015 from the Livermore Airport meteorological station were used.[80, 81] Upper air data from the Metropolitan Oakland International Airport were used to complement the surface data.[82] Determination of surface moisture conditions for meteorological data processing were based on precipitation data from the Livermore Airport meteorological station.[83] As described above, the Livermore Airport meteorological station is located approximately 0.5 mile south of the project corridor.

Topographical Data

AERMOD uses a terrain preprocessor, AERMAP version 11103, to determine elevations of the surrounding landscape.[84] Data from the National Elevation Data set, available from the United States Geological Survey, were utilized to import the elevation information for sources and receptors.[85] AERMAP was used to extract elevations from the National Elevation Data set.

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[80] National Climatic Data Center (NCDC), 2016a. TD-3505 Hourly Dataset. ASOS Station KLVK (Livermore Airport, WMO 724927, WBAN 23285). National Oceanic and Atmospheric Administration, National Centers for Environmental Information. Available at: ftp://ftp.ncdc.noaa.gov/pub/data/noaa/, accessed March 9, 2016. [Subset used: January 2011–December 2015.]

[81] National Climatic Data Center (NCDC), 2016b. DS-6405 1-Minute Dataset. ASOS Station KLVK (Livermore Airport, WBAN 23285). National Oceanic and Atmospheric Administration, National Centers for Environmental Information. Available at: ftp://ftp.ncdc.noaa.gov/pub/data/asos-onemin/, accessed March 9, 2016. [Subset used: January 2011–December 2015.]

[82] National Oceanic and Atmospheric Administration (NOAA) and Earth System Research Laboratory (ESRL), 2016. NOAA/ESRL Radiosonde Database. Forecast Systems Laboratory (FSL) data for Upper Air Station KOAK (Metropolitan Oakland International Airport, WMO 72493). Available at: https://ruc.noaa.gov/raobs/, accessed March 9, 2016. [Subset used: January 1, 2011–December 31, 2015.]

[83] National Climatic Data Center (NCDC), 2016c. Global Summary of the Month, Surface Station KLVK (Livermore Airport, WBAN 23285) for the period between January 1, 1986 and December 31, 2015. Available at: https://www.ncdc.noaa.gov/cdo-web/search?datasetid=ANNUAL, accessed March 9, 2016.

[84] United States Environmental Protection Agency (EPA), 2017c. Version 11103. Available at: https://www3.epa.gov/scram001/dispersion_related.htm, accessed February 2017.

[85] United States Geological Survey (USGS), 2016. National Elevation Dataset (NED) 1-arc second. Available at: https://www.mrlc.gov/viewerjs/, accessed March 9, 2016.

Source Configurations and Parameters

All emissions from construction, including off-site vehicle emissions from trucks and worker trips going to and from construction zones, were conservatively assumed to be included in the on-site emissions and were modeled as adjacent volume sources.

Construction would primarily occur Monday through Friday, with limited activities occurring on weekends. Although most construction activities would take place Monday through Friday, modeling was completed assuming activities would occur seven days a week, as cancer risk and $PM_{2.5}$ concentrations are based on annual averages of concentration. Construction activities were modeled between 5:00 a.m. and 7:00 p.m., seven days a week, to reflect the approximate duration of construction activities, even though some limited construction activity would take place between 7:00 p.m. and 5:00 a.m. Modeling during this timeframe is more conservative than during the typical construction hours of 7:00 a.m. to 7:00 p.m.

A summary of modeled source parameters is provided in Table 31 of Appendix H.

Risk Assessment

The purpose of the HRA analysis is to assess potential health impacts that would result from construction of the Proposed Project and Build Alternatives. Consistent with guidelines and methodologies from the BAAQMD[86] and OEHHA,[87] the HRA evaluates the estimated excess lifetime cancer risk and $PM_{2.5}$ concentrations associated with diesel exhaust that would be emitted by construction activities, and TACs associated with diesel exhaust emitted from vehicles associated with construction traffic to and from the site. The HRA evaluates the following three construction alternatives for the unmitigated and mitigated scenarios: Conventional BART Project, DMU Alternative, and Express Bus/BRT Alternative. An HRA is not conducted for construction of the Enhanced Bus Alternative because activity under that alternative would be limited to minor construction at widely separated locations for bus-related infrastructure improvements such as installing bus shelters and constructing bulb-outs. Therefore, the impacts to health risk and $PM_{2.5}$ concentration is considered de minimis.

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[86] Bay Area Air Quality Management District (BAAQMD), 2016d. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en, accessed October 2016.

[87] Office of Environmental Health Hazard Assessment (OEHHA), 2015. Air Toxics Hot Spots Program Risk Assessment Guidelines. Guidance Manual for the Preparation of Health Risk Assessments. Available at: http://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-guidance-manual-preparation-health-risk-0, accessed October 2016.

The exposure parameters and methodology used to estimate excess lifetime cancer risks for all potentially exposed sensitive populations evaluated in the construction HRA are obtained using risk assessment guidelines from the OEHHA (2015) and the BAAQMD (2016), unless otherwise noted, and are presented in Table 33 of Appendix H.

The toxicity values and methodology used to estimate excess lifetime cancer risks are the same as those described for operational impacts. Specific details on the health risk and $PM_{2.5}$ calculations and methodology are provided in Tables 32, 33, 35, and 36 of Appendix H.

Cumulative Analysis

The construction cumulative analysis takes into account other construction activities occurring within the vicinity of the Proposed Project and Build Alternatives. As shown in Table 3.A-3 in Section 3.A, Introduction to Environmental Analysis and in Appendix E, several projects could be under construction concurrently with the Proposed Project or Build Alternatives. In addition, a portion of the INP would be undergoing construction concurrent with the Proposed Project or DMU Alternative. The cumulative impact of other construction activities on health risk is evaluated at the project construction maximally exposed individual sensitive receptor (MEISR). Impacts of other construction activities are first screened out based on distance. Per the BAAQMD CEQA Guidelines, a radius of 1,000 feet around the project property boundary should be used for assessing cumulative impacts. Any construction activities that are not screened out based on distance are modeled and then evaluated for additional health risk impacts to the MEISR. It is noted that there are no significance thresholds for construction-generated dust (i.e., PM) or criteria air pollutants. Construction-generated dust is addressed on a project-level basis with best management practices. BAAQMD considers project-level criteria air pollutant thresholds to also capture cumulative impacts; if project level thresholds are exceeded, then it would also be considered a cumulative impact.

(b) Operation

Health risks associated with operational activities such as a DMU rail line, increased bus service, increased mobile source activity (i.e., additional passenger VMT), use of the diesel-fueled emergency generators, and/or maintenance yard activities were evaluated through the following three steps: (1) an emissions estimation; (2) air dispersion modeling; and (3) an HRA.

BAAQMD modeling of roadways in the Bay Area showed that the thresholds for long-term and short-term hazard indices were never exceeded. Thus, for roadways, the non-cancer chronic and acute hazard indices were not estimated in this analysis. For sources of diesel exhaust, such as buses and DMUs, the primary health impact is cancer risk. The DPM concentration at which the cancer risk significance threshold is exceeded is lower than the concentration for exceeding the chronic health index. Thus, non-cancer hazard indices from diesel exhaust were not explicitly estimated in this report.

An HRA was conducted to assess both increased excess lifetime cancer risk and localized annual average $PM_{2.5}$ concentrations for sensitive receptors located within a 3,280-foot (1,000-meter) study area of the operational sources. Based on a sensitive receptor search within the 3,280-foot (1,000-meter) study area, the following five sensitive receptor types were identified and evaluated in the HRA: residents, school children, daycare children, patients in hospitals, and recreational users. Known future developments with potential sensitive receptors were also considered in this analysis. Sensitive receptors considered for the HRA are shown in Table 3.K-5.

Sources considered in the operational HRA include (1) traffic generated by full buildout of the BART to Livermore Extension Project (roadway segments with an increase in average daily traffic volume greater than 10,000 vehicles per day); (2) buses; (3) DMUs (DMU Alternative only); (4) maintenance trucks and solvents to be used for maintenance operations at the BART and DMU maintenance facilities (Proposed Project and DMU Alternative); and (5) maintenance operation of the diesel-fired emergency generators. Under State regulatory guidelines, DPM is used as a surrogate measure of carcinogen exposure for the mixture of chemicals that make up diesel exhaust.

To evaluate DPM and $PM_{2.5}$ impacts from the Proposed Project and Build Alternatives, near-field air dispersion modeling of project operation emissions sources was conducted using AERMOD version 15181, as recommended by the BAAQMD CEQA Guidelines.[88] Air dispersion modeling applications used surface meteorological data from the Livermore Airport (located 0.5 mile south of the project corridor near the proposed Isabel Station) and upper air data from the Metropolitan Oakland International Airport (closest upper air station to the project) to provide the most representative data set for this analysis.

The ambient concentrations obtained through dispersion modeling were subsequently used in the risk assessment to quantify cancer health risk impacts and to evaluate $PM_{2.5}$ impacts. Air dispersion models such as AERMOD require a variety of inputs such as source parameters, meteorological data, topographical information, and receptor parameters, which are discussed below.

[88] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

Emissions

Emissions of DPM and $PM_{2.5}$ from off-road equipment and on-road vehicles were quantified using the emissions estimation methodologies described above for criteria pollutants. DPM emissions were conservatively assumed to be equal to PM_{10} exhaust emissions for all diesel combustion sources.

Meteorological Data

The same meteorological data used in the construction HRA described above are applied for the operational HRA.

Topographical Data

The same topographical data used in the construction HRA described above are applied for the operational HRA.

Source Configurations and Parameters

This subsection describes the source configurations and parameters used for dispersion modeling and the HRA. Modeling and the HRA for the Proposed Project and the DMU Alternative included passenger vehicles, buses, maintenance trucks, and two emergency generators. The Proposed Project also included the diesel-fueled shuttle van and the DMU Alternative included the DMU Vehicles. The Express Bus/BRT and the Enhanced Bus Alternatives only included passenger vehicle traffic and buses.

Passenger Vehicle Traffic (Conventional BART Project and Alternatives). To address the impacts of passenger vehicle traffic described in Section 3.B, Transportation, road segments with an increase in average daily traffic volume greater than 10,000 vehicles per day were identified. A screening-level risk assessment was completed for these segments using the BAAQMD Roadway Screening Analysis Calculator.[89] Cancer risk and $PM_{2.5}$ concentration were identified for the operational MEISR.

Buses (Conventional BART Project and Alternatives). Under the Proposed Project and DMU Alternative, the highest impacts associated with operation of buses are expected to occur at and around the proposed Isabel Station due to the number of buses accessing the station area and then idling briefly between trips. Bus routes near the proposed Isabel Station were modeled as line sources using AERMOD. This approach is expected to capture the highest impacts from DPM emissions, as other emissions sources included in

[89] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16, 2015.

the operational HRA (emergency generator and traffic) are also at or near the Isabel Station. For the Express Bus/BRT Alternative and Enhanced Bus Alternative, modeling of bus emissions was performed around the Dublin/Pleasanton Station, as multiple bus lines would access the station for pick-up and drop-off of passengers; therefore, the highest impacts were expected in that area. The bus routes were modeled using the projected weekday hours of operation for each route.

DMU Vehicles (DMU Alternative). The DMU route between the Dublin/Pleasanton Station and the proposed Isabel Station was modeled as a line source in AERMOD. The operations were conservatively modeled for 24 hours of the day, although projected weekday hours of operation are expected to be approximately only 21 hours per day.

Maintenance Trucks (Conventional BART Project and DMU Alternative). Emissions from maintenance trucks at the BART and DMU maintenance facilities were modeled as a series of adjacent volume sources using AERMOD. It was conservatively assumed that these two diesel-fueled light-heavy-duty[90] maintenance trucks could operate throughout the day or night; therefore, no hour-of-day restrictions were applied in the modeling.

Shuttle Van (Conventional BART Project). Emissions from the shuttle van transporting train operators between the storage and maintenance facility and Isabel Station were modeled as a series of adjacent volume sources using AERMOD. It was assumed that the diesel-fueled light-heavy-duty[91] shuttle van could operate throughout the day or night; therefore, no hour-of-day restrictions were applied in the modeling.

Emergency Generators (Conventional BART Project and DMU Alternative). The diesel generators were modeled as point sources using AERMOD. Generator capacities of 2.5 megawatt (Isabel Station) and 500 kilowatt (storage and maintenance facility) was provided by BART.[92] It was conservatively assumed that testing of the generators could occur at any time throughout the day or night; therefore, no hour-of-day restrictions were applied in the modeling.

A summary of modeled source parameters is provided in Table 31 of Appendix H. Specific details on the health risk and $PM_{2.5}$ calculations and methodology are provided in Tables 32, 34, 35, and 36 of Appendix H.

[90] EMFAC2014 vehicle class
[91] Ibid.
[92] Dean, 2017. Emails communication from Donald Dean, Environmental Coordinator, San Francisco Bay Area Rapid Transit District with Ramboll Environ. Inc. (May 1 and May 2).

Risk Assessment

The purpose of the HRA analysis is to assess potential health impacts that would result from operation of the Proposed Project and Build Alternatives. Consistent with guidelines and methodologies from the BAAQMD and OEHHA, the HRA evaluates the estimated excess lifetime cancer risk and $PM_{2.5}$ concentrations associated with diesel exhaust that would be emitted by operational activities, and TACs associated with diesel exhaust emitted from vehicles.[93,] The HRA is conducted for the Proposed Project and each alternative for both 2025 and 2040.

The exposure parameters used to estimate excess lifetime cancer risks for all potentially exposed sensitive populations for the operational scenarios are obtained using risk assessment guidelines from the OEHHA and BAAQMD, unless otherwise noted, and are presented in Table 33 of Appendix H.

This analysis uses available toxicity values, including the inhalation cancer potency factor for DPM approved by Cal/EPA.[94, 95]

The annual average DPM concentrations are modeled at all identified sensitive receptor locations within the 3,280 foot (1,000-meter) study area for use in calculating the cancer risks associated with DPM emissions. The annual average $PM_{2.5}$ concentrations are also modeled at all sensitive receptor locations.

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens following the methodology recommended by the BAAQMD and OEHHA. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (such as lungs) by the chemical-specific cancer potency factor. Details of the intake calculation methodology, toxicity values, and risk characterization methodology are provided in Tables 32, 33, 35, and 36 in Appendix H.

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[93] Bay Area Air Quality Management District (BAAQMD), 2016d. Air Toxics NSR Program Health Risk Assessment (HRA) Guidelines. January Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/rules-and-regs/workshops/2016/reg-2-5/hra-guidelines_clean_jan_2016-pdf.pdf?la=en, accessed October 2016.

[94] Office of Environmental Health Hazard Assessment (OEHHA), 2011. Technical Support Document for Cancer Potency Factors. Appendix A: Lookup Table Containing Unit Risk and Cancer Potency Values. Available at: http://oehha.ca.gov/media/downloads/crnr/appendixa.pdf, accessed October 2016.

[95] Office of Environmental Health Hazard Assessment (OEHHA), 2008. Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels. Available at: http://oehha.ca.gov/air/crnr/notice-adoption-air-toxics-hot-spots-program-technical-support-document-derivation, accessed October 2016.

Quantification of excess lifetime cancer risk is based on a 30-year exposure duration per BAAQMD and OEHHA guidance. Thus, the exposure period for the 2025 analysis overlaps with the 2040 analysis (2025–2055). Operational DPM emissions from all sources either decrease or are conservatively assumed to stay the same between 2025 and 2040 with the exception of the DMU vehicles. Given that the total net new emissions in 2040 are lower than 2025, the 2025 analysis is still conservative because emissions will decrease over time rather than increase.

Cumulative Analysis

Projects considered under the cumulative conditions are described in Section 3.A, Introduction to Environmental Analysis and Appendix E.

Stationary sources and roadways within the 1,000-foot zone of influence were included in the cumulative analysis. Stationary sources were identified using the BAAQMD Stationary Source Screening Analysis Tool and additional information requested from the BAAQMD on these sources.[96] BAAQMD-provided tools were used to estimate impacts from the nearby stationary sources on the operational MEISR.[97]Impacts from total roadway traffic were analyzed using the BAAQMD Roadway Screening Analysis Calculator and the BAAQMD Highway Screening Analysis Tool.[98,99] The Stationary Source and Traffic Screening Analyses are provided in Tables 37 and 38 of Appendix H.

[96] Bay Area Air Quality Management District (BAAQMD), 2012a. Stationary Source Screening Tool. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/contra_costa_2012.kml?la=en, accessed August 31, 2016.

[97] For gas stations, the BAAQMD provides a screening tool to scale reported maximum impacts to those at other locations.

Bay Area Air Quality Management District (BAAQMD), 2012c. Gasoline Dispensing Facility (GDF) Distance Multiplier Tool. Available at: http://www.baaqmd.gov/plans-and-climate/california-environmental-quality-act-ceqa/ceqa-tools, accessed June 2017.

[98] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16, 2015.

[99] Bay Area Air Quality Management District (BAAQMD), 2011. Highway Screening Analysis Tool. Alameda County. 6ft. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/alameda-6ft.kmz?la=en, accessed July 2017.

(4) Odors

Odor impacts for diesel exhaust are evaluated by comparing concentrations of individual chemical species of exhaust to a compilation of odor thresholds.[100, 101] Odor impacts for solvent use at the Conventional BART Project and DMU storage and maintenance facilities are expected to be de minimis because of the relatively low usage of solvents and the large distance between the storage and maintenance facility and the public (at least 1,000 feet between the BART storage and maintenance facility and the closest resident and at least 2,000 feet between the DMU storage and maintenance facility and the closest receptor). The odor analyses for construction and operations are provided in Tables 39 and 40, respectively, of Appendix H.

c. No Project Conditions

The 2025 No Project Conditions and 2040 No Project Conditions are described below. Under the 2025 and 2040 No Project Conditions, the Proposed Project and Build Alternatives would not be built. However, emissions of criteria pollutants, TACs, and odor-causing chemicals in the study area would result from new land use development and existing infrastructure. This would include the use of passenger vehicles and a continued

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[100] Amoore, J.E. and E. Hautala, 1983. Odor as and Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 2014 Industrial Chemicals in Air and Water Dilution. Journal of Applied Toxicology, Vol 3, No 6, pg 272.

[101] Concentration of individual chemical species of diesel exhaust are derived by starting with maximum average annual modeled concentrations of DPM for each alternative and estimating the concentration of VOCs using the mass emission ratio of ROG to DPM. The mass emissions ratio can be calculated using the values in Appendix H Table 8 (for construction emissions) and Appendix H Table 27 (for operational emissions). While analyzed concentrations are annual average concentrations, odors are generally detected instantaneously or on a short time-average basis (i.e., less than one hour). Shorter time-average concentrations (i.e., 1-hour maximum concentrations) are typically 10 to 30 times higher than annual average concentrations. Rough estimates of the 1-hour maximum concentration of the odor-causing constituents are still much lower than odor thresholds.

For construction, there are two major contributors to diesel exhaust: off-road equipment and trucks & vehicles. As a conservative measure, the ratio of ROG to DPM for trucks & vehicles is used because it is higher compared to the ratio for off-road equipment. For operation, with the exception of the DMU Alternative, buses are the one major contributor to diesel exhaust. Under the DMU Alternative, the DMU is another major contributor to diesel exhaust. In evaluating the DMU Alternative, the ratio of ROG to DPM for DMU is used because it is higher compared to the ratio for buses.

Concentrations for individual chemical species are estimated by multiplying the ROG concentration by a speciation profile. Speciation profiles are from the EPA Speciate database:

United States Environmental Protection Agency (EPA), 2014. Speciate Database, Version 4.4. February. Profiles 3161, 4674, and 4741. Available at: http://www.epa.gov/ttnchie1/software/speciate/, accessed June 12, 2017.

EPA Speciation Profile 4674 is used for diesel trucks and vehicles. EPA Speciation Profile 4741 is used for buses. EPA Speciation Profile 3161 is used for off-road (construction) equipment.

increase in annual VMT in the study area and associated consumption of diesel fuel, gasoline, and electricity.

For 2025 and 2040, the project impacts are evaluated against the No Project Conditions. Thus, the 2025 Proposed Project and Build Alternatives are evaluated against the 2025 No Project Conditions and the 2040 Proposed Project and Build Alternatives are evaluated against the 2040 No Project Conditions.

(1) No Project 2025 Conditions

Under 2025 No Project Conditions, air quality is expected to improve compared to existing conditions. While traffic volumes are expected to increase, emissions from motor vehicles will become cleaner as emissions standards for motor vehicles become more stringent and older cars are taken out of circulation. The CARB estimates statewide reductions of NO_x (573 tons per day [tons/day]), ROG (214 tons/day), and $PM_{2.5}$ (5 tons/day) by 2031 from State measures that address on-road light-duty and on-road heavy-duty vehicles.

(2) No Project 2040 Conditions

Under 2040 No Project Conditions, air quality conditions would continue to improve compared to the 2025 No Project Conditions, for similar reasons to those described above. In addition, by 2040, a much higher percentage of the vehicle fleet in California is expected to be electric.

d. Summary of Impacts

Table 3.K-7 summarizes the impacts of the Proposed Project and Alternatives described in the analysis below.

TABLE 3.K-7 SUMMARY OF AIR QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project**	**DMU Alternative (with EMU Option)**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Construction					
		Project Analysis			
Impact AQ-1: Result in potentially significant, localized dust-related air quality impacts during construction	NI	LSM	LSM	LSM	LSM

TABLE 3.K-7 SUMMARY OF AIR QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	No Project Alternative	Conventional BART Project	DMU Alternative (with EMU Option)	Express Bus/BRT Alternative	Enhanced Bus Alternative
Impact AQ-2: Generate emissions of NO_x, PM, and ROGs exceeding BAAQMD significance thresholds during construction	NI	LSM	LSM	LS	LS
Impact AQ-3: Generate TAC and $PM_{2.5}$ emissions that result in health risks above the BAAQMD significance thresholds during construction	NI	LSM	LSM	LSM	LS
Impact AQ-4: Result in objectionable odors affecting a substantial number of people during construction	NI	LS	LS	LS	LS
Cumulative Analysis					
Impact AQ-5(CU): Result in potentially significant, localized dust-related air quality impacts during construction under Cumulative Conditions	NI	LS	LS	LS	LS
Impact AQ-6(CU): Result in potentially significant emissions of NO_x, PM, and ROGs during construction under Cumulative Conditions	NI	LS	LS	LS	LS
Impact AQ-7(CU): Generate TAC and $PM_{2.5}$ emissions that result in health risks above the BAAQMD significance thresholds during construction under Cumulative Conditions	NI	SU	SU	LS	LS

TABLE 3.K-7 SUMMARY OF AIR QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project**	**DMU Alternative (with EMU Option)**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Impact AQ-8(CU): Result in objectionable odors affecting a substantial number of people during construction under Cumulative Conditions	NI	LS	LS	LS	LS
Operational					
Project Analysis (2025 and 2040)					
Impact AQ-9: Result in increased emissions of NO_x, PM, and ROGs above BAAQMD significance thresholds under 2025 Project Conditions	NI	LS	LS	LS	LS
Impact AQ-10: Result in increased emissions of NO_x, PM, and ROGs above BAAQMD significance thresholds under 2040 Project Conditions	NI	LS	LS	LS	LS
Impact AQ-11: Result in increased emissions of TACs and $PM_{2.5}$, resulting in increased health risk above BAAQMD significance thresholds under 2025 Project Conditions	NI	LS	LS	LS	LS
Impact AQ-12: Result in increased emissions of TACs and $PM_{2.5}$, resulting in increased health risk above BAAQMD significance thresholds under 2040 Project Conditions	S	LS	LS	LS	LS

TABLE 3.K-7 SUMMARY OF AIR QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project**	**DMU Alternative (with EMU Option)**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Impact AQ-13: Result in local concentrations of CO above BAAQMD significance thresholds under 2025 Project Conditions	NI	LS	LS	LS	LS
Impact AQ-14: Result in local concentrations of CO above BAAQMD significance thresholds under 2040 Project Conditions	LS	LS	LS	LS	LS
Impact AQ-15: Result in objectionable odors affecting a substantial number of people in 2025 and 2040	LS	LS	LS	LS	LS
Impact AQ-16: Conflict or obstruct implementation of existing air quality plans in 2025 and 2040	LS	B	B	B	B
Cumulative Analysis (2025 and 2040)					
Impact AQ-17(CU): Result in increased emissions of NO_x, PM, and ROGs above BAAQMD significance thresholds under 2025 and 2040 Cumulative Conditions	NI	LS	LS	LS	LS
Impact AQ-18(CU): Result in increased emissions of TACs and $PM_{2.5}$, resulting in increased health risk above BAAQMD significance thresholds under 2025 Cumulative Conditions	NI	SU	SU	SU	LS

TABLE 3.K-7 SUMMARY OF AIR QUALITY IMPACTS

	Significance Determinations[a]				
Impacts	**No Project Alternative**	**Conventional BART Project**	**DMU Alternative (with EMU Option)**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Impact AQ-19(CU): Result in increased emissions of TACs and $PM_{2.5}$, resulting in increased health risk above BAAQMD significance thresholds under 2040 Cumulative Conditions	S	SU	SU	LS	LS
Impact AQ-20(CU): Result in local concentrations of CO above BAAQMD significance thresholds under 2025 Cumulative Conditions	NI	LS	LS	LS	LS
Impact AQ-21(CU): Result in local concentrations of CO above BAAQMD significance thresholds under 2040 Cumulative Conditions	LS	LS	LS	LS	LS
Impact AQ-22(CU): Result in objectionable odors affecting a substantial number of people under 2025 and 2040 Cumulative Conditions	LS	LS	LS	LS	LS
Impact AQ-23(CU): Conflict or obstruct implementation of existing air quality plans under 2025 and 2040 Cumulative Conditions	LS	B	B	B	B

Notes: NOx = nitrogen oxides; PM = particulate matter; ROG = reactive organic gas; BAAQMD = Bay Area Air Quality Management Disrict; TAC = toxic air contaminant; PM2.5 = fine particulate matter; CO = carbon monoxide; DMU = diesel multiple unit; EMU = electrical multiple unit; BRT = bus rapid transit.
NI=No impact; B=Beneficial impact; LS=Less-than-Significant impact, no mitigation required; LSM=Less-than-Significant impact with mitigation; S= Significant impact of No Project Alternative (mitigation is inapplicable); SU=Significant and unavoidable, even with mitigation or no feasible mitigation available.
[a] All significance determinations listed in the table assume incorporation of applicable mitigation measures.

e. Environmental Analysis

Impacts related to project construction are described below, followed by operations-related impacts.

(1) Construction Impacts

Potential impacts related to project construction are described below, followed by cumulative construction impacts.

(a) Construction – Project Analysis

Impact AQ-1: Result in potentially significant localized dust-related air quality impacts during construction.

(No Project Alternative: NI; Conventional BART Project: LSM; DMU Alternative: LSM; Express Bus/BRT Alternative: LSM; Enhanced Bus Alternative: LSM)

Project-related demolition, excavation, soil stockpiling and handling, and other construction activities may generate wind-blown dust (including PM_{10} and $PM_{2.5}$). Construction-related dust emissions would vary from day to day, depending on the level and type of activity, silt content of the soil, and the weather.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with construction of the Proposed Project or any of the Build Alternatives. Construction activities by other agencies under the No Project Alternative include minor structural improvements for the I-580 corridor and surface roadways, as well as construction of land use development projects, including residential and commercial uses. Construction of these improvements and development projects could result in localized dust emissions. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no localized dust-related air quality impacts. **(NI)**

Conventional BART Project and Build Alternatives. Dust generated from construction activities may result in localized air quality impacts on a temporary and intermittent basis during the construction period. While the duration of construction would vary between the Proposed Project and Build Alternatives—approximately 48 months for the Proposed Project and DMU Alternative, approximately 52 months for the Express Bus/BRT Alternative, and approximately 2 months for the Enhanced Bus Alternative—the generation of wind-blown dust by the Proposed Project or any alternative during construction would have potentially significant impacts to air quality.[102]

The BAAQMD CEQA Guidelines note that individual best management practices have been shown to reduce fugitive dust by approximately 30 percent to more than 90 percent, and conclude that projects that implement construction best management practices will reduce fugitive dust emissions to a less-than-significant level. Therefore, with implementation of **Mitigation Measure AQ-1**, which requires application of the BAAQMD's best management practices to reduce fugitive dust, the Proposed Project and Build Alternatives would result in less-than-significant impacts related to fugitive dust. **(LSM)**

Mitigation Measures. As described above, the Proposed Project and Build Alternatives would have potentially significant impacts related to air quality due to localized dust. Based on BAAQMD significance thresholds, a project would not have a significant adverse air quality impact if applicable BAAQMD-recommended construction best management practices are implemented during construction activities. Therefore, with implementation of **Mitigation Measure AQ-1**, potential impacts would be reduced to a less-than-significant level.

Mitigation Measure AQ-1: BAAQMD Construction Best Management Practices (Conventional BART Project and Build Alternatives).

All construction activities for the Proposed Project and Build Alternatives shall comply with the following BAAQMD best management practices:

1. All exposed surfaces (such as parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
2. All haul trucks transporting soil, sand, or other loose material off site shall be covered.
3. All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
4. All vehicle speeds on unpaved roads shall be limited to 15 mph.

[102] While the entire construction duration would occur over approximately 5 years and include start-up and testing, the majority of the construction activities resulting in emissions would occur over approximately 4 years (48 months) for the Proposed Project and DMU Alternative, and over approximately 4.25 years (52 months) for the Express Bus/BRT Alternative. Construction of the Enhanced Bus Alternative, as well as bus infrastructure improvements under the Proposed Project and other Build Alternatives, is anticipated to occur over approximately 2 months.

5. All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
6. Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California Airborne Toxics Control Measure – Title 13 of the California Code of Regulations, Section 2485). Clear signage shall be provided for construction workers at all access points.
7. All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified visible emissions evaluator (persons who are certified to perform EPA Method 9 [Visual Opacity]).
8. Post a publicly visible sign with the telephone number and person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The BAAQMD's phone number shall also be visible to ensure compliance with applicable regulations.

Impact AQ-2: Result in emissions of ROGs, NO_x, and PM exceeding BAAQMD significance thresholds during construction.

(No Project Alternative: NI; Conventional BART Project: LSM; DMU Alternative: LSM; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

Construction activity results in emissions of ROGs, NO_x, and exhaust PM from off-road construction equipment, haul trucks, vendor trucks, employee vehicles, and architectural coating. The potential impacts from construction-related emissions of ROGs, NO_x, and PM are described here. Average daily construction emissions are shown in Table 3.K-8.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with construction of the Proposed Project or any of the Build Alternatives. Construction activities under the No Build Alternative include only minor structural improvements for the I-580 corridor and surface roadways, as well as construction of land use development projects, including residential and commercial uses. Construction of these improvements and development projects could result in emissions of ROGs, NO_x, and PM. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to ROG, NO_x, and PM emissions. **(NI)**

TABLE 3.K-8 AVERAGE DAILY CONSTRUCTION-RELATED EMISSIONS

	Average Daily Construction Emissions (lbs/day)			
	ROG	**NO_x**	**Exhaust PM_{10}/DPM[a]**	**Exhaust $PM_{2.5}$**
Significance Thresholds	**54**	**54**	**82**	**54**
Conventional BART Project				
Total Emissions	17	**80**	3.1	2.8
Above Threshold?	No	**Yes**	No	No
DMU Alternative				
Total Emissions	13	**56**	1.6	1.5
Above Threshold?	No	**Yes**	No	No
Express Bus/BRT Alternative				
Total Emissions	2.8	13	0.36	0.34
Above Threshold?	No	No	No	No
Enhanced Bus Alternative				
Total Emissions	13	40	1.3	1.2
Above Threshold?	No	No	No	No

Notes: lbs/day = pounds per day; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter; DPM = diesel particulate matter.
[a] For purposes of this analysis, it is conservatively assumed that all PM_{10} is DPM.
Paving off-gas emissions from asphalt are calculated for the Laughlin Road Parking Lot under the Express Bus/BRT Alternative. It is assumed that new surface roads, I-580, and covered parking lots will not require asphalt paving.
Bold/gray values exceed thresholds.
The emissions shown in this table are average daily construction emissions (i.e., emissions divided by time). Therefore, the average daily construction emissions for the Enhanced Bus Alternative are similar to the emissions for the Proposed Project, even though total emissions will be substantially less.

Conventional BART Project. Primary sources of NO_x, PM_{10}, and $PM_{2.5}$ emissions would be from off-road equipment, trucks, and vehicles associated with construction activity, and the primary source of ROG emissions would be architectural coatings at the proposed Isabel Station and the storage and maintenance facility. As shown in Table 3.K-8, while total average daily emissions of ROGs, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds, average daily emissions of NO_x would be 80 lbs/day, which exceeds the 54-lbs/day threshold. As shown in Table 3.K-9, this impact would be reduced to 42 lbs/day, below the significance threshold, with implementation of **Mitigation Measure AQ-2** and this impact would be less than significant. **(LSM)**

DMU Alternative. Construction for the DMU Alternative would have lower levels of activity compared to the Proposed Project because the DMU Alternative has lower levels of excavation involved with the construction of the storage and maintenance facility. Thus, off-road equipment, truck, and vehicle emissions are lower. Also, there would be less surface area for architectural coating, and thus fewer ROG emissions. As shown in Table 3.K-8, while total average daily emissions of ROGs, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds, average daily emissions of NO_x would be 56 lbs/day, slightly over the 54-lbs/day threshold. As shown in Table 3.K-9, this impact would be reduced to 37 lbs/day, below the significance threshold, with implementation of **Mitigation Measure AQ-2** and this impact would be less than significant. **(LSM)**

TABLE 3.K-9 AVERAGE DAILY CONSTRUCTION-RELATED EMISSIONS AFTER MITIGATION-CONVENTIONAL BART PROJECT AND DMU ALTERNATIVE

	Average Daily Construction Emissions (lbs/day)			
	ROG	**NO_x**	**Exhaust PM_{10}/DPM[a]**	**Exhaust $PM_{2.5}$**
Significance Thresholds	**54**	**54**	**82**	**54**
Conventional BART Project				
Total Emissions	14	42	1.3	1.2
Above Threshold?	No	No	No	No
DMU Alternative				
Total Emissions	12	37	0.84	0.78
Above Threshold?	No	No	No	No

Notes: lbs/day = pounds per day; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter; DPM = diesel particulate matter.
[a] For purposes of this analysis, it is conservatively assumed that all PM_{10} is DPM.

Express Bus/BRT Alternative. Construction activity for the Express Bus/BRT Alternative would be significantly less compared to the Proposed Project. Thus, off-road equipment, truck, and vehicle emissions would be significantly lower. There would also be fewer buildings/facilities, requiring less architectural coating and resulting in reduced ROG emissions. As shown in Table 3.K-8, total average daily emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the Express Bus/BRT Alternative would have less-than-significant impacts from emissions of ROGs, NO_x, and PM during construction. **(LS)**

Enhanced Bus Alternative. Construction activity under the Enhanced Bus Alternative would be limited to bus improvements such as excavation, paving, and construction of bus bulbs, bus shelters, and signage. As shown in Table 3.K-8, total average daily emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. As described in the Approach to Analysis, construction emissions for this alternative were estimated from conservatively scaling from the Proposed Project emissions based on construction duration. Because construction emissions are shown on an average daily basis, the construction emissions for the Enhanced Bus Alternative are nearly as high as for the Proposed Project. This is a very conservative estimate and average daily construction emissions for the Enhanced Bus Alternative are expected to be much lower than shown in Table 3.K-8. Nevertheless, construction emissions, even when conservatively estimated, are below BAAQMD significance thresholds. Therefore, the Enhanced Bus Alternative would have less-than-significant impacts from emissions of ROGs, NO_x, and PM during construction. **(LS)**

Mitigation Measures. As described above, the Proposed Project and DMU Alternative would have potentially significant impacts from emissions of NO_x that would exceed BAAQMD significance thresholds. However, with implementation of **Mitigation Measure AQ-2**, which would require BART or its contractor to prepare and implement a construction emissions reduction plan to reduce NO_x emissions from off-road equipment, potential impacts would be reduced to a less-than-significant level. Table 3.K-9 quantifies emissions from construction of the Proposed Project and the DMU Alternative based on use of Tier 4 Final engines for the five highest-emitting construction equipment types for the Proposed Project (i.e., compactors, dozers, dump trucks, scrapers, and loaders) and the four highest-emitting equipment types (i.e., compactors, dozers, dump trucks, and scrapers) for the DMU Alternative. As demontstrated in Table 3.K-9, use of such equipement would reduce construction emissions below thresholds.

As described above, the Express Bus/BRT Alternative and Enhanced Bus Alternative would not have significant impacts related to construction mass emissions of ROGs, NO_x, and PM, and no mitigation measures are required for these alternatives.

Mitigation Measure AQ-2: Construction Emissions Reduction Plan – For Mitigating Mass Emissions of NO_x (Conventional BART Project and DMU Alternative/EMU Option).

The construction contractor shall use Tier 4 Final engines for all off-road construction equipment, which would result in average daily emissions being below the BAAQMD CEQA threshold of 54 lbs/day of NO_x. If the construction contractor proposes to use off-road construction equipment with engines other than Tier 4 engines, the construction contractor shall prepare and implement a construction emissions reduction plan for review and approval by BART that demonstrates that off-road construction equipment (including owned, leased, and subcontractor vehicles) would result in average daily emissions of NO_x below 54 lbs/day. The construction emissions reduction plan shall include an equipment inventory that lists equipment quantities, equipment types, Tier levels, horsepower, estimated daily hours of use, and any emissions abatement devices for each phase of construction. Construction emissions shall be calculated based on this equipment inventory to ensure that average daily emissions are below the BAAQMD CEQA threshold of 54 lbs/day of NO_x. If modifications to the construction emissions reduction plan are required, the contractor must demonstrate to BART that the emissions from the modified equipment inventory are below threshold levels. Acceptable methods for reducing average daily emissions to below 54 lbs/day of NO_x could include but are not limited to a reduction in operating hours and the use of low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, and add-on devices such as particulate filters. Other methods for reducing emissions, which may currently be unforeseen or in development, may also be implemented as they become available. The contractor shall implement the construction emissions reduction plan during all phases of construction where off-road construction equipment is used.

Impact AQ-3: Result in TAC and $PM_{2.5}$ emissions causing increased health risk above BAAQMD significance thresholds during construction.

(No Project Alternative: NI; Conventional BART Project: LSM; DMU Alternative: LSM; Express Bus/BRT Alternative: LSM; Enhanced Bus Alternative: LS)

The use of diesel-fueled construction equipment, haul trucks, and vendor trucks results in the emissions of DPM (a TAC) and $PM_{2.5}$ during construction. Emissions of DPM and $PM_{2.5}$ were estimated based on construction activity and were then used in a dispersion model to estimate ambient air concentrations. Concentrations of DPM were combined with exposure parameters for potentially exposed sensitive populations to calculate cancer risk, as discussed in detail in the Impact Methodology subsection above. Cancer risk and $PM_{2.5}$ concentrations are shown in Tables 3.K-10 and 3.K-11, respectively.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with construction of the Proposed Project or any of the Build Alternatives. Construction activities under the No Build Alternative include only minor structural improvements for the I-580 corridor and surface roadways, as well as construction of land use development projects, including residential and commercial uses. Construction of these improvements and development projects could result in increased health risk associated with TAC and $PM_{2.5}$ emissions. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to health risk associated with TAC and $PM_{2.5}$ emissions. **(NI)**

TABLE 3.K-10 MAXIMUM EXCESS CONSTRUCTION CANCER RISK AT OFF-SITE RECEPTORS

	Excess Cancer Risk (in 1 million)[a]			
Source	**Conventional BART Project**	**DMU Alternative**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	Resident	Resident	--[b]
Project Construction	24	20	10.2	De Minimis[b]
Total	**24**	**20**	**10.2**	De Minimis[b]
Significance Threshold	10	10	10	10
Above Threshold?	**Yes**	**Yes**	**Yes**	No

Notes: -- = not applicable; **bold**/gray values exceed thresholds.
[a] Maximum cancer risk shown for all sensitive receptor types.
[b] Construction for the Enhanced Bus Alternative would be limited to bus improvements such as paving, excavation, and construction of bulb outs. Bus infrastructure improvements are anticipated to be constructed within existing street rights-of-way. Given that construction activity is anticipated to be minimal for the installation of limited bus infrastructure improvements at dispersed locations, the contribution to excess cancer risk would be de minimis.

TABLE 3.K-11 MAXIMUM ANNUAL AVERAGE CONSTRUCTION $PM_{2.5}$ CONCENTRATIONS AT OFF-SITE RECEPTORS

	$PM_{2.5}$ Concentration (μg/m³)			
Source	**Conventional BART Project**	**DMU Alternative**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Project Construction	0.074	0.073	0.036	De Minimis[a]
Total	0.074	0.073	0.036	De Minimis[a]
Significance Threshold	0.3	0.3	0.3	0.3
Above Threshold?	No	No	No	No

Notes: -- = not applicable; μg/m³ = micrograms per cubic meter; $PM_{2.5}$ = fine particulate matter.
[a] Construction for the Enhanced Bus Alternative would be limited to bus improvements such as paving, excavation, and construction of bulb outs. Bus infrastructure improvements are anticipated to be constructed within existing street rights-of-way. Given that contraction activity is anticipated to be much lower compared to that of the Proposed Project and for the DMU Alternative (with EMU Option), the contribution to $PM_{2.5}$ concentration would be de minimis.

Conventional BART Project. As shown in Table 3.K-10, the maximum cancer risk for potentially exposed sensitive populations during construction of the Proposed Project (24-in-1-million) would exceed the significance threshold of 10-in-1-million. The MEISR is located to the west of the storage and maintenance facility near Hartman Road. Table 3.K-11 shows that the maximum concentration of $PM_{2.5}$ associated with construction of the

Proposed Project (0.074 μg/m^3) would be below the significance threshold of 0.3 μg/m^3. Therefore, construction under the Proposed Project would have potentially significant impacts resulting in emissions of TACs that could cause increased health risk above BAAQMD significance thresholds, but would have less-than-significant impacts for concentration of $PM_{2.5}$. This impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure AQ-3,** which would reduce emissions from construction activities to below BAAQMD thresholds through a reduction in operating hours and/or the use of low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, or add-on devices such as particulate filters. Other methods for reducing emissions, which may currently be unforeseen or in development, may also be implemented as they become available. Construction emissions after implementation of **Mitigation Measure AQ-3**, assuming the implementation of Tier 4 Final engines for the five highest-emitting equipment types, are shown in Table 3.K-9 and the mitigated cancer risk is shown in Table 3.K-13. **(LSM)**

DMU Alternative. As shown in Table 3.K-10, the maximum cancer risk for potentially exposed sensitive populations during construction of the DMU Alternative (20-in-1-million) would exceed the significance threshold of 10-in-1-million. The MEISR is located in the Shea Homes Sage Project residential development, which is expected to be fully completed by the time construction begins on the Proposed Project. Table 3.K-11 also shows that the maximum concentration of $PM_{2.5}$ associated with the DMU Alternative construction (0.073 μg/m^3) is below 0.3 μg/m^3. Therefore, construction under the DMU Alternative would have potentially significant impacts resulting in emissions of TACs that could cause increased health risk above BAAQMD significance thresholds, but would have a less-than-significant impact for concentration of $PM_{2.5}$. This impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure AQ-3,** which would reduce emissions from construction activities to below BAAQMD thresholds through a reduction in operating hours and/or the use of low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, or add-on devices such as particulate filters. Other methods for reducing emissions, which may currently be unforeseen or in development, may also be implemented as they become available. Construction emissions after implementation of **Mitigation Measure AQ-3**, assuming the implementation of Tier 4 Final engines for the four highest-emitting equipment types, are shown in Table 3.K-9 and the mitigated cancer risk is shown in Table 3.K-13. **(LSM)**

Express Bus/BRT Alternative. As shown in Table 3.K-10, the maximum cancer risk for potentially exposed sensitive populations during construction of the Express Bus/BRT Alternative (10.2-in-1-million) would exceed the significance threshold of 10-in-1-million. The MEISR is located at the southern corner of the Dublin Station – Avalon II development. Table 3.K-11 also shows that the maximum concentration of $PM_{2.5}$ associated with the Express Bus/BRT Alternative construction (0.036 μg/m^3) is below 0.3 μg/m^3. Therefore, construction under the Express Bus/BRT Alternative would have potentially significant impacts resulting in emissions of TACs that could cause increased health risk above BAAQMD significance thresholds, but would have a less-than-significant impact for concentration of $PM_{2.5}$. This impact would be reduced to a less-than-significant level with implementation of **Mitigation Measure AQ-3,** which would reduce emissions from construction activities to below BAAQMD thresholds through a reduction in operating hours and/or the use of low-emission diesel products, alternative fuels, engine retrofit technology, after-treatment products, or add-on devices such as particulate filters. Other methods for reducing emissions, which may currently be unforeseen or in development, may also be implemented as they become available. Construction emissions after implementation of **Mitigation Measure AQ-3**, assuming the implementation of Tier 4 Final engines for the highest-emitting equipment type, are shown in Table 3.K-12 and the mitigated cancer risk is shown in Table 3.K-13. **(LSM)**

Enhanced Bus Alternative. Construction of the Enhanced Bus Alternative would be limited to bus infrastructure improvements at dispersed locations such as the installation of bus shelters at approximately 29 locations, construction of bus bulbs at approximately 10 locations, and the installation of transit signal priority equipment at approximately six locations. The limited level of construction activity for this alternative would occur along existing street rights-of-way. The Express Bus/BRT Alternative, in comparison, requires much higher levels of construction—including a new bus transfer platform supporting direct BART-and-bus connections, new bus ramps from the I-580 HOV/HOT lanes, extended BART tail tracks, new parking areas, and the relocation of approximately 2.2 miles of I-580. The Enhanced Bus Alternative avoids these construction emissions as well as emissions associated with the relocation of I-580, which requires the reconfiguration of existing freeway interchanges, ramps, overcrossings, and surface frontage roads. The construction for the Enhanced Bus Alternative is assumed to occur over the course of 2 months compared to the approximately 52-month duration of the construction for the Express Bus/BRT Alternative. The lower level of construction activity and shorter duration for the Enhanced Bus Alternative results in much lower levels of DPM. Given that construction activity for the Enhanced Bus Alternative is expected to be much less than the Express Bus/BRT Alternative, which has a cancer risk of 10.2 in a million (slightly exceeding the threshold) and a $PM_{2.5}$ concentration of 0.036 $\mu g/m^3$, the Enhanced Bus Alternative's contribution to excess cancer risk and $PM_{2.5}$ concentration would be less than significant. Therefore, the Enhanced Bus Alternative would have less-than-significant impacts related to health risk. **(LS)**

Mitigation Measures. As described above, the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative would have potentially significant impacts related to the exposure of sensitive populations to DPM emissions. However, with implementation of **Mitigation Measure AQ-3**, which would require a reduction in DPM emissions from construction activities to less than that shown in Tables 3.K-9 and 3.K-12, potential impacts would be reduced to a less-than-significant level. Table 3.K-12 quantifies emissions from construction of the Express Bus/BRT Alternative based on use of Tier 4 Final engines for the highest-emitting construction equipment type (i.e., compactors).

TABLE 3.K-12 MITIGATED AVERAGE DAILY CONSTRUCTION-RELATED EMISSIONS (EXPRESS BUS/BRT ALTERNATIVE)

	Average Daily Construction Emissions (lbs/day)			
	ROG	**NO_x**	**Exhaust PM_{10}/DPM[a]**	**Exhaust $PM_{2.5}$**
Significance Thresholds	**54**	**54**	**82**	**54**
Express Bus/BRT Alternative				
Total Emissions	2.7	12	0.32	0.30
Above Threshold?	No	No	No	No

Notes: lbs/day = pounds per day; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter;
$PM_{2.5}$ = fine particulate matter; DPM = diesel particulate matter.
[a] For purposes of this analysis, it is conservatively assumed that all PM_{10} is DPM.

Tables 3.K-13 and 3.K-14 show cancer risk and $PM_{2.5}$, respectively, after the implementation of **Mitigation Measure AQ-3** assuming the following equipment:

- Conventional BART Project – Tier 4 Final engines for the five highest-emitting equipment types (compactors, dozers, dump trucks, scrapers, loaders)
- DMU Alternative (or EMU Option)– Tier 4 Final engines for the four highest-emitting equipment types (compactors, dozers, dump trucks, scrapers)
- Express Bus/BRT Alternative – Tier 4 Final engines for the highest-emitting equipment type (compactors)
- With implementation of **Mitigation Measure AQ-3**, impacts would be less than significant. Furthermore, implementation of **Mitigation Measure AQ-3** would achieve the BAAQMD thresholds indicated in **Mitigation Measure AQ-2** (54 lbs/day of NO_x), resulting in a less-than-signficant impact (under Impact AQ-2) for the Proposed Project and the DMU Alternative.

TABLE 3.K-13 MAXIMUM EXCESS CONSTRUCTION CANCER RISK AT OFF-SITE RECEPTORS AFTER MITIGATION

	Excess Cancer Risk (in 1 million)[a]		
Source	**Conventional BART Project**	**DMU Alternative**	**Express Bus/BRT Alternative**
Receptor Type	Resident	Resident	Resident
Project Construction	9.3	9.9	8.6
Total	9.3	9.9	8.6
Significance Threshold	10	10	10
Above Threshold?	No	No	No

Note:
[a] Maximum cancer risk shown for all sensitive receptor types.

TABLE 3.K-14 MAXIMUM ANNUAL AVERAGE CONSTRUCTION $PM_{2.5}$ AT OFF-SITE RECEPTORS AFTER MITIGATION

	$PM_{2.5}$ Concentration ($\mu g/m^3$)		
Source	**Conventional BART Project**	**DMU Alternative**	**Express Bus/BRT Alternative**
Project Construction	0.037	0.044	0.032
Total	0.037	0.044	0.032
Significance Threshold	0.3	0.3	0.3
Above Threshold?	No	No	No

Notes: -- = not applicable; $\mu g/m^3$ = micrograms per cubic meter.
[a] Maximum cancer risk shown for all sensitive receptor types.

As described above, the Enhanced Bus Alternative would not have significant impacts and no mitigation measures are required for this alternative.

Mitigation Measure AQ-3: Construction Emissions Reduction Plan – For Mitigating Cancer Risk (Conventional BART Project, DMU Alternative/EMU Option, and Express Bus/BRT Alternative).

The construction contractor shall use Tier 4 Final engines for all off-road construction equipment, which would result in health risk being below BAAQMD CEQA thresholds. If the construction contractor proposes to use off-road construction equipment with engines other than Tier 4 engines, the construction contractor shall prepare and implement a construction emissions reduction plan for review and approval by BART that demonstrates that off-road construction equipment (including owned, leased, and subcontractor vehicles) would result in average daily emissions of DPM below 1.3

lbs/day (Proposed Project), 0.84 lbs/day (DMU Alternative), or 0.32 lbs/day (Express Bus/BRT Alternative). The construction emissions reduction plan should be prepared as decribed in **Mitigation Measures AQ-2**.

Impact AQ-4: Result in objectionable odors affecting a substantial number of people during construction.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The occurrence and severity of potential odor impacts depends on numerous factors. The nature, frequency, and intensity of the source, the wind speeds and direction, and the sensitivity of receiving location each contribute to the intensity of the impact. Although offensive odors seldom cause physical harm, they can be annoying and cause distress among the public, and generate citizen complaints.

Construction activities for the Proposed Project and Build Alternatives have the potential to generate objectionable odors, primarily as a result of diesel combustion. Diesel exhaust resulting from construction equipment and vehicles, while temporary, can be odorous and may have potential impacts. The BAAQMD CEQA Guidelines do not have thresholds of significance for construction-related odors.[103] Nevertheless, to evaluate significance for construction-related odors, a quantitative analysis was performed comparing concentrations of odorous constituents of diesel exhaust to published odor thresholds compliled by Amoore and Hautala.[104] The comparison analysis is shown in Table 39 of Appendix H.

The sources of odors identified for construction activities for the Proposed Project and Build Alternatives are described below.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with construction of the Proposed Project or any of the Build Alternatives. Construction activities under the No Build Alternative include only minor structural improvements for the I-580 corridor and surface roadways, as well as construction of land use development projects, including residential and commercial uses.

[103] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

[104] Amoore, J.E. and E. Hautala, 1983. Odor as and Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 2014 Industrial Chemicals in Air and Water Dilution. Journal of Applied Toxicology, Vol 3, No 6, pg 272.

Construction of these improvements and development projects could result in odors. However, the effects of the other projects associated with the No Project Alternative have been or will be addressed in environmental documents prepared for those projects before they are implemented, and the No Project Alternative would not result in new impacts as a consequence of the BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative is considered to have no impacts related to odors. **(NI)**

Conventional BART Project. The Proposed Project has the potential to create odors from diesel combustion during construction activity (i.e., off-road construction equipment, off-road trucks, on-road trucks). Diesel odors from this equipment would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials. An analysis of the odor-causing constituents of diesel exhaust from the construction equipment indicates that concentrations of the odorous chemicals are well below the odor threshold; therefore, odor impacts are not expected.

Under the Proposed Project, potential sources of odor during construction would be typical of standard construction techniques, temporary in nature, and limited during operations; they are thus not designated by the BAAQMD as potential odor sources of particular concern. Therefore, impacts from odors under the Proposed Project would be less than significant. **(LS)**

DMU Alternative. The DMU Alternative has the potential to create odors from diesel combustion from construction activity (i.e., off-road construction equipment, off-road trucks, on-road trucks). However, diesel odors from this equipment would only incrementally increase the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials. An analysis of the odor-causing constituents of diesel exhaust from the buses indicates that concentrations of the odorous chemicals are well below the odor threshold; therefore, odor impacts are not expected.

Under the DMU Alternative, potential sources of odor during construction would be typical of standard construction techniques, temporary in nature, and limited during operations; they are thus not designated by the BAAQMD as potential odor sources of particular concern. Therefore, impacts from odors under the DMU Alternative would be less than significant. **(LS)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative has the potential to create odors from diesel combustion from construction activity (i.e., off-road construction equipment, off-road trucks, on-road trucks). Diesel odors from this equipment would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials, and associated odors would not change noticeably. An analysis of the odor-causing constituents of diesel exhaust from the buses indicates that concentrations of the odorous chemicals are well below the odor threshold. Therefore, the Express Bus/BRT Alternative would have less-than-significant impacts related to odor. **(LS)**

Enhanced Bus Alternative. The Enhanced Bus Alternative has the potential to create odors from diesel combustion from construction activity (i.e., off-road construction equipment, off-road trucks, on-road trucks). However, the amount of construction associated with the Enhanced Bus Alternative is expected to be significantly lower compared to the other Alternatives. As the Proposed Project and other Alternatives have less-than-significant impacts, the Enhanced Bus Alternative would also have less-than-significant impacts related to odor. **(LS)**

Mitigation Measures. As described above, construction of the Proposed Project and Alternatives would not result in significant impacts related to objectionable odors, and no mitigation measures are required.

(b) Construction – Cumulative Analysis

The geographic study area for cumulative air quality analysis is the same as the study area described for the project in the Introduction subsection above.

The cumulative analysis for construction impacts evaluates the combined impact of construction of the Proposed Project or an alternative, along with other anticipated projects that may be under construction concurrently. Construction of the Proposed Project is anticipated to begin in 2021 and last approximately 5 years through 2026. As listed in Section 3.A, Introduction to Environmental Analysis and Appendix E, the following cumulative projects could be under construction concurrently with the Proposed Project: INP, Kaiser Dublin Medical Center, IKEA Retail Center/Project Clover, Dublin Crossing Specific Plan, Johnson Drive Economic Development Zone, Residences at California Center, ACEforward Program, Crosswinds Site, Hyatt Hotel, Las Positas College, Vasco Road/I-580 Interchange, and North Canyon Parkway/Dublin Boulevard Connection.

Impact AQ-5(CU): In combination with other projects within the vicinity, result in potentially significant localized dust-related air quality impacts during construction under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact AQ-1** above, the No Project Alternative would have no impacts associated with construction-generated dust during construction. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-1** above, the Proposed Project and Build Alternatives would generate construction-related dust, which would be mitigated to less than significant under **Mitigation Measure AQ-1**. These projects, along with potential cumulative projects, could result in construction-generated dust; however, cumulative projects would be required to undergo their own environmental review and approval process and would address any potential construction dust-related impacts through that process. Moreover, cumulative construction projects would be required to implement BAAQMD's best management practices to reduce dust-related impacts. The application of BAAQMD's best management practices will ensure that cumulative impacts from dust are less than significant. Therefore, the Proposed Project and Build Alternatives, in combination with past, present, and probable future development would have less-than-significant cumulative impacts related to construction-generated dust that exceeds significance levels. **(LS)**

Mitigation Measures. As described above, the construction of the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to related to air quality due to localized dust, and no additional mitigation measures, beyond those identified for the project impacts (Proposed Project and Build Alternatives) are required.

Impact AQ-6(CU): In combination with other projects within the vicinity, result in potentially significant emissions of ROGs, NO_x, and PM during construction under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

As discussed in the Standards of Significance subsection above, the BAAQMD's thresholds of significance for criteria air pollutants and precursors represent levels at which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions. If a project's emissions do not exceed the BAAQMD's thresholds of significance for ROGs, NO_x, and PM, then the project's contribution is not cumulatively considerable.

No Project Alternative. As described in **Impact AQ-2** above, the No Project Alternative would have no impacts associated with emissions of ROGs, NO_x, and PM during construction. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. As described in **Impact AQ-2**, the Conventional BART Project and the DMU Alternative would have less-than-significant impacts with the implementation of **Mitigation Measure AQ-2**. The Express Bus/BRT Alternative and Enhanced Bus Alternative have less-than-significant impacts and no mitigation measures are required. Thus, the construction emissions of ROGs, NO_x, and PM are below the BAAQMD's thresholds of significance, and are therefore not considered cumulatively considerable. Therefore, construction of the Proposed Project and Build Alternatives, in combination with past, present, and probable future development would have less-than-significant cumulative impacts related to ROGs, NO_x, and PM. **(LS)**

Mitigation Measures. As described above, the construction of the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to related to ROGs, NO_x, and PM, and no additional mitigation measures, beyond those identified for the project impacts (Proposed Project and DMU Alternative) are required.

Impact AQ-7(CU): In combination with other projects within the vicinity, result in TAC and $PM_{2.5}$ emissions that cause increased health risks above BAAQMD significance thresholds during construction under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: SU; DMU Alternative: SU; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

This analysis evaluates the combined health risk impacts from construction of the Proposed Project or an alternative and other cumulative projects. This cumulative analysis evaluates the contribution of TACs and $PM_{2.5}$ from construction of cumulative projects within the 1,000-foot zone of influence of the MEISR identified for the Proposed Project and each alternative under **Impact AQ-3**, as recommended by the BAAQMD CEQA guidance.[105] Projects that are not within 1,000 feet of the MEISR are not typically considered for cumulative impacts. Per the BAAQMD guidance, sources outside of the 1,000-foot zone of influence are not expected to have a significant adverse impact on health risks. A list of cumulative projects can be found in Section 3.A, Introduction to Environmental Analysis and Appendix E.

No Project Alternative. Under the project analysis for **Impact AQ-3** for construction impacts, the No Project Alternative does not result in new impacts related to health risk associated with construction TAC and $PM_{2.5}$ emissions. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project. Under the analysis for **Impact AQ-3**, the construction MEISR for the Proposed Project is located to the west of the storage and maintenance facility

[105] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

near Hartman Road and impacts to the MEISR would be reduced to less than significant with implementation of **Mitigation Measure AQ-3**. Two other construction projects within the vicinity of the MEISR—Las Positas College Improvements and the INP—are expected to be under construction concurrently with the Proposed Project. Because the construction activities at Las Positas College and related to the INP are well beyond the 1,000-foot zone of influence recommend by the BAAQMD CEQA guidance, construction activities at these locations would have de minimis impacts on cancer risk and $PM_{2.5}$ concentration at the MEISR for the Proposed Project. Thus, cumulative construction impacts to the construction MEISR for the Proposed Project would be less than the cumulative significance thresholds for cancer risk of 100-in-1-million and a $PM_{2.5}$ concentration of 0.8 $\mu g/m^3$, and impacts to this MEISR would be less than significant.

However, impacts of construction of the Proposed Project plus the INP could create health risk to a different MEISR closer to the INP development. The INP is a large project entailing the construction of transit-oriented development around the proposed Isabel Station area consisting of new residential units, office space, a business park, and commercial uses. The majority of the INP construction would occur north and west of the Isabel Station close to sensitive receptors. Based on the development levels in the INP, it is assumed that substantial construction activities for development projects under the plan would generate DPM that could expose sensitive receptors to significant health risks. It is also assumed that mitigation measures for the development of the INP will be identified to reduce construction health risk, but there may be instances where project-specific conditions cannot avoid health risks above cumulative significance thresholds of cancer risk of 100-in-1-million and a $PM_{2.5}$ concentration of 0.8 $\mu g/m^3$. While health risk impacts from mitigated Project construction would not exceed the project CEQA threshold, the cumulative impact of construction of the Proposed Project together with construction of one or more development projects under the INP may exceed the cumulative CEQA threshold at the locations of the MEISR for those development projects. Therefore, cumulative health impacts are considered potentially significant. Analysis of impacts would be incorporated in CEQA review for those projects. However, because such analysis cannot be performed at this time, the cumulative impact is conservatively considered significant and unavoidable. **(SU)**

DMU Alternative. Under the analysis for **Impact AQ-3**, the construction MEISR is located northeast of the Isabel Station at the Shea Homes Sage Project residential development for the DMU Alternative and impacts to the MEISR would be reduced to less than significant with implementation of **Mitigation Measure AQ-3**. Two other construction projects within the vicinity of the MEISR—Las Positas College Improvements and the INP—are expected to be under construction concurrently with the DMU Alternative.

Construction activities at Las Positas College are anticipated to include the demolition of existing buildings, construction of new buildings, and other site improvements. These construction activities would be approximately 2,900 feet from the MEISR and would be beyond the 1,000-foot zone of influence recommended by the BAAQMD CEQA guidance. Accordingly, the construction activity at Las Positas College would have de minimis impacts on cancer risk and $PM_{2.5}$ concentration at the MEISR.

The INP would include construction of transit-oriented development around the proposed Isabel Station area. Development would include new residential units, office space, a business park, and commercial uses. The majority of the INP construction would occur north and west of the Isabel Station, within the 1,000-foot zone of influence of the MEISR. Therefore, construction of the INP is considered in the cumulative construction impacts.

As described under **Impact AQ-3**, the DMU Alternative's construction impacts after mitigation would also be less than 10-in-1-million and $PM_{2.5}$ concentration would be less than 0.3 μg/m^3.

Based on the development levels in the INP, it is assumed that substantial construction activities for development projects under the plan would generate DPM that could expose sensitive receptors to significant health risks. It is also assumed that mitigation measures for the development of the INP will be identified to reduce construction health risk, but there may be instances where project-specific conditions cannot avoid health risks above cumulative significance thresholds of cancer risk of 100-in-1-million and a $PM_{2.5}$ concentration of 0.8 μg/m^3. While health risk impacts from the mitigated DMU Alternative's construction would not exceed the project CEQA threshold, the cumulative impact of construction of the DMU Alternative together with construction of one or more development projects under the INP may exceed the cumulative CEQA threshold at the locations of the MEISR for those development projects. Therefore, cumulative health impacts are considered potentially significant. Analysis of impacts would be incorporated in CEQA review for those projects. However, because such analysis cannot be performed at this time, the cumulative impact is conservatively considered significant and unavoidable. **(SU)**

Express Bus/BRT Alternative. Under the analysis for **Impact AQ-3**, the construction MEISR is located north of the Dublin/Pleasanton Station, at the southern corner of the Dublin Station – Avalon II development. Two other projects—IKEA Retail Center/Project Clover and Dublin Crossing Specific Plan—would be located within the vicinity of the MEISR and are anticipated to be under construction concurrently with the Express Bus/BRT Alternative.

The IKEA Retail Center/Project Clover and Dublin Crossing Specific Plan construction sites are approximately 1,542 feet and 1,285 feet, respectively, from the MEISR, and are therefore beyond the 1,000-foot zone of influence recommended by the BAAQMD for consideration in the cumulative health risk analysis. The construction activity associated with both of these projects would have de minimis impacts to cancer risk and $PM_{2.5}$ concentration at the MEISR and these projects are not further considered in this analysis.

As described under **Impact AQ-3**, the Express Bus/BRT Alternative's construction impacts would be less than 10-in-1-million and $PM_{2.5}$ concentration would be less than 0.3 μg/m^3 after mitigation. This would not exceed the cumulative risk thresholds of 100-in-1-million and $PM_{2.5}$ concentration of 0.8 μg/m^3. Therefore, the cumulative health risk from construction of the Express Bus/BRT Alternative and other cumulative projects would be less than significant. **(LS)**

Enhanced Bus Alternative. As described in **Impact AQ-3**, cancer risk and $PM_{2.5}$ are expected to be substantially lower under the Enhanced Bus Alternative than under the Proposed Project, given the relatively minor amount of construction activity associated with the Alternative. Construction activity is limited to installation of Rapid/Express route amenities at 29 locations (i.e., bus shelters, improved seating and surroundings near bus stops, ticket machines), and construction of bus bulbs at 10 locations. Given the very small impacts from construction activities of the Enhanced Bus Alternative, the cumulative health risk from construction of the Enhanced Bus Alternative and other cumulative projects would be less than significant. **(LS)**

Mitigation Measures. As described above, the Proposed Project and DMU Alternative, in combination with past, present, or probable future projects, could result in significant cumulative impacts related to emissions of TACs and $PM_{2.5}$. With implementation of **Mitigation Measure AQ-3**, the Proposed Project and DMU Alternative would not exceed the project significance threshold. Any additional mitigation for cumulative impacts related to emissions of TACs and $PM_{2.5}$ from construction of development projects under the INP would be considered in CEQA reviews of those projects. Because those mitigation measures and the MEISR locations for those projects, are not known at this time, it is not feasible to develop further mitigation for the contributions of the Proposed Project or DMU Alternative. Therefore, impacts under the Proposed Project and DMU Alternative, in combination with past, present, or probable future projects, would conservatively remain significant and unavoidable.

The Express Bus/BRT Alternative and Enhanced Bus Alternative, in combination with past, present, or probable future projects, would not result in significant cumulative impacts related to emissions of TACs and $PM_{2.5}$, and no mitigation measures are required.

Impact AQ-8(CU): In combination with other projects within the vicinity, result in objectionable odors affecting a substantial number of people during construction under Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact AQ-4** above, the No Project Alternative would have no impacts associated with odors during construction. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-4** above, the Conventional BART Project and Build Alternatives would generate construction-related odors associated with diesel exhaust that would have less-than-significant impacts. The cumulative projects could result in additional construction-related odor; however, these projects would be required to undergo their own environmental review and approval process and would address any potential construction odor impacts through that process. Additionally, odor impacts are generally localized and not likely to result in cumulative impacts from multiple projects. Therefore, the Conventional BART Project and Build Alternatives, in combination with past, present, and probable future development would have less-than-significant cumulative impacts related to construction-related odors that exceeds significance levels. **(LS)**

Mitigation Measures. As described above, the construction of the Proposed Project and Alternatives, in combination with past, present, or probable future projects, would not result in significant cumulative impacts related to odors under Cumulative Conditions, and no mitigation measures are required.

(2) Operational Impacts

Potential impacts related to project operations are described below, followed by cumulative operations impacts.

(a) Operations – Project Analysis

Potential project operations impacts for the opening year 2025 are described first, followed by impacts for the horizon year 2040.

Emissions of ROGs, NO_x, and PM

Impact AQ-9: Result in emissions of ROGs, NO_x, and PM above BAAQMD significance thresholds under 2025 Project Conditions

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The operation of the Proposed Project and Build Alternatives would result in changes in emissions of ROGs, NO_x, and PM associated with both on-road and off-road sources, including mobile and stationary sources. Mobile sources include passenger vehicles, buses, DMUs (DMU Alternative only), shuttle van (Proposed Project) and maintenance trucks (Proposed Project and DMU Alternative only). The implementation of the Proposed Project or any Build Alternative would change passenger vehicle traffic as people may decide to use public transportation or otherwise change their transportation patterns due to the Proposed Project or Build Alternatives. Emissions related to operation of the BART trains and EMU vehicles are not included in this analysis because they are powered by electricity, which would not result in local emissions of ROGs, NO_x, and PM.[106]

Operational stationary sources include emergency generators (Proposed Project, DMU Alternative, and EMU Option only), architectural coatings applied to buildings for periodic upkeep (except Enhanced Bus Alternative), and solvent cleaner emissions (Proposed Project, DMU Alternative, and EMU Option only). The potential impacts from net new emissions of ROGs, NO_x, and PM are described below.

Under 2025 Project Conditions, net emissions for the Proposed Project and each alternative are calculated as the difference between the 2025 No Project Conditions and the 2025 Project Conditions. The 2025 operational emissions for the Proposed Project and Build Alternatives are shown in Table 3.K-15 (average net daily) and Table 3.K-16 (net annual).

No Project Alternative. The 2025 No Project Alternative is the same as baseline conditions (i.e., 2025 No Project Conditions). Therefore, the 2025 No Project Alternative would have no impacts. **(NI)**

Conventional BART Project. In 2025, the Proposed Project would result in a large net reduction in VMT for passenger vehicles compared to the 2025 No Project Conditions, resulting in a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles. The largest contributor to NO_x emissions would be the buses, due to their relatively high emissions rates. Other sources would release lower levels of emissions. The Proposed Project would also include maintenance trucks, a shuttle van, emergency generators, and solvent usage at the BART storage and maintenance facility, all expected to contribute minimally to ROG, NO_x, PM_{10} and $PM_{2.5}$ emissions. As shown in Tables 3.K-15 and 3.K-16, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, in 2025, the Proposed Project would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

DMU Alternative. In 2025, there would be a smaller net reduction in VMT for passenger vehicles for the DMU Alternative compared to the Proposed Project, as the DMU

[106] While the generation of electricity results in criteria air pollutant and GHG emissions, such emissions occur locally at the power generator/plant, none of which are in the vicinity of the project; therefore, they are not considered under this impacts assessment, which focuses on impacts along the project corridor. See Sections 3.L, Greenhouse Gas Emissions and 3.M, Energy for discussions of impacts related to these topics.

Alternative would result in fewer drivers shifting from motor vehicles to the DMU. The net reduction in VMT results in a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles. Emissions associated with the buses, emergency generators, and architectural coating emissions would be similar to the Proposed Project, as activity levels for these sources are expected to be similar. The DMU Alternative would also include DMU trains, maintenance trucks and solvent usage at the DMU storage and maintenance facility. As shown in Tables 3.K-15 and 3.K-16, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, in 2025, the DMU Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

EMU Option. Emissions for the EMU Option in 2025 would be similar to the DMU Alternative, except that there would be no emissions from DMU trains. EMU vehicles are electrically powered and have no local emissions impact. As shown in Tables 3.K-15 and 3.K-16, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, in 2025, the EMU Option would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

TABLE 3.K-15 AVERAGE NET NEW DAILY OPERATIONAL EMISSIONS IN 2025

	Average Net New Daily Operational Emissions (lbs/day)			
	ROG	**NO_x**	**PM_{10}**	**$PM_{2.5}$**
Significance Thresholds	**54**	**54**	**82**	**54**
Conventional BART Project				
Total Emissions	0.75	15	-10	-4.0
Above Threshold?	No	No	No	No
DMU Alternative				
Total Emissions	5.8	26	-7.0	-2.5
Above Threshold?	No	No	No	No
EMU Option				
Total Emissions	1.6	18	-7.4	-2.9
Above Threshold?	No	No	No	No
Express Bus/BRT Alternative				
Total Emissions	2.0	19	-3.5	-1.3
Above Threshold?	No	No	No	No
Enhanced Bus Alternative				
Total Emissions	3.1	20	0.17	0.19
Above Threshold?	No	No	No	No

Note: lbs/day = pounds per day; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter;
$PM_{2.5}$ = fine particulate matter.

TABLE 3.K-16 NET NEW ANNUAL OPERATIONAL EMISSIONS IN 2025

	Maximum Net New Annual Operational Emissions (short tons/yr)			
	ROG	**NO_x**	**PM_{10}**	**$PM_{2.5}$**
Significance Thresholds	**10**	**10**	**15**	**10**
Conventional BART Project				
Total Emissions	0.14	2.8	-1.8	-0.73
Above Threshold?	No	No	No	No
DMU Alternative				
Total Emissions	1.1	4.8	-1.3	-0.45
Above Threshold?	No	No	No	No
EMU Option				
Total Emissions	0.29	3.2	-1.4	-0.53
Above Threshold?	No	No	No	No
Express Bus/BRT Alternative				
Total Emissions	0.37	3.4	-0.65	-0.25
Above Threshold?	No	No	No	No
Enhanced Bus Alternative				
Total Emissions	0.57	3.7	0.032	0.034
Above Threshold?	No	No	No	No

Notes: tons/yr = tons per year; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.
A short ton is a unit of weight that is equivalent to 2,000 pounds. While typically referred to simply as a ton, it is it is distinguished here to clarify that it is not a metric ton, which is equivalent to 1,000 kilograms.

Express Bus/BRT Alternative. In 2025, the Express Bus/BRT Alternative would result in a smaller net reduction in VMT for passenger vehicles compared to the Proposed Project, and would result in fewer mode shifts from motor vehicles. Nevertheless, there would be a net reduction in VMT resulting in a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$. Compared to the Proposed Project, bus emissions under the Express Bus/BRT Alternative would be reduced, as evidenced by the lower bus VMT shown in Table 14 of Appendix H. Architectural coating emissions would be lower compared to the Proposed Project, as there are fewer building structures requiring architectural coating. There would be no emissions generated by emergency generators under this alternative, as no generators are proposed under this alternative. As shown in Tables 3.K-15 and 3.K-16, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, in 2025, the Express Bus/BRT Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

Enhanced Bus Alternative. In 2025, the Enhanced Bus Alternative would result in a smaller net reduction in VMT for passenger vehicles compared to the 2025 Express

Bus/BRT Alternative, as the Enhanced Bus Alternative would result in fewer drivers shifting to bus. Nevertheless, there would be a net reduction in VMT resulting in a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$. Bus emissions would be lower under the Enhanced Bus Alternative compared to the Proposed Project, as the bus network would be smaller and involve fewer bus miles in operation, as evidenced by the lower bus VMT shown in Table 14 of Appendix H. There are no emissions from emergency generators or architectural coating under this alternative; thus, no emissions would be generated from these sources. As shown in Tables 3.K-15 and 3.K-16, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ are below BAAQMD significance thresholds. Therefore, in 2025, the Enhanced Bus Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to emissions of ROGs, NO_x, and PM in 2025, and no mitigation measures are required.

Impact AQ-10: Result in emissions of ROGs, NO_x, and PM above BAAQMD significance thresholds under 2040 Project Conditions

(No Project Alternative: LS; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

Under 2040 Project Conditions, net new emissions are calculated as the difference between the 2040 No Project Conditions and the 2040 Project Conditions. 2040 Project operational emissions for the Proposed Project and Build Alternatives are shown in Table 3.K-17 (average net daily emissions) and Table 3.K-18 (net annual emissions).

No Project Alternative. In 2040, the No Project Alternative would have higher passenger vehicle traffic compared to baseline conditions (the 2025 No Project Conditions). The number of bus trips, however, would be the same as in 2025. Emissions of PM and ROG are primarily driven by passenger vehicle traffic and are thus expected to be higher in 2040 compared to baseline conditions in 2025. NO_x emissions are primarily driven by bus traffic and are thus expected to be at least equivalent to 2025 conditions (due to same VMT) but more likely reduced over time as bus fleets are converted from diesel to hybrid electric or full electric.[107] The increase in daily passenger VMT for the No Project

[107] According to the LAVTA Short Range Transit Plan, LAVTA is looking into vehicles with alternative propulsion technologies such as all-electric for future vehicles purchases. The Short Range Transit Plan does not discuss a schedule for bus replacement to all-electric. Thus, at the very least, 2040 bus emissions would stay equivalent to 2025 emissions.

Livermore-Amador Valley Transit Authority (LAVTA), 2016. LAVTA Short Range Transit Plan. Available at: http://www.wheelsbus.com/wp-content/uploads/2015/08/FINAL-SRTP.pdf, accessed June 2017.

Alternative from 2025 to 2040 is 171,417 miles.[108] The increase in emissions of ROGs, NO_x, and PM is expected to be below BAAQMD significance thresholds.[109] **(LS)**

TABLE 3.K-17 AVERAGE NET NEW DAILY OPERATIONAL EMISSIONS IN 2040

	Average Net New Daily Operational Emissions (lbs/day)			
	ROG	**NO_x**	**PM_{10}**	**$PM_{2.5}$**
Significance Thresholds	**54**	**54**	**82**	**54**
Conventional BART Project				
Total Emissions	0.37	11	-20	-7.9
Above Threshold?	No	No	No	No
DMU Alternative				
Total Emissions	6.5	25	-11	-3.9
Above Threshold?	No	No	No	No
EMU Option				
Total Emissions	1.8	15	-11	-4.4
Above Threshold?	No	No	No	No
Express Bus/BRT Alternative				
Total Emissions	-0.68	18	-7.7	-3.0
Above Threshold?	No	No	No	No
Enhanced Bus Alternative				
Total Emissions	-3.0	19	-0.59	-0.15
Above Threshold?	No	No	No	No

Notes: lbs/day = pounds per day; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.

[108] 2040 No Project daily VMT is 928,428 miles. 2025 No Project daily VMT is 757,011 miles. The difference is: 928,428 miles – 757,011 miles = 171,417 miles.

[109] As shown in Table 3.K-6 (Change in Annual Net Passenger VMT), the reduction in annual VMT due to the 2040 Conventional BART Project is 73,770,403 miles. In comparison, the increase in annual VMT from 2025 No Project to 2040 No Project is 51,425,100 miles (daily VMT increase of 171,417 miles x 300 day per year conversion factor). The reduced emissions associated with the VMT changes in the 2040 Conventional BART Project (shown in Table 28 of Appendix H) are all well below the significance thresholds. Since the increase in annual VMT in the 2040 No Project is less than the decrease in annual VMT for the 2040 Conventional BART Project, and because bus emissions would be at most equivalent in 2040 under the No Project Alternative to 2040 Conventional BART Project, the increase in emissions of ROGs, NO_x, $PM_{2.5}$, and PM_{10} must be less than the BAAQMD significance thresholds.

TABLE 3.K-18 NET NEW ANNUAL OPERATIONAL EMISSIONS IN 2040

	Maximum Net New Annual Operational Emissions (short tons/yr)			
	ROG	**NO_x**	**PM_{10}**	**$PM_{2.5}$**
Significance Thresholds	**10**	**10**	**15**	**10**
Conventional BART Project				
Total Emissions	0.068	2.0	-3.6	-1.4
Above Threshold?	No	No	No	No
DMU Alternative				
Total Emissions	1.2	4.5	-2.0	-0.72
Above Threshold?	No	No	No	No
EMU Option				
Total Emissions	0.32	2.8	-2.1	-0.81
Above Threshold?	No	No	No	No
Express Bus/BRT Alternative				
Total Emissions	-0.12	3.3	-1.4	-0.55
Above Threshold?	No	No	No	No
Enhanced Bus Alternative				
Total Emissions	-0.54	3.5	-0.11	-0.027
Above Threshold?	No	No	No	No

Notes: tons/yr = tons per year; ROG = reactive organic gas; NO_x = nitrogen oxides; PM_{10} = respirable particulate matter; $PM_{2.5}$ = fine particulate matter.
A short ton is a unit of weight that is equivalent to 2,000 pounds. While typically referred to simply as a ton, it is it is distinguished here to clarify that it is not a metric ton, which is equivalent to 1,000 kilograms.

Conventional BART Project. In 2040 the Proposed Project would result in a net reduction in VMT for passenger vehicles compared to the 2040 No Project Conditions. While there would be a greater reduction in VMT associated with the Proposed Project, the passenger vehicles would have fewer emissions due to the CARB's requirements for cleaner vehicles in 2040. Thus, there would be a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles. Buses also would have lower emissions in 2040, consistent with regulatory requirements. The emergency generators, maintenance trucks, shuttle van, and the architectural coatings have the same levels of emissions as in the 2025 analysis. As shown in Tables 3.K-17 and 3.K-18, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the Proposed Project would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

DMU Alternative. In 2040, the DMU Alternative would result in a larger net reduction in VMT for passenger vehicles compared to 2040 No Project Conditions than in 2025, but the passenger vehicles would produce fewer emissions due to the CARB's requirements for cleaner vehicles in 2040. Nevertheless, there would be a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles in 2040. Bus emissions, emergency generators, maintenance trucks, and architectural coating emissions would be similar to the Proposed Project, as activity levels for these sources are expected to be similar. DMU emissions are higher compared to 2025 because of a greater number of DMU VMT. As shown in Tables 3.K-17 and 3.K-18, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the DMU Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

EMU Option. Emissions for the EMU Option would be similar to the DMU Alternative, except that there would be no emissions from DMU vehicles. As shown in Tables 3.K-17 and 3.K-18, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the EMU Option would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

Express Bus/BRT Alternative. In 2040, the Express Bus/BRT Alternative would result in a larger net reduction in VMT for passenger vehicles compared to 2040 No Project Conditions than in 2025. However, this is balanced by lower emission factors from cleaner vehicle fleets in 2040. Nevertheless, there would still be a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles. Buses would also have lower emissions in 2040, reflecting regulatory requirements for cleaner engines, and architectural coating emissions would be the same as in 2025. As shown in Tables 3.K-17 and 3.K-18, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the Express Bus/BRT Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

Enhanced Bus Alternative. In 2040 the Enhanced Bus Alternative would result in a larger net reduction in VMT for passenger vehicles than in 2025. However, this is balanced by lower emission factors from cleaner vehicle fleets in 2040. Nevertheless, there would still be a net reduction in emissions for ROGs, NO_x, PM_{10}, and $PM_{2.5}$ for passenger vehicles. Buses would also have lower emissions in 2040, reflecting regulatory requirements for cleaner engines. As shown in Tables 3.K-17 and 3.K-18, total average net daily and net annual emissions of ROGs, NO_x, PM_{10}, and $PM_{2.5}$ would be below BAAQMD significance thresholds. Therefore, the Express Bus/BRT Alternative would have less-than-significant impacts related to emissions of ROGs, NO_x, and PM. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to emissions of ROGs, NO_x, and PM in 2040, and no mitigation measures are required.

Emissions of TACs and $PM_{2.5}$ Causing Increased Health Risk

Impact AQ-11: Result in emissions of TACs and $PM_{2.5}$ causing increased health risk above BAAQMD significance thresholds under 2025 Project Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

Operational sources of TACs and $PM_{2.5}$ include passenger vehicles associated with localized increases in traffic volumes on certain roadway segments, buses, DMUs (DMU Alternative), maintenance trucks (Proposed Project, DMU Alternative, and EMU Option), a shuttle van (Proposed Project), emergency generators (Proposed Project, DMU Alternative, and EMU Option), and solvent cleaning activities (Proposed Project, DMU Alternative, and EMU Option).

Health impacts associated with TACs contribute to increased cancer risk as well as chronic and/or acute impacts. As described under Approach to Analysis, the primary TAC analyzed for this project is DPM. The OEHHA recommends evaluating DPM as a surrogate for the combination of TACs for health impacts from diesel combustion sources. For sources of diesel exhaust, cancer risks tends to approach thresholds at lower concentrations of diesel exhaust than for non-cancer hazard (chronic and acute) indices due to the toxic profile of the exhaust. Therefore, only cancer risk is evaluated for TAC impacts. Apart from health impacts from TACs, the BAAQMD has a separate significance threshold for $PM_{2.5}$ concentrations. With the exception of solvent cleaning activities, all operational sources listed above emit DPM (a TAC) and $PM_{2.5}$.

Emissions of DPM and $PM_{2.5}$ were modeled to determine concentrations for the Proposed Project and Build Alternatives. TAC concentrations were further used to estimate impacts to cancer risk. Key assumptions for the analysis are noted below.

- It is assumed that solvent use would occur at a level that does not require permitting by the BAAQMD (less than 150 pounds of ROGs per year), and would therefore have negligible impacts to health risk (i.e., expected to contribute less than a 1-in-1-million increased cancer risk).
- To assess the localized increases in traffic volumes, the BAAQMD CEQA Guidelines recommend estimating health risk for roadways with net increase of 10,000 vehicles per day or more.[110] To evaluate project impacts, roadway segments with a net increase

[110] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

of 10,000 vehicles per day or greater were evaluated using the BAAQMD Roadway Screening Analysis Calculator.

- This impact analysis conservatively does not account for the reduction in VMT that would result under the Proposed Project and Build Alternatives, which would reduce emissions of TACs and $PM_{2.5}$. Accounting for the reduction in VMT would result in a small-to-moderate reduction in the concentration of TACs and $PM_{2.5}$, depending on the Alternative. In an effort to simplify the analysis, this assessment conservatively does not incorporate complex modeling that would be required to account for the reduction in TACs and $PM_{2.5}$ associated with the reduction in VMT, resulting in relatively small reductions in concentration of TACs and $PM_{2.5}$.

The lifetime excess project cancer risk at the MEISR and maximum $PM_{2.5}$ concentrations for 2025 are shown in Tables 3.K-19 and 3.K-20, respectively, for the Proposed Project and Build Alternatives.

TABLE 3.K-19 MAXIMUM OPERATIONAL PROJECT CANCER RISK AT OFF-SITE RECEPTORS IN 2025

	Excess Cancer Risk (in 1 million)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	Resident	Resident	Resident	Resident
Traffic	--[a]	--[a]	--[a]	--[a]	--[a]
Buses	6.1	6.1	6.1	4.1	6.3
DMU	--	1.6	--	--	--
Generator (Isabel Station)	0.44	0.44	0.44	--	--
Generator (Maintenance Facility)	0.025	0.043	0.043	--	--
Maintenance Trucks and Shuttle Van [c,d]	9.1E-06	2.1E-05	2.1E-05	--	--
Solvent Use	--[b]	--[b]	--[b]	--	--
Total	6.5	8.2	6.6	4.1	6.3
Significance Threshold	10	10	10	10	10
Above Threshold?	No	No	No	No	No

Notes: -- = not applicable.
[a] Incremental increase in traffic volume is less than 10,000 vehicles per day for all roadway segments. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[b] Solvent use in the storage and maintenance facility for the Proposed Project, DMU Alternative, and EMU Option would be less than the BAAQMD permitting thresholds. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[c] A numerical value with "E" denotes scientific notation; thus, 5.6E-06 is equivalent to 5.6×10^{-6}.
[d] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.

TABLE 3.K-20 MAXIMUM ANNUAL AVERAGE OPERATIONAL PROJECT $PM_{2.5}$ CONCENTRATIONS AT OFF-SITE RECEPTORS IN 2025

	$PM_{2.5}$ Concentration (μg/m³)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	School	Resident	Resident	Resident
Traffic	--[a]	--[a]	--[a]	--[a]	--[a]
Buses	0.0087	0.00043	0.0087	0.0057	0.0085
DMU	--	0.022	--	--	--
Generator (Isabel Station)[b]	0.00059	4.2E-05	0.00059	--	--
Generator (Maintenance Facility) [c]	3.3E-05	0.00013	5.8E-05	--	--
Maintenance Trucks and Shuttle Van [c]	2.3E-08	6.4E-08	5.8E-08	--	--
Total	0.0093	0.023	0.0093	0.0057	0.0085
Significance Threshold	0.3	0.3	0.3	0.3	0.3
Above Threshold?	No	No	No	No	No

Notes: -- = not applicable; μg/m³ = micrograms per cubic meter; $PM_{2.5}$ = fine particulate matter.
[a] Incremental increase in traffic volume is less than 10,000 vehicles per day for all roadway segments. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[b] A numerical value with "E" denotes scientific notation; thus, 3.7E-05 is equivalent to 3.7×10^{-5}.
[c] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.

No Project Alternative. The 2025 No Project Alternative is the same as baseline conditions (i.e., 2025 No Project Conditions). Therefore, the 2025 No Project Alternative would have no impacts. **(NI)**

Conventional BART Project. In 2025, the Proposed Project would result in potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations due to changes in passenger vehicle activity, new bus routes, activities at the storage and maintenance facility, and emergency generators. The key inputs to the analysis are described below.

- In 2025, the Proposed Project would have an overall net reduction in VMT of 38,250,574 miles compared to the 2025 No Project Conditions. However, as described above, this analysis conservatively does not quantify the reduction in TAC and $PM_{2.5}$ associated with the net reduction in VMT.
- No roadway segments were projected to have an increase of 10,000 vehicles per day. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle.

- New and modified bus routes, as described in Chapter 2, Project Description, were also evaluated. The focus of the modeling analysis was at the Isabel Station north touchdown structure plaza where bus connections would be provided for BART riders.
- New emergency generators are assumed to be located at the Isabel North Station area and at the storage and maintenance facility.
- DPM emissions from maintenance vehicles at the storage and maintenance facility and a shuttle van were conservatively included in the modeling analysis, although the emissions are relatively low.

In 2025, the cancer risk MEISR and maximum $PM_{2.5}$ concentration for the Proposed Project are located at the Shea Homes Sage Project residential development currently under construction approximately 340 meters northeast of the proposed Isabel Station. This residential area is assumed to be fully constructed by the time the Proposed Project is in operation.

Table 3.K-19 shows that the increased cancer risk at the MEISR is 6.5-in-1-million and Table 3.K-20 shows that the maximum $PM_{2.5}$ concentration is 0.0093 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$, respectively. Therefore, the Proposed Project in 2025 would have less-than-significant impacts related to health risk. **(LS)**

DMU Alternative. In 2025, the DMU Alternative would result in similar emission sources as the Proposed Project, except that it would include DPM emissions from the DMU vehicles. The new and modified bus routes, emergency generators, and maintenance trucks at the storage and maintenance facility would be similar to the Proposed Project. Key inputs to the analysis that differ from the Proposed Project are described below as follows: passenger vehicle activity and DMU vehicle activity.

- In 2025, the DMU Alternative would have an overall net reduction in VMT of 28,578,215 miles compared to the 2025 No Project Conditions. However, as described above, this analysis conservatively does not quantify the reduction in TAC and $PM_{2.5}$ associated with the net reduction in VMT.
- No roadway segments under this alternative were projected to have an increase of 10,000 vehicles per day. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- Emissions for the DMU vehicle were modeled for its operational route along I-580 from the Dublin/Pleasanton Station to the Isabel Station. DMU vehicles would have approximately 776,400 vehicle miles per year in 2025.

In 2025, the cancer risk MEISR for the DMU Alternative is located in the Shea Homes Sage Project residential development (approximately 340 meters northeast of the proposed

Isabel Station), similar to the Proposed Project, and the maximum $PM_{2.5}$ concentration is located at the Tri-Valley Regional Occupational Program near the intersection of Kitty Hawk Road and Armstrong Street (approximately 235 meters southwest of the proposed Isabel Station).

Table 3.K-19 shows that the increased cancer risk at the MEISR is 8.2-in-1-million and Table 3.K-20 shows that the maximum $PM_{2.5}$ concentration is 0.023 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$, respectively. Therefore, the 2025 DMU Alternative would have less-than-significant impacts related to health risk. **(LS)**

EMU Option. In 2025, the EMU Option cancer risk and $PM_{2.5}$ concentrations would be similar to the DMU Alternative, except that the DMU vehicle would be replaced with an EMU vehicle, which does not emit TACs or $PM_{2.5}$ locally. The MEISR and maximum $PM_{2.5}$ concentration are located in the Shea Homes Sage Project residential development, similar to the Proposed Project. Table 3.K-19 shows that the increased cancer risk at the MEISR is 6.6-in-1-million and Table 3.K-20 shows that the maximum $PM_{2.5}$ concentration is 0.0093 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$ respectively. Therefore, the 2025 EMU Option would have less-than-significant impacts related to health risk. **(LS)**

Express Bus/BRT Alternative. In 2025, the Express Bus/BRT Alternative would result in a new bus transfer platform at the Dublin/Pleasanton Station to allow bus connections from I-580 HOV/HOT lanes to the station. Existing and new feeder bus service would run from the Dublin/Pleasanton Station on I-580 toward the east. Key inputs to the analysis are described below as follows: passenger vehicle activity and new bus routes.

- The 2025 Express Bus/BRT Alternative would have an overall net reduction in VMT of 13,357,023 miles compared to the 2025 No Project Conditions. However, as described above, this analysis conservatively does not quantify the reduction in TAC and $PM_{2.5}$ associated with the net reduction in VMT.
- No roadway segments would have an increase of 10,000 vehicles per day under this alternative; thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- New and modified bus routes, as described in Chapter 2, Project Description, were evaluated. The focus of the modeling analysis was at the Dublin/Pleasanton Station where bus connections would be provided to BART riders.

In 2025, the cancer risk MEISR and maximum $PM_{2.5}$ concentration for the Express Bus/BRT Alternative are located at the Dublin Station – Avalon II apartment complex, approximately 127 meters north of the Dublin/Pleasanton Station. Table 3.K-19 shows that the increased cancer risk at the MEISR is 4.1-in-1-million and Table 3.K-20 shows that the maximum $PM_{2.5}$ concentration is 0.0057 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and

0.3 μg/m^3, respectively. Therefore, the 2025 Express Bus/BRT Alternative would have less-than-significant impacts related to health risk. **(LS)**

Enhanced Bus Alternative. In 2025, the Enhanced Bus Alternative would have new and modified bus routes, as described in Chapter 2, Project Description. Key inputs to the analysis are described below as follows: passenger vehicle activity and new bus routes.

- The 2025 Enhanced Bus Alternative would have an overall net reduction in VMT of 75,668 miles compared to the 2025 No Project Conditions. However, as described above, this analysis conservatively does not quantify the reduction in TAC and $PM_{2.5}$ associated with the net reduction in VMT.
- No roadway segments are projected to have an increase of 10,000 vehicles per day under this alternative. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- For the new and modified bus routes, the focus of the modeling analysis was at the Dublin/Pleasanton Station where bus connections would be provided to BART riders.

The MEISR and maximum $PM_{2.5}$ concentration are located at the DR Horton Espirit residential development, approximately 530 meters northeast of the Dublin/Pleasanton Station. Table 3.K-19 shows that the increased cancer risk at the MEISR is 6.3-in-1-million and Table 3.K-20 shows that the maximum $PM_{2.5}$ concentration is 0.0085 μg/m^3, which are below the thresholds of 10-in-1-million and 0.3 μg/m^3, respectively. Therefore, the 2025 Express Bus/BRT Alternative would have less-than-significant impacts related to health risk. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to increased health risk in 2025, and no mitigation measures are required.

Impact AQ-12: Result in emissions of TACs and $PM_{2.5}$ causing increased health risk above BAAQMD significance thresholds under 2040 Project Conditions.

(No Project Alternative: S; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The lifetime excess project cancer risk at the MEISR and maximum $PM_{2.5}$ concentrations for 2040 Project Conditions are shown in Tables 3.K-21 and 3.K-22, respectively, for the Proposed Project and Alternatives.

No Project Alternative. In 2040, health risk impacts from emissions of TACs and $PM_{2.5}$ would be driven by passenger vehicle and bus traffic because they would be the largest sources of operational diesel exhaust emissions. Bus routes and annual VMT will remain unchanged between the 2025 baseline (2025 No Project Conditions) and the 2040 No

Project Alternative, based on the analysis by Arup.[111] Bus emissions of TACs and $PM_{2.5}$ are thus expected to be at least equivalent to 2025 conditions (due to same VMT) but more likely reduced over time as bus fleets are converted from diesel to hybrid electric or full

TABLE 3.K-21 MAXIMUM OPERATIONAL PROJECT CANCER RISK AT OFF-SITE RECEPTORS IN 2040

	Excess Cancer Risk (in 1 million)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	Resident	Resident	Resident	Resident
Traffic	1.3	--[a]	--[a]	--[a]	--[a]
Buses	2.7	2.7	2.7	3.9	6.1
DMU	--	1.8	--	--	--
Generator (Isabel Station)	0.44	0.44	0.44	--	--
Generator (Maintenance Facility)	0.025	0.043	0.043	--	--
Maintenance Trucks and Shuttle Van[c,d]	4.5E-06	9.9E-06	9.9E-06	--	--
Solvent Use	--[b]	--[b]	--[b]	--	--
Total	4.5	5.0	3.2	3.9	6.1
Significance Threshold	10	10	10	10	10
Above Threshold?	No	No	No	No	No

Notes: -- = not applicable.
[a] Incremental increase in traffic volume is less than 10,000 vehicles per day for all roadway segments. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[b] Solvent use in the storage and maintenance facility under the Proposed Project, DMU Alternative, and EMU Option would be less than BAAQMD permitting thresholds. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[c] A numerical value with "E" denotes scientific notation; thus, 2.7E-06 is equivalent to 2.7×10^{-6}.
[d] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.

[111] Arup, 2017a. BART to Livermore Extension Bus and Overall Operations and Maintenance Cost Technical Memorandum. July.

TABLE 3.K-22 MAXIMUM ANNUAL AVERAGE OPERATIONAL PROJECT $PM_{2.5}$ CONCENTRATIONS AT OFF-SITE RECEPTORS IN 2040

	$PM_{2.5}$ Concentration (µg/m³)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	School	Resident	Resident	Resident
Traffic	0.016	--[a]	--[a]	--[a]	--[a]
Buses	0.0039	0.00021	0.0039	0.0053	0.0082
DMU	--	0.025	--	--	--
Generator (Isabel Station)[b]	0.00059	4.2E-05	0.00059	--	--
Generator (Maintenance Facility)	3.3E-05	0.00013	5.8E-05	--	--
Maintenance Trucks and Shuttle Van[c]	1.7E-08	4.7E-08	4.3E-08	--	--
Total	0.021	0.025	0.0046	0.0053	0.0082
Significance Threshold	0.3	0.3	0.3	0.3	0.3
Above Threshold?	No	No	No	No	No

Notes: -- = not applicable; PM_{10} = respirable particulate matter.
[a] Incremental increase in traffic volume is less than 10,000 vehicles per day for all roadway segments. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[b] A numerical value with "E" denotes scientific notation; thus, 3.7E-05 is equivalent to 3.7×10^{-5}.
[c] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.

electric.[112] As described in **Impact AQ-7**, the increase in overall regional passenger VMT from 2025 No Project to 2040 No Project is 171,417 daily miles or 51,425,100 annual miles.[113] This is roughly 20 percent higher than the annual VMT decrease for passenger vehicles for the 2040 DMU Alternative (42,745,966 miles, Table 3.K-6). Table 30 of

[112] According to the LAVTA Short Range Transit Plan, LAVTA is looking into vehicles with alternative propulsion technologies such as all-electric for future vehicles purchases. The Short Range Transit Plan does not discuss a schedule for bus replacement to all-electric. Thus, at the very least, 2040 bus emissions would stay equivalent to 2025 emissions.

LAVTA, 2016. LAVTA Short Range Transit Plan. Available at: http://www.wheelsbus.com/wp-content/uploads/2015/08/FINAL-SRTP.pdf, accessed June 2017.

[113] 2040 No Project daily VMT is 928,428 miles. 2025 No Project daily VMT is 757,011 miles. The difference is as follows: 928,428 miles – 757,011 miles = 171,417 miles. To convert from daily VMT to annual VMT, the daily VMT is multiplied by 300 days/year. This is consistent with the Plan Bay Area 2040 Public Review Draft Environmental Impact Report.

Source: Cambridge Systematics, 2017. Personal communication with BART regarding BART to Livermore Extension Project VMT Projections. July 19.

Appendix H shows that the change in DPM and $PM_{2.5}$ emissions due to the decrease in passenger traffic in the DMU Alternative is 2.1 tons/yr and 0.87 tons/yr, respectively. Thus, the increase in emissions due to passenger traffic in the 2040 No Project Alternative compared to the 2025 No Project Alternative would be approximately 20 percent higher, or 2.5 tons/yr and 1.0 tons/yr for DPM and $PM_{2.5}$ emissions, respectively. While dispersion modeling and an HRA of these emissions has not been performed, it is conservatively assumed that the 2040 No Project Alternative would have a significant impact as a result of the increased emissions of DPM and $PM_{2.5}$. **(S)**

Conventional BART Project. In 2040, emissions of TACs and $PM_{2.5}$ would be similar to those in 2025, with differences described below.

- There is one segment of Airway Boulevard projected to have an increase of more than 10,000 vehicles per day. This segment is to the south of I-580 and east of the Isabel Station. All other roadway segments would have a net increase of less than 10,000 vehicles per day or a net decrease in roadway volume. Thus, this one roadway segment was evaluated for contribution to incremental health risk and $PM_{2.5}$ concentration.
- In 2040 the Proposed Project would result in a greater reduction in annual VMT (73,770,403 fewer miles annually) compared to the Proposed Project in 2025 (38,250,574 fewer miles annually). While this reduction in VMT is conservatively not quantified in this analysis, the reduced VMT would result in reduced emissions of TACs and $PM_{2.5}$. Bus activity in 2040 is expected to be similar to feeder bus service in 2025. However, DPM emissions associated with bus operations would be significantly lower as the transit agencies switch to cleaner fleets, consistent with requirements of the CARB Statewide Truck and Bus Regulation.[114]

The MEISR for cancer risk and maximum $PM_{2.5}$ concentration are at the same location as the Proposed Project in 2025 (Shea Homes Sage Project residential development). Tables 3.K-21 and 3.K-22, respectively, show that the increased cancer risk at the MEISR is 4.5-in-1-million and the maximum $PM_{2.5}$ concentration is 0.021 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$, respectively. Therefore, the 2040 Proposed Project would have less-than-significant impacts related to health risk. **(LS)**

DMU Alternative. The DMU Alternative emissions of TACs and $PM_{2.5}$ would be similar in 2040 to those in 2025, with differences noted below.

[114] California Code of Regulations, Title 13, Section 2025. Regulation to Reduce Emissions of Diesel Particulate Matter, Oxides of Nitrogen and Other Criteria Pollutants from In-Use Heavy-Duty Diesel-Fueled Vehicles. ("Truck and Bus Regulation"). Effective December 31, 2014.

- In 2040 there would be a greater reduction in annual VMT (42,745,966 fewer miles annually) compared to 2025 (28,578,215 fewer miles annually). While this reduction in VMT is conservatively not quantified in this analysis, the reduced VMT would result in reduced emissions of TACs and $PM_{2.5}$.
- No roadway segments are projected to have an increase of 10,000 vehicles per day under this alternative. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- DMU vehicle activity would increase from 776,400 car miles per year in 2025 to 864,100 car miles per year in 2040. This would result in increased emissions of DPM and $PM_{2.5}$.
- Truck activity at the storage and maintenance facility in 2040 is assumed to be similar to activity in 2025. However, emissions of DPM and $PM_{2.5}$ are expected to be lower, as truck emissions would be cleaner due to replacement of older fleet vehicles with newer vehicles, the emissions of which would be consistent with the CARB Tier Standards.
- As in the 2040 Proposed Project analysis, DPM emissions from buses would be lower compared to 2025, due to the CARB requirements for lower emissions.

The MEISR for cancer risk and maximum $PM_{2.5}$ concentration would be at the same locations as the DMU Alternative in 2025 noted above (Shea Homes Sage Project residential development and Tri-Valley Regional Occupational Program, respectively). Tables 3.K-21 and 3.K-22 show that the increased cancer risk at the MEISR is 5.0-in-1-million and the maximum $PM_{2.5}$ concentration is 0.025 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$, respectively. Therefore, the 2040 DMU Alternative would have less-than-significant impacts related to health risk. **(LS)**

EMU Option. The EMU Option conditions in 2040 would be similar to 2025, except that there would be no emissions associated with DMU vehicles, as EMU vehicles would be in use instead. The MEISR and maximum $PM_{2.5}$ concentration would be at the same location as in 2025 (Shea Homes Sage Project residential development). Tables 3.K-21 and 3.K-22 show that the increased cancer risk at the MEISR is 3.2-in-1-million and the maximum $PM_{2.5}$ concentration is 0.0046 $\mu g/m^3$, which are below the thresholds of 10-in-1-million and 0.3 $\mu g/m^3$, respectively. Therefore, the 2040 EMU Option would have less-than-significant impacts related to health risk. **(LS)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative emissions of TACs and $PM_{2.5}$ in 2040 would be similar to 2025, with differences described below.

- In 2040, there would be a greater reduction in annual VMT (28,586,697 fewer miles annually) compared to 2025 (13,357,023 fewer miles annually). While this reduction in

VMT is conservatively not quantified in this analysis, the reduced VMT would result in reduced emissions of TACs and $PM_{2.5}$.

- No roadway segments are projected to have an increase of 10,000 vehicles per day under this alternative. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- As in the 2040 Proposed Project analysis, DPM emissions from buses are lower compared to 2025 due to the CARB requirements for lower emissions.

The MEISR for cancer risk and maximum $PM_{2.5}$ concentration are located at the Elan at Dublin Station apartment complex. Tables 3.K-21 and 3.K-22 show that the increased cancer risk at the MEISR is 3.9-in-1-million and the maximum $PM_{2.5}$ concentration is 0.0053 μg/m^3, which are below the thresholds of 10-in-1-million and 0.3 μg/m^3, respectively. Therefore, the 2040 Express Bus/BRT Alternative would have less-than-significant impacts related to health risk. **(LS)**

Enhanced Bus Alternative. The Enhanced Bus Alternative emissions of TACs and $PM_{2.5}$ in 2040 would be similar to 2025, with differences noted below.

- In 2040, there would be a greater reduction in annual VMT (2,722,388 fewer miles annually) compared to 2025 (75,668 fewer miles annually). While this reduction in VMT is conservatively not quantified in this analysis, the reduced VMT would result in reduced emissions of TACs and $PM_{2.5}$.
- No roadway segments are projected to have an increase of 10,000 vehicles per day under this alternative. Thus, the contribution to incremental cancer risk and $PM_{2.5}$ concentration is not evaluated for changes in passenger vehicle activity.
- As in the 2040 Proposed Project analysis, DPM emissions from buses are lower compared to 2025 due to the CARB requirements for lower emissions.

The MEISR for cancer risk and maximum $PM_{2.5}$ concentration are located at the same residential area as under the 2025 Enhanced Bus Alternative (DR Horton Espirit residential development). Tables 3.K-21 and 3.K-22 show that the increased cancer risk at the MEISR is 6.1-in-1-million and the maximum $PM_{2.5}$ concentration is 0.0082 μg/m^3, which are below the thresholds of 10-in-1-million and 0.3 μg/m^3, respectively. Therefore, the 2040 Enhanced Bus Alternative would have less-than-significant impacts related to health risk. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Build Alternatives would not result in significant impacts related to health risk in 2040, and no mitigation measures are required.

Concentrations of Carbon Monoxide

Impact AQ-13: Result in local concentrations of CO above BAAQMD significance thresholds for 2025 Project Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

CO concentration is a direct function of motor vehicle activity (particularly during peak commuting hours) and meteorological conditions. Under specific meteorological conditions combined with high motor vehicle activity, CO concentrations may reach unhealthy levels for local sensitive land uses, such as residential areas, schools, preschools, playgrounds, and hospitals. As a result, the BAAQMD recommends analysis of CO emissions at a local rather than a regional level.

BAAQMD provides a screening methodology based on peak hourly traffic volumes at affected intersections. If a project would contribute 44,000 vehicles per hour to an intersection or 24,000 vehicles per hour for intersections where vertical or horizontal air mixing would be limited (e.g., tunnel, parking garage, bridge underpass, natural or urban street canyon, or below-grade roadway), it could violate or contribute to a violation of NAAQS or CAAQS for CO.[115]

No Project Alternative. The 2025 No Project Alternative is the same as baseline conditions (i.e., 2025 No Project Conditions). Therefore, the 2025 No Project Alternative would have no impacts. **(NI)**

Conventional BART Project and Build Alternatives. Potential CO impacts from the Proposed Project and Build Alternatives were evaluated for intersections within the transportation study area, described in Section 3.B, Transportation. Traffic at intersections was approximated using the one-way PM peak traffic volumes for major roadway segments. Based on these volumes, none of the study area intersections would be expected to exceed either the 44,000-vehicles-per-hour threshold or the 24,000-vehicles-per-hour threshold for intersections where vertical or horizontal air mixing would be limited.

Intersection traffic volumes for 2025 Project Conditions are shown in Table 3.K-23 and listed below.

[115] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

TABLE 3.K-23 PEAK HOURLY INTERSECTION TRAFFIC COUNTS IN 2025

Alternative	Peak Hourly Intersection Traffic Volume (vehicles per hour)
Conventional BART Project	9,010
DMU Alternative	9,026
Express Bus/BRT Alternative	8,982
Enhanced Bus Alternative	8,939

Note: Values shown represent the maximum PM peak hourly traffic volume at the worst-case intersection for the Proposed Project and each alternative.
Source: Arup, 2017c. Personal communication with BART regarding BART to Livermore Extension Project Intersection Turning Movements. July 19.

- **2025 Proposed Project.** The greatest intersection volumes would be 9,010 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).
- **2025 DMU Alternative.** The greatest intersection volumes would be 9,026 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).
- **2025 Express Bus/BRT Alternative.** The greatest intersection volumes would be 8,982 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).
- **2025 Enhanced Bus Alternative.** The greatest intersection volumes would be 8,939 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).

Each intersection would be below the most conservative screening threshold of 24,000 vehicles per hour.

Therefore, as described above, traffic vehicle volumes associated with the Proposed Project and Build Alternatives would be below BAAQMD screening thresholds for CO concentrations, and refined quantitative analysis is not required. Therefore, the Proposed Project and Build Alternatives would result in less-than-significant impacts related to CO concentrations. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to local concentrations of CO in 2025, and no mitigation measures are required.

Impact AQ-14: Result in local concentrations of CO above BAAQMD significance thresholds for 2040 Project Conditions.

(No Project Alternative: LS; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. Potential CO impacts from the 2040 No Project Alternative were evaluated for intersections within the transportation study area, described in Section 3.B, Transportation. Based on intersection volumes, none of the study area intersections would be expected to exceed either the 44,000-vehicles-per-hour threshold or the 24,000-vehicles-per-hour threshold for intersections where vertical or horizontal air mixing would be limited. The greatest intersection volume would be 9,870 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard). Each intersection would be below the most conservative screening threshold of 24,000 vehicles per hour. Therefore, as described above, traffic vehicle volumes associated with the 2040 No Project Alternative would be below BAAQMD screening thresholds for CO concentrations, and refined quantitative analysis is not required. Therefore, the 2040 No Project Alternative would result in less-than-significant impacts related to CO concentrations. **(LS)**

Conventional BART Project and Build Alternatives. Potential CO impacts from the Proposed Project and Build Alternatives were evaluated for intersections within the transportation study area, described in Section 3.B, Transportation, similar to that for 2025. Based on intersection volumes, none of the study area intersections would be expected to exceed either the 44,000-vehicles-per-hour threshold or the 24,000-vehicles-per-hour threshold for intersections where vertical or horizontal air mixing would be limited.

Intersection traffic volumes for 2040 Project Conditions are shown in Table 3.K-24 and listed below.

- **2040 Proposed Project.** The greatest intersection volumes would be 10,166 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).
- **2040 DMU Alternative.** The greatest intersection volumes would be 10,059 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).
- **2040 Express Bus/BRT Alternative.** The greatest intersection volumes would be 9,903 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).2040 Enhanced Bus Alternative. The greatest intersection volumes would be 9,871 vehicles per hour at Intersection 2 (Hopyard Road/Dougherty Road and Dublin Boulevard).

TABLE 3.K-24 PEAK HOURLY INTERSECTION TRAFFIC COUNTS IN 2040

	Peak Hourly Intersection Traffic Volume (vehicles per hour)
Conventional BART Project	10,166
DMU Alternative	10,059
Express Bus/BRT Alternative	9,903
Enhanced Bus Alternative	9,871

Note: Values shown represent the maximum PM peak hourly traffic volume at the worst-case intersection for the Proposed Project and each alternative.
Source: Arup, 2017c. Personal communication with BART regarding BART to Livermore Extension Project Intersection Turning Movements. July 19.

Each intersection would be below the most conservative screening threshold of 24,000 vehicles per hour.

Therefore, as described above, traffic vehicle volumes associated with the Proposed Project and Build Alternatives would be below BAAQMD screening thresholds for CO concentrations, and refined quantitative analysis is not required. Therefore, the Proposed Project and Build Alternatives would result in less-than-significant impacts related to CO concentrations. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to local concentrations of CO in 2040, and no mitigation measures are required.

Impact AQ-15: Result in objectionable odors affecting a substantial number of people in 2025 and 2040.

(No Project Alternative: LS; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The occurrence and severity of potential odor impacts depends on numerous factors. The nature, frequency, and intensity of the source, the wind speeds and direction, and the sensitivity of receiving location each contribute to the intensity of the impact. Although offensive odors seldom cause physical harm, they can be annoying and cause distress among the public, and generate citizen complaints.

Operational activities for the Proposed Project and Build Alternatives have the potential to generate objectionable odors, primarily as a result of diesel combustion. Operational sources of diesel exhaust include buses (all alternatives), DMU trains (DMU Alternative), the maintenance trucks (Proposed Project, DMU Alternative, and EMU Option), shuttle van (Proposed Project), and the emergency generators (Proposed Project, DMU Alternative, and EMU Option). Another potential source of odor is solvent use at the Proposed Project and DMU storage and maintenance facility.

The BAAQMD CEQA Guidelines specifically identify wastewater treatment plants, oil refineries, asphalt plants, chemical manufacturing, painting/coating operations, coffee roasters, food processing facilities, recycling operations, and metal smelters as operational odor sources of particular concern. For such uses, the BAAQMD recommends a buffer zone of 1 to 2 miles to avoid potential odor conflicts. The Proposed Project and Build Alternatives do not include any of these odor-producing sources. The BAAQMD CEQA Guidelines have a threshold of significance for operational-related odors of five confirmed complaints per year averaged over 3 years.[116] Given that the sources of odors are not yet in operation, this is not a useful threshold for determining significance. Thus, to evaluate significance for operational-related odors, a quantitative analysis was performed comparing concentrations of odorous constituents of diesel exhaust to published odor thresholds.[117] The comparison analysis is shown in Appendix H.

The sources of odors identified for operational activities for the Proposed Project and Alternatives are described below.

No Project Alternative. The No Project Alternative is not expected to result in objectionable odors. It does not include the Isabel Station or storage and maintenance facility (Proposed Project and DMU Alternative), and would therefore not include the associated activities in these areas with the potential to create odors, such as emergency generator use, maintenance trucks, shuttle van, solvent use, and area coating. The odor sources in both 2025 and 2040 would include diesel emissions from (non-BART) passenger vehicles and buses. From the 2025 No Project Conditions to the 2040 No Project Conditions, passenger vehicle emissions are expected to increase while bus emissions are expected to decrease. The increase in passenger vehicle emissions over the study area is not expected to contribute to a significant odor impact. **(LS)**

Conventional BART Project. The Proposed Project has the potential to create odors from diesel combustion during operational activity (i.e., emergency generator, shuttle van, and buses). With respect to the operation of buses, there would be an average of 217 net new

[116] Bay Area Air Quality Management District (BAAQMD), 2017. California Environmental Quality Act Air Quality Guidelines. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/ceqa_guidelines_may2017-pdf.pdf?la=en, accessed May 2017.

[117] Amoore, J.E. and E. Hautala, 1983. Odor as and Aid to Chemical Safety: Odor Thresholds Compared with Threshold Limit Values and Volatilities for 2014 Industrial Chemicals in Air and Water Dilution. Journal of Applied Toxicology, Vol 3, No 6, pg 272.

bus trips per day, and diesel odors from these operations would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials. An analysis of the odor-causing constituents of diesel exhaust from the buses indicates that concentrations of the odorous chemicals are roughly 1,000 times less than the odor threshold.[118]

It is estimated that the shuttle van used to transport train operators between the storage and maintenance facility and Isabel Station will only travel up to 20 miles per day; therefore, odor impacts from this source are expected to be negligible. There would also be odors associated with solvent usage at the storage and maintenance facility. However, given the distance between the storage and maintenance facility and the public, these odors would not noticeably change existing conditions. Based on the above, impacts from odors under the Proposed Project would be less than significant. **(LS)**

DMU Alternative. The DMU Alternative has the potential to create odors from diesel combustion from operational activity (i.e., emergency generators, DMU operation, solvent use, and buses). However, there would be a limited number of DMU-powered vehicles (six married pairs), and diesel odors from these operations would incrementally increase the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials. In addition, the DMU Alternative would use trains with diesel engines that are compliant with the EPA's Tier 4 Final standards. Tier 4 Final standards require PM and NO_x emissions that are about 90 percent reduced from Tier 3 standards.[119] As a result, diesel emissions would have substantially reduced odors compared to engines from prior standards. With respect to the operation of buses, there would be an average of 217 net new bus trips per day, and diesel odors from these operations would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials. An analysis of the odor-causing constituents of diesel exhaust from the buses and DMU indicates that concentrations of the odorous chemicals are roughly 1,000 times less than the odor threshold.

There would be odors associated with solvent usage at the storage and maintenance facility. However, given the distance between the storage and maintenance facility and the public, these odors would not noticeably change existing conditions. Therefore, impacts from odors under the DMU Alternative would be less than significant. **(LS)**

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[118] The concentrations estimated are annual average concentrations. Odors are generally detected instantaneously or on a short time-average basis (i.e., 1 hour). Shorter time-average concentrations (i.e., 1-hour maximum concentrations) can be up to 10 times higher than annual average concentrations. Nevertheless, a rough estimate of a 1-hour maximum concentration of the odor-causing constituents would still be roughly 100 times lower than odor thresholds.

[119] United States Environmental Protection Agency (EPA), 2016e. Non-road emission standards. Available at: https://www3.epa.gov/otaq/nonroad-diesel.htm, accessed October 21.

EMU Option. The EMU Option would have fewer odor impacts compared to the DMU Alternative because EMU vehicles would be powered by electricity, and thus would not be a source of emissions of diesel exhaust. Therefore, the EMU Option would have reduced impacts associated with odors compared to the DMU Alternative. The EMU Option would have minor odors associated with the storage and maintenance facility, similar to those described above for the DMU Alternative. Overall, the EMU Option would result in less-than-significant impacts related to odors. **(LS)**

Express Bus/BRT Alternative. The Express Bus/BRT Alternative has the potential to create odors from diesel combustion from operational activity (i.e., buses). With respect to the operation of new buses, there would be an average of 212 net new bus trips per day; diesel odors from these operations would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials, and associated odors would not change noticeably. An analysis of the odor-causing constituents of diesel exhaust from the buses indicates that concentrations of the odorous chemicals are roughly 1,000 times less than the odor threshold. Therefore, the Express Bus/BRT Alternative would have less-than-significant impacts related to odor. **(LS)**

Enhanced Bus Alternative. The Enhanced Bus Alternative has the potential to create odors from diesel combustion from operational activity (i.e., buses). With respect to the operation of new buses, there would be an average of 200 net new bus trips per day; diesel odors from these operations would be minor additions to the existing diesel and gasoline odors associated with vehicles on I-580 and nearby arterials, and associated odors would not change noticeably. An analysis of the odor-causing constituents of diesel exhaust from the buses indicates that concentrations of the odorous chemicals are roughly 1,000 times less than the odor threshold. Therefore, the Enhanced Bus Alternative would have less-than-significant impacts related to odor. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to objectionable odors, and no mitigation measures are required.

Impact AQ-16: Conflict with or obstruct implementation of existing air quality plans in 2025 and 2040.

(No Project Alternative: LS; Conventional BART Project: B; DMU Alternative: B; Express Bus/BRT Alternative: B; Enhanced Bus Alternative: B)

The most recently adopted air quality plan for the Bay Area is the 2017 Clean Air Plan (Spare the Air, Cool the Climate: A Blueprint for Clean Air and Climate Protection in the Bay Area), which is an update to the BAAQMD's 2010 Clean Air Plan. The 2017 Clean Air Plan serves as a multi-pollutant air quality plan to protect public health and the climate. The 2017 Clean Air Plan control strategy includes revised, updated, and new measures in the following control measure categories: stationary source measures, transportation measures, energy, buildings, agriculture, natural working lands, waste management, water, and "super-GHGs."

The California CEQA Guidelines Environmental Checklist Form (Appendix G) asks whether a project would "conflict with or obstruct implementation of the applicable air quality plan" in the determination of air quality impacts. The BAAQMD CEQA Guidelines recommend that, where an air quality plan consistency determination is required the Lead Agency consider the following three questions:

1. Does the project support the primary goals of the air quality plan?
2. Does the project include applicable control measures from the air quality plan?
3. Does the project disrupt or hinder implementation of any clean air plan control measures?

With regard to the first question, the BAAQMD CEQA Guidelines state that the primary goals of the Clean Air Plan are to:

- Attain air quality standards
- Reduce population exposure and protect public health in the Bay Area
- Reduce GHG emissions and protect the climate

Any project that is inconsistent with these goals is not considered consistent with the 2017 Clean Air Plan. If emissions and health impacts associated with a project are below the BAAQMD CEQA thresholds of significance, the project is considered to be consistent with the current Clean Air Plan.

As to the second question, the Clean Air Plan includes 85 control measures to reduce emissions of PM, PM precursors, and other air pollutants from a wide variety of emissions sources. The control measures can be classified into eight main categories, as follows: (1) transportation; (2) energy; (3) buildings; (4) agriculture; (5) natural and working lands; (6) waste management; (7) water; and (8) super-GHGs. The Proposed Project and Build Alternatives are evaluated for inclusion of applicable control measures.

The basis for evaluating consistency with the Clean Air Plan is whether the Proposed Project or Build Alternatives would disrupt or hinder implementation of any Clean Air Plan control measure.

No Project Alternative. Under the No Project Alternative, the BART to Livermore Extension Project would not be implemented and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. The benefits of the Proposed Project and Build Alternatives, including suppporting the Clean Air Plan's Transportation Control measures for Local and Regional Bus and Rail Service Improvements and Bicycle and Pedestrian Access, which would contribute to lowering vehicle usage and reducing emissions, would not be realized under the No Project Alterantive. Nevertheless, other projects would be expected to incorporate other measures to ensure consistency with the Clean Air Plan. In any case, any conflict with the Clean Air Plan woult not be a consequence of BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative would have less-than-significant impacts related to consistency with the 2017 Clean Air Plan. **(LS)**

Conventional BART Project and Build Alternatives. Regarding the first question for consistency determination, **Impacts AQ-1** through **AQ-6** are all less than significant with mitigation. Therefore, the project can be considered to be consistent with the 2017 Clean Air Plan.

To address the second question for consistency determination, the control measures applicable to the Proposed Project and Build Alternatives, and how those measures would be achieved, are discussed below.

- Stationary Control Measure SS36: PM from Trackout. Under the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative, construction best management practices (**Mitigation Measure AQ-1)** will be implemented, which includes a requirement that all visible mud or dirt track-out onto adjacent public roads be removed using wet power vacuum street sweepers at least once per day. Furthermore, the use of dry power sweeping will be prohibited.
- Transportation Control Measure TR3: Local and Regional Bus Service Improvements. New Express and Rapid routes would be added as a result of the Proposed Project and Build Alternatives.
- Transportation Control Measure TR4: Local and Regional Rail Service Improvements. An extension to the existing BART line from the Dublin/Pleasanton Station to Isabel Station would be added under the Proposed Project. Alternatively, an extension using DMU or EMU technology would be added under the DMU Alternative (or EMU Option) extending between the Dublin/Pleasanton Station to Isabel Station.
- Transportation Control Measures TR5: Transit Efficient and Use. Under the Proposed Project and Build Alternatives, bus-related infrastructure improvements will include real-time information via digital messaging boards and pre-paid ticketing with Clipper.
- Transportation Control Measure TR9: Bicycle and Pedestrian Access and Facilities. Under the Proposed Project and DMU Alternative, in the vicinity of the proposed Isabel Station, bicycle lanes would be constructed on East Airway Boulevard. The bicycle lanes would be 6 feet wide and would connect to the existing bicycle lanes on Isabel Avenue and Airway Boulevard to the west, to the existing multi-use trail along Stealth Street, and to the planned multi-use trail along Airway Boulevard east of the site. Additionally, a 5-foot-wide sidewalk would be constructed along the north side of East Airway Boulevard. The proposed Isabel Station would be accessible from both the

north and south side of I-580. Bicycle lockers and racks would be provided at each side of the station. Also, pedestrian and bicycle access to the Isabel Station would be provided from sidewalks and bicycle lanes along Isabel Avenue and East Airway Boulevard, as well as a proposed trail along Las Positas Creek that would extend under I-580, which is being developed by the City of Livermore.

- Transportation Control Measure TR22: Construction, Freight, and Farming Equipment. Under the Proposed Project, DMU Alternative, and Express Bus/BRT Alternative, a Construction Emissions Reduction Plan (**Mitigation Measures AQ-2 and 3**) would be required for DPM emission reductions for off-road construction equipment. This would be achieved by including the use of late-model engines, low-emission diesel products, alternative fuels, add-on devices such as particulate filters, and/or other options as they become available.

As described above, the Proposed Project and Build Alternatives are consistent with Clean Air Plan measures, including mobile source measures, transportation control measures, and energy and climate measures. Therefore, the Proposed Project and Build Alternatives meet the second criterion for consistency with the Clean Air Plan.

The Proposed Project and Build Alternatives would not affect any Clean Air Plan measures.

- Of the stationary source measures, three potentially apply to the project regarding stationary source permitting and the Air Toxics "Hot Spots" Program. Compliance with air permitting and potential Air Toxics "Hot Spots" Program requirements will ensure that the Proposed Project and Build Alternatives do not disrupt or hinder any Clean Air Plan control measures.
- Transportation control measures are strategies to reduce vehicles trips, vehicle use, VMT, vehicle idling, or traffic congestion. They also include measures to accelerate the replacement of older, dirtier vehicles and equipment largely through incentive programs. The project does not disrupt or hinder any of these measures.
- Energy and climate measures are focused on decreasing electricity demand and decarbonizing electricity production. The project does not disrupt or hinder any of these measures.
- Buildings control measures are focused on implementing the CAL-Green (Title 24) statewide building energy code, decarbonizing buildings, and reducing urban heat island effects. The project does not disrupt or hinder any of these measures.
- The project does not disrupt or hinder any agricultural activities.
- Natural and Working Lands control measures focus on carbon sequestration in rangeland and wetlands and urban tree planting. The project does not disrupt or hinder any of these measures.

- Waste Management control measures focus on landfill emissions, composting, recycling, and waste reduction. The project does not disrupt or hinder any of these measures.
- Water control measures focus on limiting emissions at treatment facilities and conserving water. The project does not disrupt or hinder any of these measures.
- Super-GHG control measures focus on reducing emissions of methane, black carbon, and fluorinated gases. The project does not disrupt or hinder any of these measures.

Therefore, the Proposed Project and Build Alternatives would be beneficial to the implementation of the Clean Air Plan. **(B)**

Mitigation Measures. As described above, the Proposed Project and Alternatives would not result in significant impacts related to air quality plans, and no mitigation measures are required.

(b) Operations – Cumulative Analysis

Potential cumulative operations impacts for the opening year 2025 are described first, followed by cumulative impacts for the horizon year 2040.

The study area for cumulative impacts is the same as the study area identified in the Introduction subsection above.

Emissions of ROGs, NO_x, and PM

Impact AQ-17(CU): Result in emissions of ROGs, NO_x, and PM above BAAQMD significance thresholds under 2025 and 2040 Cumulative Conditions

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; EMU Option: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

As discussed in the Standards of Significance subsection above, the BAAQMD's thresholds of significance for criteria air pollutants and precursors represent levels at which a project's individual emissions would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions. If a project's emissions do not exceed the BAAQMD's thresholds of significance for ROGs, NO_x, and PM, then the project's contribution is not cumulatively considerable.

No Project Alternative. As described in **Impacts AQ-9** and **AQ-10** above, the No Project Alternative would have no impacts associated with operational emissions of ROGs, NO_x, and PM for 2025 and 2040 Project Conditions. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. As discussed in **Impacts AQ-9** and **AQ-10** above, the Proposed Project and Build Alternatives would generate operational emissions of ROGs, NO_x, and PM that would be below the BAAQMD's thresholds of significance and not considered cumulatively considerable. Thus, the Proposed Project and Build Alternatives, in combination with past, present, and probable future development would have less-than-significant cumulative impacts related to operational emissions of ROGs, NO_x, and PM exceeding significance levels. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to emissions of ROGs, NO_x, and PM under 2025 and 2040 Cumulative Conditions, and no mitigation measures are required.

Emissions of TACs and $PM_{2.5}$ Causing Increased Health Risk

Impact AQ-18(CU): Result in emissions of TACs and $PM_{2.5}$ causing increased health risk above BAAQMD significance thresholds under 2025 Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: SU; DMU Alternative: SU; EMU Option: SU; Express Bus/BRT Alternative: SU; Enhanced Bus Alternative: LS)

Under the 2025 cumulative analysis, impacts from TAC and $PM_{2.5}$ emissions from overall roadway volumes and permitted sources are considered. Projects considered under the cumulative conditions are described in Section 3.A, Introduction to Environmental Analysis and Appendix E. This includes the INP (Proposed Project and DMU Alternatives only) and the Dublin/Pleasanton Station Parking Expansion. The effects of the INP and the Dublin/Pleasanton Station Parking Expansion projects on traffic are incorporated into the roadway volumes used in this cumulative analysis.

Per the BAAQMD Recommended Methods for Screening and Modeling Local Risks and Hazards, a 1,000-foot radius is generally recommended around the project property boundary to identify existing sources that may individually or cumulatively impact new receptors or contribute to the cumulative impact of new sources.[120] Existing stationary sources within 1,000 feet of the collective footprint include diesel-fired emergency generators, printing operations, gas stations, surface coating operations, and solvent wipe cleaning operations. No new stationary sources of TAC emissions were identified for cumulative projects.

[120] Bay Area Air Quality Management District (BAAQMD), 2012b. Recommended Methods for Screening and Modeling Local Risks and Hazards. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en, accessed February 2017.

The reduction in VMT from the Proposed Project and Build Alternatives, compared to the No Project Conditions, is described for informational purposes. However, similar to the project analysis above, the cumulative analysis conservatively does not consider the reduction in VMT, which would further reduce emissions of TACs and $PM_{2.5}$, beyond the levels described herein.

The lifetime excess cumulative cancer risk at the MEISR and maximum $PM_{2.5}$ concentrations for 2025 are shown in Tables 3.K-25 and 3.K-26, respectively, for the Proposed Project and Build Alternatives under the 2025 Cumulative Conditions. These tables represent the impact attributed to the Proposed Project or an alternative under Cumulative Conditions, including all other sources of TAC and $PM_{2.5}$ emissions within 1,000 feet of the MEISR locations.

TABLE 3.K-25 MAXIMUM OPERATIONAL CANCER RISK AT OFF-SITE RECEPTORS, 2025 CUMULATIVE CONDITIONS

	Excess Cancer Risk (in 1 million)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	Resident	Resident	Resident	Resident
Traffic[a]	126	124	124	127	67
Buses	6.1	6.1	6.1	4.1	6.3
DMU	--	1.6	--	--	--
Generator (Isabel Station)	0.44	0.44	0.44	--	--
Generator (Maintenance Facility)	0.025	0.043	0.043	--	--
Maintenance Trucks and Shuttle Van[b,d]	9.1E-06	2.1E-05	2.1E-05	--	--
Solvent Use	--[c]	--[c]	--[c]	--	--
Non-Project Sources	--	--	--	9.9	4.2
Total	**132**	**132**	**131**	**141**	77
Significance Threshold	100	100	100	100	100
Above Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	No

Notes: -- = not applicable. **Bold**/gray values exceed thresholds.
[a] Includes traffic impact from INP and Dublin/Pleasanton Parking Expansion. The analysis considers roadway segments with an average of greater than 10,000 vehicles per day.
[b] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.
[c] Solvent use in the storage and maintenance facility under the Proposed Project, DMU Alternative, and EMU Option would be less than BAAQMD permitting thresholds. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[d] A numerical value with "E" denotes scientific notation; thus, 5.6E-06 is equivalent to 5.6×10^{-6}.

TABLE 3.K-26 MAXIMUM ANNUAL AVERAGE OPERATIONAL $PM_{2.5}$ CONCENTRATIONS AT OFF-SITE RECEPTORS, 2025 CUMULATIVE CONDITIONS

	$PM_{2.5}$ Concentration (µg/m³)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	School	Resident	Resident	Resident
Traffic[a]	0.82	1.15	0.80	0.86	0.58
Buses	0.0087	0.00043	0.0087	0.0057	0.0085
DMU	--	0.022	--	--	--
Generator (Isabel Station)	0.00059	4.2E-05	0.00059	--	--
Generator (Maintenance Facility)	3.3E-05	1.3E-04	5.8E-05	--	--
Maintenance Trucks and Shuttle Van[b,c]	2.3E-08	6.4E-08	5.8E-08	--	--
Non-Project Sources	--	--	--	0.0097	0.0050
Total	**0.83**	**1.17**	**0.81**	**0.87**	0.59
Significance Threshold	0.8	0.8	0.8	0.8	0.8
Above Threshold?	**Yes**	**Yes**	**Yes**	**Yes**	No

Notes: -- = not applicable; $PM_{2.5}$ = fine particulate matter. **Bold**/gray values exceed thresholds.
[a] Includes traffic impact from INP and Dublin/Pleasanton Parking Expansion. The analysis considers roadway segments with an average of greater than 10,000 vehicles per day.
[c] A shuttle van is included for the Proposed Project only.
[b] Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.
[c] A numerical value with "E" denotes scientific notation; thus, 3.7E-05 is equivalent to 3.7×10^{-5}.

No Project Alternative. As described in **Impact AQ-11** above, the No Project Alternative would have no impacts associated with health risk during operations under 2025 Project Conditions. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project. Under the 2025 Cumulative Conditions, there would be potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations, as described under **Impact AQ-11** for the Proposed Project (including for bus routes, maintenance trucks, a shuttle van, and emergency generators), with the following key inputs noted for roadway segments, stationary sources, and VMT:

- There are five roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- Per the BAAQMD Stationary Source Screening Analysis Tool and additional information provided by the BAAQMD, there are no stationary sources within the 1,000-foot zone

of influence of the MEISR.[121, 122]As such, there are no existing stationary sources that are expected to impact the MEISR.

- The 2025 Cumulative Conditions would have an overall net reduction in VMT of 32,649,225 miles compared to the 2025 No Project Conditions. This net decrease in VMT would be less than the Proposed Project in 2025 by approximately 5,600,000 VMT.

The MEISR and maximum $PM_{2.5}$ concentration are the same locations described under **Impact AQ-11** for the Proposed Project in 2025 analysis (Shea Homes Sage Project residential development). Table 3.K-25 shows that the cumulative cancer risk at the MEISR is 132-in-1-million and Table 3.K-26 shows the maximum $PM_{2.5}$ concentration is 0.83 $\mu g/m^3$, which are above the thresholds of 100-in-1-million and 0.8 $\mu g/m^3$, respectively. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the Proposed Project, the cumulative cancer risk threshold would be exceeded. It should also be noted that emissions from vehicles are expected to decrease over time as more vehicles become electrified. As the rate of electrification of vehicles is unknown at this time, the anlaysis does not include elecrification. Thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-25 and 3.K-26 are conservative. Therefore, under the 2025 Cumulative Conditions, the Proposed Project would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

DMU Alternative. Under the 2025 Cumulative Conditions, the DMU Alternative would have potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations, as described under **Impact AQ-11** (including for bus routes, DMU vehicles, maintenance vehicles, and emergency generators), with the following key inputs noted for roadway segments, stationary sources, and VMT:

- There are four roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR for cancer risk and two roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR for $PM_{2.5}$ concentration.[123] In addition, I-580 is within 1,000 feet of both the cancer risk and $PM_{2.5}$ concentration MEISR. Both will impact the MEISRs.

[121] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16.

[122] Kirk, 2016. Email communication from Alison Kirk, Senior Environmental Planner, Bay Area Air Quality Management District, with Ramboll Environ, Inc. September 28, 2016.

[123] Unless otherwise noted, the MEISR for cancer risk and $PM_{2.5}$ concentrations are generally in the same location. In some cases, such as in the DMU Alternative, the MEISR for cancer risk and $PM_{2.5}$ concentration are at different locations.

- Per the BAAQMD Stationary Source Screening Analysis Tool and additional information provided by the BAAQMD, there are no stationary sources within the 1,000-foot zone of influence of the MEISR.[124, 125] As such, there are no existing stationary sources that are expected to impact the MEISR.
- Under 2025 Cumulative Conditions, the DMU Alternative would have an overall net reduction in VMT of 21,858,079 miles compared to the 2025 No Project Conditions. This net decrease in VMT would be less than the 2025 DMU Alternative by approximately 6,720,000 VMT.

The MEISR and maximum $PM_{2.5}$ concentration are the same locations described under **Impact AQ-11** for the 2025 DMU Alternative analysis (Shea Homes Sage Project and Tri-Valley Regional Occupational Program, respectively). Table 3.K-25 shows that the cumulative cancer risk at the MEISR is 132-in-1-million and Table 3.K-26 shows the maximum $PM_{2.5}$ concentration is 1.17 μg/m^3, which are above the thresholds of 100-in-1-million and 0.8 μg/m^3, respectively. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the DMU Alternative the cumulative cancer risk threshold would be exceeded. This analysis does not include the electrification of vehicles for the reasons described above, and thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-25 and 3.K-26 are conservative. Therefore, under the 2025 Cumulative Conditions, the DMU Alternative would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

EMU Option. Under the 2025 Cumulative Conditions, the EMU Option would have potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations, as described under **Impact AQ-11** (including for bus routes, maintenance vehicles, and emergency generators). Roadway segments, stationary sources, and VMT would be as described above for the DMU Alternative under 2025 Cumulative Conditions. The MEISR for cancer and MEISR for $PM_{2.5}$ concentration are the same locations described under **Impact AQ-11** for the 2025 EMU Option analysis (Shea Homes Sage Project residential development). Table 3.K-25 shows that the cumulative cancer risk at the MEISR is 131-in-1-million and Table 3.K-26 shows the maximum $PM_{2.5}$ concentration is 0.81 μg/m^3, which are above the thresholds of 100-in-1-million and 0.8 μg/m^3, respectively. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the EMU Option the

[124] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16, 2015.

[125] Kirk, 2016. Email communication from Alison Kirk, Senior Environmental Planner, Bay Area Air Quality Management District, with Ramboll Environ, Inc. September 28, 2016.

cumulative cancer risk threshold would be exceeded. This analysis does not include the electrification of vehicles for the reasons described above, and thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-25 and 3.K-26 are conservative. Therefore, under the 2025 Cumulative Conditions, the EMU Option would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

Express Bus/BRT Alternative. Under the 2025 Cumulative Conditions, the Express Bus/BRT Alternative would have potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations, as described under **Impact AQ-8** for bus routes, with the following key inputs noted for roadway segments, stationary sources, and VMT:

- There are six roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- Per the BAAQMD Stationary Source Screening Analysis Tool and additional information provided by the BAAQMD, there are two diesel generators located within 1,000 feet of the MEISR that were included in the cumulative analysis.[126, 127]
- Under 2025 Cumulative Conditions, the Express Bus/BRT Alternative would have an overall net reduction in VMT of 19,509,613 miles compared to the 2025 No Project Conditions. This net decrease in VMT would be greater than the 2025 Express Bus/BRT Alternative by approximately 6,150,000 VMT.

The MEISR and maximum $PM_{2.5}$ concentration are the same locations described under **Impact AQ-11** for 2025 Express Bus/BRT Alternative (Dublin Station – Avalon II apartments located north of the Dublin/Pleasanton Station). Table 3.K-25 shows that the cumulative cancer risk at the MEISR is 141-in-1-million and Table 3.K-26 shows that the maximum $PM_{2.5}$ concentration is 0.87 μg/m³, which are above the thresholds of 100-in-1-million and 0.8 μg/m³, respectively. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the Express Bus/BRT Alternative the cumulative cancer risk threshold would be exceeded. This analysis does not include the electrification of vehicles for the reasons described above, and thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-25 and 3.K-26 are conservative. Therefore, under the 2025 Cumulative Conditions, the Express Bus/BRT Alternative would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

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[126] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16, 2015.

[127] Kirk, 2016. Email communication from Alison Kirk, Senior Environmental Planner, Bay Area Air Quality Management District, with Ramboll Environ, Inc. September 28, 2016.

Enhanced Bus Alternative. Under the 2025 Cumulative Conditions, the Enhanced Bus Alternative would have potential impacts to health risk associated with TAC and $PM_{2.5}$ concentrations, as described under **Impact AQ-11** for bus routes, with the following key inputs noted for roadway segments, stationary sources, and VMT:

- There are three roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- Per the BAAQMD Stationary Source Screening Analysis Tool and additional information provided by the BAAQMD, there are two diesel generators located within 1,000 feet of the MEISR that were included in the cumulative analysis.[128, 129]
- Under the 2025 Cumulative Conditions, the Enhanced Bus Alternative would have an overall net reduction in VMT of 8,705,948 miles compared to the 2025 No Project Conditions. This net decrease in VMT would be greater than the 2025 Enhanced Bus Alternative by approximately 8,630,000 VMT.

The MEISR and maximum $PM_{2.5}$ concentration are the same locations described under **Impact AQ-11** for the 2025 Enhanced Bus Alternative (DR Horton Espirit residential development located northeast of the Dublin/Pleasanton Station). Tables 3.K-25 and 3.K-26, respectively, show that the cumulative cancer risk at the MEISR is 77-in-1-million and the maximum $PM_{2.5}$ concentration is 0.59 $\mu g/m^3$, which are below the thresholds of 100-in-1-million and 0.8 $\mu g/m^3$, respectively. It should be noted that while cancer risk and $PM_{2.5}$ would be below the thresholds at the MEISR for the Enhanced Bus Alterantive and thus, less than significant, the health risk impact at the location of the MEISRs for the Proposed Project and DMU Alternative (i.e., Shea Homes Sage Project and Tri-Valley Regional Occupational Program, respectively) would still exceed 100-in-1-million solely due to traffic from I-580 under the Enhanced Bus Alternative. The BAAQMD CEQA Guidelines Recommended Methods for Screening and Modeling Local Risks and Hazards recommends that the assessment of the cumulative impact be performed at the location of the MEISR for the project.[130] In this scenario, the MEISR is located far enough from I-580 to not have a significant contribution from the highway. Therefore, under the 2025

[128] Bay Area Air Quality Management District (BAAQMD), 2015. Roadway Screening Analysis Calculator. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/screeningcalculator_4_16_15-xlsx.xlsx?la=en, accessed April 16, 2015.
[129] Kirk, 2016. Email communication from Alison Kirk, Senior Environmental Planner, Bay Area Air Quality Management District, with Ramboll Environ, Inc. September 28, 2016.
[130] Bay Area Air Quality Management District (BAAQMD), 2012b. Recommended Methods for Screening and Modeling Local Risks and Hazards. May. Available at: http://www.baaqmd.gov/~/media/files/planning-and-research/ceqa/risk-modeling-approach-may-2012.pdf?la=en, accessed February 2017.

Cumulative Conditions, the Enhanced Bus Alternative would not contribute to significant cumulative impacts related to health risk. **(LS)**

Mitigation Measures. As described above, the Proposed Project, DMU Alternative, EMU Option, and Express Bus/BRT Alternative would contribute to significant and unavoidable cumulative impacts related to emission of TACs and $PM_{2.5}$, together with past, present, and probable future projects under 2025 Cumulative Conditions. It should be noted that even without the Proposed Project or these Build Alterantives, the location of the MEISRs would still experience health risk impacts (from I-580) exceeding the cumulative significance threshold. For example, at the southwest corner of the Shea Homes Sage Project (the location of the Proposed Project MEISR), the cancer risk contribution from existing traffic on I-580 already exceeds 100-in-1-million without the Proposed Project. There are no feasible mitigation measures that could be applied that would reduce this to a less-than-significant level because the contribution to cancer risk from traffic on I-580 exceeds the significance level. Mitigating emissions from traffic on I-580 is not feasible. Therefore, cumulative impacts related to emissions of TACs and $PM_{2.5}$ would remain significant and unavoidable.

The Enhanced Bus Alternative, in combination with past, present, or probable future projects, would not contribute to significant cumulative impacts related to emissions of TACs and $PM_{2.5}$ under 2025 Cumulative Conditions, and no mitigation measures are required.

Impact AQ-19(CU): Result in emissions of TACs and $PM_{2.5}$ causing increased health risk above BAAQMD significance thresholds under 2040 Cumulative Conditions.

(No Project Alternative: S; Conventional BART Project: SU; DMU Alternative: SU; EMU Option: SU; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

The approach to the 2040 cumulative analysis is similar to the 2025 cumulative analysis described above. The lifetime excess cumulative cancer risk at the MEISR and maximum $PM_{2.5}$ concentrations for 2040 are shown in Tables 3.K-27 and 3.K-28 respectively, for the Proposed Project and Build Alternatives in 2040. These tables represent the impact attributed to the Proposed Project or an alternative under 2040 Cumulative Conditions including all other sources of TAC and $PM_{2.5}$ emissions within 1,000 feet.

No Project Alternative. As described in **Impact AQ-12** the 2040 No Project Alternative would have a significant impact compared to the 2025 No Project Alternative due to an increase in DPM and $PM_{2.5}$ emissions from regional non-BART passenger vehicle traffic. Therefore, the increased emissions associated with the No Project Alternative would contribute to a significant cumulative impact together with those of other projects under 2040 Cumulative Conditions. **(S)**

TABLE 3.K-27 MAXIMUM OPERATIONAL CANCER RISK AT OFF-SITE RECEPTORS, UNDER 2040 CUMULATIVE CONDITIONS

	Excess Cancer Risk (in 1 million)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	Resident	Resident	Resident	Resident
Traffic[a]	120	119	119	78	73
Buses	2.7	2.7	2.7	3.9	6.1
DMU	--	1.8	--	--	--
Generator (Isabel Station)	0.44	0.44	0.44	--	--
Generator (Maintenance Facility)	0.025	0.043	0.043	--	--
Maintenance Trucks and Shuttle Van[b,d]	4.5E-06	9.9E-06	9.9E-06	--	--
Solvent Use	--[c]	--[c]	--[c]	--	--
Non-Project Sources	--	--	--	9.9	4.2
Total	**123**	**124**	**122**	92	83
Significance Threshold	100	100	100	100	100
Above Threshold?	**Yes**	**Yes**	**Yes**	No	No

Notes: -- = not applicable. **Bold**/gray values exceed thresholds.
[a] Includes traffic impact from INP and Dublin/Pleasanton Parking Expansion. The analysis considers roadway segments with an average of greater than 10,000 vehicles per day.
[b] A shuttle van is included for the Proposed Project only. Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.
[c] Solvent use in the storage and maintenance facility under the Proposed Project, DMU Alternative, and EMU Option would be less than BAAQMD permitting thresholds. Cancer risk is not explicitly evaluated and is assumed to be negligible.
[d] A numerical value with "E" denotes scientific notation; thus, 2.7E-05 is equivalent to 2.7×10^{-5}.

TABLE 3.K-28 MAXIMUM ANNUAL AVERAGE OPERATIONAL $PM_{2.5}$ CONCENTRATIONS AT OFF-SITE RECEPTORS, UNDER 2040 CUMULATIVE CONDITIONS

	$PM_{2.5}$ Concentration (µg/m³)				
Source	**Conventional BART Project**	**DMU Alternative**	**EMU Option**	**Express Bus/BRT Alternative**	**Enhanced Bus Alternative**
Receptor Type	Resident	School	Resident	Resident	Resident
Traffic[a]	0.75	1.10	0.73	0.73	0.66
Buses	0.0039	0.00021	0.0039	0.0053	0.0082
DMU	--	0.025	--	--	--
Generator (Isabel Station)	0.00059	4.2E-05	0.00059	--	--
Generator (Maintenance Facility)	3.3E-05	1.3E-04	5.8E-05	--	--
Maintenance Trucks and Shuttle Van[b]	1.7E-08	4.7E-08	4.3E-08	--	--
Non-Project Sources	--	--	--	0.0097	0.0050
Total	0.75	**1.12**	0.74	0.75	0.67
Significance Threshold	0.8	0.8	0.8	0.8	0.8
Above Threshold?	No	**Yes**	No	No	No

Notes: -- = not applicable; µg/m³ = micrograms per cubic meter; $PM_{2.5}$ = fine particulate matter. **Bold**/gray values exceed thresholds.
[a] Includes traffic impact from INP and Dublin/Pleasanton Parking Expansion. The analysis considers roadway segments with an average of greater than 10,000 vehicles per day.
[c] A shuttle van is included for the Proposed Project only.
[b] Maintenance trucks are included for the Proposed Project, DMU Alternative, and EMU Option.
[c] A numerical value with "E" denotes scientific notation; thus, 3.7E-05 is equivalent to 3.7×10^{-5}.

Conventional BART Project. Under the 2040 Cumulative Conditions, sources of TACs and $PM_{2.5}$, as well as the MEISR and maximum $PM_{2.5}$ concentration locations, would be similar to those described under **Impact AQ-18(CU)** for the 2025 Cumulative Conditions with the following differences:

- There are four roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- There would be an overall net reduction in VMT of 82,390,212 miles compared to the 2040 No Project Conditions. This net decrease in VMT under Cumulative Conditions would be greater than the 2040 Proposed Project by approximately 8,600,000 more miles.

Tables 3.K-27 and 3.K-28 show that the cumulative cancer risk at the MEISR is 123-in-1-million and the maximum $PM_{2.5}$ concentration is 0.75 µg/m³. The cancer risk is above the threshold of 100-in-1-million and the $PM_{2.5}$ concentration is below the threshold of 0.8 µg/m^3. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the Proposed Project the cumulative cancer risk threshold would be exceeded. It should also be noted that emissions from vehicles are expected to decrease over time as more vehicles become electrified. As the rate of electrification of vehicles is unknown at this time, the anlaysis does not include elecrification. Thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-27 and 3.K-28 are conservative. Therefore, under the 2040 Cumulative Conditions, the Proposed Project would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

DMU Alternative. Under the 2040 Cumulative Conditions, sources of TACs and $PM_{2.5}$, as well as the MEISR and maximum $PM_{2.5}$ concentration locations, would be similar to those described under **Impact AQ-18(CU)** for the 2025 Cumulative Conditions with the following differences:

- There are four roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR for cancer risk and one roadway segment projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR for $PM_{2.5}$ concentration. In addition, I-580 is within 1,000 feet of both the cancer risk and $PM_{2.5}$ concentration MEISR. Both will impact the MEISRs.
- There would be an overall net reduction in VMT of 49,924,896 miles compared to the 2040 No Project Conditions. This net decrease in VMT would be greater than the 2040 DMU Alternative by approximately 7,178,000 VMT.

Tables 3.K-27 and 3.K-28 show that the cumulative cancer risk at the MEISR is 124-in-1-million and the maximum $PM_{2.5}$ concentration is 1.12 µg/m^3, respectively, which are above the thresholds of 100-in-1-million and 0.8 µg/m^3, respectively. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the DMU Alternative the cumulative cancer risk threshold would be exceeded. This analysis does not include the electrification of vehicles for the reasons described above, and thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-27 and 3.K-28 are conservative. Therefore, under the 2040 Cumulative Conditions, the DMU Alternative would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

EMU Option. Under the 2040 Cumulative Conditions, sources of TACs and $PM_{2.5}$, as well as the MEISR and maximum $PM_{2.5}$ concentration locations, would be similar to those described under **Impact AQ-18(CU)** for the 2025 Cumulative Conditions with the following differences:

- There are four roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- There would be an overall net reduction in VMT of 49,924,896 miles compared to the 2040 No Project Conditions. This net decrease in VMT would be greater than the 2040 DMU Alternative by approximately 7,178,000 VMT.

Tables 3.K-27 and 3.K-28, respectively, show that the cumulative cancer risk at the MEISR is 122-in-1-million and the maximum $PM_{2.5}$ concentration is 0.74 μg/m^3. The cancer risk is above the threshold of 100-in-1-million and the $PM_{2.5}$ concentration is below the threshold of 0.8 μg/m^3. It should be noted that the contribution of I-580 to the cancer risk exceeds the cumulative threshold, given its proximity to the MEISR. Thus, even without the EMU Option the cumulative cancer risk threshold would be exceeded. This analysis does not include the electrification of vehicles for the reasons described above, and thus, the cumulative cancer risk and $PM_{2.5}$ concentrations in Tables 3.K-27 and 3.K-28 are conservative. Therefore, under the 2040 Cumulative Conditions, the EMU Option would contribute to significant and unavoidable cumulative impacts related to health risk. **(SU)**

Express Bus/BRT Alternative. Under the 2040 Cumulative Conditions, sources of TACs and $PM_{2.5}$ would be similar to those described under **Impact AQ-18(CU)** for the 2025 Cumulative Conditions with the following differences:

- There are three roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- There would be an overall net reduction in VMT of 34,691,838 miles compared to the 2040 No Project Conditions. This net decrease in VMT would be greater than the 2040 Express Bus/BRT Alternative by approximately 6,100,000 VMT.

Tables 3.K-27 and 3.K-28 show that the cumulative cancer risk at the MEISR is 92-in-1-million and the maximum $PM_{2.5}$ concentration is 0.75 μg/m^3, respectively, which are below the thresholds of 100-in-1-million and 0.8 μg/m^3, respectively. While the cumulative health risk impact is less than significant at the location of the MEISR for the Express Bus/BRT Alternative, the health risk impact at the location of the MEISRs for the Proposed Project and DMU Alternative (i.e., Shea Homes Sage Project and Tri-Valley Regional Occupational Program, respectively) would still exceed 100-in-1-million solely due to traffic from I-580 under the Express Bus/BRT Alternative. The BAAQMD CEQA Guidelines Recommended Methods for Screening and Modeling local Risks and Hazards recommends that the assessment of the cumulative impact be performed at the location of the MEISR for the project. Under the Express Bus/BRT Alterantive, the MEISR for is located far enough from I-580 to not have a significant contribution from the highway.

Therefore, under 2040 Cumulative Conditions, the Express Bus/BRT Alternative would not contribute to significant cumulative impacts related to health risk. **(LS)**

Enhanced Bus Alternative. Under the 2040 Cumulative Conditions, sources of TACs and $PM_{2.5}$, as well as the MEISR and maximum $PM_{2.5}$ concentration locations, would be similar to those described under **Impact AQ-18(CU)** for the 2025 Cumulative Conditions with the following differences:

- There are three roadway segments projected to have greater than 10,000 vehicles per day within 1,000 feet of the MEISR. In addition, I-580 is within 1,000 feet of the MEISR. Both will impact the MEISR.
- There would be an overall net reduction in VMT of 8,834,264 miles compared to the 2040 No Project Conditions. This net decrease in VMT would be greater than the 2040 Enhanced Bus Alternative by approximately 6,100,000 VMT.

Tables 3.K-27 and 3.K-28 show that the increased cancer risk at the MEISR is 83-in-1-million and the maximum $PM_{2.5}$ concentration is 0.67 $\mu g/m^3$, respectively, which are below the thresholds of 100-in-1-million and 0.8 $\mu g/m^3$, respectively. While the cumulative health risk impact is less than significant at the location of MEISR for the Enhanced Bus Alternative, the health risk impact at the location of the MEISRs for the Proposed Project and DMU Alternative (i.e., Shea Homes Sage Project and Tri-Valley Regional Occupational Program, respectively) would still exceed 100-in-1-million solely due to traffic from I-580 under the Enhanced Bus Alternative. The BAAQMD CEQA Guidelines Recommended Methods for Screening and Modeling Local Risks and Hazards recommends that the assessment of the cumulative impact be performed at the location of the MEISR for the project. Under the Enhanced Bus Alterantive, the MEISR for is located far enough from I-580 to not have a significant contribution from the highway. Therefore, under 2040 Cumulative Conditions, the Enhanced Bus Alternative would not contribute to significant cumulative impacts related to health risk. **(LS)**

Mitigation Measures. As described above, the Proposed Project, DMU Alternative, and EMU Option would contribute, in combination with past, present, or probable future projects, to significant and unavoidable cumulative impacts related to health risk under 2040 Cumulative Conditions. Similar to **Impact AQ-18(CU)**, it should be noted that even without the Proposed Project or these Build Alterantives, the location of the MEISRs would experience health risk impacts (from I-580) exceeding the cumulative significance threshold in absence of the project. For example, at the southwest corner of the Shea Homes Sage Project (the location of the Proposed Project MEISR), the cancer risk contribution from existing traffic on I-580 already exceeds 100-in-1-million without the Proposed Project. There are no feasible mitigation measures that could be applied that would reduce this to a less-than-significant level because the contribution to cancer risk from traffic on I-580 exceeds the significance level. Mitigating emissions from traffic on

I-580 is not feasible. Therefore, cumulative impacts related to emissions of TACs and $PM_{2.5}$ would remain significant and unavoidable.

The Express Bus/BRT Alterantive and Enhanced Bus Alternative, would not contribute to significant cumulative impacts related to emissions of TACs and $PM_{2.5}$ under 2040 Cumulative Conditions, and no mitigation measures are required.

Concentrations of Carbon Monoxide

Impact AQ-20(CU): Result in local concentrations of CO above BAAQMD significance thresholds under 2025 Cumulative Conditions.

(No Project Alternative: NI; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As described in **Impact AQ-10** above, the No Project Alternative would have no impacts associated with local concentrations of CO for 2025 Project Conditions. Therefore, the No Project Alternative would not contribute to cumulative impacts. **(NI)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-13** above, the Proposed Project and Build Alternatives would not result in significantly elevated concentrations of CO in 2025. The peak hourly intersection traffic counts would be below the screening threshold for CO impacts. The cumulative projects could result in additional traffic, and thus contribute to CO concentrations; however, these projects would be required to undergo their own environmental review and approval process and would address any potential CO concentration impacts through that process. Additionally, CO impacts are highly localized and are not likely to result in cumulative impacts from multiple projects. Therefore, the Conventional BART Project and Build Alternatives, in combination with past, present, and probable future development would have less-than-significant cumulative impacts related to local concentrations of CO. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to emissions of CO under 2025 Cumulative Conditions, and no mitigation measures are required.

Impact AQ-21(CU): Result in local concentrations of CO above BAAQMD significance thresholds under 2040 Cumulative Conditions.

(No Project Alternative: LS; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As discussed in **Impact AQ-14** above, the No Project Alternative would not result in significantly elevated concentrations of CO in 2040. The peak hourly intersection traffic counts would be below the screening threshold for CO impacts. Cumulative proejcts along with those under the No Project Alterantive, would be required to undergo their own environmental review and approval process and would address any potential CO concentration impacts through that process. Additionally, CO impacts are highly localized and are not likely to result in cumulative impacts from multiple projects. Therefore, under 2040 Cumulative Conditions, the No Project Alternative would not contribute to significant cumulative impacts related to local concentrations of CO. **(LS)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-14** above, the Proposed Project and Build Alternatives would not result in significantly elevated concentrations of CO in 2040 as the peak hourly intersection traffic counts would be below the screening threshold for CO impacts. Cumulative projects would be required to undergo their own environmental review and approval process and would address any potential CO concentration impacts through that process. Additionally, CO impacts are highly localized and are not likely to result in cumulative impacts from multiple projects. Therefore, the Proposed Project and Build Alternatives, in combination with past, present, and probable future development, would have less-than-significant cumulative impacts related to local concentrations of CO. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to emissions of CO under 2040 Cumulative Conditions, and no mitigation measures are required.

Impact AQ-22(CU): Result in objectionable odors affecting a substantial number of people in 2025 and 2040 Cumulative Conditions

(No Project Alternative: LS; Conventional BART Project: LS; DMU Alternative: LS; Express Bus/BRT Alternative: LS; Enhanced Bus Alternative: LS)

No Project Alternative. As discussed in **Impact AQ-15** above, the No Project Alternative would not generate significant odors from operational activities. The cumulative projects could result in additional source of diesel exhaust or other odorous emissions, and thus contribute to odor impacts; however, these projects are required to undergo their own environmental review and approval process and would address any potential odor impacts through that process. Additionally, odor impacts are generally localized and not likely to result in cumulative impacts from multiple projects. Therefore, the No Project Alternative, in combination with past, present, and probable future development, would have less-than-significant cumulative impacts related to objectionable odors. **(LS)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-15** above, the Proposed Project and Build Alternatives would generate not significant odors from operational activities. The cumulative projects could result in additional source of diesel exhaust or other odorous emissions, and thus contribute to odor impacts; however, these projects are required to undergo their own environmental review and approval process and would address any potential odor impacts through that process. Additionally, odor impacts are generally localized and not likely to result in cumulative impacts from multiple projects. Therefore, the Proposed Project and Build Alternatives, in combination with past, present, and probable future development, would have less-than-significant cumulative impacts related to objectionable odors. **(LS)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to odors under 2025 and 2040 Cumulative Conditions, and no mitigation measures are required.

Impact AQ-23(CU): Conflict with or obstruct implementation of existing air quality plans under 2025 and 2040 Cumulative Conditions.

(No Project Alternative: LS; Conventional BART Project: B; DMU Alternative: B; Express Bus/BRT Alternative: B; Enhanced Bus Alternative: B)

No Project Alternative. As desrcibed in **Impact AQ-16** above, the BART to Livermore Extension Project would not be implemented under the No Project Alternative and there would be no physical changes in the environment associated with the Proposed Project or any of the Build Alternatives. The benefits of the Proposed Project and Build Alternatives, including suppporting the Clean Air Plan's Transportation Control measures for Local and Regional Bus and Rail Service Improvements and Bicycle and Pedestrian Access, which would contribute to lowering vehicle usage and reducing emissions, would not be realized under the No Project Alterantive. Nevertheless, other projects would be expected to incorporate other measures to ensure consistency with the Clean Air Plan. Any conflict with the Clean Air Plan would not be a consequence of BART Board of Directors' decision not to adopt a project. Therefore, the No Project Alternative would have less-than-significant cumulative impacts related to consistency with the 2017 Clean Air Plan. **(LS)**

Conventional BART Project and Build Alternatives. As discussed in **Impact AQ-16** above, the Proposed Project and Build Alternatives would be consistent with the 2017 Clean Air Plan and would incorporate five of the control measures identified in the plan. Cumulative projects are required to undergo their own environmental review and approval process and would address any potential impacts related to consistency with the Clean Air Plan through that process. Under the Proposed Project and the DMU Alternative, the INP would also be implemented, which incorporates transit oriented development. Placing residential and commercial developments oriented around transit, such as the proposed Isabel Station, is consistent with the Land Use Strategies control measure of the 2017 Clean Air Plan. Therefore, the Proposed Project and Build Alternatives, in combination with past, present, and probable future development would have benefical cumulative impacts related to consistency with the 2017 Clean Air Plan. **(B)**

Mitigation Measures. As described above, the Proposed Project and Alternatives in combination with past, present, or probable future projects would not result in significant cumulative impacts related to the implementation of existing air quality plans under 2025 and 2040 Cumulative Conditions, and no mitigation measures are required.