California High-Speed Rail Authority

Merced to Fresno Section: Central Valley Wye

Air Quality and Global Climate Change Technical Report

October 2017

CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation Federal Railroad Administration

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ACRONYMS AND ABBREVIATIONS

$\mu g/m^3$	micrograms per cubic meter
AB	(California) Assembly Bill
AQMD	Air Quality Management District
Authority	California High-Speed Rail Authority
BMP	best management practice
BNSF	BNSF Railway
BRT	bus rapid transit
CAAQS	California ambient air quality standards
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
CARB	California Air Resources Board
CEQA	California Environmental Quality Act
C.F.R.	Code of Federal Regulations
CO	carbon monoxide
COG	Council of Governments
DE	diesel exhaust
DPM	diesel particulate matter
EIR	environmental impact report
EIS	environmental impact statement
EMission FACtors 2011	EMFAC2011
EMission FACtors 2014	EMFAC2014
FAA	Federal Aviation Administration
Fed. Reg.	Federal Register
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
GC	General Conformity
GHG	greenhouse gas
HCM	Highway Capacity Manual
HDM	Highway Design Manual
HI	hazard index
HOV	high-occupancy vehicle
HQ	hazard quotient
HSR	high-speed rail

IAMF	impact avoidance and minimization feature
MCAG	Merced County Association of Governments
MEIR	maximally exposed individual resident
MMT	million metric tons
MSAT	mobile source air toxics
MY	model year
NAAQS	national ambient air quality standards
NEPA	National Environmental Policy Act
NHTSA	National Highway Traffic Safety Administration
NO_2	nitrogen dioxide
NOx	nitrogen oxides
OEHHA	Office of Environmental Health Hazard Assessment
O_3	ozone
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PM	particulate matter
PMT	Program Management Team
RC	Regional Consultant
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
SB	(California) Senate Bill
SFBAB	San Francisco Bay Area Basin
SIL	significant impact level
SJVAB	San Joaquin Valley Air Basin
SJVAPCD	San Joaquin Valley Air Pollution Control District
SO_2	sulfur dioxide
SR	State Route
TAC	toxic air contaminant
UPRR	Union Pacific Railroad
USEPA	U.S. Environmental Protection Agency
VERA	voluntary emissions reduction agreement
VMT	vehicle miles traveled
VOC	volatile organic compound

EXECUTIVE SUMMARY

The California High-Speed Rail Authority (Authority) has prepared this *Merced to Fresno Section: Central Valley Wye Air Quality and Global Climate Change Technical Report* (Central Valley Wye Air Quality and Global Climate Change Technical Report) to support the *Merced to Fresno Section: Central Valley Wye Draft Supplemental Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (EIS)* (Draft Supplemental EIR/EIS). The Draft Supplemental EIR/EIS tiers from the original *Merced to Fresno Section Final EIR/EIS* (Merced to Fresno Final EIR/EIS) (Authority and FRA 2012). When the Authority and the Federal Railroad Administration approved the Merced to Fresno Section in 2012, they deferred a decision on the wye connection for a future environmental analysis. Since then, the Authority and Federal Railroad Administration have identified four new alternatives for consideration.

This technical report characterizes existing conditions and analyzes air quality and global climate change effects of the four Central Valley Wye alternatives:

- State Road (SR) 152 (North) to Road 13 Wye Alternative
- SR 152 (North) to Road 19 Wye Alternative
- Avenue 21 to Road 13 Wye Alternative
- SR 152 (North) to Road 11 Wye Alternative

Air quality and global climate change comprise statewide and regional emissions, criteria pollutant construction emissions, greenhouse gas construction emissions, particulate matter, and mobile source air toxics. This technical report addresses effects resulting from the high-speed rail track alignment for the Central Valley Wye alternatives. The Central Valley Wye alternatives also include electrical interconnections and PG&E network upgrades, which are not evaluated in this technical report. This report identifies relevant federal, state, regional, and local regulations and requirements; methods used for the analysis of effects; the affected environment; potential effects on air quality and global climate change in the Central Valley Wye resource study area (RSA) that could result from construction and operations of the Central Valley Wye alternatives; and impact avoidance and minimization features (IAMF) that would avoid, minimize, or reduce effects.

Summary of Effects

The effects of the Central Valley Wye alternatives on air quality and global climate change resource areas include:

Statewide Criteria Pollutant Emissions

In the absence of the Central Valley Wye alternatives, statewide emissions for some criteria pollutants—volatile organic compounds (VOC), carbon monoxide (CO), nitrogen oxides (NO_x)—would decrease from 2015 to 2040, while statewide emissions for other criteria pollutants—sulfur dioxide (SO_2), particulate matter smaller than or equal to 10 microns in diameter (PM_{10}), particulate matter smaller than or equal to 2.5 microns in diameter ($PM_{2.5}$)—would increase from 2015 to 2040. Emissions from some pollutant sources (roadways and aircraft) would decrease by a small percentage despite population and economic growth in California because of advances in engine technology. Emissions from other sources of pollutants (e.g., power plants) would increase because the increase in electricity demand would outpace the reduction effect from the use of renewable energy sources.

The Central Valley Wye alternatives would result in an increase in emissions from power plants but lower emissions from roadways and aircraft. Overall, the Central Valley Wye alternatives would result in a decrease in all criteria pollutant emissions when comparing between 2015, 2029, and 2040 conditions with the Central Valley Wye alternatives to 2015, 2029, and 2040 conditions without the Central Valley Wye alternatives. These patterns apply to all ridership scenarios. Thus, on a statewide level, the effect of the Central Valley Wye alternatives does not change the overall trends in pollutant emissions that would occur in its absence.

Regional Criteria Pollutant Emissions

On the regional level, the Central Valley Wye alternatives would result in net decreases in criteria pollutant emissions. The Central Valley Wye alternatives would result in net decreases of all criteria pollutant emissions when comparing the 2015, 2029 and 2040 conditions with the Central Valley Wye alternatives to 2015, 2029, and 2040 conditions without the Central Valley Wye alternatives. While the Central Valley Wye alternatives, as part of the Silicon Valley to Central Valley line, is anticipated to be operational by 2025, an analysis of 2029 ensures more mature ridership numbers are used, given that the opening year does not likely represent the full anticipated ridership scenario.

Statewide and Regional Greenhouse Gas Emissions

When evaluating by emissions type (i.e., on-road, aircraft, and power plant), the Central Valley Wye alternatives, as part of the statewide high-speed rail (HSR) project, would contribute to a reduction in both regional and statewide on-road and aircraft greenhouse gas (GHG) emissions, but would increase indirect GHG emissions associated with power plants under both the 2015 CEQA existing baseline and 2029 and 2040 National Environmental Policy Act (NEPA) future baselines when comparing Central Valley Wye alternatives conditions to conditions without the Central Valley Wye alternatives. However, the overall effect of the Central Valley Wye alternatives is that it would result in a net reduction of regional and statewide GHG emissions in each year, as the reduction in on-road and aircraft emissions are sufficient to offset the increase in power plant emissions. Because of the global mixing that occurs with GHGs and the net decrease in regional and statewide emissions, the Central Valley Wye alternatives are not likely to result in effects on long-term GHG statewide and regional emissions.

Criteria Pollutant Construction Emissions

Construction activities associated with the Central Valley Wye alternatives would result in criteria pollutant emissions. Emissions would exceed the General Conformity (GC) *de minimis* thresholds for NOx (in 2019-2022) in the San Joaquin Valley Air Basin where the primary construction activities would occur but not for any pollutants in the San Francisco Bay Area Basin (SFBAB) where material hauling in that air basin could occur. Emissions would exceed the San Joaquin Valley Air Pollution Control District's annual CEQA thresholds for NOx (in 2019-2022), and PM10 (in 2019-2020) for primary construction activities; emissions from material hauling in the SFBAB would exceed the daily CEQA threshold for NOx (in 2021 and 2022, the years in which hauling in the SFBAB would occur) established by the Bay Area Air Quality Management District (BAAQMD), which has jurisdiction over the SFBAB. Central Valley Wye alternatives construction activities would not exceed the applicable national ambient air quality standards (NAAQS) and California ambient air quality standards (CAAQS) or substantially contribute to further exceedances of PM_{10} standards. The health risk assessment concludes the incremental increase in cancer risk associated with the diesel particulate matter (DPM) emissions from construction equipment exhaust would not exceed the applicable threshold of 20 in 1 million, nor would the acute noncancer hazard index or chronic noncancer hazard index exceed the applicable unit-less threshold of 1.0. The design of the Central Valley Wye alternatives includes features to minimize fugitive dust emissions though the implementation of a fugitive dust control plan that would minimize the adverse air quality effects associated with construction activities (AQ-IAMF#1: Fugitive Dust Emissions), and therefore the Central Valley Wye alternatives are not likely to result in effects on air quality or localized health risks.

Greenhouse Gas Construction Emissions

The total GHG construction emissions of the Central Valley Wye alternatives would be less than 0.02 percent of the total annual statewide GHG emissions. The increase in GHG emissions generated during construction would be offset in approximately 31 month or less by net GHG reductions during operations (because of reduced car and aircraft trips in the Merced-to-Fresno area and statewide). Therefore, the Central Valley Wye alternatives are not likely to result in effects on long-term GHG construction emissions.

Particulate Matter

The Central Valley Wye alternatives would not likely cause an adverse effect on air quality for PM_{10}/$PM_{2.5}$ standards because it is not a new or expanded highway project that would have a significant number of diesel vehicles; a project that affects a Level of Service D, E, or F intersection with a significant number of diesel vehicles; a new or expanded bus or rail terminal with a significant number of diesel vehicles; or a project that affects areas that are identified as sites of $PM_{2.5}$- or PM_{10} violations. Thus, the Central Valley Wye alternatives are not a project of air quality concern.

Mobile Source Air Toxics

Emissions in 2029 and 2040 will likely be lower than present levels, as a result of the U.S. Environmental Protection Agency (USEPA) national control programs, which are projected to reduce annual mobile source air toxics (MSAT) emissions by over 90 percent between 2010 and 2050. The magnitude of the USEPA-projected reductions is so great (even after accounting for vehicle miles traveled (VMT) growth) that MSAT emissions in the RSA are likely to be lower in the future in nearly all cases, even without the Central Valley Wye alternatives. Therefore, the Central Valley Wye alternatives would not likely cause an adverse effect on air quality of MSATs.

1 INTRODUCTION

1.1 Background of HSR Program

The Authority proposes to construct, operate, and maintain an electric-powered HSR system in California. When completed, the nearly 800-mile train system would provide new passenger rail service to more than 90 percent of the state's population. More than 200 weekday trains would serve the statewide intercity travel market. The HSR would be capable of operating speeds of up to 220 miles per hour, with state-of-the art safety, signaling, and automatic train control systems. The system would connect and serve the major metropolitan areas of California, extending from San Francisco and Sacramento in the north to San Diego in the south.

The Authority commenced its environmental planning process with the 2005 *Final Program EIR/EIS for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and FRA 2005), and then began preparing second-tier, project-level environmental evaluations for sections of the statewide HSR system. The 2012 Merced to Fresno Final EIR/EIS (Authority and FRA 2012) was the first project-level EIR/EIS that the Authority certified and the Federal Railroad Administration (FRA) approved. The Merced to Fresno Final EIR/EIS identified the Merced to Fresno Section: Hybrid Alternative as the preferred alternative and examined two design options for an east-west connection to the San Jose to Merced Section, referred to as the "wye connection" (Authority and FRA 2012: pages 2-3 and 2-21). When the Authority and the FRA approved the Merced to Fresno Section later in 2012, they deferred a decision on the wye connection for a future environmental analysis.

1.2 Organization of this Technical Report

This technical report includes the following sections:

- Section 2, Merced to Fresno Section: Central Valley Wye Alternatives, provides a description of the Central Valley Wye alternatives.
- Section 3, Laws, Regulations, and Orders, identifies the federal, state, and local laws, guidance, and policies relevant to air quality and global climate change for the Central Valley Wye alternatives.
- Section 4, Pollutants of Concern, describes the pollutants relevant to the Central Valley Wye alternatives and included in this analysis.
- Section 5, Methods for Evaluating Effects, describes the methods used to determine and evaluate potential effects.
- Section 6, Affected Environment, describes the existing conditions with respect to air quality and global climate change, and relevant background information for these resources.
- Section 7, Air Quality Effects Analysis, describes effects on air quality, both adverse and beneficial.
- Section 8, Global Climate Change Effects Analysis, describes effects on global climate change, both adverse and beneficial.
- Section 9, Cumulative Effects, describes effects on cumulative air quality and global climate change.
- Section 10, Conformity Analysis, discusses the Central Valley Wye alternative's applicability and adherence to the U.S. Environmental Protection Agency's (USEPA) Conformity Rule.
- Section 11, References, provides a list of the references cited in this technical report.
- Section 12, Preparer Qualifications, identifies the individuals involved in preparing this report and their credentials.

Additional details on air quality and global climate change are provided in:

- Appendix A, Air Quality and Global Climate Change Impact Avoidance and Minimization Features, provides the list of relevant impact avoidance and minimization features used in this technical report.
- Appendix B, Construction and Operational Emissions Calculation Background Information, provides the information used to determine construction emissions.
- Appendix C, Potential Impacts from Induced Winds, provides details on the analysis and calculations used to determine wind-induced dust from train movement.
- Appendix D, Quarry and Ballast Hauling Memorandum, provides a discussion of the methodology and results for the material hauling analysis.
- Appendix E, Localized Impacts from Construction, provides details on the health risk assessment.

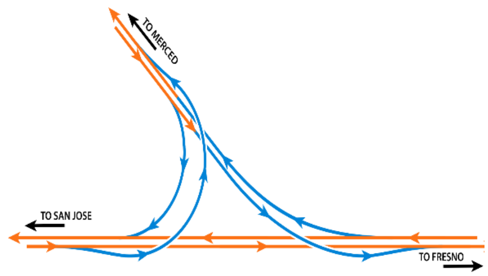
2 MERCED TO FRESNO SECTION: CENTRAL VALLEY WYE ALTERNATIVES

The Central Valley Wye alternatives would create the east-west HSR connection between the north-south San Jose to Merced Section to the west and the north-south Merced to Fresno Section to the east.[1] The four Central Valley Wye alternatives (see Figures 2-1 to 2-4) are:

- SR 152 (North) to Road 13 Wye Alternative
- SR 152 (North) to Road 19 Wye Alternative
- Avenue 21 to Road 13 Wye Alternative
- SR 152 (North) to Road 11 Wye Alternative

This section describes the common design features of the four alternatives, followed by descriptions of each alternative.

Central Valley Wye Schematic



2.1 No Project Alternative

The No Project Alternative considers the effects of current land use plans for the region encompassing the Central Valley Wye. It incorporates improvements to the highway, aviation, conventional passenger rail, and freight rail systems in the HSR Central Valley Wye area through the 2040 time horizon for the environmental analysis. The No Project Alternative is intended to allow for the comparison of effects between the Central Valley Wye alternatives and the effects of not approving the Central Valley Wye alternatives (CEQA Guidelines; 40 C.F.R. § 1502.14(d)).

Should the Central Valley Wye alternatives not be constructed, current and future HSR projects would be limited to the HSR system south of Madera to Los Angeles/Anaheim and between San Francisco and Gilroy. Approved HSR projects include the first construction segment between Madera and Kern Counties, a distance of 130 miles that represents a portion of the larger initial operating section. When built, the initial operating section would allow for HSR service between Merced and the San Fernando Valley (Authority 2014: page 11). The No Project Alternative would not preclude further approvals and development of the initial operating section south of Madera.

The first construction segment, under construction in 2016, parallels the existing BNSF Railway (BNSF) right-of-way and State Route (SR) 99 and extends from Avenue 19 near the city of Madera in the unincorporated area of Madera County to Poplar Avenue just north of the city of Shafter in Kern County. The first construction segment may provide track capacity for conventional rail operations in the interim while the initial operating section is under construction. It would not be possible to complete the initial operating section north to Merced and the extension of the HSR system west to San Francisco and Gilroy should the Central Valley Wye alternatives not be constructed.

2.2 Common Features

The Central Valley Wye alternatives would cross rural areas in unincorporated Merced and Madera Counties, and would travel through the southern portion of Chowchilla and the rural-

[1] The term *wye* refers to the Y-like formation created at the point where train tracks branch off the mainline to continue in different directions. The transition of mainline track to a wye requires splitting two tracks into four tracks that cross over one another before the wye “legs” (segments) can diverge in opposite directions to allow two-way travel. For the Merced to Fresno Section of the HSR system, the two tracks traveling east-west from the San Jose to Merced Section must become four tracks—a set of two tracks branching toward Merced to the north and a set of two tracks branching toward Fresno to the south.

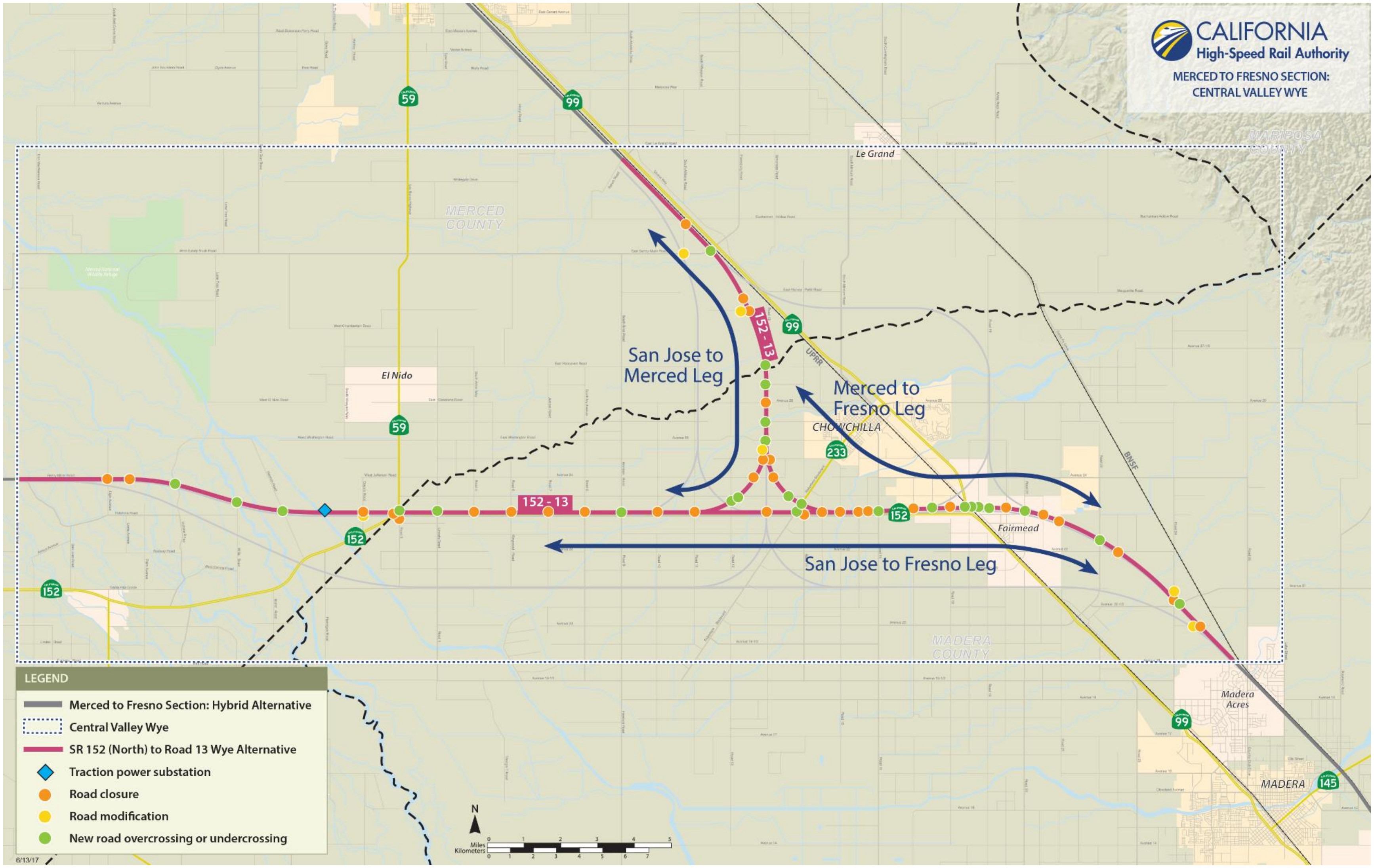
residential community of Fairmead. Volume 3 of the Draft Supplemental EIR/EIS provides detailed design drawings that support the descriptions of the Central Valley Wye alternatives.

The HSR alignment would be entirely grade-separated, meaning that crossings of roads, railroads, and other transport facilities would use overpasses or underpasses so that the HSR would operate independently of other modes of transport. The HSR right-of-way would also be fenced to prevent public or vehicle access. The Central Valley Wye alternatives project footprints would primarily consist of the train right-of-way, which would accommodate two sets of tracks in an area with a minimum width of 100 feet. Additional right-of-way would be required to accommodate grade separations, embankments, traction power facilities, and transitional portions of the Central Valley Wye alternatives that allow for bidirectional interface between north-south and east-west trending alignments.

The Central Valley Wye alternatives would include at-grade, below-grade, and above-grade (elevated) track segments. The at-grade track would be laid on an earthen railbed raised 6–10 feet (embankment heights are in excess of 35 feet) off the ground level, set on ties with rock ballast; fill and ballast for the railbed would be obtained from permitted borrow sites and quarries. Below-grade track would be laid in open cut, trench, or cut-and-cover tunnel at a depth that would allow roadway and other grade-level uses above the track. Elevated track segments would span some waterways, roadways, railroad, and other HSR tracks, and would consist of precast, prestressed concrete box girders, cast-in-place concrete box girders, or steel box girders. The height of elevated track sections would depend on the height of existing structures below, or clearances to existing roads or other HSR facilities, and would range from 35 to 90 feet above grade. Columns would be spaced approximately 100–120 feet apart on average.

2.3 SR 152 (North) to Road 13 Wye Alternative

he SR 152 (North) to Road 13 Wye Alternative (Figure 2-1) follows the existing Henry Miller Road and SR 152 rights-of-way as closely as possible in the east-west direction, and the Road 13, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation routes or corridors are necessary to accommodate design requirements; specifically, wider curves are necessary to accommodate the speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 13 Wye Alternative would not follow existing transportation rights-of-way where it transitions from following one transportation corridor to another.



Sources: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015

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Figure 2-1 SR 152 (North) to Road 13 Wye Alternative Alignment and Key Design Features

2.3.1 Alignment and Ancillary Features

The SR 152 (North) to Road 13 Wye Alternative would extend approximately 52 miles, mostly at-grade on raised embankment, although it would also have aerial structures and a segment of retained cut (depressed alignment). The wye configuration of this alternative would be located southwest of the city of Chowchilla, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 13.

As shown on Figure 2-1, this alternative would begin in Merced County at the intersection of Henry Miller Road and Carlucci Road, and would continue at-grade on embankment due east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River and Eastside Bypass. Approaching Willis Road, the alignment would cross the San Joaquin River on an aerial structure, then would return to embankment. It would then cross the Eastside Bypass on an aerial structure. After crossing the Eastside Bypass, the alignment would continue east and cross SR 59 at-grade just north of the existing SR 152/SR 59 interchange, entering Madera County. The SR 152/SR 59 interchange would be reconstructed a little to the south and SR 59 would be grade-separated to pass above the HSR on an aerial structure. The alignment would continue east at-grade along the north side of SR 152 toward Chowchilla, splitting into two legs (four tracks) near Road 11 to transition to the Merced to Fresno Section: Hybrid Alternative, and would cross Ash Slough on an aerial structure. All but the northbound track of the San Jose to Merced section of the alignment (leg) would then return to at-grade embankment. The northbound track would rise to cross over the tracks of the San Jose to Fresno leg on aerial structure as it curves north toward Merced. The SR 152 (North) to Road 13 Wye Alternative legs would be routed as described below and as shown on Figure 2-1:

- The southbound track of the San Jose to Merced leg would be at-grade. This split (where tracks separate) would be west of Chowchilla, at approximately Road 11. The two San Jose to Merced tracks would continue north on the eastern side of Road 13, crossing Ash Slough and the Chowchilla River, and then would cross over Road 13 to its west side. As the tracks return to grade, they would curve northwest, crossing Dutchman Creek on an aerial structure, and follow the west side of the Union Pacific Railroad (UPRR)/SR 99 corridor. At Sandy Mush Road, the alignment would descend into a shallow cut (depressed) section for approximately 0.5 mile, with a retained cut-and-cover undercrossing at Caltrans' Sandy Mush Road overhead. The alignment would return to grade and continue along the west side of the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alternative at Ranch Road.
- The San Jose to Fresno leg of this alternative would continue east from the split near Road 11 and along the north side of SR 152 toward Chowchilla. It would be predominantly at-grade, crossing several roads and Berenda Slough on aerial structures. The alignment would pass south of Chowchilla at-grade then would rise to cross over the UPRR/SR 99 corridor and Fairmead Boulevard on an aerial structure. East of the UPRR/SR 99 corridor, the alternative would extend at-grade through Fairmead, north of Avenue 23. At approximately Road 20, the alignment would curve southeast toward the BNSF corridor and cross Dry Creek on a short aerial structure. The San Jose to Fresno leg would align parallel to the west side of the BNSF corridor as it meets the Merced to Fresno Section: Hybrid Alternative at Avenue 19.
- The Merced to Fresno leg of the alternative would split from the San Jose to Fresno leg near Road 14, where the southbound track of the Merced to Fresno leg would ascend on aerial structure, crossing over the tracks of the San Jose to Fresno leg. The northbound track would curve northwest, rise on a high embankment crossing over several roads, and continue on an at-grade embankment until joining the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be installed in at-grade embankments along this alternative where the alignment intersects wildlife corridors. A traction power (electrical) substation site and Pacific Gas and Electric Company (PG&E) electrical switching station would be located immediately east of where the SR 152 (North) to Road 13 Wye Alternative crosses the

Eastside Bypass. This new 115-kilovolt PG&E switching station would connect to the existing El Nido transmission lines. The new PG&E switching station would allow the existing PG&E power line to connect to the HSR traction power system. PG&E may need to upgrade existing facilities to serve the HSR system. In that instance, the Authority would work with PG&E to identify, design, and implement changes to existing PG&E facilities, including completing any additional environmental review and documentation necessary, in coordination with the California Public Utilities Commission.

2.3.2 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 13 Wye Alternative would require the permanent closure of 38 public roadways at selected locations and the construction of 24 overcrossings or undercrossings in lieu of closure. Figure 2 1 shows the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152, where roads currently cross at-grade but need to be closed to convert SR 152 to a fully access-controlled corridor. The 14 proposed closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 1/2, Road 15, Road 15 1/2, Road 15 3/4, Road 17, and Road 18. Planned new grade separations along SR 152 at the SR 59/SR 152 Interchange, Road 4/Lincoln Road, Road 12, and Road 17 1/2 would maintain access to, and across, SR 152. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders. Each of the new interchanges would require realigning SR 152. Three new interchanges are proposed between SR 59 and SR 99 to provide access to SR 152: at Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where other roads are perpendicular to the proposed HSR. Between these over- or undercrossings, 24 additional roads would be closed, as shown on Figure 2-1. Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

2.3.3 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 13 Wye Alternative would cross over the UPRR right-of-way south of Chowchilla. This alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). In areas where the SR 152 (North) to Road 13 Wye Alternative parallels the UPRR right-of-way, the alternative maintains a minimum horizontal clearance of 102 feet from the centerline to the UPRR right-of-way.

2.3.4 Summary

Table 2-1 summarizes the design features for the SR 152 (North) to Road 13 Wye Alternative.

Table 2-1 Design Features of the SR 152 (North) to Road 13 Wye Alternative

Feature	SR 152 (North) to Road 13 Wye
Total length (linear miles)[1]	52
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	3
Below-grade profile (linear miles)[1]	0.5
Number of straddle bents	32
Number of railroad crossings	1
Number of major water crossings	12

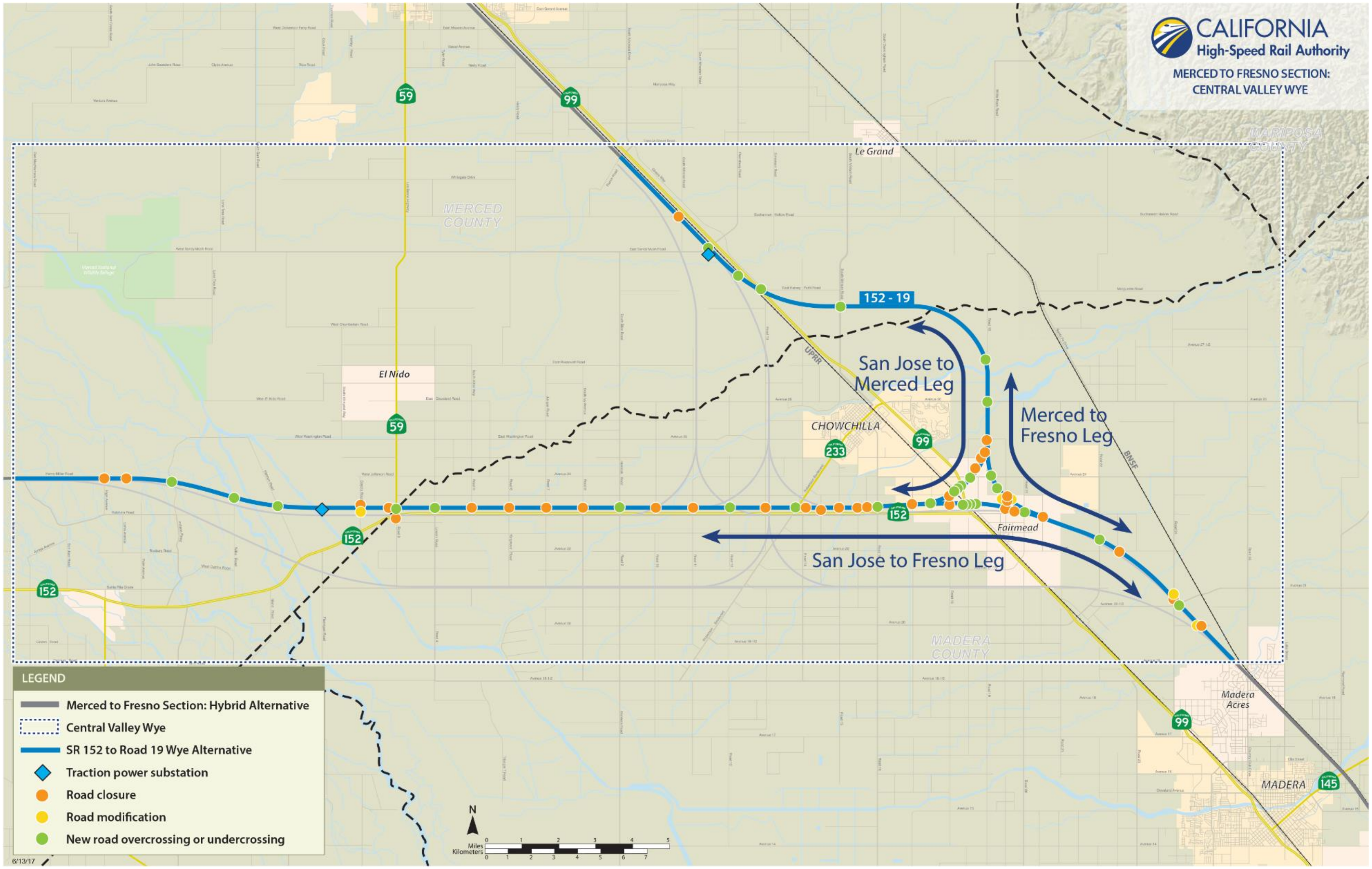
Feature	SR 152 (North) to Road 13 Wye
Number of road crossings	62
Approximate number of public roadway closures	38
Number of roadway overcrossings and undercrossings	24
Traction power substation sites	1
Switching and paralleling stations	1 switching station, 8 paralleling stations
Signaling and train-control elements	18
Communication towers	9
Wildlife crossing structures	39

Source: Authority, 2016a

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure was divided by a factor of 2 to convert to dual-track equivalents.

2.4 SR 152 (North) to Road 19 Wye Alternative

The SR 152 (North) to Road 19 Wye Alternative (Figure 2-2) is designed to follow the existing Henry Miller Road and SR 152 rights-of-way as closely as practicable in the east-west direction and Road 19, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors would be necessary to accommodate design requirements; specifically, larger curves would be necessary to accommodate the high speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 19 Wye Alternative would not follow existing transportation rights-of-way as it transitions from following one transportation corridor to another.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015

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Figure 2-2 SR 152 (North) to Road 19 Wye Alternative Alignment and Key Design Features

2.4.1 Alignment and Ancillary Features

The SR 152 (North) to Road 19 Wye Alternative would extend approximately 55 miles, mostly at-grade on embankment, although it would also have aerial structures, retained cut (depressed alignment), and depressed tunnel undercrossings of major railroad and highway corridors. The wye configuration of this alternative would be located southeast of the city of Chowchilla and north of Fairmead, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 19.

Beginning at the intersection of Henry Miller Road and Carlucci Road (at the same point in Merced County as the SR 152 [North] to Road 13 Wye Alternative), this alternative would continue east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River. It would cross the river on an aerial structure, returning to an at-grade embankment, then onto another aerial structure to cross the Eastside Bypass. After crossing the Eastside Bypass, the alignment would continue east and cross SR 59 at-grade just north of the existing SR 152/SR 59 interchange, where it would enter Madera County. It would continue east at-grade along the north side of SR 152 toward Chowchilla, crossing Ash Slough and Berenda Slough on aerial structures. As it crosses Road 16, the alignment would split into two legs (four tracks) to transition to the Merced to Fresno Section: Hybrid Alternative. East of Road 17, the San Jose to Merced leg would curve northeast, rising to cross the UPRR/SR 99 corridor on an aerial structure, and then would continue north along the east side of Road 19.

As the alignment approaches Avenue 25, the San Jose to Merced and Merced to Fresno legs would converge, requiring the northbound track of the San Jose to Merced leg to rise on an aerial structure and cross over the tracks of the Merced to Fresno leg.

- The San Jose to Merced leg would continue north to just south of Ash Slough, where it would curve west, cross Ash Slough and the Chowchilla River on aerial structures, and continue west approximately 0.5 mile south of Harvey Pettit Road. West of South Minturn Road, the leg would curve northwest and descend below-grade into a series of three tunnels crossing under the SR 99 and UPRR corridors and the Caltrans Sandy Mush Road overhead. The UPRR tracks would be reconstructed on the roof of the HSR cut-and-cover tunnels, while maintaining the same horizontal and vertical alignment. Construction of this type of below-grade crossing would require temporarily realigning the UPRR tracks. Approximately 0.6 mile north of Sandy Mush Road, the alternative would ascend to grade and continue along the UPRR/SR 99 corridor to connect with the Merced to Fresno Section: Hybrid Alternative at Ranch Road.
- The San Jose to Fresno leg would continue east from Road 16 and, east of Road 18, ascend on an aerial structure to cross SR 99 north of the SR 99/SR 152 interchange. East of the UPRR/SR 99 corridor, the leg would continue north of Avenue 23 through Fairmead, descending to grade east of Road 18 3/4. The alternative would then curve southeast toward the BNSF corridor, crossing Dry Creek on a short aerial structure, and continuing along the west side of the BNSF corridor to join the Merced to Fresno Section: Hybrid Alternative at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 20 1/2. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on aerial structures over several road crossings, and then continue at-grade to join the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be provided in at-grade embankments where the alignment intersects wildlife corridors. A traction power (electrical) substation site and PG&E electrical switching station would be located immediately east of where the SR 152 (North) to Road 19 Wye Alternative would cross the Eastside Bypass. This new 115-kilovolt PG&E switching station would connect to existing El Nido transmission lines. A second traction power substation site and PG&E switching station would be located in the vicinity of Sandy Mush Road on the east side of the UPRR/SR 99 corridor. This new 115-kilovolt PG&E switching station would connect to existing Le Grand transmission lines. The new PG&E switching stations would allow the existing power line to connect to the HSR traction power system. The Authority and PG&E would work together to design and complete any additional environmental documentation necessary for upgrades to existing upstream PG&E facilities that may be required to serve the HSR system, in coordination with the California Public Utilities Commission.

2.4.2 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 19 Wye Alternative would require the permanent closure of 36 public roadways at selected locations and the construction of 29 overcrossings or undercrossings. Table 2-2 and Figure 2-2 show the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152 where roads currently cross at-grade but must be closed to convert SR 152 to a fully access-controlled corridor. The proposed 14 closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 1/2, Road 15, Road 15 1/2, Road 15 3/4, Road 17, and Road 18. New grade separations are planned along SR 152 at the SR 59/SR 152 interchange, Road 4/Lincoln Road, Road 12, SR and Road 17 1/2. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders, and several of these interchanges would require realigning SR 152. Interchanges between SR 59 and SR 99 that would provide access to SR 152 are Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where roads would be perpendicular to the proposed HSR. Between these over- or undercrossings, 22 additional roads would be closed (Figure 2-2). Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

The SR 152 (North) to Road 19 Wye Alternative would cross over SR 99 at three locations. South of Chowchilla, both the San Jose to Merced and the San Jose to Fresno legs would rise on aerial structures to cross SR 99. Another crossing of SR 99 would be at the northern end of the alternative, where it descends below-grade into an undercrossing tunnel segment. SR 99 would be temporarily realigned during construction, and would be reconstructed on the roof of the undercrossing tunnel.

2.4.3 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 19 Wye Alternative would cross over the UPRR corridor at three separate locations. South of Chowchilla, both the San Jose to Merced and the San Jose to Fresno legs would rise on aerial structures to cross the UPRR operational right-of-way. In these instances, the alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). The third crossing of the UPRR corridor would be at the northern end of the alternative, where the alignment would descend into an undercrossing tunnel. The UPRR tracks would be reconstructed on the roof of the HSR tunnel, maintaining the same vertical alignment. Construction of this crossing would require the temporary detour (shoofly)[2] of the UPRR tracks. Where the SR 152 (North) to Road 19 Wye Alternative would parallel UPRR operational right-of-way, a horizontal clearance of more than 50 feet would be maintained.

2.4.4 Summary

Table 2-2 summarizes the design features for the SR 152 (North) to Road 19 Wye Alternative.

[2] A shoofly is a temporary track alignment that detours trains around a construction site.

Table 2-2 Design Features of the SR 152 (North) to Road 19 Wye Alternative

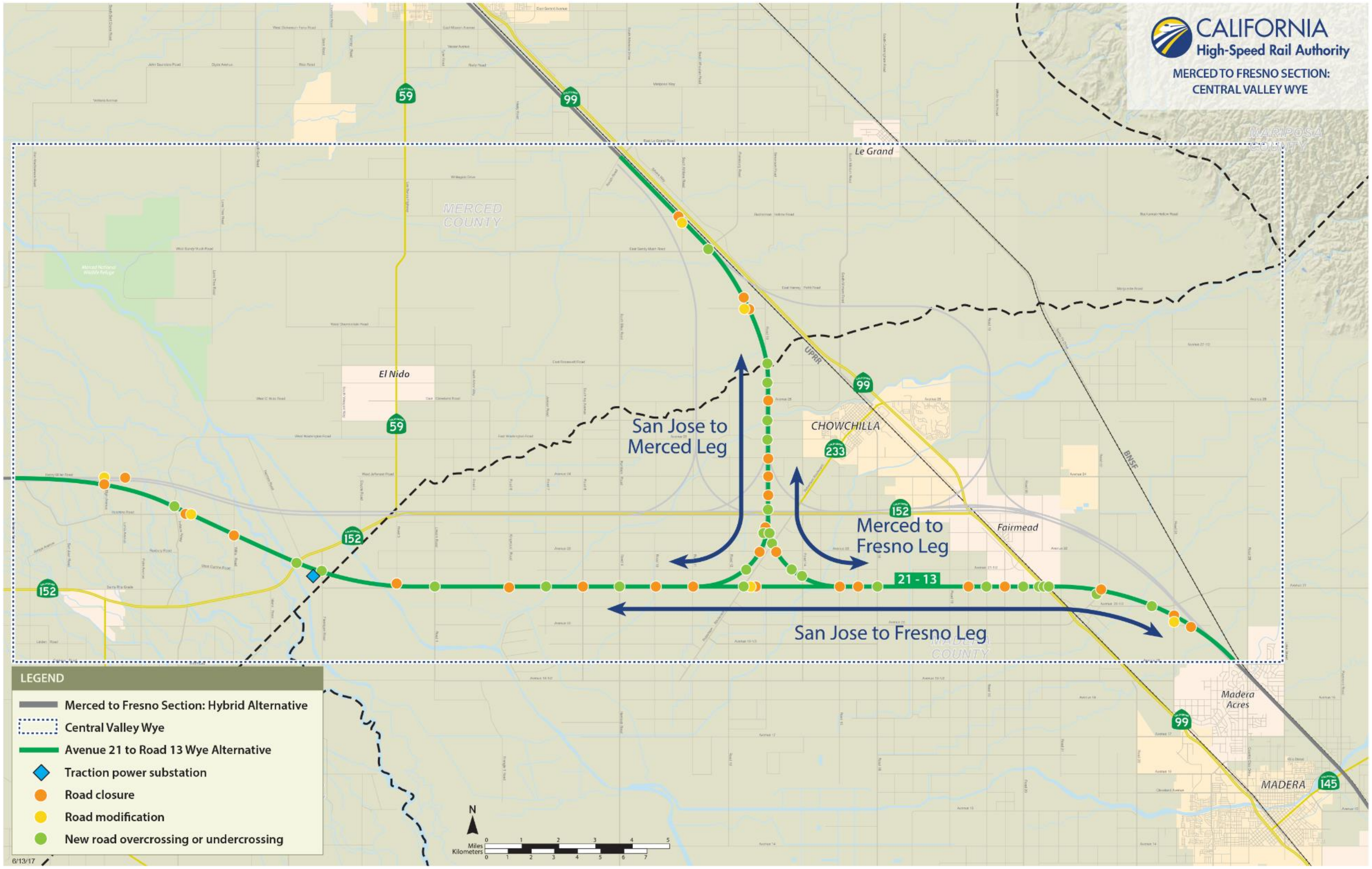
Feature	SR 152 (North) to Road 19 Wye
Total length (linear miles)[1]	55
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	3.5
Below-grade profile (linear miles)[1]	3
Number of straddle bents	31
Number of railroad crossings	3
Number of major water crossings	13
Number of road crossings	65
Approximate number of public roadway closures	36
Number of roadway overcrossings and undercrossings	29
Traction power substation sites	2
Switching and paralleling stations	2 switching stations, 7 paralleling stations
Signaling and train-control elements	21
Communication towers	6
Wildlife crossing structures	41

Source: Authority, 2016a

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure was divided by a factor of 2 to convert to dual-track equivalents.

2.5 Avenue 21 to Road 13 Wye Alternative

The Avenue 21 to Road 13 Wye Alternative (Figure 2-3) is designed to follow the existing Henry Miller Road and Avenue 21 rights-of-way as closely as practicable in the east-west direction and the Road 13, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors would be necessary to accommodate design requirements; specifically, larger curves would be necessary to accommodate the high speeds of the HSR compared to lower-speed roadway alignments. The Avenue 21 to Road 13 Wye Alternative would not follow existing transportation rights-of-way as it transitions from following one transportation corridor to another.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015

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Figure 2-3 Avenue 21 to Road 13 Wye Alternative Alignment and Key Design Features

2.5.1 Alignment and Ancillary Features

The Avenue 21 to Road 13 Wye Alternative would extend approximately 53 miles, mostly at-grade on embankment, although it would also have aerial structures and a short segment of retained cut (depressed alignment). The wye configuration of this alternative would be located approximately 4 miles southwest of the city of Chowchilla, with the east-west axis along the north side of Avenue 21 and the north-south axis on the east side of Road 13.

Beginning at the intersection of Henry Miller Road and Carlucci Road (at the same point in Merced County as the SR 152 [North] to Road 13 Wye Alternative), west of Elgin Avenue this alternative would curve southeast toward the San Joaquin River and Eastside Bypass. East of Willis Road, the alignment would rise to an aerial structure to cross the river, SR 152, and the Eastside Bypass. The alignment would continue east along the north side of Avenue 21, crossing Ash Slough on an aerial structure. Southwest of Chowchilla, near Road 11, the alignment would split into two legs (four tracks) for transition to the Merced to Fresno Section: Hybrid Alternative. The San Jose to Merced leg would curve northeast, cross Road 13, and continue north along the east side of Road 13. At the beginning of the San Jose to Merced leg, the northbound track alternative would rise onto an aerial structure to cross over the tracks of the San Jose to Fresno leg. The Avenue 21 to Road 13 Wye Alternative legs would be routed as described below and shown on Figure 2-3:

- As the San Jose to Merced leg approaches SR 152, it would converge with the Merced to Fresno leg, requiring the northbound track of the San Jose to Merced leg to rise on an aerial structure and cross over the tracks of the Merced to Fresno leg. The San Jose to Merced leg would continue north on an elevated alignment crossing Ash Slough, the Chowchilla River, and Road 13 on aerial structures. As the leg returns to grade, it would curve northwest, cross Dutchman Creek on an aerial structure, and follow along the west side of the UPRR/SR 99 corridor. At Sandy Mush Road, the alternative would descend into a shallow cut (depressed) section for approximately 0.5 mile, with a retained cut-and-cover undercrossing tunnel segment at the Caltrans Sandy Mush Road Overhead. The alternative would return to grade and continue along the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alternative at Ranch Road.
- The San Jose to Fresno leg would continue east from the split near Road 11 along the north side of Avenue 21 toward Chowchilla. It would be predominantly at-grade on embankment, ascending to cross Berenda Slough on an aerial structure. East of the wye configuration, the alignment would extend south of Chowchilla, ascend on an aerial structure east of Road 19 1/2, and cross the UPRR/SR 99 corridor. The alternative would extend south of Fairmead and curve southeast toward the BNSF corridor, cross Dry Creek on an aerial structure, and run adjacent to the west side of the BNSF corridor to its meeting with the Merced to Fresno Section: Hybrid Alternative at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 15. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on aerial structures over several road crossings, and then continue on an at-grade embankment to join the San Jose to Merced leg near SR 152.

Wildlife undercrossing structures would be provided along this alternative in at-grade embankment portions of the HSR corridor where the alignment extends through wildlife corridors. A traction power (electrical) substation site and PG&E electrical switching station would be located on the west side of Flanagan Road. This new 115-kilovolt PG&E switching station would connect to existing El Nido transmission lines. The Authority and PG&E would work together to design and complete any additional environmental documentation necessary for upgrades to existing upstream PG&E facilities that may be required to serve the HSR system, in coordination with the California Public Utilities Commission.

2.5.2 State Highway or Local Roadway Modifications

The Avenue 21 to Road 13 Wye Alternative would require the permanent closure of 30 public roadways at selected locations and the construction of 28 overcrossings or undercrossings. Table 2-3 and Figure 2-3 show the anticipated state highway and local roadway closures. This alternative would require the fewest roadway and state highway modifications.

The Avenue 21 to Road 13 Wye Alternative would rise on aerial structures and cross over state highway facilities in three locations: SR 59 at Harmon Road, SR 152 at Road 13, and SR 99 at Avenue 21. Where other roads would be perpendicular to the proposed HSR, over- or undercrossings are planned at distances from less than 2 miles to 5 miles. Between these over- and undercrossings, some roads may be closed. Local roads paralleling the HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

2.5.3 Freight or Passenger Railroad Modifications

The Avenue 21 to Road 13 Wye Alternative would cross the UPRR operational right-of-way on an aerial structure south of Fairmead and maintain a vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on other UPRR rights-of-way, spurs, and facilities. A horizontal clearance of more than 50 feet would be maintained where the Avenue 21 to Road 13 Wye Alternative would parallel UPRR operational right-of-way.

2.5.4 Summary

Table 2-3 summarizes the design features for the Avenue 21 to Road 13 Wye Alternative.

Table 2-3 Design Features of the Avenue 21 to Road 13 Wye Alternative

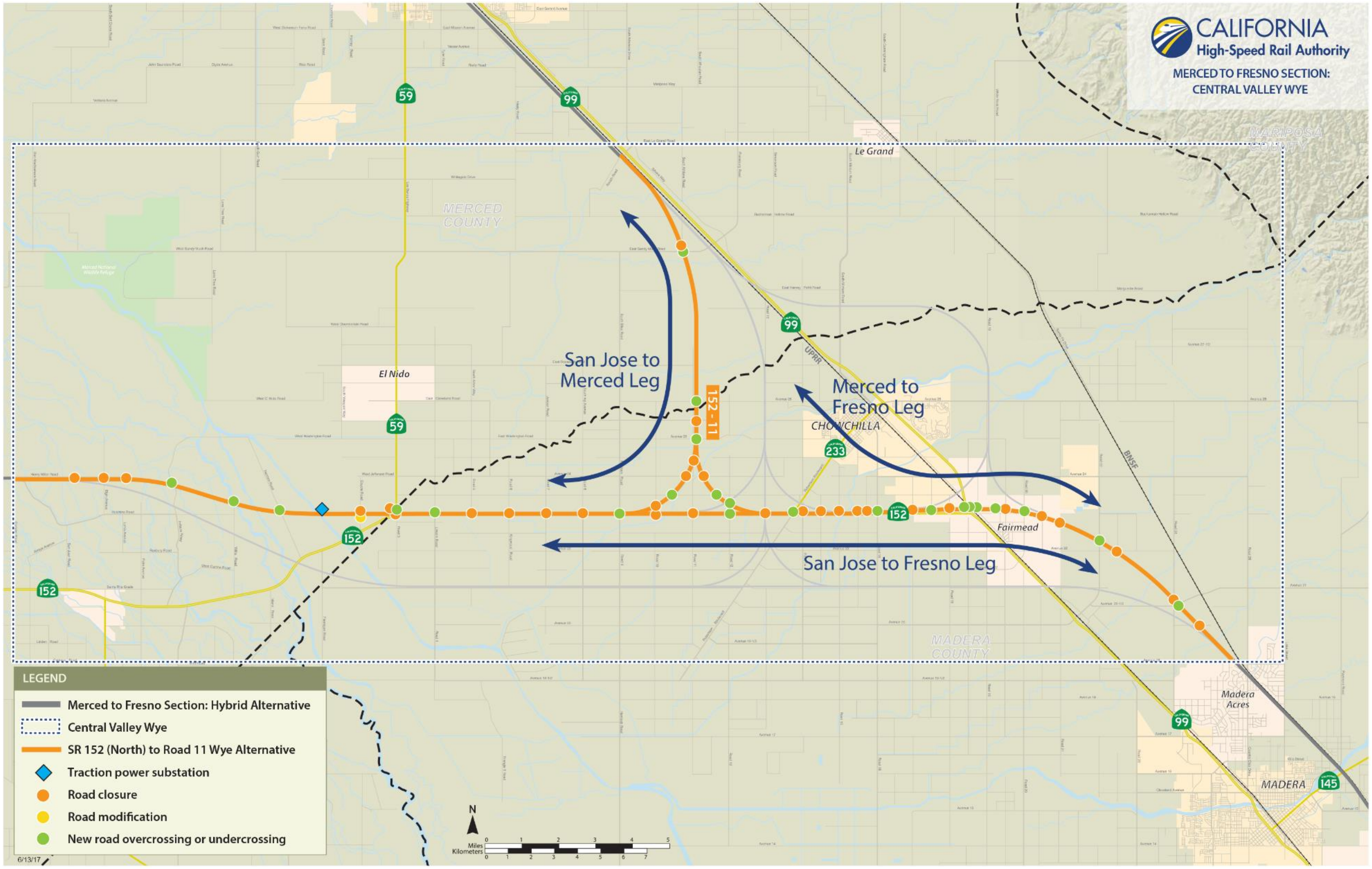
Feature	Avenue 21 to Road 13 Wye
Total length (linear miles)[1]	53
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	4
Below-grade profile (linear miles)[1]	0.5
Number of straddle bents	32
Number of railroad crossings	1
Number of major water crossings	11
Number of road crossings	58
Approximate number of public roadway closures	30
Number of roadway overcrossings and undercrossings	28
Traction power substation sites	1
Switching and paralleling stations	1 switching station, 7 paralleling stations
Signaling and train-control elements	15
Communication towers	6
Wildlife crossing structures	44

Source: Authority, 2016a

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure was divided by a factor of 2 to convert to dual-track equivalents.

2.6 SR 152 (North) to Road 11 Wye Alternative

The SR 152 (North) to Road 11 Wye Alternative (Figure 2-4) follows the existing Henry Miller Road and SR 152 rights-of-way as closely as practicable in the east-west direction, and the Road 11, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors are necessary to accommodate design requirements; specifically, wider curves are necessary to accommodate the speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 11 Wye Alternative would not follow existing transportation rights-of-way where it transitions from following one transportation corridor to another.



Source: Authority, 2016a; ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015

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Figure 2-4 SR 152 (North) to Road 11 Wye Alternative Alignment and Key Design Features

2.6.1 Alignment and Ancillary Features

The SR 152 (North) to Road 11 Wye Alternative would extend approximately 51 miles, mostly at-grade on raised embankment, although it would also have aerial structures. The wye configuration of this alternative would be located west-southwest of the city of Chowchilla, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 11.

Like the other three alternatives, this alternative would begin in Merced County at the intersection of Henry Miller Road and Carlucci Road, and would continue at-grade on embankment east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River and Eastside Bypass. Approaching Willis Road, the alignment would rise to cross the San Joaquin River on an aerial structure, return to embankment, then cross the Eastside Bypass on an aerial structure. After crossing the Eastside Bypass, this alternative would continue east, crossing SR 59 at-grade just north of the existing SR 152/SR 59 interchange, entering Madera County. To accommodate the SR 152 (North) to Road 11 Wye Alternative, the SR 152/SR 59 interchange would be reconstructed slightly to the south, and SR 59 would be grade-separated to pass above the HSR on an aerial structure. The alignment would continue east at-grade along the north side of SR 152 toward Chowchilla, splitting into two legs (four tracks) near Road 10 to transition to the Merced to Fresno Section: Hybrid Alternative, and would cross Ash Slough on an aerial structure. All but the northbound track of the San Jose to Merced leg of the alternative would then return to at-grade embankment; the northbound track would rise to cross over the tracks of the San Jose to Fresno leg on an aerial structure as it curves north toward Merced. The SR 152 (North) to Road 11 Wye Alternative legs would be routed as described below and shown on Figure 2-4:

- The southbound track of the San Jose to Merced leg would turn north at-grade. This split would be west of Chowchilla, at approximately Road 10. The two San Jose to Merced tracks would continue north on the eastern side of Road 11, crossing the Chowchilla River, and then would cross over Road 11 to follow its west side. As the tracks return to grade, they would curve northwest, crossing Dutchman Creek on an aerial structure, following the west side of the UPRR)/SR 99 corridor. The alignment would continue north, crossing over Sandy Mush Road on an aerial structure. The alignment would return to grade and continue along the west side of the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alternative at Ranch Road.
- The San Jose to Fresno leg would continue east from the wye split near Road 10, along the north side of SR 152 toward Chowchilla. It would be predominantly at-grade, ascending on aerial structures at several road crossings and Berenda Slough. The leg would pass south of Chowchilla at-grade then rise to cross over the UPRR/SR 99 corridor and Fairmead Boulevard on an aerial structure. East of the UPRR/SR 99 corridor, the alignment would extend at-grade through Fairmead, north of Avenue 23. At approximately Road 20, the leg would curve southeast toward the BNSF corridor and cross Dry Creek on a short aerial structure. The SR 152 (North) to Road 11 Wye Alternative would align parallel to the west side of the BNSF corridor as it meets the Merced to Fresno Section: Hybrid Alternative at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 13. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on a high embankment crossing over several roads, and continue at-grade on embankment to join the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be installed in at-grade embankments along this alternative where the alignment extends through wildlife corridors. A traction power (electrical) substation site and PG&E electrical switching station would be located immediately east of where the SR 152 (North) to Road 11 Wye Alternative crosses the Eastside Bypass. This new 115-kilovolt PG&E switching station would connect to the existing El Nido transmission lines. The new PG&E switching station would allow the existing PG&E power line to connect to the HSR traction power system. PG&E may need to upgrade existing facilities to serve the HSR system. In that instance, the Authority would work with PG&E to identify, design, and implement changes to existing PG&E facilities, including completing environmental review and clearance in coordination with the California Public Utilities Commission.

2.6.2 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 11 Wye Alternative would require the permanent closure of 33 public roadways at selected locations and the construction of 24 overcrossings or undercrossings in lieu of closure. Table 2-4 and Figure 2-4 show the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152 where roads currently cross at-grade but need to be closed in order to convert SR 152 to a fully access-controlled corridor. The 14 proposed closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 1/2, Road 15, Road 15 1/2, Road 15 3/4, Road 17, and Road 18. Planned new grade separations along SR 152 at the SR 59/SR 152 Interchange, Road 4/Lincoln Road, Road 12, and Road 17 1/2 would maintain access to SR 152. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders. Several of these new interchanges would require realigning SR 152. Three new interchanges are proposed between SR 59 and SR 99 to provide access to SR 152: at Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where other roads are perpendicular to the proposed HSR Between these over- or undercrossings, 19 additional roads would be closed. Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

2.6.3 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 11 Wye Alter native would cross over the UPRR right-of-way as it passes south of Chowchilla. This alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). Horizontal clearance (more than 50 feet) would be maintained where the SR 152 (North) to Road 11 Wye Alternative would parallel UPRR operational right-of-way.

2.6.4 Summary

Table 2-4 summarizes the design features for the SR 152 (North) to Road 11 Wye Alternative.

Table 2-4 Design Features of the SR 152 (North) to Road 11 Wye Alternative

Feature	SR 152 (North) to Road 11 Wye
Total length (linear miles)[1]	51
At-grade profile (linear miles)[1]	46.5
Elevated profile (linear miles)[1]	4.5
Below-grade profile (linear miles)[1]	0
Number of straddle bents	27
Number of railroad crossings	1
Number of major water crossings	13
Number of road crossings	57
Approximate number of public roadway closures	33

Feature	SR 152 (North) to Road 11 Wye
Number of roadway overcrossings and undercrossings	24
Traction power substation sites	1
Switching and paralleling stations	1 switching stations, 7 paralleling stations
Signaling and train-control elements	19
Communication towers	9
Wildlife crossing structures	37

Source: Authority, 2016a
[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure was divided by a factor of 2 to convert to dual-track equivalents.

2.7 Central Valley Wye Impact Avoidance and Minimization Features

The Authority has developed IAMFs that would avoid and minimize potential impacts. IAMFs are standard practices and design features that provide specific means to avoid and minimize environmental and community impacts. IAMFs may involve the development of a plan or program, such as a dust control plan, to minimize impacts on air quality, or require or restrict an action, such as limiting construction material delivery hours, to minimize impacts on traffic during peak travel times. IAMFs differ from mitigation measures in that they are part of the Central Valley Wye alternatives and would be implemented by the Authority as a binding commitment included as part of project approval. In contrast, mitigation measures (where adopted) would further reduce, compensate for, or offset impacts of the Central Valley Wye alternatives. Impacts and mitigation measures are not discussed in this technical report. A complete discussion of potential impacts and mitigation measures is provided in the Draft Supplemental EIR/EIS.

Appendix A presents complete descriptions of all IAMFs related to air quality and global climate change. Volume 2 of the Draft Supplemental EIR/EIS, Appendix 2-B, California High-Speed Rail: Impact Avoidance and Minimization Features, presents complete descriptions of all IAMFs for the Central Valley Wye alternatives.

The Authority and FRA would implement the following IAMFs to address potential Central Valley Wye alternatives impacts on air quality and global climate change:

- AQ-IAMF#1: Fugitive Dust Emissions
- AQ-IAMF#2: Selection of Coatings

3 LAWS, REGULATIONS, AND ORDERS

This section provides a summary of federal, state, and local laws, regulations, orders, programs, or plans that pertain to air quality and climate change in the geographic area that is affected by the Central Valley Wye alternatives. For complete descriptions, refer to Section 3.3.2, Laws, Regulations, and Orders, of the Merced to Fresno Final EIR/EIS (Authority and FRA 2012: pages 3.3-1 through 3.3-9). Where applicable, the summaries that follow identify updates or amendments that have been made since the Merced to Fresno Final EIR/EIS was completed.

Air pollution is a general term that refers to one or more chemical substances that degrade the quality of the atmosphere. Air pollutants degrade the atmosphere by reducing visibility, damaging property, and combining to form smog. Air pollutants result in adverse effects on humans by reducing the productivity or vigor of crops or natural vegetation, and by reducing human or animal health. *Air quality* describes the amount of air pollution to which the public is exposed.

National air quality is governed by the federal Clean Air Act (CAA), which is administered by the USEPA. Air quality in California is governed by the CAA and the California Clean Air Act, which is administered by the California Air Resources Board (CARB). The California Clean Air Act, as amended in 1992, delegates local enforcement of air quality regulations to air districts in the state and requires them to achieve and maintain state ambient air quality standards. The laws, regulations and orders presented in this section are presented first at the federal level, followed by state, regional then local.

3.1 Federal

3.1.1 Clean Air Act (Updated since the Merced to Fresno Final EIR/EIS)

The CAA defines nonattainment areas as geographic regions designated as not meeting one or more of the National Ambient Air Quality Standards (NAAQS), which are standards that the USEPA has established for *criteria pollutants*. The CAA requires that a state implementation plan (SIP) be prepared for each nonattainment area and a maintenance plan be prepared for each former nonattainment area that subsequently demonstrated compliance with the standards. A SIP is a compilation of a state's air quality control plans and rules, approved by the USEPA. Section 176(c) of the CAA provides that federal agencies cannot engage, support, or provide financial assistance for licensing, permitting, or approving any project unless the project conforms to the applicable SIP. The state's and USEPA's goals are to eliminate or reduce the severity and number of violations of the NAAQS and to achieve expeditious attainment of these standards.

The six major criteria pollutants subject to the NAAQS are ozone (O_3), particulate matter (PM) (PM_{10} is PM more than 10 microns in diameter and $PM_{2.5}$ is PM more than 2.5 microns in diameter), carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and lead (Pb). The California Ambient Air Quality Standards (CAAQS) are statewide standards established by the CARB that are generally more stringent than the NAAQS and incorporate additional standards for sulfates, hydrogen sulfide, vinyl chloride, and visibility reducing particles. California's regulations are discussed in more detail in Section 3.2, State.

Table 3-1 summarizes state and federal standards by pollutant. Table 3-1 also shows the standards for each pollutant by averaging time and the method of measurement. The primary standards are intended to protect public health. The secondary standards are intended to protect the nation's welfare and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the general welfare.

Since completion of the Merced to Fresco Final EIR/EIS, the USEPA has revised the NAAQS for 8-hour ozone. Table 3-1 summarizes the current NAAQS (as of May 2016).

3.1.2 Conformity Rule

Pursuant to CAA Section 176I requirements, the USEPA promulgated Title 40 of the Code of Federal Regulations (C.F.R.) Part 51 (40 C.F.R. § 51) Subpart W and 40 C.F.R. Part 93, Subpart B, "Determining Conformity of General Federal Actions to State or Federal Implementation Plans" (see 58 Fed. Reg. 63214 [November 30, 1993], as amended, and 75 Fed. Reg. 17253 [April 5, 2010]). These regulations, commonly referred to as the General Conformity (GC) Rule, apply to all federal actions, including those by FRA, except for those federal actions, which are excluded from review (e.g., stationary source emissions) or related to transportation plans, programs, and projects under Title 23 United States Code or the Federal Transit Act, which are subject to Transportation Conformity.

40 C.F.R. Part 51, Subpart W, applies in states where the state has an approved SIP revision adopting GC regulations; 40 C.F.R. Part 93, Subpart B, applies in states where the state does not have an approved SIP revision adopting GC regulations.

The GC Rule is used to determine if federal actions meet the requirements of the CAA and the applicable SIP by ensuring that air emissions related to the action do not:

- Cause or contribute to new violations of a NAAQS
- Increase the frequency or severity of any existing violation of a NAAQS
- Delay timely attainment of a NAAQS or interim emission reduction

A conformity determination under the GC Rule is required if the federal agency determines that all of the following criteria apply:

- The action will occur in a nonattainment or maintenance area
- One or more specific exemptions do not apply to the action
- The action is not included in the federal agency's "presumed to conform" list
- The emissions from the proposed action are not within the approved emissions budget for an applicable facility
- The total direct and indirect emissions of a pollutant (or its precursors), are at or above the *de minimis* levels established in the GC regulations (75 Fed. Reg. 17255)

Conformity regulatory criteria are listed in 40 C.F.R. 93.158. An action will be required to conform to the applicable SIP if, for each pollutant that exceeds the *de minimis* emissions level in 40 C.F.R. 93.153(b) or otherwise requires a conformity determination due to the total of direct and indirect emissions from the action, the action meets the requirements of 40 C.F.R. 93.158(c).

In addition, federal activities may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emissions reductions toward attainment. The Central Valley Wye alternatives are subject to review under the USEPA GC Rule. However, there may be some smaller highway elements of the Central Valley Wye alternatives that would be dealt with through case-by-case modification of the regional transportation plan (RTP) consistent with transportation conformity.

3.1.3 Mobile Source Air Toxics/Hazardous Air Pollutants (Updated since the Merced to Fresno Final EIR/EIS)

In addition to the NAAQS criteria pollutants, the USEPA regulates MSATs. In February 2007, the USEPA finalized the Control of Hazardous Air Pollutants from Mobile Sources rule to reduce hazardous air pollutant (HAP) emissions from mobile sources. The rule limits the benzene content of gasoline and reduces toxic emissions from passenger vehicles and gas cans. The USEPA estimates that in 2030 this rule would reduce total emissions of MSATs by 330,000 tons and VOC emissions (precursors to O_3 and $PM_{2.5}$) by more than 1 million tons. The latest revision to this rule occurred in October of 2008. This revision added additional specific benzene control technologies that the previous rule did not include. However, no federal ambient standards exist for MSATs; the USEPA has not established NAAQS or provided standards for hazardous air pollutants.

By 2010, the USEPA's existing programs had reduced MSATs by more than 1 million tons from 1999 levels (USEPA 2015a). In addition to controlling pollutants, such as hydrocarbons, PM, and NO_X, recent USEPA regulations, including increased fuel efficiency standards for highway vehicles (October 2012 Corporate Average Fuel Economy standards for model year 2017 vehicles and beyond) and engine tier standards in nonroad equipment (Tier 4 engine emissions standards), controlling emissions from highway vehicles and nonroad equipment could result in large reductions in toxic emissions to the air. Furthermore, the USEPA is developing programs that would provide additional benefits (further controls) for small nonroad gasoline engines, diesel locomotives, and marine engines. A variety of USEPA programs reduces risk in communities. These programs include Clean School Bus USA, the Voluntary Diesel Retrofit Program, Best Workplaces for Commuters, and the National Clean Diesel Campaign.

Table 3-1 State and Federal Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards [1]		National Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3,6]	Method [7]
Ozone (O_3)[8]	1 Hour	0.09 ppm (180 µg/m³)	Ultraviolet Photometry	—	Same as Primary Standard	Ultraviolet Photometry
	8 Hour	0.070 ppm (137 µg/m³)		0.070 ppm (137 µg/m³)		
Respirable Particulate Matter (PM_{10})[9]	24 Hour	50 µg/m³	Gravimetric or Beta Attenuation	150 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	20 µg/m³		—		
Fine Particulate Matter ($PM_{2.5}$)[9]	24 Hour	—	—	35 µg/m³	Same as Primary Standard	Inertial Separation and Gravimetric Analysis
	Annual Arithmetic Mean	12 µg/m³	Gravimetric or Beta Attenuation	12.0 µg/m³	15 µg/m³	
Carbon Monoxide (CO)	1 Hour	20 ppm (23 mg/m³)	Non-Dispersive Infrared Photometry	35 ppm (40 mg/m³)	—	Non-Dispersive Infrared Photometry
	8 Hour	9.0 ppm (10 mg/m³)		9 ppm (10 mg/m³)	—	
	8 Hour (Lake Tahoe)	6 ppm (7 mg/m³)		—	—	
Nitrogen Dioxide (NO_2)[10]	1 Hour	0.18 ppm (339 µg/m³)	Gas Phase Chemiluminescence	100 ppb (188 µg/m³)	—	Gas Phase Chemiluminescence
	Annual Arithmetic Mean	0.030 ppm (57 µg/m³)		0.053 ppm (100 µg/m³)	Same as Primary Standard	
Sulfur Dioxide (SO_2)[11]	1 Hour	0.25 ppm (655 µg/m³)	Ultraviolet Fluorescence	75 ppb (196 µg/m³)	—	Ultraviolet Fluorescence; Spectrophotometry (Pararosaniline Method)
	3 Hour	—		—	0.5 ppm (1300 µg/m³)	
	24 Hour	0.04 ppm (105 µg/m³)		0.14 ppm (for certain areas)[11]	—	
	Annual Arithmetic Mean	—		0.030 ppm (for certain areas)[11]	—	
Lead[12,13]	30 Day Average	1.5 µg/m³	Atomic Absorption	—	—	High Volume Sampler and Atomic Absorption
	Calendar Quarter	—		1.5 µg/m³ (for certain areas)[12]	Same as Primary Standard	
	Rolling 3-Month Average	—		0.15 µg/m³		

Pollutant	Averaging Time	California Standards [1]		National Standards [2]		
		Concentration [3]	Method [4]	Primary [3,5]	Secondary [3, 6]	Method [7]
Visibility Reducing Particles[14]	8 Hour	See footnote 14	Beta Attenuation and Transmittance through Filter Tape	No National Standards		
Sulfates	24 Hour	25 µg/m³	Ion Chromatography			
Hydrogen Sulfide	1 Hour	0.03 ppm (42 µg/m³)	Ultraviolet Fluorescence			
Vinyl Chloride[12]	24 Hour	0.01 ppm (26 µg/m³)	Gas Chromatography			

Source: CARB 2016a

[1] California standards for ozone, carbon monoxide (except 8-hour Lake Tahoe), sulfur dioxide (1 and 24 hour), nitrogen dioxide, and particulate matter (PM_{10}, $PM_{2.5}$, and visibility reducing particles), are values that are not to be exceeded. All others are not to be equaled or exceeded. California ambient air quality standards are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations

[2] National standards (other than ozone, particulate matter, and those based on annual arithmetic mean) are not to be exceeded more than once a year. The ozone standard is attained when the fourth highest 8-hour concentration measured at each site in a year, averaged over 3 years, is equal to or less than the standard. For PM_{10}, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µg/m³ is equal to or less than 1. For $PM_{2.5}$, the 24-hour standard is attained when 98 percent of the daily concentrations, averaged over 3 years, are equal to or less than the standard. Contact the USEPA for further clarification and current national policies.

[3] Concentration expressed first in units in which it was promulgated. Equivalent units given in parentheses are based upon a reference temperature of 25°C and a reference pressure of 760 torr. Most measurements of air quality are to be corrected to a reference temperature of 25°C and a reference pressure of 760 torr; ppm in this table refers to ppm by volume, or micromoles of pollutant per mole of gas.

[4] Any equivalent measurement method that can be shown to the satisfaction of the CARB to give equivalent results at or near the level of the air quality standard, may be used.

[5] National Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health.

[6] National Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

[7] Reference method as described by the USEPA. An "equivalent method" of measurement may be used but must have a "consistent relationship to the reference method" and must be approved by the USEPA.

[8] On October 1, 2015, the national 8-hour ozone primary and secondary standards were lowered from 0.075 to 0.070 ppm

[9] On December 14, 2012, the national annual $PM_{2.5}$ primary standard was lowered from 15 µg/m³ to 12.0 µg/m³. The existing national 24-hour $PM_{2.5}$ standards (primary and secondary) were retained at 35 µg/m³, as was the annual secondary standard of 15 µg/m³. The existing 24-hour PM_{10} standards (primary and secondary) of 150 µg/m³ also were retained. The form of the annual primary and secondary standards is the annual mean, averaged over 3 years.

[10] To attain the 1-hour national standard, the 3-year average of the annual 98th percentile of the 1-hour daily maximum concentrations at each site must not exceed 100 ppb. Note that the national 1-hour standard is in units of parts per billion (ppb). California standards are in units of parts per million (ppm). To directly compare the national 1-hour standard to the California standards the units can be converted from ppb to ppm. In this case, the national standard of 100 ppb is identical to 0.100 ppm.

[11] On June 2, 2010, a new 1-hour SO_2 standard was established and the existing 24-hour and annual primary standards were revoked. To attain the 1-hour national standard, the 3-year average of the annual 99th percentile of the 1-hour daily maximum concentrations at each site must not exceed 75 ppb. The 1971 SO_2 national standards (24-hour and annual) remain in effect until 1 year after an area is designated for the 2010 standard, except that in areas designated nonattainment for the 1971 standards, the 1971 standards remain in effect until implementation plans to attain or maintain the 2010 standards are approved. Note that the 1-hour national standard is in units of ppb. California standards are in units of ppm. To compare the 1-hour national standard directly to the California standard the units can be converted to ppm. In this case, the national standard of 75 ppb is identical to 0.075 ppm.

[12] The CARB has identified lead and vinyl chloride as "toxic air contaminants" with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

[13] The national standard for lead was revised on October 15, 2008 to a rolling 3-month average. The 1978 lead standard (1.5 µg/m³ as a quarterly average) remains in effect until 1 year after an area is designated for the 2008 standard, except that in areas designated nonattainment for the 1978 standard, the 1978 standard remains in effect until implementation plans to attain or maintain the 2008 standard are approved.

[14] 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.

°C = degrees Celsius
µg/m3 = micrograms per cubic meter
CARB = California Air Resources Board
mg/m3 = milligrams per cubic meter
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
ppb = parts per billion
ppm = parts per million
USEPA = U.S. Environmental Protection Agency

3.1.4 Federal Greenhouse Gas Guidance (Updated since the Merced to Fresno Final EIR/EIS)

Climate change and GHG emission reductions are a concern at the federal level. Laws, regulations, plans, and policies address global climate change issues. This section summarizes key federal regulations relevant to the Central Valley Wye alternatives.

In *Massachusetts v. U.S. Environmental Protection Agency, et al.*, 549 U.S. 497 (2007), the United States Supreme Court ruled that GHGs fit within the CAA's definition of air pollutants and that the USEPA has the authority to regulate GHG (United States Supreme Court 2007).

On September 22, 2009, the USEPA published the final rule that requires mandatory reporting of GHG emissions from large sources in the United States. The rule amends CAA Regulations under 40 C.F.R. Parts 86, 87, 89 90 and 94 and provides a new section, Part 98. The USEPA uses the reports to collect accurate and comprehensive emissions data that can inform future policy decisions. Facilities that emit 25,000 metric tons or more per year of GHG emissions must submit annual reports to the USEPA under Subpart C of the final rule. The final rule covers the GHGs carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), hydrofluorocarbons, perfluorocarbons, sulfur hexafluoride, and other fluorinated gases, including nitrogen trifluoride and hydrofluorinated ethers. This is not a transportation-related regulation. However, the methodology developed as part of this regulation is helpful in identifying potential GHG emissions.

On October 5, 2009, President Obama signed U.S. Presidential Executive Order (USEO) 13514; *Federal Leadership in Environmental, Energy, and Economic Performance*. USEO 13514 requires federal agencies to set a 2020 GHG emission-reduction target within 90 days, increase energy efficiency, reduce fleet petroleum consumption, conserve water, reduce waste, support sustainable communities, and leverage federal purchasing power to promote environmentally responsible products and technologies. On December 7, 2009, the Final Endangerment and Cause or Contribute Findings for Greenhouse Gases (endangerment finding), under Section 202(a) of the CAA, went into effect. The endangerment finding states that current and projected concentrations of the six key well-mixed GHGs in the atmosphere (CO_2, CH_4, N_2O, hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) threaten the public health and welfare of current and future generations. Furthermore, it states that the combined emissions of these well-mixed GHGs from new motor vehicles and new motor vehicle engines contribute to GHG pollution, which threatens public health and welfare (USEPA 2016a).

Based on the endangerment finding, the USEPA revised vehicle emission standards under the CAA. The USEPA and National Highway Traffic Safety Administration updated the Corporate Average Fuel Economy fuel standards on May 7, 2010 (75 Fed. Reg. 25324), requiring substantial improvements in fuel economy for all vehicles sold in the Unites States. The new standards apply to new passenger cars, light-duty trucks, and medium-duty passenger vehicles, covering model years 2012 through 2016. The USEPA GHG standards require these vehicles to meet an estimated combined average emissions level of 250 grams of CO_2 per mile in the model year 2016, which would be the equivalent to 35.5 miles per gallon if the automotive industry were to meet this CO_2 level solely through fuel economy improvements.

On September 15, 2011, the USEPA and National Highway Traffic Safety Administration issued a Final Rule of Greenhouse Gas Emissions Standards and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles (76 Fed. Reg. 57107). This final rule is tailored to each of the three regulatory categories of heavy-duty vehicles: combination tractors, heavy-duty pickup trucks and cars, and vocational vehicles. The USEPA and National Highway Traffic Safety Administration estimated that the new standards in this rule will reduce CO_2 emissions by approximately 270 million metric tons (MMT) and save 530 million barrels of oil over the life of vehicles sold during the 2014 through 2018 model years. On August 16, 2016, the USEPA and the National Highway Traffic Safety Administration (NHTSA) signed Phase 2 of these standards, which apply to model years 2019–2027 medium- and heavy-duty vehicles. USEPA and NHTSA have determined that the Phase 2 standards will lower CO_2 emissions by approximately 1.1

billion metric tons and save up to 2 billion barrels of oil over the life of vehicles sold under the program (USEPA 2016b).

On October 15, 2012, the USEPA and the NHTSA issued Corporate Average Fuel Economy standards for model years 2017 and beyond; these standards will reduce GHG emissions by increasing the fuel economy of light duty vehicles to 54.5 mpg by model year 2025. To further California's support of the national program to regulate emissions, CARB submitted a proposal that would allow automobile manufacturer compliance with the USEPA's requirements to show compliance with California's requirements for the same model years. The Final Rulemaking Package was filed on December 6, 2012, and the final rulemaking became effective December 31, 2012. In July 2016, the USEPA, NHTSA and CARB released a mid-term evaluation of the October 2012 final rule in a draft technical assessment report (USEPA, CARB, and NHTSA 2016). The draft technical assessment report concludes that:

- A wider range of technologies exists for manufacturers to use to meet the model year 2022–2025 standards, and at costs that are similar or lower, than those projected in the 2012 rule.
- Advanced gasoline vehicle technologies will continue to be the predominant technologies, with modest levels of strong hybridization and very low levels of full electrification (plugin vehicles) needed to meet the standards.
- The car/truck mix reflects updated consumer trends that are informed by a range of factors including economic growth, gasoline prices, and other macro-economic trends. However, as the standards were designed to yield improvements across the light duty vehicle fleet, irrespective of consumer choice, updated trends are fully accommodated by the footprint-based standards.

On February 18, 2010, the White House Council on Environmental Quality released draft guidance regarding the consideration of GHG in NEPA documents for federal actions. Since the Merced to Fresno Final EIR/EIS, updated draft guidance was subsequently released in December 2014 and final guidance was subsequently released in August 2016 (CEQ 2016). The 2016 guidance:

- Encourages agencies to draw from their experience and expertise to determine the appropriate level (broad, programmatic, or project- or site-specific) and type (quantitative or qualitative) of analysis required to comply with NEPA
- Discusses methods to analyze reasonably foreseeable direct, indirect, and cumulative GHG emissions and climate effects. Recommends that agencies quantify a proposed action's projected direct and indirect GHG emissions, taking into account available data and GHG quantification tools that are suitable for the proposed agency action.
- Recommends that agencies use projected GHG emissions (to include, where applicable, carbon sequestration implications associated with the proposed agency action) as a proxy for assessing potential climate change effects when preparing a NEPA analysis for a proposed agency action.
- Counsels agencies to use the information developed during the NEPA review to consider alternatives that are more resilient to the effects of climate change.

3.2 State

3.2.1 California Clean Air Act

The California Clean Air Act requires nonattainment areas to achieve and maintain the health-based California Ambient Air Quality Standards (CAAQS) by the earliest practicable date. The act is administered by the CARB at the state level and by local air quality management districts at the regional level. The air districts are required to develop plans and control programs for attaining the state standards.

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

3.2.2 Mobile Source Air Toxics/Toxic Air Contaminants (New since the Merced to Fresno Final EIR/EIS)

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

In August 1998, the CARB identified DPM from diesel-fueled engines as a TAC. In September 2000, CARB approved a comprehensive Diesel Risk Reduction Plan to reduce emissions from both new and existing diesel-fueled engines and vehicles. The goal of the plan is to reduce respirable DPM emissions and the associated health risk by 75 percent in 2010 and by 85 percent by 2020. The plan identifies 14 measures that target new and existing on-road vehicles (e.g., heavy-duty trucks and buses), off-road equipment (e.g., graders, tractors, forklifts, sweepers, and boats), portable equipment (e.g., pumps), and stationary engines (e.g., stand-by power generators).

The CARB has adopted regulations to reduce emissions from both on-road and off-road heavy-duty diesel vehicles (e.g., equipment used in construction). These regulations, known as Airborne Toxic Control Measures, reduce the idling of school buses and other commercial vehicles, control DPM, and limit the emissions of ocean-going vessels in California waters. The regulations also include measures to control emissions of air toxics from stationary sources. The California Toxics Inventory, developed by interpolating from CARB estimates of total organic gases and PM, provides emissions estimates by stationary, area-wide, on-road mobile, off-road mobile, and natural sources (CARB 2013).

3.2.3 California Greenhouse Gas Guidance

California has taken proactive steps, briefly described in the following sections, to address the issues associated with GHG emissions and climate change.

3.2.3.1 Assembly Bill 1493

With the passage of Assembly Bill (AB) 1493 in 2002, California launched an innovative and pro-active approach for dealing with GHG emissions and climate change at the state level. AB 1493 requires CARB to develop and implement regulations to reduce automobile and light truck GHG emissions. These stricter emissions standards apply to automobiles and light trucks beginning with the 2009 model year. Although litigation was filed challenging these regulations and USEPA initially denied California's related request for a waiver, a waiver has since been granted (CARB 2013).

3.2.3.2 Executive Order S-3-05

On June 1, 2005, Governor Schwarzenegger signed California Executive Order (EO) S-3-05. The goal of EO S-3-05 is to reduce California's GHG emissions to (1) 2000 levels by 2010, (2) 1990 levels by 2020, and (3) 80 percent below the 1990 levels by 2050. EO S-3-05 also requires Cal-EPA to prepare biennial science reports regarding the potential impact of continued global warming on certain sectors of the state economy. As a result of the thorough scientific analysis collected in these biennial reports, the comprehensive Climate Adaptation Strategy was released in December 2009 after extensive interagency coordination and stakeholder input. The latest of these reports, *Climate Action Team Biennial Report*, was published in December 2010 (Cal-EPA 2010).

3.2.3.3 Assembly Bill 32

One goal of EO S-03-05 is further reinforced by AB 32, the Global Warming Solutions Act of 2006, which requires the state to reduce GHG emissions to 1990 levels by 2020. AB 32 mandates that the CARB create a plan that includes market mechanisms and that it implement rules to achieve "real, quantifiable, cost-effective reductions of greenhouse gases." Separately, EO S-20-06 directs state agencies to begin implementing AB 32, including the recommendations made by the state's Climate Action Team (Office of the Governor 2006).

The following are specific requirements of AB 32:

- The CARB will prepare and approve a scoping plan for achieving the maximum technologically feasible and cost-effective reductions in GHG emissions from sources or categories of sources of GHGs by 2020 (Cal. Health and Safety Code § 38561). The scoping plan, approved by the CARB on December 12, 2008 and updated on May 22, 2014, provides an outline for future actions to reduce GHG emissions in California by implementing regulations, market mechanisms, and other measures. The scoping plan includes the implementation of an HSR system as a GHG reduction measure, estimating a 2020 reduction of 1 MMT of CO_2 equivalent (CO_2e).
- The CARB will identify the statewide level of greenhouse gas emissions in 1990 to serve as the emissions limit to be achieved by 2020 (Cal. Health and Safety Code § 38550). In December 2007, the CARB approved the 2020 emission limit of 427 MMT CO_2e of GHG.
- The CARB will adopt a regulation requiring the mandatory reporting of greenhouse gas emissions (Cal. Health and Safety Code § 38530). In December 2007, CARB adopted a regulation requiring the largest industrial sources to report and verify their GHG emissions. The reporting regulation serves as a solid foundation to determine GHG emissions and track future changes in emission levels.

3.2.3.4 California Executive Order S-01-07

With EO S-01-07, Governor Schwarzenegger set forth the low-carbon fuel standard for California. Under this EO, the carbon intensity of California's transportation fuels is to be reduced by at least 10 percent by 2020 (Office of the Governor 2007).

3.2.3.5 California Environmental Quality Act Guidelines Amendments to Address Greenhouse Gas Emissions (New since the Merced to Fresno Final EIR/EIS)

The CEQA Guidelines amendments of December 30, 2009 specifically require lead agencies to address GHG emissions in determining the significance of environmental effects, and to consider feasible means to mitigate the significant effects of GHG emissions. Provisions of the CEQA Guidelines amendments pertaining to addressing GHG emissions include the following (California Natural Resources Agency 2009):

- A lead agency may consider the following when assessing the significance of impacts from GHG emissions:
  - The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting
  - Whether the project emissions exceed a threshold of significance that the lead agency determines applies to the project
  - The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions
- When an agency makes a statement of overriding considerations, the agency may consider adverse environmental effects in the context of or statewide environmental benefits.

- Lead agencies shall consider feasible means of mitigating GHG emissions that may include, the following:
  - Measures in an existing plan or mitigation program for the reduction of emissions that are required as part of the lead agency's decision.
  - Reductions in emissions resulting from a project through implementation of project features, project design, or other measures.
  - Off-site measures, including offsets.
  - Measures that sequester GHGs.
  - In the case of the adoption of a plan (e.g., general plan, long-range development plan, or GHG reduction plan), mitigation may include specific measures that may be implemented on a project-by-project basis. Mitigation may also incorporate specific measures or policies found in an adopted ordinance or regulation that reduces the cumulative effect of emissions.

3.2.3.6 Senate Bill 375

Senate Bill (SB) 375, signed into law by Governor Schwarzenegger on September 30, 2008, became effective January 1, 2009. This law requires the state's 18 Metropolitan Planning Organizations (MPO) to develop the Sustainable Communities Strategies as part of their regional transportation plans (RTP) through integrated land use and transportation planning, and to demonstrate an ability to attain the GHG emissions reduction targets that CARB established for the region by 2020 and 2035. This would be accomplished through either the financially constrained Sustainable Communities Strategy as part of the RTP or an unconstrained Alternative Planning Strategy. If regions develop integrated land use, housing, and transportation plans that meet the Senate Bill (SB) 375 targets, new projects in these regions can be relieved of certain CEQA review requirements.

In accordance with SB 375, the CARB appointed a Regional Targets Advisory Committee on January 23, 2009, to provide recommendations on factors to be considered and methodologies to be used in the CARB's target setting process. The Regional Targets Advisory Committee was required to provide its recommendations in a report to the CARB by September 30, 2009, to include any relevant issues such as data needs, modeling techniques, growth forecasts, jobs-housing balance, interregional travel, various land use/transportation issues affecting GHG emissions, and overall issues relating to setting these targets. The CARB proposed draft targets on June 30, 2010, and adopted the final targets on September 23, 2010. The CARB must update the regional targets every 8 years (or 4 years if it so chooses) consistent with each MPO's update of its RTP.

3.2.3.7 California Executive Order B-30-15 (New since the Merced to Fresno Final EIR/EIS)

EO B-30-15 established a medium-term goal for 2030 of reducing GHG emissions by 40 percent below 1990 levels and requires CARB to update its current AB 32 Scoping Plan to identify measures to meet the 2030 target. The EO supports EO S-3-05 but currently is only binding on state agencies.

3.2.4 Senate Bill 32, California Global Warming Solutions Act of 2006: Emissions Limit, and Assembly Bill 197, State Air Resources Board, Greenhouse Gases, Regulations (New since the Merced to Fresno Final EIR/EIS)

SB 32 (Pavley) bill requires CARB to assure that statewide GHG emissions are reduced to at least 40 percent below the 1990 level by 2030, consistent with the target set forth in EO B-30-15. The bill was co-joined with AB 197 (Garcia), both of which became operative if the bills are enacted and become effective on or before January 1, 2017. AB 197 creates requirements to form a Joint Legislative Committee on Climate Change Policies, requires CARB to prioritize direct emission reductions and consider social costs when adopting regulations to reduce GHG emissions beyond the 2020 statewide limit, requires CARB to prepare reports on sources of

GHGs and other pollutants, establishes 6-year terms for voting members of CARB, and adds two legislators as non-voting members of CARB. Both bills were signed by Governor Brown in September 2016.

3.2.5 California Asbestos Control Measures

CARB has adopted two airborne toxic control measures for controlling naturally occurring asbestos—the Asbestos Airborne Toxic Control Measure for Surfacing Applications (California Code of Regulations, Title 17, Section 93106) and the Asbestos Airborne Toxic Control Measure for Construction, Grading, Quarrying, and Surface Mining Operations (California Code of Regulations, Title 17, Section 93105). Also, the USEPA is responsible for enforcing regulations relating to asbestos renovations and demolitions; however, the USEPA can delegate this authority to state and local agencies. CARB and local air districts have been delegated authority to enforce the Federal National Emission Standards for Hazardous Air Pollutants regulations for asbestos.

3.2.6 Air Quality Plans

3.2.6.1 State Implementation Plan

The San Joaquin Valley Air Pollution Control District (SJVAPCD) and CARB develop planning documents for pollutants for which the RSA is classified as a federal nonattainment or maintenance area, for approval by the USEPA. The San Joaquin Valley Air Basin (SJVAB) is presently guided by the California SIP (CARB 2015a) and other planning documents. The following are the relevant SIP documents for the SJVAB:

- 2016 8-Hour Ozone Plan (SJVAPCD 2016a)
- 2007 Ozone Plan (SJVAPCD 2007a)
- 2004 Extreme Ozone Attainment Demonstration Plan (SJVAPCD 2004)
- 2013 Plan for the Revoked 1-Hour Ozone Standard (SJVAPCD 2013)
- 2015 Plan for the 1997 $PM_{2.5}$ Standard (SJVAPCD 2015a)
- 2016 Moderate Area Plan for the 2012 $PM_{2.5}$ Standard (SJVAPCD 2016b)
- 2004 Revision to the California State Implementation Plan for Carbon Monoxide (CARB 2004)
- 2007 PM_{10} Maintenance Plan and Request for Redesignation (SJVAPCD 2007b)

3.2.6.2 2016 Ozone Plan for the 2008 8-Hour Ozone Standard (New since the Merced to Fresno Final EIR/EIS)

On June 16, 2016, the SJVAPCD adopted its 2016 Ozone Plan for the 2008 8-Hour Ozone Standard. The 2016 plan addresses the federal mandates of the 2008 8-hour ozone NAAQS by setting a strategy to attain the 75 ppb 8-hour ozone standard by no later than December 31, 2031. NOx emissions, with implementation of the plan, are anticipated to be reduced by 60percent between 2012 and 2031 (SJVAPCD 2016a).

3.2.6.3 2007 Ozone Attainment Plan

On May 5, 2010, the USEPA reclassified the 8-hour O_3 nonattainment of the San Joaquin Valley from “serious” to “extreme.” The reclassification requires the State of California to incorporate more stringent requirements, such as lowering permitting thresholds and implementing reasonably available control technologies at more sources (USEPA 2015b).

The 2007 8-hour Ozone Air Quality Plan contained a comprehensive list of regulatory and incentive-based measures to reduce emissions of O_3 and PM precursors throughout the San Joaquin Valley. On December 18, 2007, the SJVAPCD Governing Board adopted the plan with an amendment to extend the rule adoption schedule for organic waste operations.

On January 8, 2009, the USEPA found that the motor vehicle budgets for 2011, 2014, and 2017 from the 2007 8-hour Ozone Plan were adequate for transportation conformity decisions, but that the 2008, 2020, and 2023 motor vehicle budgets from the 2007 8-hour Ozone Plan were not adequate for transportation conformity purposes (USEPA 2009a).

3.2.6.4 2004 Extreme Ozone Attainment Plan

Subsequent to the adoption of the San Joaquin Valley's 2004 Extreme Ozone Attainment Demonstration Plan, the USEPA revoked the 1-hour O_3 standard effective on June 15, 2005, for certain areas, including the SJVAB. The requirement for SJVAPCD to submit a plan for that standard remains in effect for the San Joaquin Valley (USEPA 2008). On March 8, 2010, the USEPA approved San Joaquin Valley's 2004 Extreme Ozone Attainment Demonstration Plan for 1-hour O_3. As a result of subsequent litigation, the USEPA withdrew its plan approval in November 2012 and the SJVAPCD and CARB withdrew this plan from consideration.

3.2.6.5 2013 Plan for the Revoked 1-Hour Standard (New since the Merced to Fresno Final EIR/EIS)

The SJVAPCD's 2013 Plan for the Revoked 1-Hour Ozone Standard was approved by the District Governing Board at a public hearing on September 19, 2013 (SJVAPCD 2013). As discussed in the plan, preliminary modeling confirms that the San Joaquin Valley would attain the revoked 1-hour O_3 standard by 2017.

3.2.6.6 2015 $PM_{2.5}$ Plan (New since the Merced to Fresno Final EIR/EIS)

The SJVAPCD Governing Board adopted the 2015 *Plan for the 1997 $PM_{2.5}$ Standard* on April 16, 2015. The Plan sets out the strategy to attain the federal 1997 24-hour $PM_{2.5}$ standard of 65 µg/m^3 by 2018 and annual $PM_{2.5}$ standard of 15 µg/m^3 by 2020 (SJVAPCD 2012b).

3.2.6.7 2016 $PM_{2.5}$ Plan (New since the Merced to Fresno Final EIR/EIS)

The SJVAPCD Governing Board adopted the 2016 Moderate Area Plan for the 2012 $PM_{2.5}$ Standard on September 15, 2016. The Plan identifies a strategy to attain the federal annual $PM_{2.5}$ standard of 12 micrograms per cubic meter (µg/m^3). Additionally, the plan satisfies the mandate to submit a Moderate attainment plan to the USEPA by October 2016, demonstrates that attaining the 2012 $PM_{2.5}$ standard by the Moderate nonattainment area deadline of 2021 would be impractical, and formally requests that the SJVAB be reclassified from a Moderate nonattainment area to a Serious nonattainment area (SJVAPCD 2016b).

3.2.6.8 2004 Revision to California State Implementation Plan for Carbon Monoxide

On July 22, 2004, the CARB approved an update to the SIP that shows how 10 areas, including the SJVAB, will maintain the CO standard through 2018; revises emission estimates; and establishes new on-road motor vehicle emission budgets for transportation conformity purposes (CARB 2004). On November 30, 2005, the USEPA approved and promulgated the *Implementation Plans and Designation of Areas for Air Quality Purposes* (USEPA 2005). This revision provides a 10-year update to the CO maintenance plan and establishes new CO motor-vehicle emissions budgets for the purposes of determining transportation conformity.

3.2.6.9 2007 PM_{10} Maintenance Plan and Request for Redesignation

CARB approved SJVAPCD's 2007 PM_{10} Maintenance Plan and Request for Redesignation with modifications to the transportation conformity budgets. On September 25, 2008, the USEPA redesignated the San Joaquin Valley as in attainment for the PM_{10} NAAQS and approved the PM_{10} Maintenance Plan (SJVAPCD 2007b).

3.3 Regional and Local

3.3.1 San Joaquin Valley Air Pollution Control District (Updated since the Merced to Fresno EIR/EIS)

The SJVAPCD is responsible for (1) implementing air quality regulations, including developing plans and control measures for stationary sources of air pollution to meet the NAAQS and CAAQS; (2) implementing permit programs for the construction, modification, and operation of sources of air pollution; and (3) enforcing air pollution statutes and regulations governing stationary sources. With CARB oversight, the SJVAPCD administers local regulations.

The SJVAPCD also coordinates transportation and air quality planning activities with the eight San Joaquin Valley transportation planning agencies. The SJVAPCD and the transportation planning agencies coordinate on mobile emissions inventory development, transportation control measure development and implementation, and transportation conformity.

The SJVAPCD prepared the *Guide for Assessing and Mitigating Air Quality Impacts* (GAMAQI) to assist lead agencies and project applicants in evaluating the potential air quality impacts of projects in the SJVAB (SJVAPCD 2002). The GAMAQI provides SJVAPCD-recommended procedures for evaluating potential air quality impacts during the CEQA environmental review process. The GAMAQI provides guidance on evaluating short-term (construction) and long-term (operational) air emissions. The 2002 GAMAQI was updated and was adopted by the SJVAPCD Board on March 19, 2015 (SJVAPCD 2015b). Conversation with SJVAPCD staff indicates projects that were initiated or had a Notice of Preparation issued prior to the adoption of the 2015 GAMAQI may continue to use the 2002 GAMAQI to evaluate project impacts (Siong pers. comm.). Consequently, this evaluation uses the SJVPACD's 2002 GAMAQI guidance on the following:

- Criteria and thresholds for determining whether a project may have a significant adverse air quality effect
- Specific procedures and modeling protocols for quantifying and analyzing air quality effects
- Methods to mitigate air quality impacts
- Information for use in air quality assessments and environmental documents that will be updated more frequently, such as air quality data, regulatory setting, climate, and topography

SJVAPCD has specific air quality-related planning documents, rules, and regulations. This section summarizes the local planning documents and regulations that may be applicable to the Central Valley Wye alternatives as administered by SJVAPCD with CARB oversight. There are also local city and county policies that pertain to air quality and climate change. The policies of the general plans focus on managing sources of air pollutants through mixed-use and transit- and pedestrian-friendly neighborhoods. Additional details regarding the applicable rules can be found at the SJVAPCD website, www.valleyair.org/rules/1ruleslist.htm.

The major revisions associated with the SJVAPCD's 2015 GAMAQI are that it:

- Formalizes quantitative construction mass emission thresholds (tons/year)
- Formalizes quantitative mass emission thresholds for CO, sulfur oxide (SO_X), PM_{10} and $PM_{2.5}$ (tons/year)
- Requires an ambient air quality analysis with dispersion modeling ("hot-spot" analysis) for all criteria pollutants if mass emissions from any criteria pollutant exceeds a 100 pounds/day screening level
- Ties SJVAPCD Indirect Source Review Rule 9510 into their CEQA process

ICF staff consulted with SJVAPD planning staff in May 4, 2015 to discuss whether the assessment of emissions in this document should use the SJVAPCD's 2002 or 2015 CEQA GAMAQI thresholds of significance (Siong pers. comm.). SJVAPCD indicated that projects may continue to use their 2002 GAMAQI for projects that were initiated prior to the adoption of their 2015 GAMAQI. In addition, a project's Notice of Preparation date can be used for determining whether a project should use the 2015 GAMAQI relative to the adoption of the 2015 GAMAQI. Consequently, although the SJVAPCD most recently adopted GAMAQI were adopted on March 19, 2015, the assessment of the Central Valley Wye alternative's emissions in this document uses SJVAPCD's 2002 GAMAQI based on the guidance received on May 4, 2015, as the Notice of Preparation for the Central Valley Wye alternatives was issued prior to the March 19, 2015 adoption of the updated GAMAQI (Siong pers. comm.).

However, while the SJVAPCD's thresholds of significance in the 2002 GAMAQI are used to evaluate emissions associated with the Central Valley Wye alternatives, an analysis was conducted to evaluate whether the Central Valley Wye alternatives would exceed the thresholds from the 2015 GAMAQI. The results of this analysis indicates the Central Valley Wye alternatives would not exceed any thresholds from the 2015 GAMAQI.

3.3.1.1 Rule 8011, General Requirements—Fugitive Dust Emission Sources

Fugitive dust regulations are applicable to outdoor fugitive dust sources. Operations, including construction operations, must control fugitive dust emissions in accordance with SJVAPCD Regulation VIII (SJVAPCD 2004a). According to Rule 8011, the SJVAPCD requires the implementation of control measures for fugitive dust emission sources. The Central Valley Wye alternatives would also implement the mandatory control measures listed in Table 6-2 in the GAMAQI (SJVAPCD 2002) to reduce fugitive dust emissions. These measures are not considered mitigation measures because they are required by law.

Many of the control measures required by the SJVAPCD are the same or similar to the control measures listed in the Statewide Program EIR/EIS (Authority and FRA 2005). The SJVAPCD Rule 8011 requirements are listed here:

- All disturbed areas, including storage piles, which are not being actively used for construction purposes, will be effectively stabilized for dust emissions using water or a chemical stabilizer/suppressant, or covered with a tarp or other suitable cover or vegetative ground cover.
- All on-site unpaved roads and off-site unpaved access roads will be effectively stabilized for dust emissions using water or a chemical stabilizer/suppressant.
- All land clearing, grubbing, scraping, excavation, land leveling, grading, cut-and-fill, and demolition activities will be effectively controlled of fugitive dust emissions by utilizing an application of water or by presoaking.
- With the demolition of buildings up to six stories in height, all exterior surfaces of the building will be wetted during demolition.
- All materials transported off-site will be covered or effectively wetted to limit visible dust emissions, and at least 6 inches of freeboard space from the top of the container will be maintained.
- All operations will limit or expeditiously remove the accumulation of mud or dirt from adjacent public streets at the end of each workday. The use of dry rotary brushes is expressly prohibited except where preceded or accompanied by sufficient wetting to limit the visible dust emissions. Use of blower devices is expressly forbidden.
- Following the addition of materials to, or the removal of materials from, the surface of outdoor storage piles, piles will be effectively stabilized of fugitive dust emissions utilizing sufficient water or a chemical stabilizer/suppressant.
- Within urban areas, trackout will be immediately removed when it extends 50 or more feet from the site and at the end of each workday.
- Any site with 150 or more vehicle trips per day will prevent carryout and trackout.

3.3.2 Transportation Plans and Programs (Updated since the Merced to Fresno Final EIR/EIS)

Regional transportation planning agencies and MPOs within the SJVAB, the Merced County Association of Governments (MCAG) and the Madera County Transportation Commission (MCTC) are responsible for preparing RTPs. RTPs address a region's transportation goals, objectives, and policies for the next 20 to 25 years and identify the actions necessary to achieve those goals. MPOs prepare Federal Transportation Improvement Programs, which are 5-year programs of proposed projects that incrementally develop the RTP and contain a listing of proposed transportation projects for which funding has been committed. Transportation conformity projects are analyzed for air quality conformity with the SIP as components of RTPs and Federal Transportation Improvement Programs.

The MCAG adopted the 2014 RTP on September 25, 2014 (MCAG 2014), and MCTC adopted the 2014 RTP on July 11, 2014 (MCTC 2014). Both RTPs discuss the Central Valley Wye alternatives, but it is not included in the constrained project list (i.e., a list of projects for which funding has been committed), and is therefore not included in the transportation conformity determination.

3.3.3 Associations of Governments (Updated since the Merced to Fresno Final EIR/EIS)

California has 25 regional planning agencies. The regional planning agencies in the vicinity of the Central Valley Wye alternatives are the MCAG and the MCTC. MCAG comprises representatives from Merced County and the cities of Atwater, Dos Palos, Gustine, Livingston, Los Banos, and Merced. As a regional transportation planning agency and MPO, MCAG is the primary transportation facilitator in Merced County (MCAG 2015). The MCTC is the regional transportation planning agency and the designated MPO for Madera County, which includes the City of Madera (MCTC 2015).

Each planning agency is responsible for establishing the long-range priorities for the regional transportation system through the development of the 20-year RTP and transportation improvement program, as required by state law. These plans identify improvements across the entire system, including the road and highway network, bus and rail transit systems, freight transportation, the environment, and advanced technologies. As required under SB 375, the two agencies considered Sustainable Communities Strategies as part of their most recent RTPs. However, MCTC found it cannot meet its GHG reduction targets under SB 375 and has opted to adopt an Alternative Planning Strategy in place of the binding Sustainable Communities Strategy, while MCAG adopted Amendment 1 on May 19, 2016 that contains their SCS. The current plans of the responsible planning agencies in the vicinity of the Central Valley Wye alternatives are discussed in the following sections.

3.3.4 General Plans, Policies, and Ordinances

Table 3-2 summarizes local and regional laws and regulations that were identified and considered in preparation of this analysis.

Policy Title	Summary
Merced County	
2030 Merced County General Plan, Economic Development Element (2013	▪ Policy Economic Development (ED)-1.7: Improving Merced County's Quality of Life (SO/PI). Economic development efforts shall include consideration of improving air quality, developing an educated workforce, promoting safe/crime-free communities, protecting water quality, and increasing recreational opportunities as a means to improve the quality of life for residents and workers and to attract new industries to the County.
2030 Merced County General Plan, Land Use Element (2013)	▪ Policy Land Use (LU)-10.9: Air Quality Management Coordination (IGC). Coordinate with the San Joaquin Valley Air Pollution Control District and affected agencies and neighboring jurisdictions in the San Joaquin Valley Air Basin to confirm regional cooperation on cross-jurisdictional and regional transportation and air quality issues, and to establish parallel air quality programs and implementation measures, such as trip reduction ordinances and indirect source programs. ▪ Policy LU-10.10: San Joaquin Valley Air Pollution Control District Consultation (IGC). Consult with the San Joaquin Valley Air Pollution Control District during CEQA review for discretionary projects that have the potential for causing adverse air quality impacts. Certify that development projects are submitted to the District for CEQA comments and review of air quality analysis.

Policy Title	Summary
2030 Merced County General Plan, Transportation and Circulation Element (2013)	▪ Policy Circulation (CIR)-1.3: Transportation Efficiency (RDR). Encourage transportation programs that result in more efficient energy use, reduce greenhouse gas emissions and noise levels, and improve air quality.
2030 Merced County General Plan, Air Quality Element (2013)	▪ Policy Air Quality (AQ)-1.6: Air Quality Improvement (SO). Support and implement programs to improve air quality throughout the County by reducing emissions related to vehicular travel and agricultural practices. ▪ Policy AQ-2.3: Cumulative Impacts (RDR). Encourage the reduction of cumulative air quality impacts produced by projects that are not significant by themselves, but result in cumulatively significant impacts in combination with other development. ▪ Policy AQ-2.5: Innovative Mitigation Measures (RDR, IGC, JP). Encourage innovative mitigation measures and project redesign to reduce air quality impacts by coordinating with the San Joaquin Valley Air Pollution Control District, project applicants, and other interested parties. ▪ Air Quality Element Goal AQ-3. Improve air quality through improved public facilities and operations and to serve as a model for the private sector. ▪ Policy AQ-4.7: Planning Integration (RDR). Require land use, transportation, and air quality planning to be integrated for the most efficient use of resources and a healthier environment. ▪ Air Quality Element Goal AQ-6. Improve air quality in Merced County by reducing emissions of PM_{10}, $PM_{2.5}$, and other particulates from mobile and non-mobile sources.
Madera County	
Madera County General Plan, Transportation and Circulation (1995	▪ Policy 2.H.6: The County shall work with other responsible agencies, including the Madera County Transportation Commission and the San Joaquin Valley Unified Air Pollution Control District, to develop other measures to reduce vehicular travel demand and meet air quality goals.
Madera County General Plan (1995)	▪ Goal 5.J: To protect and improve air quality in Madera County and the region. ▪ Policy 5.J.1: The County shall cooperate with other agencies to develop a consistent and effective approach to air quality planning and management. To this end, the County shall coordinate with other jurisdictions in the San Joaquin Valley to establish parallel air quality programs and implementation measures. ▪ Policy 5.J.2: The County shall support the San Joaquin Valley Unified Air Pollution Control District (SJVUAPCD) in its development of improved ambient air quality monitoring capabilities and the establishment of standards, thresholds, and rules to more adequately address the air quality impacts of new development. ▪ Goal 5.K: To integrate air quality planning with the transportation planning process. ▪ Implementation Program 5.10: The County shall coordinate with other local, regional, and state agencies, including the SNUAPCD and the ARB, in incorporating regional and state clean air plans into County planning and project review procedures. The County shall also cooperate with the SNUAPCD and ARB in the following efforts: o a. Enforcing the provision of the California and Federal Clean Air Acts, state and regional policies, and established standards for air quality; o b. Establishing monitoring stations to accurately determine the status of carbon monoxide, ozone, nitrogen dioxide, hydrocarbon, and PM-10 concentrations; o c. Developing consistent procedures and thresholds for evaluating both project-specific and cumulative air quality impacts for proposed projects.

Policy Title	Summary
Madera County General Plan Air Quality Element (2010)	▪ AQ Policy A1.1.4: During project review, approval, and implementation, work with Caltrans, ARB, SJVAPCD, and MCTC to minimize the air quality, mobility, and social impacts of large-scale transportation projects on existing communities and planned sensitive land uses. ▪ AQ Policy C1.1.1: Assess and mitigate project air quality impacts using analysis methods and significance thresholds recommended by the SJVAPCD and require that projects do not exceed established SJVAPCD thresholds.
City of Chowchilla	
City of Chowchilla 2040 General Plan, Land Use Element (City of Chowchilla 2011)	▪ Objective LU 21: Support the principles of reducing air pollutants through land use, transportation, and energy use planning. ▪ Policy LU 21.1: Encourage transportation modes that minimize contaminant emissions from motor vehicle use.
City of Chowchilla 2040 General Plan, Circulation Element (2011)	▪ Policy CI 10.2: Support coordination with other cities, counties and planning agencies concerning consideration and management of land use, jobs / housing balance and transportation planning as a means of improving air quality.
City of Chowchilla 2040 General Plan, Public Services Element (2011)	▪ Policy PS 10.12: Separate, buffer and protect sensitive receptors from significant sources of air pollutants to the greatest extent possible.
City of Chowchilla 2040 General Plan, Open Space and Conservation Element (2011)	▪ Objective OS 23: To Implement and enforce State and Regional regulations pertaining to greenhouse gas emissions and climate change. ▪ Policy OS 23.1: The City supports local, regional, and statewide efforts to reduce the emission of greenhouse gases linked to climate change.

Sources: City of Chowchilla, 2011; Madera County, 1995; Madera County, 2010; Merced County, 2013;
Caltrans = California Department of Transportation
ARB = California Air Resources Board
SJVAPCD = San Joaquin Valley Air Pollution Control Board
MCTC = Madera County Transportation Commission

4 POLLUTANTS OF CONCERN

This section describes pollutants of concern in the Central Valley Wye RSA.

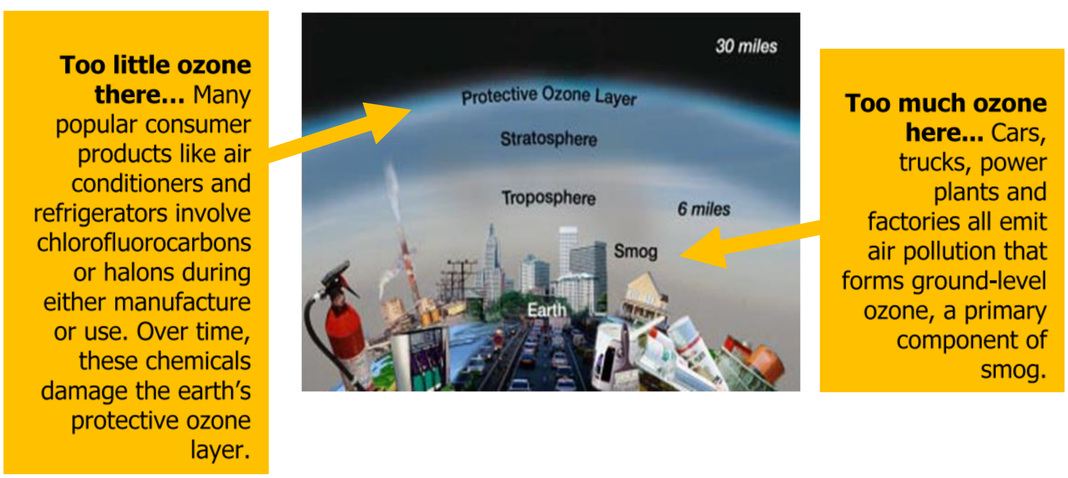
4.1 Criteria Pollutants

Criteria pollutants are pollutants for which federal and state ambient air quality standards have been established to protect public health and welfare (Section 3.1, Federal). The sources of these pollutants, their effects on human health and the nation's welfare, and their final deposition in the atmosphere vary considerably. The following sections provide a brief description of each criteria pollutant.

4.1.1 Ozone

O_3 is a colorless toxic gas. As shown on Figure 4-1, O_3 is found in both the Earth's upper and lower atmosphere. In the upper atmosphere, O_3 is a naturally occurring gas that helps to prevent the sun's harmful ultraviolet rays from reaching the Earth. Substantial O_3 formations generally require a stable atmosphere with strong sunlight; therefore, high levels of O_3 are generally a concern in the summer.

In the lower atmosphere, O_3 is human-generated. Although O_3 is not directly emitted, it forms in the lower atmosphere through a chemical reaction between certain hydrocarbons, referred to as VOCs, and NO_X, which are emitted from industrial sources and automobiles. Hydrocarbons are compounds composed primarily of hydrogen and carbon atoms. Total organic gas and reactive organic gases (ROG) are the two classes of hydrocarbons that are inventoried by CARB. ROGs have relatively high photochemical reactivity. The principal nonreactive hydrocarbon is CH_4, which is also a GHG (refer to Section 4.3, Greenhouse Gases). The major source of ROGs is the incomplete combustion of fossil fuel in internal combustion engines. Other sources of ROGs include the evaporative emissions associated with paints and solvents, the application of asphalt paving, and household consumer products. ROGs do not directly cause adverse effects on human health, but cause adverse effects by reactions of ROG to form secondary pollutants. ROGs are also transformed into organic aerosols in the atmosphere, contributing to higher levels of fine PM and lower visibility. The CARB uses the term ROG for air quality analysis and defines it the same as the federal term "VOC." In this report, ROG is assumed to be equivalent to VOC.



Source: USEPA, 2003

Figure 4-1 Ozone in the Atmosphere

The main ingredient of smog is O_3, which also enters the bloodstream through the respiratory system and interferes with the transfer of oxygen, depriving sensitive tissues in the heart and brain of oxygen. In addition, O_3 can damage vegetation by inhibiting its growth. The effects of changes in VOC and NO_X emissions for the Central Valley Wye alternatives are examined on regional and statewide levels.

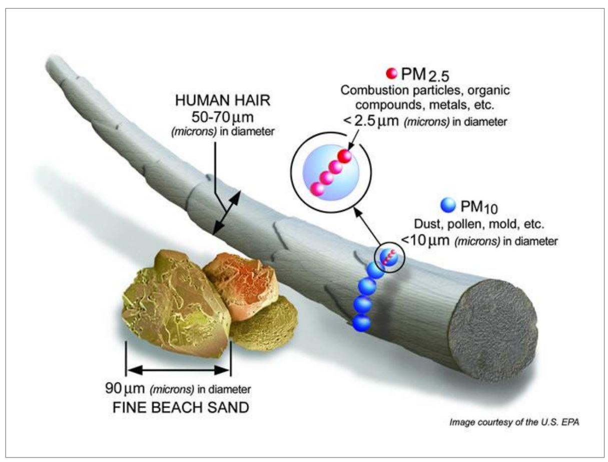
4.1.2 Particulate Matter

PM pollution is composed of solid particles or liquid droplets that are small enough to remain suspended in the air. In general, particulate pollution can include dust, soot, and smoke, which can be irritating but usually are not toxic. Particulate pollution can also include salts, acids, and metals. However, PM pollution can also include substances that are highly toxic. Of particular concern are those particles that are smaller than or equal to 10 microns (µm) (PM_{10})—approximately 1/7 the thickness of a human hair—or 2.5µm ($PM_{2.5}$), approximately 1/28 the thickness of a human hair (Figure 4-2). PM can form when gases emitted from motor vehicles undergo chemical reactions in the atmosphere.

Major sources of PM_{10} include motor vehicles; wood-burning stoves and fireplaces; dust from construction, landfills, and agriculture; wildfires and brush/waste burning; industrial sources; windblown dust from open lands; and atmospheric chemical and photochemical reactions. These suspended particulates produce haze and reduce visibility.

A small portion of PM is the product of fuel combustion processes. However, the combustion of fossil fuels (by motor vehicles, power generation, and industrial facilities) accounts for a significant portion of $PM_{2.5}$ pollution. $PM_{2.5}$ also results from fuel combustion in residential fireplaces and wood stoves. In addition, $PM_{2.5}$ can be formed in the atmosphere from gases such as SO_2, NO_X, and VOCs.

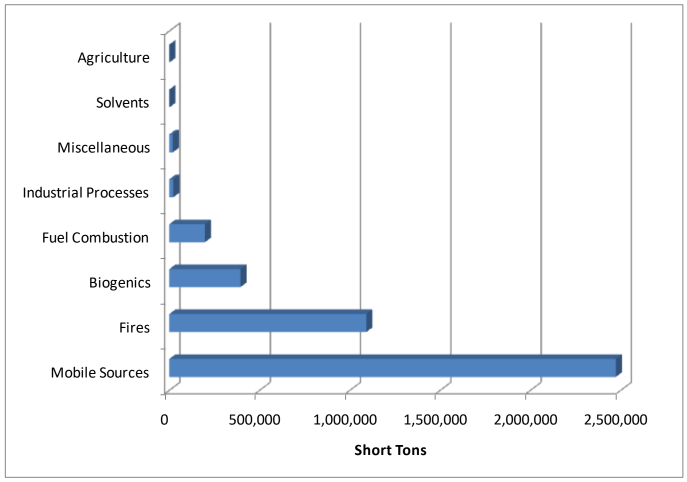
The main health effect of airborne PM is on the respiratory system. Both PM_{10} and $PM_{2.5}$ can penetrate the human respiratory system's natural defenses and damage the respiratory tract when inhaled. Both tend to collect in the upper portion of the respiratory system, but $PM_{2.5}$ or less can penetrate deeper into the lungs and damage lung tissues. The effects of PM_{10} and $PM_{2.5}$ emissions for the Central Valley Wye alternatives are examined on a localized (i.e., microscale) basis, on a regional basis, and on a statewide basis.



Source: USEPA, 2015c

Figure 4-2
Relative Particulate Matter Size

4.1.3 Carbon Monoxide



Source: USEPA, 2015d

Figure 4-3
Sources of CO in California (2011)

CO is a colorless gas that interferes with the transfer of oxygen to the brain. CO is emitted almost exclusively from the incomplete combustion of fossil fuels. As shown on Figure 4-3, on-road motor vehicle exhaust is the primary source of CO in California. In cities, 85 percent to 95 percent of all CO emissions may come from motor vehicle exhaust. Prolonged exposure to high levels of CO can cause headaches, drowsiness, loss of equilibrium, and heart disease. CO levels are generally highest in the colder months of the year when inversion conditions (i.e., warmer air traps colder air near the ground) are more frequent. CO concentrations can vary greatly over relatively short distances. Relatively high concentrations of CO are typically found near congested intersections, along heavily used roadways carrying slow-moving traffic, and in areas where atmospheric dispersion is inhibited by urban street canyon conditions. Consequently, CO concentrations must be predicted on a microscale basis.

4.1.4 Nitrogen Dioxide

NO_2 is a brownish gas that irritates the lungs. It can cause breathing difficulties at high concentrations. NO_2 is one of a group of highly reactive gases known as oxides of nitrogen, or NOx. As with O_3, NO_2 can be formed through a reaction between nitric oxide and atmospheric oxygen. NO_2 also contributes to the formation of PM_{10}. At atmospheric concentrations, NO_2 is only potentially irritating. At high concentrations, the result is a brownish-red cast to the atmosphere and reduced visibility. There is some indication of a relationship between NO_2 and chronic (long-term) pulmonary fibrosis. As discussed in Section 4.1.1, Ozone, the effects of changes in NO_X emissions for the Central Valley Wye alternatives are also examined on a regional and statewide level.

4.1.5 Lead

Pb is a stable element that persists and accumulates in the environment and in animals. Its principal effects in humans are on the blood-forming, nervous, and renal systems. Pb levels from mobile sources in the urban environment have decreased significantly because of the federally mandated switch to lead-free gasoline, and effects are expected to continue to decrease. An analysis of the effects of lead emissions from transportation projects is therefore not warranted and is not conducted for this analysis.

4.1.6 Sulfur Dioxide

SO_2 is a gas produced by high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, industry, and domestic heating. Industrial chemical manufacturing is another source of SO_2. SO_2 is an irritant that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 can also cause plant leaves to turn yellow, and SO_2 can corrode iron and steel. Although heavy-duty diesel vehicles emit SO_2, the USEPA (and other regulatory agencies) do not consider transportation sources to be significant contributors to this pollutant. Therefore, an analysis of the effects of SO_2 emissions from transportation projects is not warranted and is not conducted for this analysis.

4.2 Toxic and Noncriteria Pollutants

A TAC is defined by California law as an air pollutant that “may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health.” The USEPA uses the term HAP in a similar sense. Controlling air toxic emissions became a national priority with the passage of the CAA, in which Congress mandated that the USEPA regulate 188 air toxics, also known as HAPs. TACs can be emitted from stationary and mobile sources. The effects of TACs and other noncriteria pollutants for the Central Valley Wye alternatives are examined on a localized basis.

4.2.1 Asbestos

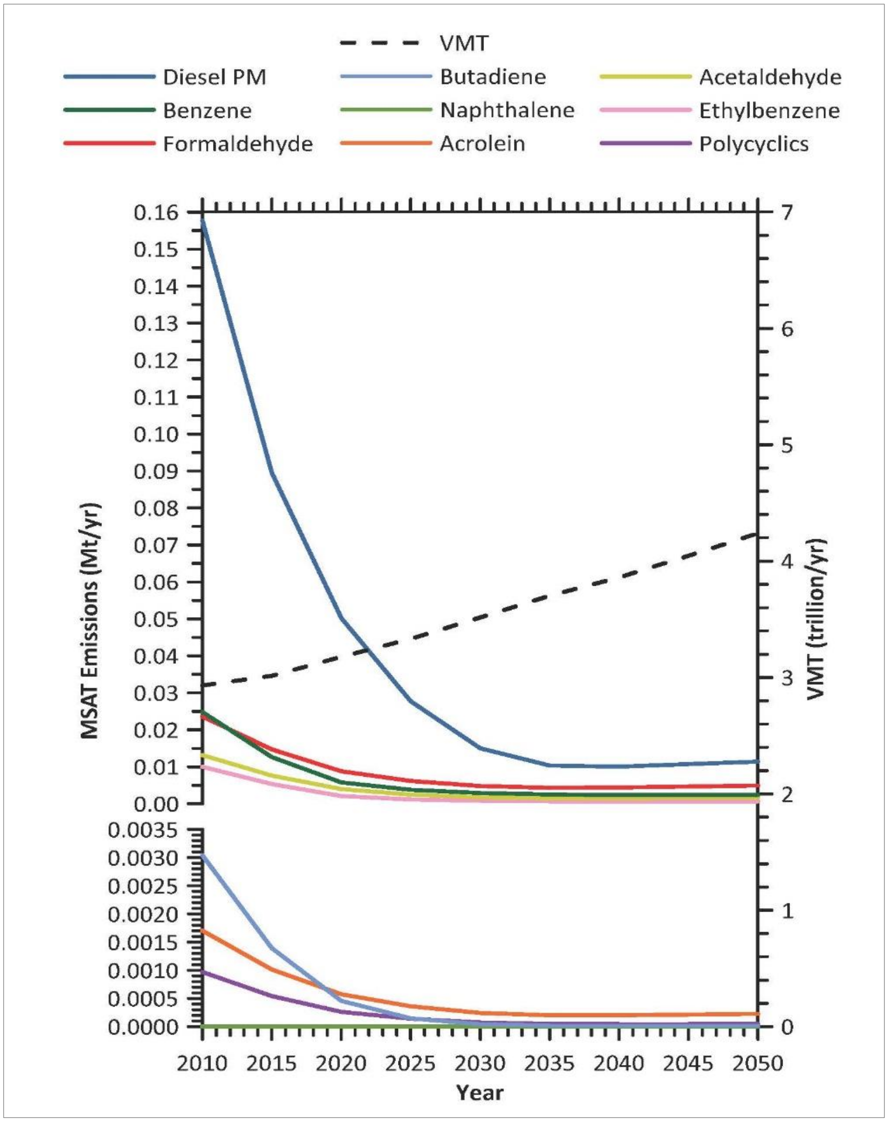
Asbestos deposits from brake wear may be present on surfaces and in the ambient air along the HSR alignment. In addition, asbestos-containing materials may have been used in constructing buildings that will be demolished. Asbestos minerals occur in rocks and soil (known as naturally occurring asbestos, or NOA) as the result of natural geologic processes, often in veins near earthquake faults in the coastal ranges and the foothills of the Sierra Nevada and in other areas of California. NOA most commonly occurs in ultramafic rock (i.e., igneous and metamorphic rock with low silica content) that has undergone partial or complete alteration to serpentine rock (or serpentinite) and often contains chrysotile asbestos. In addition, another form of asbestos, tremolite, is associated with ultramafic rock, particularly near geologic faults.

Natural weathering or human disturbance can break NOA down to microscopic fibers, which is easily suspended in air. When inhaled, these thin fibers irritate tissues and resist the body’s natural defenses. Chronic inhalation exposure to asbestos of humans can lead to a lung disease called asbestosis, which is a diffuse fibrous scarring of the lungs. Symptoms of asbestosis include shortness of breath, difficulty in breathing, and coughing. Asbestosis is a progressive disease (i.e., the severity of symptoms tends to increase with time, even after the exposure has stopped). In severe cases, this disease can lead to death due to impairment of respiratory function. A large number of occupational studies have reported that exposure to asbestos by inhalation can cause lung cancer and mesothelioma, which is a rare cancer of the membranes lining the abdominal cavity and surrounding internal organs. The USEPA considers asbestos to be a human carcinogen (i.e., cancer-causing agent) (USEPA 2000). The effects of asbestos for the Central Valley Wye alternatives are examined on a regional and localized basis.

4.2.2 Mobile Source Air Toxics

The USEPA has assessed an expansive list of air toxics in its 2007 rule on the Control of Hazardous Air Pollutants from Mobile Sources and identified a group of 93 compounds emitted from mobile sources that are listed in their Integrated Risk Information System.

Under the 2007 rule, the USEPA sets standards on fuel composition, vehicle exhaust emissions, and evaporative losses from portable containers. The new standards are estimated to reduce total emissions of MSATs by 330,000 tons in 2030, including 61,000 tons of benzene. Concurrently, total emissions of VOCs will be reduced by over 1.1 million tons in 2030 as a result of adopting these standards. Future emissions would likely be lower than present levels as a result of the USEPA’s national control programs that are projected to reduce MSAT emissions by 91 percent from 2010 to 2050, even if VMT increases by 45 percent, as shown on Figure 4-4.



Source: FHWA, 2016

Trends for specific locations may be different, depending on locally derived information representing vehicle miles traveled, vehicle speeds, vehicle mix, fuels, emission-control programs, meteorology, and other factors.

Figure 4-4 Projected National MSAT Emission Trends (2010–2050) for Vehicles Operating on Roadways using USEPA's MOVES2014a Model

The USEPA identified seven compounds with significant contributions from mobile sources that are among the national- and regional-scale cancer risk drivers from its National Air Toxics Assessment (USEPA 1999). These are acrolein, benzene, 1,3-butadiene, DPM plus diesel exhaust organic gases, formaldehyde, naphthalene, and polycyclic organic matter (POM). This list, however, is subject to change in consideration of future USEPA rules. The effects of MSATs for the Central Valley Wye alternatives are examined on a regional and local level. The following paragraphs describe these MSATs.

Acrolein is a colorless to yellow liquid that burns easily, is readily volatilized, and has a disagreeable odor. It is present as a product of incomplete combustion in the exhausts of stationary equipment (e.g., boilers and heaters) and mobile sources. It is also a secondary pollutant formed through the photochemical reaction of VOCs and NO_X in the atmosphere.

Acrolein is considered to have high acute toxicity, and it causes upper respiratory tract irritation and congestion in humans. The major effects from chronic (long-term) inhalation exposure to acrolein in humans consist of general respiratory congestion and eye, nose, and throat irritation. No information is available on the reproductive, developmental, or carcinogenic effects of acrolein in humans. USEPA considers acrolein data to be inadequate for an assessment of human carcinogenic potential.

Benzene is a volatile, colorless, highly flammable liquid with a sweet odor. Most of the benzene in ambient air is from incomplete combustion of fossil fuels and evaporation from gasoline service stations. Acute inhalation exposure to benzene causes neurological symptoms, such as drowsiness, dizziness, headaches, and unconsciousness in humans. Chronic inhalation of certain levels of benzene causes disorders in the blood in humans. Benzene specifically affects bone marrow (the tissues that produce blood cells). Aplastic anemia, excessive bleeding, and damage to the immune system (by changes in blood levels of antibodies and loss of white blood cells) may develop. Available human data on the developmental effects of benzene are inconclusive because of concomitant exposure to other chemicals, inadequate sample size, and lack of quantitative exposure data. The USEPA has classified benzene as a known human carcinogen by inhalation.

1,3-Butadiene is a colorless gas with a mild gasoline-like odor. Sources of 1,3-butadiene released into the air include motor vehicle exhaust, manufacturing and processing facilities, forest fires or other combustion, and cigarette smoke. Acute exposure to 1,3-butadiene by inhalation in humans results in irritation of the eyes, nasal passages, throat, and lungs. Neurological effects, such as blurred vision, fatigue, headache, and vertigo, have also been reported at very high exposure levels. One epidemiological study reported that chronic exposure to 1,3-butadiene by inhalation resulted in an increase in cardiovascular diseases, such as rheumatic and arteriosclerotic heart diseases. Other human studies have reported effects on blood (ATSDR 2012). No information is available on reproductive or developmental effects of 1,3-butadiene in humans. The USEPA has classified 1,3-butadiene as a probable human carcinogen by inhalation.

DPM/Diesel Exhaust Organic Gases are a complex mixture of hundreds of constituents in either a gaseous or particle form. Gaseous components of diesel exhaust (DE) include CO_2, oxygen, nitrogen, water vapor, CO, nitrogen compounds, sulfur compounds, and numerous low-molecular-weight hydrocarbons. Among the gaseous hydrocarbon components of DE that are individually known to be of toxicological relevance are several carbonyls (e.g., formaldehyde, acetaldehyde, acrolein), benzene, 1,3-butadiene, and polycyclic aromatic hydrocarbons (PAH) and nitro-PAHs. DPM is composed of a center core of elemental carbon and adsorbed organic compounds, as well as small amounts of sulfate, nitrate, metals, and other trace elements. DPM consists primarily of $PM_{2.5}$, including a subgroup with a large number of particles having a diameter less than 0.1 µm. Collectively, these particles have a large surface area, which makes them an excellent medium for adsorbing organic compounds. Also, their small size makes them highly respirable and able to reach the deep lung. Several potentially toxicologically relevant organic compounds, including PAHs, nitro-PAHs, and oxidized PAH derivatives, are on the particles. DE is emitted from on-road mobile sources such as automobiles and trucks, and from off-road mobile sources (e.g., diesel locomotives, marine vessels, and construction equipment). DPM is directly emitted from diesel-powered engines (primary PM) and can be formed from the gaseous compounds emitted by diesel engines (secondary PM).

Acute or short-term (e.g., episodic) exposure to DE can cause acute irritation (e.g., eye, throat and bronchial), neurophysiological symptoms (e.g., lightheadedness and nausea), and respiratory symptoms (e.g., cough and phlegm). Evidence also exists for an exacerbation of allergenic responses to known allergens and asthma-like symptoms (USEPA 2002). Information from the available human studies is inadequate for a definitive evaluation of possible noncancer health effects from chronic exposure to DE. However, on the basis of extensive animal evidence, DE is judged to pose a chronic respiratory hazard to humans. The USEPA has determined that DE is "likely to be carcinogenic to humans by inhalation" and that this hazard applies to environmental exposures (USEPA 2002).

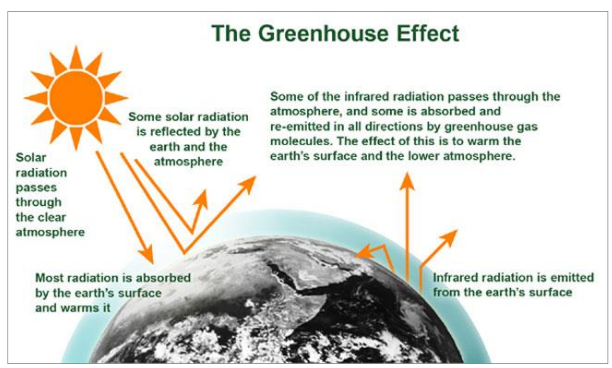
Formaldehyde is a colorless gas with a pungent, suffocating odor at room temperature. The major emission sources of formaldehyde appear to be power plants, manufacturing facilities, incinerators, and automobile exhaust. However, most of the formaldehyde in ambient air is a result of secondary formation through photochemical reaction of VOCs and NO_X. The major toxic effects caused by acute formaldehyde exposure by inhalation are eye, nose, and throat irritation, and effects on the nasal cavity. Other effects from exposure to high levels of formaldehyde in humans are coughing, wheezing, chest pains, and bronchitis. Chronic exposure to formaldehyde by inhalation in humans has been associated with respiratory symptoms and eye, nose, and throat irritation. The USEPA considers formaldehyde to be a probable human carcinogen.

Naphthalene is used in mothballs and in the production of phthalic anhydride, a chemical compound used in industrial processes that can cause adverse health effects in humans. Acute (short-term) exposure of humans to naphthalene by inhalation, ingestion, and dermal contact is associated with hemolytic anemia, damage to the liver, and neurological damage. Cataracts have also been reported in workers acutely exposed to naphthalene by inhalation and ingestion. Chronic (long-term) exposure of workers and rodents to naphthalene reportedly causes cataracts and damage to the retina. Hemolytic anemia has been reported in infants born to mothers who sniffed and ingested naphthalene (as mothballs) during pregnancy. Available data are inadequate to establish a causal relationship between exposure to naphthalene and cancer in humans. The USEPA has classified naphthalene as a Group C, possible human carcinogen.

Polycyclic Organic Matter (POM) defines a broad class of compounds that includes PAHs, of which benzo[a]pyrene is a member. POM compounds are formed primarily by combustion and are present in the atmosphere in particulate form. Sources of air emissions are diverse and include cigarette smoke, vehicle exhaust, home heating, laying tar, and grilling meat. Cancer is the major concern from exposure to POM. Epidemiologic studies have reported an increase in lung cancer in humans exposed to coke oven emissions, roofing tar emissions, and cigarette smoke; all of these mixtures contain POM compounds (USEPA 2016c). Animal studies have reported respiratory tract tumors from inhalation exposure to benzo[a]pyrene, and forestomach tumors, leukemia, and lung tumors from oral exposure to benzo[a]pyrene. The USEPA has classified seven PAHs (benzo[a]pyrene, benz[a]anthracene, chrysene, benzo[b]fluoranthene, benzo[k]fluoranthene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene) as Group B2, probable human carcinogens.

4.3 Greenhouse Gases

Gases that trap heat in the atmosphere, or GHGs, are necessary to life, because they keep the planet's surface warmer than it otherwise would be. This is referred to as the *greenhouse effect* (Figure 4-5). As concentrations of GHGs increase, however, the Earth's temperature increases. According to National Oceanic and Atmospheric Administration and National Aeronautics and Space Administration data, the Earth's average surface temperature has increased by 1.2 degrees Fahrenheit (°F) to 1.4°F in the last 100 years (USEPA 2016d). According to the USEPA, seven of the top 10 warmest years on record have occurred since 1998, and the top 10 warmest years on record worldwide have all occurred since 1998. Most of the warming in recent decades is very likely the result of human activities. Other aspects of the climate are also changing, such as rainfall patterns, snow and ice cover, and sea level (USEPA 2016e).



Source: USEPA, 2015e

Figure 4-5
The Greenhouse Effect

Some GHGs, such as CO_2, occur naturally and are emitted into the atmosphere through natural processes and human activities. Other GHGs (e.g., fluorinated gases) are created and emitted solely through human activities. GHGs differ in their ability to trap heat. For example, 1 ton of emissions of CO_2 has a different effect than 1 ton of emissions of CH_4. To compare emissions of different GHGs, a weighting factor called global warming potential (GWP) is used. To use a GWP, the heat-trapping ability of 1 metric ton (1,000 kilograms) of CO_2 is taken as the standard, and emissions are expressed in terms of CO_2e. The GWP of CO_2 is 1, the GWP of CH_4 is 28, and the GWP of N_2O is 298. The following are the principal GHGs that enter the atmosphere because of human activities.

- **CO_2**—Carbon dioxide enters the atmosphere from the burning of fossil fuels (oil, natural gas, and coal), solid waste, trees and wood products, and also as a result of other chemical reactions (e.g., manufacture of cement). CO_2 is also removed from the atmosphere (or "sequestered") when it is absorbed by plants as part of the biological carbon cycle.
- **CH_4**—Methane is emitted during the production and transport of coal, natural gas, and oil. CH_4 emissions also result from livestock and other agricultural practices and from the decay of organic waste in municipal solid waste landfills.
- **N_2O**—Nitrous oxide is emitted during agricultural and industrial activities, as well as during combustion of fossil fuels and solid waste.
- **Fluorinated Gases**—Hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride are synthetic, powerful GHGs that are emitted from a variety of industrial processes. Fluorinated gases are sometimes used as substitutes for ozone-depleting substances (e.g., chlorofluorocarbons, hydrochlorofluorocarbons, and halons). These gases are typically emitted in smaller quantities, but because they are potent GHGs, they are sometimes referred to as High GWP gases.

Due to the global nature of GHG emissions, GHGs will be examined on a statewide level and regional level. Effects of locally emitted GHGs are felt cumulatively and felt worldwide. There is no direct relationship between local GHG emissions and the degree of local effects from climate change.

5 METHODS FOR EVALUATING EFFECTS

This section discusses the methodology used to determine the air quality and global climate change operational and construction effects of the Central Valley Wye alternatives. The discussion includes the baseline physical conditions that were assumed in the analysis.

The existing conditions baseline for this analysis is 2015, and this baseline is used for CEQA purposes. The Central Valley Wye alternatives would be constructed and in operation by 2029, and the full Phase 1 of the statewide HSR system would be operational by 2040. The existing background conditions (e.g., background traffic volumes, trip distribution, and vehicle emissions) of 2015 would change over the 25-year span to full operations in 2040. Changes to the transportation network over the next 25 years would result from funded transportation projects planned to be constructed by 2029 and 2040. The build-out of local development plans would also affect background traffic volumes. Changes in vehicle emissions over the next 25 years would result from application of updated and more stringent vehicle emissions standards, as well as changing background traffic and vehicle miles traveled. Given these anticipated changes in background conditions over the life of the Central Valley Wye alternatives from 2015 existing conditions, the Central Valley Wye alternative's air quality operations effects are evaluated against three baseline conditions: For the evaluation under NEPA, operational emissions in 2029 and 2040 are evaluated by comparing conditions with the Central Valley Wye alternatives to conditions without the Central Valley Wye alternatives in those future years. For the evaluation under CEQA, operational emissions in 2015 are evaluated by comparing conditions with the Central Valley Wye alternatives to conditions without the Central Valley Wye alternatives in 2015.

Temporary transportation-related effects, such as those from temporary road closures during construction, are not based on level of service and would therefore be evaluated only against existing conditions. Construction of the alignment alone could reconfigure the existing roadway network, permanently redirecting existing traffic and causing traffic effects at intersections and road segments that receive the redirected traffic. The existing conditions baseline would be particularly helpful for evaluating these effects, and mitigation based on the existing conditions baseline would be appropriate.

5.1 Definition of Resource Study Area

The resource study area (RSA) for air quality and global climate change comprises the state, the regional (SJVAB), and the local study area (areas immediately adjacent to construction activities). Each of these components of the RSA is described in the text that follows.

5.1.1 Statewide Study Area

A statewide study area was identified to evaluate potential changes in air quality from large-scale, non-localized factors. Such factors include HSR power requirements, changes in air traffic, and project conformance with the SIP.

5.1.2 Regional Study Area

The Central Valley Wye alternatives portion of the HSR system that would potentially affect regional air pollutant concentrations is located in the SJVAB. The SJVAB, which is approximately 250 miles long and 35 miles wide, is the second-largest air basin in the state and comprises San Joaquin, Stanislaus, Merced, Madera, Fresno, Kings, and Tulare Counties and the San Joaquin Valley portion of Kern County. The SJVAB is defined by the mountains of the Sierra Nevada to the east (8,000 to 14,000 feet in elevation), the Coast Ranges to the west (averaging 3,000 feet in elevation), and the Tehachapi Mountains to the south (6,000 to 8,000 feet in elevation). To the north, the valley opens to the sea at the Carquinez Strait, where the Sacramento–San Joaquin River Delta empties into San Francisco Bay.

During construction, the hauling of ballast material from quarries outside of the SJVAB to Central Valley wye alternatives construction sites could potentially affect regional air pollutant concentrations in another air basin. For the analysis of material-hauling emissions, the San Francisco Bay Area Air Basin (SFBAAB) is included in the regional study area.

5.1.3 Local

Local study areas are areas of potential major air emission activities, including areas where construction would occur along the Central Valley Wye alternative alignments and near construction staging areas. Local study areas are generally defined as areas within 1,000 feet of the Central Valley Wye alternative alignments or construction staging areas. Analyses performed by the CARB indicate that providing a separation of 1,000 feet from diesel sources and high-traffic areas substantially reduces diesel PM concentrations, public exposure, and asthma symptoms in children (Cal-EPA and CARB 2005).

5.2 Statewide and Regional Air Quality Emission Calculations

The emission burden analysis of a project determines a project's overall effect on air quality levels. The Central Valley Wye alternatives would affect long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The HSR system would also affect electrical demand throughout the state. Analysts calculated operational emissions for two ridership scenarios: a medium ridership scenario and a high ridership scenario. These scenarios are based on the level of ridership as presented in the HSR 2016 Business Plan (Authority 2016b). The tables in the effects analysis therefore present two values for operational emissions for each pollutant, corresponding to these two scenarios.

5.2.1 On-Road Vehicles

Analysts evaluated on-road vehicle emissions using average daily estimates and associated average daily speed estimates for each affected county.[3] Analysts estimated emission factors using the CARB emission factor program, EMission FACtors 2014 (CARB 2015b). Analysts set parameters in the program for each county to reflect their individual conditions, and statewide conditions are reflected with statewide parameters.

The analysis was conducted for the following modeling years:

- Existing Year (2015)
- Opening Year (2029)
- Design Year (2040)

To determine overall pollutant burdens generated by on-road vehicles, analysts multiplied the estimated VMT by the applicable pollutant's emission factors, which are based on speed, vehicle mix, and analysis year.

5.2.2 Aircraft Emissions

Analysts used the Federal Aviation Administration's Aviation Environmental Design Tool (2016) to estimate aircraft emissions. The tool estimates the emissions generated from specified numbers of landing and take-off cycles. Along with emissions from the aircraft themselves, emissions generated from associated ground maintenance requirements are included. Analysts calculated average aircraft emissions based on the profile of aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the HSR using the results of the travel demand modeling analyses conducted for the Central Valley Wye alternatives, based on the ridership estimates presented in the HSR 2016 Business Plan (Authority 2016b).

5.2.3 Power Plant Emissions

Analysts conservatively estimated the electrical demands due to propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities as part of the Central Valley Wye alternatives design. Analysts derived average emission factors for each kilowatt-hour required from CARB statewide emission inventories of electrical and cogeneration facilities data

[3] VMT data is based on the Authority's *2016 Business Plan*

along with USEPA eGRID2012 (released 10/25) electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

The HSR system would be powered by the state's electric grid. Because no dedicated power generating facilities are proposed for the HSR system or Central Valley Wye alternatives, no specific source facilities can be identified. Emission changes from power generation can therefore be predicted only on a statewide level. In addition, because of the state requirement that an increasing fraction (50 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, the emissions generated for the HSR system are expected to be lower in the future than the emissions estimated for this analysis, which are based on the state's current power portfolio. Furthermore, under 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources.

5.3 Analysis of Local Operation Emission Sources

Local operational sources associated with the Central Valley Wye alternatives include the operation of the traction power, switching, and paralleling stations. These sources would not result in appreciable air pollutants, as site visits would be infrequent and power usage would be limited. Therefore, this analysis does not quantify emissions from these local sources and the analysis of operational criteria pollutant emissions focuses on statewide and regional roadway, aircraft, and energy emissions.

5.4 Microscale Carbon Monoxide Analysis

The Central Valley Wye alternatives would not include any stations, heavy maintenance facilities, or other sources of substantial vehicle traffic. Accordingly, this analysis does not warrant a CO microscale hot-spot analysis.

5.5 Particulate Matter (PM_{10} and $PM_{2.5}$) Hot-Spot Analysis

Although the Central Valley Wye alternatives portion of the HSR system is subject to the GC guidelines and not the transportation conformity guidelines, the local study area is classified as a nonattainment area for $PM_{2.5}$ and a federal maintenance area for PM_{10}. Consequently, analysts conducted a hot-spot analysis following the USEPA's 2013 *Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas* (USEPA 2015f). The analysis focused on potential air quality concerns under NEPA from the Central Valley Wye alternative's effects on roads and followed the recommended practice in the USEPA's Final Rule regarding the localized or hot-spot analysis of $PM_{2.5}$ and PM_{10} (40 C.F.R. § 93, issued March 10, 2006).

The USEPA specifies in 40 C.F.R. Part 93.123(b)(1) that only "projects of air quality concern" are required to undergo a $PM_{2.5}$ and PM_{10} hot-spot analysis. The USEPA defines projects of air quality concern as certain highway and transit projects that involve significant levels of diesel traffic, or any other project identified by the $PM_{2.5}$ SIP as a localized air quality concern. Projects of air quality concern, as defined by 40 C.F.R. Part 93.123(b)(1), include the following:

- New or expanded highway projects that have a significant number of or significant increase in diesel vehicles.
- Projects affecting intersections that are at Level of Service D, E, or F with a significant number of diesel vehicles or those that will degrade to Level of Service D, E, or F because of increased traffic volumes from the significant number of diesel vehicles related to the Central Valley Wye alternatives.
- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location.
- Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$- or PM_{10}-applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation.

5.6 Mobile Source Air Toxics Analysis

On February 3, 2006, the Federal Highway Administration (FHWA) released *Interim Guidance on* Air *Toxic Analysis in NEPA Documents* (FHWA 2006). This guidance was superseded on September 30, 2009, by the FHWA's *Interim Guidance Update on Mobile Source Air Toxic Analysis in NEPA Documents* (Interim Guidance) (FHWA 2009), and was most recently updated on October 16, 2016 (FHWA 2016). The Interim Guidance advises on when and how to analyze MSATs in the NEPA process for highway projects. This guidance is interim because MSAT science is still evolving. As the science progresses, the FHWA is expected to update the guidance.

A qualitative analysis provides a basis for identifying and comparing the potential differences in MSAT emissions, if any, among the Central Valley Wye alternatives. The Updated Interim Guidance groups projects into the following tier categories:

- No analysis for projects without any potential for meaningful MSAT effects.
- Qualitative analysis for projects with low potential MSAT effects.
- Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

The Central Valley Wye alternatives has a low potential for MSAT effects. Accordingly, a qualitative analysis was used to provide a basis for identifying and comparing the potential differences in MSAT emissions, if any, among the Central Valley Wye alternatives. The qualitative assessment is derived, in part, from an FHWA study titled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (FHWA 2011).

5.7 Health Risk Assessment and Local Air Quality Effects

According to the Office of Environmental Health Hazard Assessment (OEHHA), health risk assessment is the process of assessing the risk of cancer or other illnesses in the general population from exposure to chemicals. Cancer risk is typically expressed as the maximum number of new cases of cancer projected to occur in a population of one million people due to exposure to the cancer-causing substance(s) over a long period, such as 30 or 70 years. For example, a cancer risk of one in 1 million means that in a population of 1 million people, not more than one additional person would be expected to develop cancer as the result of the exposure to the substance evaluated for causing that risk. Noncancer risk includes both acute and chronic risk of adverse reactions from exposure to a chemical and are determined by comparing the actual level of exposure to that not expected to cause any adverse effects, even in the most susceptible people. Health risk assessment considers groups that may be particularly sensitive to exposure, including children. (OEHHA 2001; OEHHA 2015).

Construction activities along the Central Valley Wye alternatives could emit pollutants that have the potential to cause adverse health effects on nearby sensitive receptors. Construction activities also emit pollutants for which EPA and CARB have established federal (NAAQS) and state (CAAQS) ambient air quality standards, respectively. A detailed air dispersion modeling analysis and health risk assessment was conducted to determine whether these standards would be exceeded.

Analysts conducted air dispersion modeling analysis using USEPA's AERMOD (version 15181) to predict pollutant concentrations at locations near the construction sites. Emissions from construction activities were grouped into three categories: rail line, road crossing, and concrete batch plants. All construction emissions were assigned to one of these features (details on the allocation of emissions to each feature are provided in Appendix E). To estimate the effects of construction conservatively and to account for the currently unknown location of each feature, a representative 2-mile segment of rail line was modeled. This segment included a road crossing and concrete batch plant modeled in the same location as the road construction location, with intersecting rail line and road crossing footprints and the concrete batch plant located at the intersection. Localized air quality effects were evaluated for each feature individually and for the combined effect of all features concurrently under construction. Based on consultation with Authority staff, a construction work area that was determined to be representative of a typical 2-mile work area was modeled, as it is not practical to model the entire length of the alignment or all possible wye alternatives, configurations, and locations for the project components that compose each alternative. Additionally, pollutants are unlikely to have any appreciable localized effect on sensitive receptors if they are emitted a distance greater than 2 miles away. Concentrations of analyzed TAC criteria air pollutants were estimated at the construction area boundary and surrounding areas. Cancer and noncancer health effects were estimated assuming a 25-meter setback from the construction area to represent residential uses and surrounding areas conservatively. Only regulatory default options and the rural dispersion algorithm of AERMOD were used in the analysis, although the modeling approach to adjust the surface friction velocity under low-wind/stable conditions was also included based on consultation with the SJVAPCD (Reed pers. comm. 2015). The maximum modeled concentrations for each relevant pollutant and averaging period concentrations were compared with the applicable NAAQS and CAAQS. Health-related effects were modeled with the CARB HARP2 model (Version 16217).

Local meteorological data were used in the air dispersion modeling analysis. The most recent 5 years of representative meteorological data available from SJVAPCD, specially processed to include SJVAPCD preferred "Adjusted U*"[4] approach, was obtained. Data for the Merced station for years 2009–2013 were used for all modeling. Merced was the closest station with 5 years of recent data available at the time of analysis.

For the criteria air pollutant concentration analysis, modeling was conducted with receptors placed at the edge of the "fenceline" of construction activities. A grid of receptors was created in each of the four quadrants outlined by the intersecting rail line and road crossing footprints. Receptor spacing of 25 meters and receptor heights of 1.2 meters were used in all cases. The Authority provided the analysts with monthly emissions and emission schedule for construction of these features, which were used for the dispersion modeling (refer to Appendix B for the emissions). Activity was assumed to occur from 8 a.m. through 5 p.m., Monday through Friday. Maximum pollutant concentrations were compared to the NAAQS and CAAQS thresholds. The air dispersion modeling that underlies the health risk calculations is identical to that for criteria pollutants, with three exceptions. First, each grid of receptors was set back 25 meters from the "fenceline" of construction activities to represent residential locations, following guidance from the SJVAPCD. Second, to account for meteorological conditions conservatively in the assessment of acute risks, a second dispersion analysis was conducted with uniform release of emissions at all days and times to identify worst-case hourly effects. Third, additional pollutants related to health risk were analyzed.[4] Cancer risks and the noncancer chronic and acute hazard index associated with construction emissions of TACs were determined for the maximally exposed individual resident (MEIR) using CARB's HARP2 model (CARB 2016e). The calculations for cancer risk are those of a multipathway assessment following SJVAPCD rule APR 1906 (SJVAPCD 2015c) and conservatively account for both the varying emissions schedule and the increased sensitivity of children. The reported total cancer risk represents the most conservative case of a child in the third trimester at the beginning of construction exposed to emissions throughout the construction period at the MEIR location. Increased incremental cancer risks were compared to the SJVAPCD CEQA threshold of 20 in 1 million to assess the level of effects. Acute and chronic noncancer risks are conservatively based on the peak annual emissions. Reported hazard index values represent the sum of hazard quotients values for all pollutants on the most significantly affected target organ system. Chronic and acute hazard indices were compared to the SJVAPCD CEQA unit-less threshold of 1 to assess the level of effects.

[4] Refer to Appendix E for more information

5.8 Asbestos

Asbestos causes cancers of the lung and the lining of internal organs, as well as asbestosis and pleural disease, which inhibit lung function. The USEPA is addressing concerns about potential effects of NOA in a number of areas in California.

The California Geological Survey has identified ultramafic rocks in California to be the source of NOA, and in August 2000, the California Department of Conservation, Division of Mines and Geology published *A General Location Guide for Ultramafic Rocks in California Areas More Likely to Contain Naturally Occurring Asbestos* (CDMG 2000). Analysts used this study to determine if NOA occurs within the local study area.

5.9 Greenhouse Gas Analysis

As discussed in Section 5.2, Statewide and Regional Air Quality Emission Calculations, the Central Valley Wye alternatives would reduce long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The Central Valley Wye alternatives would also affect electricity demand throughout the state. These elements would affect GHG emissions in both the statewide and regional study areas. The methodology for estimating GHG emissions associated with construction and operations of the Central Valley Wye alternatives is discussed in the following sections.

5.9.1 On-Road Vehicle Emissions

Analysts conducted the on-road vehicle GHG emission analysis using the same methods as described for air quality emission calculations in Section 5.2.1, On-Road Vehicles.

5.9.2 Aircraft Emissions

Analysts calculated aircraft emissions by using the fuel consumption factors and emission factors from the CARB's 2000–2014 *Greenhouse Gas Emissions Inventory Technical Support Document* and the accompanying appendix (CARB 2016b). The emission factor includes both landing and take-off and cruise operations (formula: aircraft emissions per flight = fuel consumption × emission factor; aircraft emissions = flights removed × aircraft emissions per flight). Analysts calculated average aircraft GHG emissions based on the profile of intrastate aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the Central Valley Wye alternatives through the travel demand modeling analysis conducted for the Central Valley Wye alternatives, based on the ridership estimates presented in the HSR 2016 Business Plan (Authority 2016b).

5.9.3 Power Plant Emissions

The electrical demands due to propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities were calculated as part of the project design. Average GHG emission factors for each kilowatt-hour required were derived from USEPA eGRID2012 electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

In addition, because of the state requirement that an increasing fraction (50 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, the emissions generated for the HSR system are expected to be lower in the future when compared to emissions estimated for this analysis.

5.10 Construction Phase

Analysts quantitatively estimated construction phase emissions for the earthwork and major civil construction activity during construction of the following components of the Central Valley Wye alternatives:

- At-grade rail segments
- Elevated rail segments

- Retained fill rail segments
- Electrical substations
- Roadways and roadway overcrossings

These major construction activities would account for the vast majority of earthwork, the largest amount of diesel-powered off-road construction equipment, and the majority of material to be hauled along public streets, compared with the other minor construction activities for the Central Valley Wye alternatives. These activities would therefore also account for the vast majority of the regional and localized construction emissions that building the Central Valley Wye alternatives would generate.

Analysts also quantified regional and localized emissions from minor construction activities, such as mobilization and demobilization, and these sources of emissions would contribute fewer emissions than the major construction activities identified. Analysts then used the estimated construction emissions from both major and minor activities to evaluate the regional and localized air quality effects during the construction phase.

This analysis utilized Central Valley Wye alternatives–specific information when available. When Central Valley Wye alternatives–specific information was not available, such as for architectural coating, this analysis used default emission rates for activities. Central Valley Wye alternatives information used for the construction emission estimates and details of the construction emission calculations are provided in Appendix B.

5.10.1 Construction Quantities and Schedule

At-grade track sections would be built using conventional railroad construction techniques. A typical sequence would include clearing, grubbing, grading, and compacting the railbed; applying crushed rock ballast; laying track; and installing electrical and communications systems.

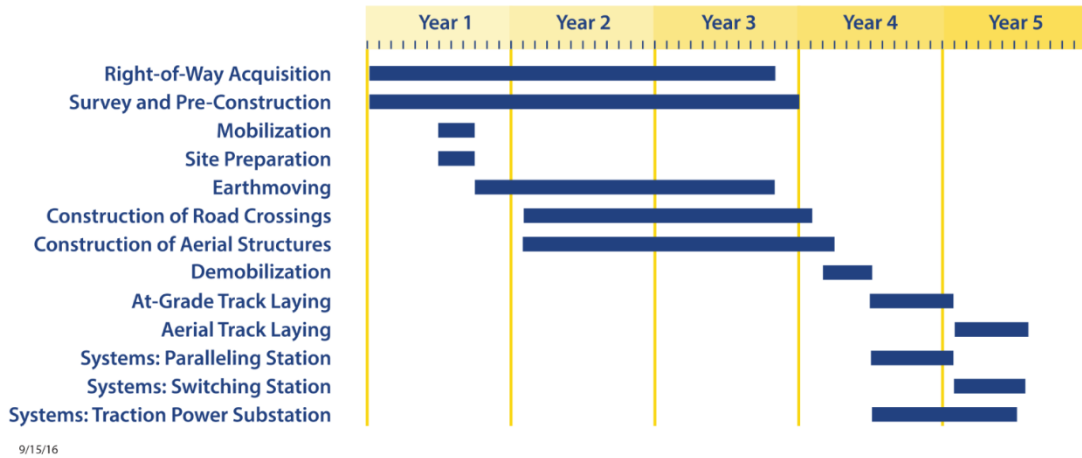
The precast segmental construction method is proposed for elevated track sections. In this construction method, large concrete bridge segments would be mass produced at an on-site temporary casting yard. Precast segments would then be transported atop the already-completed portions of the elevated track and installed using a special gantry crane positioned on the aerial structure. Although the precast segmental method is the favored technique for aerial structure construction, other methods may be used, including cast-in-place, box girder, or precast span-by-span techniques.

Preconstruction activities would be conducted during final design and include geotechnical investigations, identification of staging areas, initiation of site preparation and demolition, relocation of utilities, and implementation of temporary, long-term, and permanent road closures. Additional studies and investigations to develop construction requirements and worksite traffic control plans would be conducted as needed.

Major construction activities for the Central Valley Wye alternatives would include earthwork and excavation support systems construction, bridge and aerial structure construction, and railroad systems construction (including track work, traction electrification, signaling, and communications). During peak construction periods, work is envisioned to be under way at several locations along the route, with overlapping construction of various Central Valley Wye alternatives elements. Working hours and workers present at any time would vary, depending on the activities being performed. Pursuant to its adopted sustainability policy (Policy Directive POLI-PLAN-03), the Authority intends to build the Central Valley Wye alternatives using sustainable methods that:

- Minimize the use of nonrenewable resources
- Minimize the effects on the natural environment
- Protect environmental diversity
- Emphasize the use of renewable resources in a sustainable manner

A typical construction schedule and duration of activities is depicted on Figure 5-1.



Source: Authority, 2016a

Figure 5-1 Typical Construction Durations

5.10.2 Models Used for Construction Emissions

This analysis includes criteria pollutant and GHG emissions from regional building demolition and construction of the at-grade rail segments, elevated rail segments, retained-fill rail segments, and traction power substations, which analysts calculated using emission factors from the CARB's OFFROAD 2011 and 2007 models (CARB 2016f). The OFFROAD 2011 model provides the latest emission factors for off-road construction equipment and accounts for lower fleet population and growth factors that resulted from the economic recession, and updated load factors based on feedback from engine manufacturers. For emission rates not available in OFFROAD 2011, the analysis conservatively applied rates from OFFROAD 2007. CARB recommends the use of emission rates from the OFFROAD models to capture the latest off-road construction assumptions. The emissions estimates also used OFFROAD 2011 default load factors (the ratio of average equipment horsepower utilized to maximum equipment horsepower) and useful life parameters. Analysts calculated the following to determine construction emissions:

- Mobile source emission burdens from worker vehicle trips and truck trips using VMT estimates and appropriate emission factors from EMFAC2014.
- Fugitive dust emissions from dirt and aggregate handling using emission factors derived from equations from the USEPA's AP-42 (USEPA 2006a).
- Construction exhaust emissions from equipment, fugitive dust emissions from earthmoving activities, and emissions from worker vehicle trips, deliveries, and material hauling in a spreadsheet tool specific to the Central Valley Wye alternatives for each year of construction.

5.10.3 General Assumptions for Methodologies

Analysts used Central Valley Wye alternatives–specific data, including construction equipment lists and the construction schedule, for construction associated with the alignment/guideway, and performed calculations for each year of construction. The analysis groups major activities into the following categories. The anticipated schedule for each category is also indicated:

- Mobilization, assumed to occur at two main staging areas: December 2018 – March 2019
- Site preparation including demolition, land clearing, and grubbing: December 2018 – March 2019
- Earthmoving: March 2019 – March 2021
- Roadway Crossings: June 2019–June 2021

- Elevated structures: June 2019–August 2021
- Demobilization: August 2021–December 2021
- Track laying: elevated, at-grade, and retained fill: December 2021–December 2022
- Material hauling emissions, including truck and rail: December 2021–December 2022
- Paralleling station: December 2021–June 2022
- Traction power supply station: December 2021–December 2022
- Switching station: June 2022–December 2022

5.10.3.1 Regulatory Control Measures

Many of the control measures required by the SJVAPCD Regulation VIII are the same as or similar to the control measures listed in the Statewide Program EIR/EIS (Authority and FRA 2005). The emission reductions associated with SJVAPCD Regulation VIII are the same as the emission reductions associated with the Statewide Program EIR/EIS (Authority and FRA 2005), listed in Section 6.10.3.1 of that document.

5.10.4 Construction Activities

This analysis considers Central Valley Wye alternatives construction activities for the 11 major activities listed in Section 5.10.3, General Assumptions for Methodologies, described in more detail here.

5.10.4.1 Mobilization

For the purposes of this analysis, mobilization is assumed to take approximately 3 months for each leg. This analysis calculated emissions associated with mobilization using OFFROAD 2011 emission factors. Fugitive dust from mobilization includes worker trips and construction equipment exhaust.

5.10.4.2 Site Preparation

Demolition

Analysts calculated demolition emissions associated with existing structures using OFFROAD 2011 emissions factors. In addition to the fugitive dust emissions resulting from the destruction of existing buildings, this analysis estimates emissions for worker trips, construction equipment exhaust, and truck-hauling exhaust. The square footage of land use estimated by the team for demolition for each alternative is presented in Table 5-1.

Table 5-1 Area of Demolition Activities

Alternative	Total Area (square feet)
SR 152 (North) to Road 13 Wye	972,500
SR 152 (North) to Road 19 Wye	887,250
Avenue 21 to Road 13 Wye	504,750
SR 152 (North) to Road 11 Wye	702,750

Source: Author's compilation, 2017

Land Grubbing

Land grubbing refers to the site preparation activities for the HSR alignment construction. This analysis estimates emissions from land grubbing using the OFFROAD 2011 emission factors as well as a site-specific equipment list. Fugitive dust from land-grubbing activities includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

5.10.4.3 Earth Moving

The earthmoving activities include grading, trenching, and cut/fill activities for the alignment construction. This analysis estimates emissions associated with the earthmoving activities using OFFROAD 2011 emission factors as well as a site-specific equipment list. Fugitive dust from earth moving activities includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

5.10.4.4 High-Speed Rail Alignment Construction (Elevated Structures, Track Laying, and Retained Fill)

The HSR alignment construction includes the following construction phases and operation of a concrete batch plant:

- Constructing structures for the elevated rail
- Laying elevated rail and at-grade rail
- Constructing the retaining wall for the retained-fill rail
- Laying retained-fill rail

Rail Type and Alignment Alternatives

This analysis considers three rail types (elevated, at-grade, and retained fill). Table 5-2 summarizes the lengths of at-grade rail and elevated rail (including retained-fill rail) for each Central Valley Wye alternative. The emissions of each alternative/operation would be the sum of the at-grade, elevated, and retained-fill emissions.

Table 5-2 Central Valley Wye Alternative Alignment Lengths

Alternative	Total Length (miles)[1]	At-Grade Length (miles)[1]	Elevated Length, including Retained Fill (miles)[1]
SR 152 (North) to Road 13 Wye	52	46	6
SR 152 (North) to Road 19 Wye	55	45	8
Avenue 21 to Road 13 Wye	53	47	5
SR 152 (North) to Road 11 Wye	51	45	6

Source: Author's compilation, 2017
[1] Values are rounded to the nearest significant digit.

Concrete Batch Plants

Concrete would be required to build bridges used to support the elevated sections of the Central Valley Wye alternatives and for the retaining walls used to support the retained-fill sections of the alignment. To provide enough concrete on-site, it is estimated that batch plants would operate in the RSA during construction of those sections. Because the locations of the concrete batch plants are unknown, this analysis estimates fugitive dust emissions associated with the plants based on the total amount of concrete required and on emission factors from Chapter 11.12 of AP-42 (USEPA 2006b). This analysis includes emissions from on-road truck trips associated with transporting material to and from the concrete batch plants in the material-hauling emissions calculations.

5.10.4.5 Material Hauling

This analysis calculates emissions from the exhaust of trucks used to haul material (including concrete slabs) to the construction site using heavy-duty truck emission factors from EMFAC2014 and anticipated travel distances of haul trucks within the SJVAB. Ballast and sub-ballast materials could potentially be hauled by rail within the air basin. Analysts used locomotive emission factors from the USEPA document, *Emission Factors for Locomotives* (USEPA 2009b), and the travel distance by rail to the construction site to estimate rail emissions.

Ballast and sub-ballast materials could potentially be transported from locations outside the SJVAB. Quarries external to the SJVAB were analyzed to represent a worst-case scenario in the event that quarries located within the SVJAB had insufficient capacity to supply sufficient ballast and sub-ballast materials required for the Central Valley Wye alternatives. This analysis estimated emissions from ballast and sub-ballast material hauling by trucks and locomotives outside the SJVAB based on the travel distances and transportation method (by rail or by truck) from the locations where ballast materials would be available. Analysts used heavy-duty truck emission factors from EMFAC2014 to estimate emissions from haul trucks hauling material originating from outside of the SJVAB. This analysis uses rail emission factors using USEPA guidance (USEPA 2009b) to estimate the locomotive emissions. Track construction is anticipated to occur from December 2021 through December 2022; thus, analysts calculated a multiyear weighted emission factor for trucks and locomotives based on the 2021 emission factors and number of days of track construction in 2021, and the 2022 emission factors and the number of days of track construction in 2022. Other construction materials would likely be delivered from supply facilities within the SJVAB.

Analysts identified five potential quarries that could provide ballast material. All of the quarries identified are located within 110 rail miles and 100 highway miles of the SJVAB and are located in the SFBAAB. The capacity of the five quarries would be sufficient to provide the material needed to build the Central Valley Wye alternatives. Appendix D provides additional details on the capacity of the quarries.

This analysis was based on the assumption that ballast and sub-ballast would be transferred by diesel truck from the quarry to rail (if there was no railhead on-site) and then by rail to the border of SJVAB; entirely by rail to the border of the SJVAB (if there was a railhead on-site); or by diesel truck from the quarry to the border of the SJVAB. As such, emissions associated with ballast material transport would occur outside of the SJVAB and within the SFBAAB; details of the emission estimates for material hauling outside the SJVAB are summarized in Appendix D.

5.10.4.6 Power Distribution Station Construction (Traction Power Supply, Switching, and Paralleling Stations)

Emissions associated with construction of the traction power substations, switching stations, and paralleling stations would be from mass site grading, building construction, and architectural coatings. This analysis does not consider paving activities because these stations would not have paved areas and access roads would be covered with gravel. Fugitive dust from building the power distribution stations includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

5.10.4.7 Roadway Crossing Construction

The Central Valley Wye alternatives would include construction easement, easement for columns within a state facility, or modification of overcrossings or interchanges. Fugitive dust from construction of the roadway crossings includes that from worker trips, construction equipment exhaust, and truck-hauling exhaust.

5.10.4.8 Demobilization

Analysts calculated emissions associated with demobilization using OFFROAD 2011. Fugitive dust from demobilization includes that from worker trips and construction equipment exhaust.

6 AFFECTED ENVIRONMENT

6.1 Meteorology and Climate

Air quality is affected by both the rate and location of pollutant emissions, and by meteorological conditions that influence movement and dispersal of pollutants in the atmosphere. Atmospheric conditions, such as wind speed, wind direction, and air temperature gradients, along with local topography, provide the link between air pollutant emissions and local air quality levels.

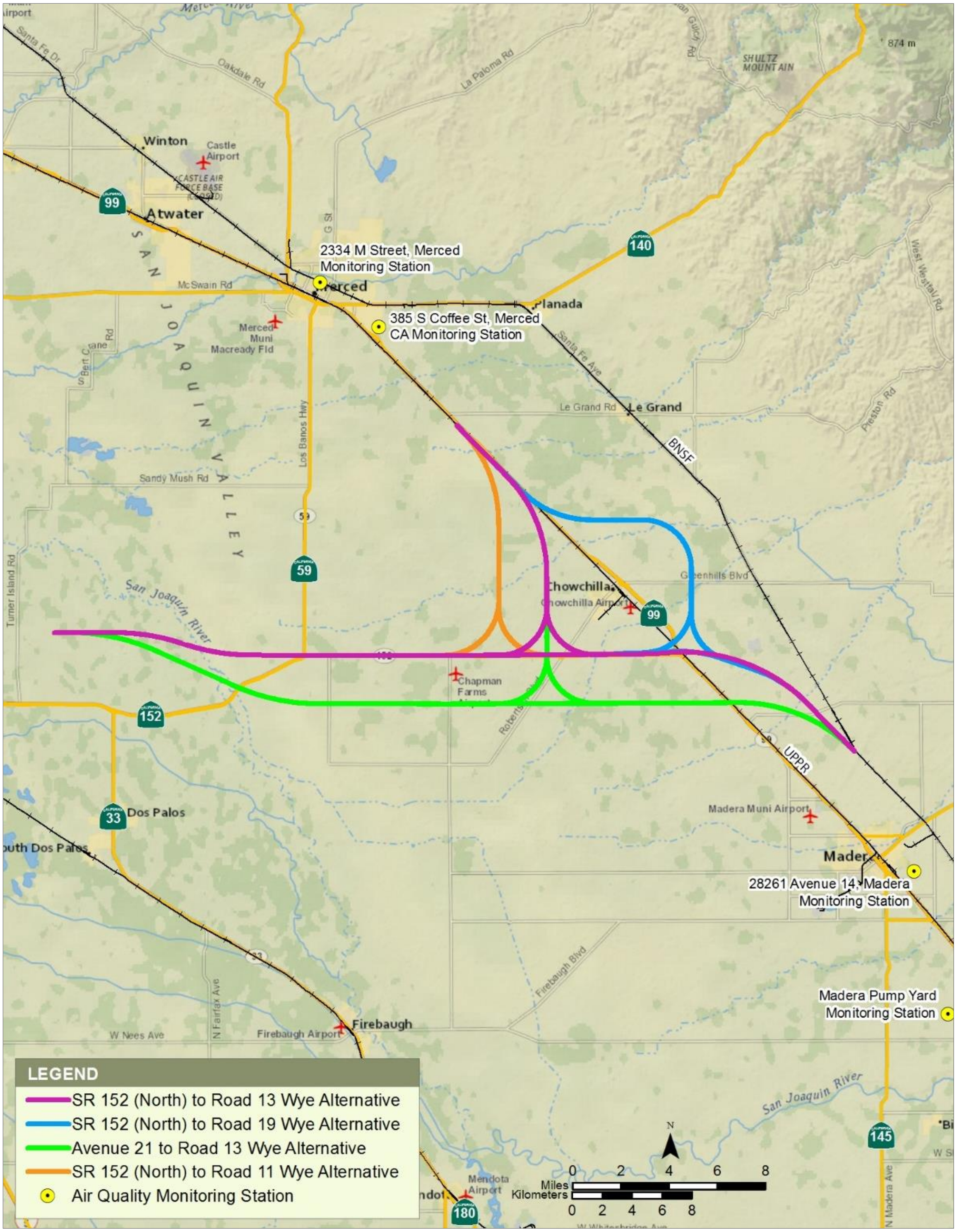
Elevation and topography can affect localized air quality. The Central Valley Wye alternatives RSA is in the SJVAB, which encompasses the southern two-thirds of California's Central Valley. The SJVAB is approximately 250 miles long and is shaped like a narrow bowl. The sides and southern boundary of the bowl are bordered by mountain ranges. The valley's weather conditions include frequent temperature inversions; long, hot summers; and stagnant, foggy winters, all of which are conducive to the formation and retention of air pollutants (SJVAPCD 2015c).

The SJVAB is typically arid in the summer months, with cool temperatures and prevalent tule fog (a dense ground fog) in the winter and fall. The average high temperature in the summer months is in the mid-90s F and the average low in the winter is in the high 40s. January is typically the wettest month of the year, with an average of about 2 inches of rain. Wind direction is typically from the northwest with mean speeds between 5–8 mph annually (WRCC 2015).

6.2 Ambient Air Quality

CARB maintains ambient air monitoring stations for criteria pollutants throughout California. The stations closest to the Central Valley Wye alternatives are the Merced Coffee Avenue, Merced M Street, Madera Yard Pump Station, and Madera Avenue 14, shown on Figure 6-1. These stations monitor NO_2, O_3, PM_{10}, and $PM_{2.5}$ and represent regional land uses, which range from urban and residential to rural and agricultural. The stations do not monitor for SO_2, but the Madera Pump Yard Station monitored for CO for two years of the three year period. Air quality standards, primarily for O_3 and PM, have been exceeded in the SJVAB because of existing industrial and agricultural sources. Table 6-1 summarizes the results of ambient monitoring at the four stations from 2013 through 2015, which are the most recent years for which data are available. A brief summary of the monitoring data includes the following:

- Monitored data do not exceed either the state or national standards for CO.
- O_3 values exceed the state 1-hour, state 8-hour, and national 8-hour O_3 standards at all stations where data are available in 2013 through 2015.
- PM_{10} values exceed the state 24-hour standards at all stations where data are available in 2013 through 2015. PM_{10} values do not exceed the national 24-hour standards.
- $PM_{2.5}$ values exceed the national 24-hour standards at all stations where data are available in 2013 through 2015. $PM_{2.5}$ values exceed the national annual standards at the Merced Coffee Avenue, Merced M Street, and the Madera Avenue 14 stations for two or more years.



Source: CARB, 2016c

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Figure 6-1 Air Quality Monitoring Stations Closest to the Central Valley Wye Alternatives

Table 6-1 Ambient Criteria Pollutant Concentration Data at Air Quality Monitoring Stations Closest to the Central Valley Wye Alternatives

Air Pollutant	Standard/Exceedance	Merced Coffee Station			Merced M Street Station			Madera Pump Yard Station			Madera Avenue 14 Station		
		2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
Carbon Monoxide (CO)	Year coverage	NM	NM	NM	NM	NM	NM	NM	N/A	N/A	NM	NM	NM
	Max. 1-hour concentration (ppm)	NM	NM	NM	NM	NM	NM	NM	2.7	5.8	NM	NM	NM
	Max. 8-hour concentration (ppm)	NM	NM	NM	NM	NM	NM	NM	0.9	3.1	NM	NM	NM
	# Days>federal 1-hour std. of >35 ppm	NM	NM	NM	NM	NM	NM	NM	0	0	NM	NM	NM
	# Days>Federal 8-hour Std. of >9 ppm	NM	NM	NM	NM	NM	NM	NM	0	0	NM	NM	NM
	# Days>California 8-hour Std. of >9 ppm	NM	NM	NM	NM	NM	NM	NM	0	0	NM	NM	NM
Ozone (O_3)	Year Coverage[1]	94	96	83	NM	NM	NM	84	85	82	90	88	96
	Max. 1-hour Concentration (ppm)	0.100	0.100	0.102	NM	NM	NM	0.100	0.108	0.111	0.121	0.102	0.108
	Max. 8-hour Concentration (ppm)	0.092	0.088	0.090	NM	NM	NM	0.088	0.098	0.087	0.101	0.095	0.086
	# Days>Federal 8-hour Std. of >0.070 ppm	29	40	29	NM	NM	NM	23	45	29	43	33	28
	# Days>California 1-hour Std. of >0.09 ppm	5	3	2	NM	NM	NM	2	6	1	3	3	3
	# Days>California 8-hour Std. of >0.07 ppm	31	44	34	NM	NM	NM	24	45	31	46	37	28
Nitrogen Dioxide (NO_2)	Year Coverage	91	91	90	NM	NM	NM	52	83	91	NM	NM	NM
	Max. 1-hour Concentration (ppm)	0.052	0.054	0.035	NM	NM	NM	0.060	0.043	0.033	NM	NM	NM
	Annual Average (ppm)	N/A	N/A	N/A	NM	NM	NM	N/A	N/A	N/A	NM	NM	NM
	# Days>California 1-hour Std. of >0.18 ppm	0	0	0	NM	NM	NM	0	0	0	NM	NM	NM

Air Pollutant	Standard/Exceedance	Merced Coffee Station			Merced M Street Station			Madera Pump Yard Station			Madera Avenue 14 Station		
		2013	2014	2015	2013	2014	2015	2013	2014	2015	2013	2014	2015
Respirable Particulate Matter (PM_{10})	Year Coverage	NM	NM	NM	90	95	98	NM	NM	NM	N/A	N/A	N/A
	Max. 24-hour Concentration (µg/m³)	NM	NM	NM	80.5	92.7	94.0	NM	NM	NM	110.3	92.3	112.0
	#Days>Fed. 24-hour Std. of >150 µg/m³	NM	NM	NM	0	0	0	NM	NM	NM	0	0	0
	#Days>California 24-hour Std. of >50 µg/m³	NM	NM	NM	13	9	5	NM	NM	NM	N/A	N/A	N/A
	Annual Average (µg/m³)	NM	NM	NM	36.2	31.0	30.6	NM	NM	NM	37.4	35.2	32.9
Fine Particulate Matter ($PM_{2.5}$)	Year Coverage	99	99	99	92	90	100	NM	NM	NM	100	100	99
	Max. 24-hour Concentration (µg/m³)	75.1	64.5	61.2	68.9	53.7	60.8	NM	NM	NM	87.5	80.2	62.0
	State Annual Average (µg/m³)	13.2	N/A	N/A	N/A	N/A	N/A	NM	NM	NM	17.9	14.0	13.9
	#Days>Fed. 24-hour Std. of >35 µg/m³	16	16	15	11	5	5	NM	NM	NM	24	24	12
	Annual Average (µg/m³)	13.2	10.8	12.7	13.5	11.2	12.6	NM	NM	NM	17.8	13.5	13.7

Source: CARB, 2016c, USEPA 2017a
[1] Coverage is for an 8-hour standard.
µg/m³ = micrograms per cubic meter
NM = not monitored
N/A = not available
> = greater than
Std. = standard
Max = maximum

6.3 Attainment Status

The USEPA and CARB designate each air basin within California as attainment, maintenance, or nonattainment based on the area's ability to meet ambient air quality standards. Because air basins are formed by geographic features that create distinctive regional climates, they typically have the same attainment statuses as the counties or portions of counties they contain. Air basins are designated as attainment for a criteria pollutant when the concentration of that pollutant is below the ambient air quality standard. If a criteria pollutant concentration is above the ambient air quality standard, the area is in nonattainment for that pollutant. An air basin previously designated as nonattainment that subsequently demonstrated compliance with the ambient air quality standards is designated as a maintenance area.

Table 6-2 summarizes the federal (under NAAQS) and state (under CAAQS) attainment status for the SJVAB. Under the federal criteria, the SJVAB is currently designated as nonattainment for 8-hour O_3, the 1997 annual $PM_{2.5}$ standard (annual standard of 15 micrograms per cubic meter [$\mu g/m^3$]) and 24-hour standard of 65 $\mu g/m^3$), and the 2006 24-hour $PM_{2.5}$ standard (35 $\mu g/m^3$). The SJVAB is a maintenance area for PM_{10} and CO.[5] The SJVAB is in attainment for the NO_2 and SO_2 NAAQS. The SJVAB is unclassified for the Pb NAAQS.

Under the state criteria, the SJVAB is currently designated as nonattainment for 8-hour O_3, PM_{10}, and $PM_{2.5}$. The SJVAB is an attainment/unclassified area for the state CO standard and an attainment area for the state NO_2, SO_2, and Pb standards. The SJVAB is an unclassified area for the state hydrogen sulfide standard and the visibility-reducing particle standard, and is classified as an attainment area for sulfates and vinyl chloride.

Table 6-2 Current Federal and State Attainment Status for the San Joaquin Valley Air Basin

Pollutants	Federal Classification	State Classification
O3	Nonattainment (Extreme)	Nonattainment
PM_{10}	Maintenance	Nonattainment
$PM_{2.5}$	Nonattainment	Nonattainment
CO	Urban areas of Fresno, Kern, San Joaquin, and Stanislaus Counties: Maintenance Remaining Basin: Attainment	Attainment/Maintenance
NO2	Attainment	Attainment
SO2	Attainment	Attainment
Pb	No designation/classification	Attainment
Hydrogen Sulfide	No standard	Unclassified
Visibility-reducing Particles	No standard	Unclassified
Sulfates	No standard	Attainment
Vinyl Chloride	No standard	Attainment

Sources: USEPA, 2015f; SJVAPCD 2015c
CO = carbon monoxide
Emission Inventory
NO_2 = nitrogen dioxide
O_3 = ozone
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SJVAB = San Joaquin Valley Air Basin
SO_2 = sulfur dioxide

[5] Urban areas of Fresno, Kern, San Joaquin, and Stanislaus Counties are classified as maintenance areas for CO, while the remainder of the SJVAB is classified as an attainment area for CO.

6.3.1 Criteria Pollutants

The CARB maintains an annual emission inventory for each county and air basin in the state. The inventory for the SJVAB is composed of data submitted to CARB by the SJVAPCD plus estimates for certain source categories, which are provided by CARB staff. The 2015 air pollutant inventory data for the SJVAB is summarized in Table 6-3.

In the SJVAPCD, mobile source emissions account for 586 tons per day (74 percent) and 229 tons per day (86 percent) of the basin's CO and NO_X emission inventory, respectively. Area-wide sources account for over 486 tons per day (93 percent) and 1,069 tons per day (59 percent) of the basin's PM and total organic gas emissions, respectively, and stationary sources account for 7 tons per day (73 percent) of the basin's SO_X emissions.

Table 6-3 2015 Estimated Annual Average Emissions for the San Joaquin Valley Air Basin (tons per day)

Source Category	TOG	ROG	CO	NO_X	SO_X	PM	PM_{10}	$PM_{2.5}$
Stationary Sources								
Fuel Combustion	17.7	3.3	23.2	25.1	3.4	5.7	5.3	5.1
Waste Disposal	481.9	22.3	0.5	0.3	0.1	0.6	0.2	0.1
Cleaning and Surface Coatings	24.8	21.6	0.0	–	–	0.1	0.1	0.1
Petroleum Production and Marketing	131.2	32.4	0.6	0.3	0.1	0.2	0.2	0.1
Industrial Processes	17.6	16.5	0.9	4.7	3.4	17.5	8.5	3.4
Total Stationary Sources	673.3	96.1	25.3	30.4	7	24.2	14.2	8.8
Stationary Sources Percentage of Total	*37%*	*28%*	*3%*	*11%*	*73%*	*5%*	*5%*	*12%*
Area-Wide Sources								
Solvent Evaporation	52.8	47.4	–	–	–	–	–	–
Miscellaneous Processes	1016	132.1	185.1	13.2	1.3	486.4	249.3	53.8
Total Area-wide Sources	1068.8	179.5	185.1	13.2	1.3	486.4	249.3	53.8
Area-wide Sources Percentage of Total	*59%*	*52%*	*23%*	*5%*	*14%*	*93%*	*90%*	*74%*

Source Category	TOG	ROG	CO	NO_X	SO_X	PM	PM_{10}	$PM_{2.5}$
Mobile Sources								
On-road Motor Vehicles	36.7	33.5	334	137.9	0.7	8.5	8.5	4.4
Other Mobile Sources	36.7	35.2	252	90.7	0.5	5	6	5.5
Total Mobile Sources	73.4	68.6	586	228.6	1.3	13.6	14.5	9.9
Mobile Sources Percentage of Total	*4%*	*20%*	*74%*	*84%*	*14%*	*3%*	*5%*	*14%*
Grand Total	1815.5	344.3	796.3	272.3	9.6	524.1	278.1	72.6

Source: CARB, 2015c
– = no value
CO = carbon monoxide
NO_X = nitrogen oxide
PM = particulate matter
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
ROG = reactive organic gas
SO_X = sulfur oxide
TOG = total organic gas

6.3.2 Statewide Greenhouse Gas Emissions

As a part of AB 32, the CARB established an emissions inventory for 1990 and a projected limit for 2020. Because climate change is a global and not a regional issue, specific inventories have not been prepared for the individual air basins. The CARB approved a non-sector-specific statewide 2020 limit on December 6, 2007. The statewide 2020 limit was based on the total 1990 GHG emissions inventory and was initially 427 MMT CO_2e. It was later revised using the scientifically updated Intergovernmental Panel on Climate Change 2007 fourth assessment report global warming potentials to 431 MMT CO_2e (CARB 2015d).

A summary of the 2013 statewide emissions inventory is included in Table 6-4, which is the most recent year for which data are available. As shown in the table, transportation accounts for the largest percentage of statewide GHG emissions, at 37 percent. Electric power and industrial account for the second and third largest percentages of statewide GHG emissions, at approximately 20 percent for each category (CARB 2016d).

Table 6-4 2014 California Statewide Greenhouse Gas Emissions Inventory by Sector

Emission Category	2014 (MMT CO_2e)	Percentage of Total
Transportation	159.53	36%
Electric power (In State and Imports)	88.24	20%
Industrial	93.32	21%
Commercial and Residential	38,34	9%
Agriculture	36.11	8%
High GWP	17.15	4%

Emission Category	2014 (MMT CO_2e)	Percentage of Total
Recycling and Waste	8.85	2%
Total California Emissions	**441.54**	100%

Source: CARB, 2016c
GWP = Global Warming Potential
MMT CO_2e = million metric tons of CO_2 equivalent

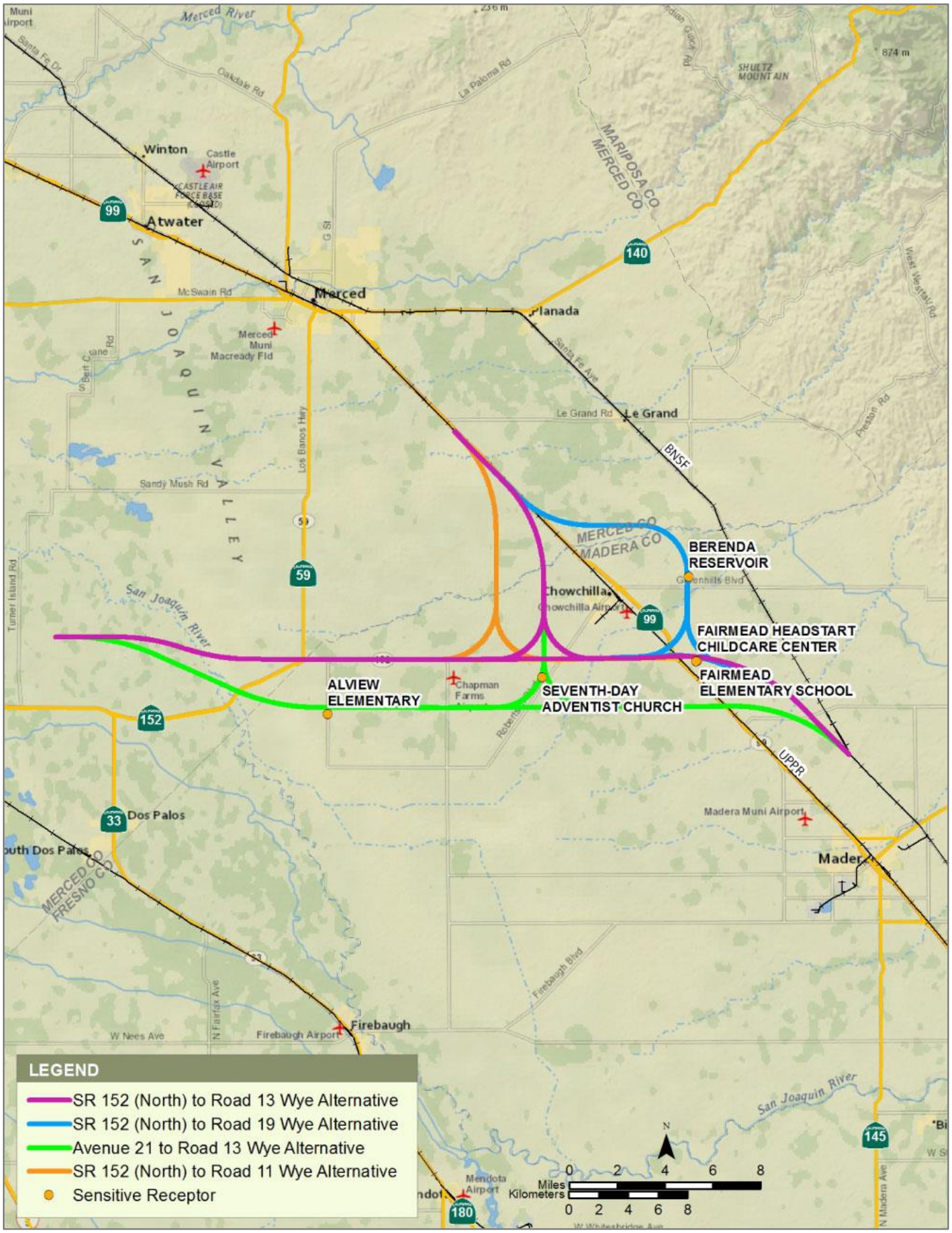
6.4 Sensitive Receptors

The people in some locations are considered more sensitive to adverse effects from air pollution than others. These locations are termed *sensitive receptors,* and comprise schools, daycare facilities, elderly care establishments, medical facilities, and other areas with people considered particularly vulnerable to the effects of poor air quality. Analyses performed by the CARB indicate that providing a separation of at least 1,000 feet from diesel sources and high-traffic areas would substantially reduce exposure to air contaminants and decrease asthma symptoms in children (CARB 2005). Sensitive receptors located within 1,000 feet of the Central Valley Wye alternatives are shown in Table 6-5 and on Figure 6-2.

Table 6-5 Sensitive Receptors within 1,000 Feet of the Central Valley Wye Alternatives

Sensitive Receptors	Distance (feet)			
	SR 152 (North) to Road 13	SR 152 (North) to Road 19	Avenue 21 to Road 13	SR 152 (North) to Road 11
Alview Elementary School[1]	N/A	N/A	Within project footprint	N/A
Chowchilla Seventh-Day Adventist Church	N/A	N/A	Within project footprint	N/A
Fairmead Head Start Childcare Center	350	300	N/A	350
Fairmead Elementary School	460	410	N/A	460
Residences	Adjacent to project footprint	Adjacent to project footprint	Adjacent to project footprint	Adjacent to project footprint

Source: Author's compilation, 2017
[1] The school is located within the temporary construction easement and utility easement of the Avenue 21 to Road 13 Wye Alternative.
N/A indicates that the sensitive receptor is not within 1,000 feet of the Central Valley Wye alternative.
SR = State Route



Source: Parsons, 2012; Google Inc., 2016

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Figure 6-2 Locations of Sensitive Receptors

7 AIR QUALITY EFFECTS ANALYSIS

Using the methods described in Section 5, this section evaluates and discusses the effects of the Central Valley Wye alternatives on emissions of criteria pollutants, TACs, MSATs, odors, and asbestos generated during construction and operations.

7.1 No Project Alternative

Tables 7-1 and 7-2 summarize estimated statewide emission burdens under No Project conditions in the years 2015, 2029, and 2040 under the medium ridership scenario and the high ridership scenario, respectively. As shown in Tables 7-1 through 7-3, total emissions for some pollutants decrease from 2015 to 2029 to 2040 (VOC, CO and NO_X). For other pollutants (SO_2, PM_{10}, $PM_{2.5}$), total emissions increase from 2015 to 2029 to 2040.

Table 7-1 Estimated Statewide Emissions without the Central Valley Wye Alternatives:[1] Medium Ridership Scenario

Project Element	VOC (tons/yr)[2]	CO (tons/yr)[2]	NO_X (tons/yr)[2]	SO_2 (tons/yr)[2]	PM_{10} (tons/yr)[2]	$PM_{2.5}$ (tons/yr)[2]
Year 2015						
On-Road Vehicles	7,785	323,019	33,326	816	22,977	6,238
Aircraft	338	2,888	2,779	299	84	84
Power Plants	1,646	29,616	15,531	2,303	2,953	2,683
Total Statewide Emissions	9,768	355,523	51,636	3,418	26,013	9,004
Year 2029						
Roadways	1,615	119,273	9,279	543	25,805	6,784
Aircraft	411	3,445	3,391	367	103	102
Power Plants	1,977	39,934	19,081	2,879	3,606	3,275
Total Statewide Emissions	4,004	162,651	31,751	3,789	29,514	10,161
Year 2040						
On-Road Vehicles	996	86,627	6,312	489	27,540	7,091
Aircraft	474	3,968	3,908	423	118	118
Power Plants	2,205	45,146	20,858	3,177	3,921	3,564
Total Statewide Emissions	3,675	135,741	31,077	4,089	31,580	10,773

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show statewide emissions without either the Central Valley Wye alternatives or HSR system
[2]Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

Table 7-2 Estimated Statewide Emissions without the Central Valley Wye Alternatives:[1] High Ridership Scenario

Project Element	VOC (tons/yr) [2]	CO (tons/yr) [2]	NO_X (tons/yr) [2]	SO_2 (tons/yr) [2]	PM_{10} (tons/yr) [2]	$PM_{2.5}$ (tons/yr) [2]
Year 2015						
On-Road Vehicles	7,746	321,414	33,161	812	22,862	6,207
Aircraft	315	2,692	2,589	279	78	78
Power Plants	1,646	29,616	15,531	2,303	2,953	2,683
Total Statewide Emissions	9,707	353,722	51,281	3,394	25,894	8,968
Year 2029						
Roadways	1,627	120,369	9,467	555	26,370	6,929
Aircraft	341	2,856	2,811	304	85	85
Power Plants	1,977	39,934	19,081	2,879	3,606	3,275
Total Statewide Emissions	3,946	163,158	31,360	3,738	30,061	10,289
Year 2040						
On-Road Vehicles	1,029	89,456	6,518	505	28,439	7,323
Aircraft	520	4,348	4,282	464	129	129
Power Plants	2,205	45,146	20,858	3,177	3,921	3,564
Total Statewide Emissions	3,753	138,950	31,658	4,145	32,490	11,016

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show statewide emissions without either the Central Valley Wye alternatives or HSR system

[2]Totals may not add up exactly due to rounding.

CO = carbon monoxide

NO_X = nitrogen oxide

PM_{10} = particulate matter smaller than or equal to 10 microns in diameter

$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter

SO_2 = sulfur dioxide

VOC = volatile organic compounds

yr = year

7.2 Statewide and Regional Operational Emissions Analysis

Tables 7-3 and 7-4 summarize estimated statewide emission burdens with the Central Valley Wye alternatives in the years 2015, 2029, and 2040 for the medium ridership scenario and the high ridership scenario, respectively. The ridership scenarios are described in Section 5.2, Statewide and Regional Air Quality Emission Calculations. As shown in Table 7-3 and Table 7-4, total emissions for some pollutants decrease from 2015 to 2029 to 2040 (VOC, CO, and NO_X). For other pollutants (SO_2, PM_{10}, $PM_{2.5}$), total emissions increase from 2015 to 2029 to 2040. Comparing Tables 7-1 through 7-2 to Tables 7-3 to 746 shows that emissions with the Central Valley Wye alternatives follow the same general trends as the emissions trends without the Central Valley Wye alternatives.

Table 7-3 Estimated Statewide Emissions with the Central Valley Wye Alternatives:[1] Medium Ridership Scenario

Project Element	VOC (tons/yr) [2]	CO (tons/yr) [2]	NO_X (tons/yr) [2]	SO_2 (tons/yr) [2]	PM_{10} (tons/yr) [2]	$PM_{2.5}$ (tons/yr) [2]
Year 2015						
On-Road Vehicles	7,654	317,613	32,769	802	22,592	6,133
Aircraft	237	2,027	1,949	210	59	59
Power Plants	1,659	29,823	15,636	2,320	2,976	2,704
Total Statewide Net Emissions	9,550	349,462	50,354	3,332	25,627	8,896
Year 2029						
Roadways	1,600	118,149	9,191	537	25,562	6,720
Aircraft	346	2,900	2,855	309	86	86
Power Plants	1,988	40,110	19,171	2,894	3,626	3,293
Total Statewide Net Emissions	3,935	161,159	31,217	3,740	29,274	10,099
Year 2040						
On-Road Vehicles	990	86,063	6,204	480	27,040	6,964
Aircraft	335	2,805	2,763	299	84	83
Power Plants	2,217	45,353	20,963	3,194	3,944	3,585
Total Statewide Net Emissions	3,542	134,221	29,929	3,973	31,068	10,632

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show statewide emissions with the Central Valley Wye alternatives + HSR system

[2] Totals may not add up exactly due to rounding.

CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

Table 7-4 Estimated Statewide Emissions with the Central Valley Wye Alternatives:[1] High Ridership Scenario

Element	VOC (tons/yr) [2]	CO (tons/yr) [2]	NO_X (tons/yr) [2]	SO_2 (tons/yr) [2]	PM_{10} (tons/yr) [2]	$PM_{2.5}$ (tons/yr) [2]
Year 2015						
On-Road Vehicles	7,567	313,982	32,394	793	22,334	6,063
Aircraft	218	1,863	1,792	193	54	54
Power Plants	1,660	29,843	15,647	2,322	2,978	2,706
Total Statewide Net Emissions	9,444	345,688	49,832	3,308	25,366	8,823
Year 2029						
Roadways	1,630	120,349	9,362	547	26,038	6,846
Aircraft	269	2,253	2,218	240	67	67
Power Plants	1,989	40,128	19,180	2,895	3,628	3,294
Total Statewide Net Emissions	3,888	162,730	30,761	3,683	29,733	10,207
Year 2040						
On-Road Vehicles	1,004	87,282	6,360	492	27,748	7,145
Aircraft	386	3,230	3,181	345	96	96
Power Plants	2,218	45,373	20,974	3,195	3,946	3,587
Total Statewide Net Emissions	3,608	135,886	30,515	4,032	31,791	10,828

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show statewide emissions with the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

Table 7-5 summarizes the net change in emissions between the two ridership scenarios with the Central Valley Wye (absolute emissions shown in Tables 7-3 through 7-4) and without the Central Valley Wye alternatives (absolute emissions shown in Tables 7-1 through 7-2) for the 2015 existing CEQA baseline and the 2029 and 2040 future NEPA baselines. As shown in Table 7-5, the Central Valley Wye alternatives are predicted to have a beneficial effect on (i.e., reduction) statewide emissions of all pollutants under both ridership scenarios in 2015, 2029, and 2040 when comparing conditions with the Central Valley Wye alternatives to conditions without the Central Valley Wye alternatives.

7.2.1 On-Road Vehicles

As shown in Tables 7-6 and 7-7, the Central Valley Wye alternatives are predicted to reduce regional VMT and on-road emissions, respectively, for the 2015 existing CEQA baseline and the 2029 and 2040 future NEPA baselines (under both ridership scenarios), resulting in a beneficial effect on regional air quality. The Central Valley Wye alternatives design incorporates measures to reduce effects on air quality, including the implementation of a fugitive dust control plan (AQ-IAMF#1, Fugitive Dust Emissions) and requiring the use of low-VOC paint (AQ-IAMF#2, Selection of Coatings).

The HSR is predicted to reduce statewide and regional criteria pollutant emissions associated with roadways, because travelers would use the HSR rather than drive. The on-road vehicle emission analysis is based on VMT changes and associated average daily speed estimates calculated for each affected county. Analysts obtained emission factors from EMFAC2014, using statewide parameters.

With the Central Valley Wye alternatives, some vehicles may need to travel additional distances to cross the HSR track on new roadway overheads. On average, roadway overheads would be provided approximately every 2 miles along the track. It is estimated that vehicles would not have to travel more than 3.1 miles out-of-direction to cross the HSR tracks. The width of the roadway overheads would accommodate both farm equipment and school buses traveling in opposite lanes. Because of the number of roadway overheads, it is expected that additional distances vehicles would travel to cross the HSR tracks would be negligible relative to regional VMT reductions; therefore, this is not discussed further in the analysis.

7.2.2 Train Movement

The Central Valley Wye alternatives would use electric multiple-unit trains, with the power distributed through the overhead contact system. The HSR would not produce direct emissions from combustion of fossil fuels and associated emissions. However, trains traveling at high velocities, such as those associated with the proposed HSR, create sideways turbulence and rear wake, which could re-suspend particulates from the surface surrounding the track, resulting in fugitive dust emissions. Assuming a friction velocity of 0.62 foot per second to re-suspend soils in the local study area , an HSR passing at 220 mph could re-suspend soil particles out to approximately 10 feet from the train (Watson 1996). Based on the USEPA methodology for estimating emissions from wind erosion (USEPA 2006c), the Central Valley Wye alternatives could generate approximately 14–15 tons per year of PM_{10} and 2.2–2.3 tons per year of $PM_{2.5}$, depending on the alternative (refer to Tables 7-11 and 7-12). Details of the analysis and calculations are provided in Appendix C.

The San Joaquin Valley region has high rates of asthma in adults and children. Because the HSR is electrically powered, it would not generate direct combustion emissions along its route that would cause substantial health concerns, such as asthma or other respiratory diseases. A detailed analysis of wind-induced fugitive dust emissions from HSR travel is discussed in Appendix C. Based on this analysis, fugitive dust emissions from HSR travel are not expected to result in sufficient amounts of dust to cause health concerns.

Table 7-5 Estimated Statewide Emission Burden Changes due to Operation of the Central Valley Wye Alternatives vs. No Project[1] (under the Medium and High Scenarios)

Element	VOC (tons/yr)[2]		CO (tons/yr)[2]		NO_X (tons/yr)[2]		SO_2 (tons/yr)[2]		PM_{10} (tons/yr)[2]		$PM_{2.5}$ (tons/yr)[2]	
	M	H	M	H	M	H	M	H	M	H	M	H
2015 Existing Baseline												
On-Road Vehicles	-130	-179	-5,406	-7,432	-558	-767	-14	-19	-385	-529	-104	-144
Aircraft	-101	-97	-862	-829	-829	-798	-89	-86	-25	-24	-25	-24
Power Plants	12	14	207	227	105	116	17	19	23	25	21	23
Total Statewide Net Emissions	-219	-262	-6,061	-8,034	-1,281	-1,448	-86	-86	-387	-528	-108	-145
Year 2029												
Roadways	-15	3	-1,124	-20	-87	-105	-5	-7	-243	-332	-64	-84
Aircraft	-65	-72	-545	-602	-536	-593	-58	-64	-16	-18	-16	-18
Power Plants	11	12	176	194	90	99	14	16	19	21	18	20
Total Statewide Net Emissions	-70	-58	-1,493	-428	-534	-599	-49	-55	-240	-328	-62	-82
2040 Future Baseline												
On-Road Vehicles	-7	-25	-564	-2,174	-109	-158	-9	-12	-500	-691	-127	-178
Aircraft	-139	-134	-1,162	-1,118	-1,145	-1,101	-124	-119	-35	-33	-35	-33
Power Plants	12	14	207	227	105	116	17	19	23	25	21	23
Total Statewide Net Emissions	-133	-145	-1,520	-3,065	-1,148	-1,144	-116	-113	-512	-699	-141	-188

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide emissions with and without the Central Valley Wye alternatives + HSR system
[2] Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

Table 7-6 On-Road Vehicle Miles Traveled for Operation of the Central Valley Wye Alternatives and the No Project Alternative[1] (under the Medium and High Scenarios)

Area	No Project VMT Total Annual Traffic[2]		Central Valley Wye VMT Total Annual Traffic[2]	
	Medium	High	Medium	High
Year 2015				
Madera	739,860,357	724,470,074	650,104,437	610,842,505
Merced	1,239,904,084	1,217,771,426	1,095,973,335	1,023,513,300
Regional Total	1,979,764,441	1,942,241,501	1,746,077,772	1,634,355,805
Year 2029				
Madera	879,276,635	943,930,006	798,912,066	842,737,993
Merced	1,506,540,248	1,649,405,517	1,392,147,947	1,495,480,175
Regional Total	2,385,816,883	2,593,335,522	2,191,060,013	2,338,218,168
Year 2040				
Madera	1,089,403,184	1,351,421,592	964,659,976	1,193,501,450
Merced	1,842,074,869	2,205,535,193	1,642,039,221	1,935,554,314
Regional Total	2,931,478,053	3,556,956,785	2,606,699,197	3,129,055,764

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. This table shows statewide and regional VMT with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.

Table 7-7 On-Road Vehicle Emission Changes due to Operation of the Central Valley Wye Alternatives vs. No Project[1] (under the Medium and High Scenarios)

Element	VOC (tons/yr)[2]		CO (tons/yr)[2]		NO_X (tons/yr)[2]		SO_2 (tons/yr)[2]		PM_{10} (tons/yr)[2]		$PM_{2.5}$ (tons/yr)[2]	
	M	H	M	H	M	H	M	H	M	H	M	H
2015 Existing Baseline												
Madera	-3	-4	-127	-161	-15	-20	0	0	-10	-13	-3	-3
Merced	-5	-7	-196	-265	-24	-33	-1	-1	-16	-22	-4	-6
Total Regional Net Emissions	-9	-11	-324	-427	-40	-53	-1	-1	-26	-35	-7	-9
Year 2029												
Madera	-1	-1	-29	-37	-3	-4	0	0	-9	-11	-2	-3
Merced	-1	-1	-46	-62	-4	-6	0	0	-12	-16	-3	-4
Total Regional Net Emissions	-1	-2	-75	-99	-8	-10	0	-1	-21	-27	-6	-7
2040 Future Baseline												
Madera	0	-1	-36	-39	-3	-4	0	0	-13	-17	-3	-4
Merced	-1	-1	-56	-63	-5	-6	0	-1	-22	-17	-6	-3
Total Regional Net Emissions	-1	-1	-92	-102	-8	-10	-1	-1	-36	-34	-9	-8

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system

[2]Totals may not add up exactly due to rounding.

CO = carbon monoxide

NO_X = nitrogen oxide

PM_{10} = particulate matter smaller than or equal to 10 microns in diameter

$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter

SO_2 = sulfur dioxide

VMT = vehicle miles traveled

VOC = volatile organic compounds

yr = year

7.2.3 Aircraft Emissions

The Central Valley Wye alternatives could affect travel at the regional airports in the San Joaquin Valley, because the HSR is predicted to reduce the number of aircraft flights.

Analysts used the Federal Aviation Administration's Aviation Environmental Design Tool (2016) to estimate aircraft emissions. This tool estimates the emissions generated from specified numbers of landing and take-off cycles. Along with emissions from the aircraft themselves, emissions generated from associated ground maintenance requirements are included. Analysts calculated average aircraft emissions based on the profile of aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the HSR using the results of the travel demand modeling analyses conducted for the project section, based on the ridership estimates presented in the California High-Speed Rail Authority's *2016 Business Plan* (Authority 2016b).

Table 7-8 shows the total number of flights with and without the Central Valley Wye alternatives in 2015 and in 2029 and 2040, for both ridership scenarios.

Relative to the 2015 existing CEQA baseline and 2029 and 2040 Future NEPA baselines, there would be a net decrease in all criteria pollutant emissions when comparing conditions with the Central Valley Wye alternatives to conditions without the Central Valley Wye alternatives (Table 7-9). The decrease in emissions would occur because the HSR is predicted to reduce statewide and regional criteria pollutant emissions associated with aircraft, as travelers are expected to shift away from flying and use the HSR.

7.2.4 Indirect Power Plant Emissions

Analysts conservatively estimated the electrical demands caused by propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities as part of the project section design. Analysts derived average emission factors for each kilowatt-hour required from CARB statewide emission inventories of electrical and cogeneration facilities data along with USEPA eGRID2012 (released 10/2015) electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

The HSR system is currently analyzed as if it would be powered by the state's current electric grid. This is a conservative assumption because of the state requirement that an increasing fraction of electricity (50 percent by 2030) generated for the state's power portfolio come from renewable energy sources. As such, the emissions generated for the HSR system are expected to be lower in the future than the emissions estimated for this analysis. Furthermore, under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources.

Table 7-8 Aircraft Flights for Operation of the Central Valley Wye Alternatives and the No Project Alternative[1] (under the Medium and High Scenarios)

Area	Total No Project Number of Flights (per year)		Total Central Valley Wye alternatives Number of Flights (per year)	
	Medium	High	Medium	High
Year 2015				
Regional (San Joaquin Valley)	3,438	3,117	1,644	2,110
Statewide Total	268,567	250,276	188,430	173,177
Year 2029				
Regional (San Joaquin Valley)	4,147	2,553	2,659	1,409
Statewide Total	329,614	273,240	277,475	215,599
Year 2040				
Regional (San Joaquin Valley)	4,831	6,097	2,337	4,698
Statewide Total	380,189	416,659	268,814	309,505

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. This table show statewide and regional flights with and without the Central Valley Wye alternatives + HSR system

Table 7-9 Aircraft Emission Changes due to Operation of the Central Valley Wye Alternatives vs. No Project[1] (under the Medium and High Scenarios)

Element	VOC (tons/yr)[2]		CO (tons/yr)[2]		NO_X (tons/yr)[2]		SO_2 (tons/yr)[2]		PM_{10} (tons/yr)[2]		$PM_{2.5}$ (tons/yr)[2]	
	M	H	M	H	M	H	M	H	M	H	M	H
2015 Existing Baseline												
Regional (San Joaquin Valley)	-2	-1	-19	-11	-19	-10	-2	-1	-1	0	-1	0
Total Statewide Net Emissions	-101	-97	-862	-829	-829	-798	-89	-86	-25	-24	-25	-24
2029 Future Baseline												
Regional (San Joaquin Valley)	-2	-1	-16	-12	-15	-12	-2	-1	0	0	0	0
Total Statewide Net Emissions	-65	-72	-545	-602	-536	-593	-58	-64	-16	-18	-16	-18
2040 Future Baseline												
Regional (San Joaquin Valley)	-3	-2	-26	-15	-26	-14	-3	-2	-1	0	-1	0
Total Statewide Net Emissions	-139	-134	-1,162	-1,118	-1,145	-1,101	-124	-119	-35	-33	-35	-33

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide and regional emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

Table 7-10 Power Plant Emission Changes due to Operation of the Central Valley Wye Alternatives vs. No Project[1] (under the Medium and High Scenarios)

Element	VOC (tons/yr)[2]		CO (tons/yr)[2]		NO_X (tons/yr)[2]		SO_2 (tons/yr)[2]		PM_{10} (tons/yr)[2]		$PM_{2.5}$ (tons/yr)[2]	
	M	H	M	H	M	H	M	H	M	H	M	H
2015 Existing Baseline												
Statewide	12	14	207	227	105	116	17	19	23	25	21	23
Regional	1	1	21	23	11	12	2	2	2	3	2	2
2029 Future Baseline												
Statewide	11	12	176	194	90	99	14	16	19	21	18	20
Regional	1	1	18	19	9	10	1	2	2	2	2	2
2040 Future Baseline												
Statewide	12	14	207	227	105	116	17	19	23	25	21	23
Regional	1	1	21	23	11	12	2	2	2	3	2	2

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide and regional emissions with and without the Central Valley Wye alternatives + HSR system

[2]Totals may not add up exactly due to rounding.

CO = carbon monoxide
MWh = megawatt-hour(s)
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds
yr = year

7.2.5 Local Operation Emission Sources

The operation of the power traction, switching, and paralleling stations would not result in appreciable quantities of air pollutants because site visits would be infrequent and power usage would be limited. Therefore, this analysis did not quantify emissions from these stations.

7.2.6 Regional Operational Criteria Pollutant Emissions Summary

Tables 7-11 through 7-13 show a summary of the total emission changes due to operation of the Central Valley Wye alternatives for the medium and high ridership scenarios for the 2015 existing CEQA baseline (Table 7-11), 2029 future NEPA baseline (Table 7-12), and 2040 future NEPA baseline (Table 7-13). Results include the indirect emissions from regional vehicle travel, aircraft, and power plants, and direct operational emissions from HSR train movement.

As shown in Table 7-11, the Central Valley Wye alternatives would result in a net regional decrease in emissions of all criteria pollutants. These decreases in emissions would be beneficial to the SJVAB and help the basin meet its attainment goals for O_3. Lower ridership would result in fewer regional benefits, although it would still constitute a net benefit.

Table 7-11 Summary of Regional Criteria Pollutant Emissions Changes due to Operation of the Central Valley Wye Alternatives – 2015 Existing Baseline[1] (under the Medium and High Scenarios) (tons per year)

Element	VOC (tons/yr)		CO (tons/yr)		NOX (tons/yr)		SO2 (tons/yr)		PM10 (tons/yr)		PM2.5 (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
On-Road Vehicles	-9	-11	-324	-427	-40	-53	-1	-1	-26	-35	-7	-9
Aircraft	-2	-1	-19	-11	-19	-10	-2	-1	-1	0	-1	0
Power Plants	1	1	21	23	11	12	2	2	2	3	2	2
Direct Emissions (Fugitive dust from train movement)[2]												
SR 152 (North) to Road 13 Wye Alternative									15		2.2	
SR 152 (North) to Road 19 Wye Alternative									14		2.2	
Avenue 21 to Road 13 Wye Alternative									15		2.3	
SR 152 (North) to Road 11 Wye Alternative									14		2.1	
Total Emissions[3]												
SR 152 (North) to Road 13 Wye Alternative	-10	-11	-323	-415	-48	-51	-1	0	-10	-17	-3	-5
SR 152 (North) to Road 19 Wye Alternative	-10	-11	-323	-415	-48	-51	-1	0	-11	-18	-3	-5
Avenue 21 to Road 13 Wye Alternative	-10	-11	-323	-415	-48	-51	-1	0	-10	-17	-3	-5
SR 152 (North) to Road 11 Wye Alternative	-10	-11	-323	-415	-48	-51	-1	0	-10	-17	-3	-5

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system

[2] Direct dust emissions from train movement do not depend on ridership, so emissions are the same for both scenarios

[3] The total includes the indirect and direct emissions.

CO = carbon monoxide
N/A = not applicable
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VMT = vehicle miles traveled
VOC = volatile organic compound

Table 7-12 Summary of Regional Emissions Changes due to Operation of the Central Valley Wye Alternatives in Opening Year – 2029 (tons per year) vs. No Project 2029[1] (under the Medium and High Scenarios)

Element	VOC (tons/yr)		CO (tons/yr)		NO_X (tons/yr)		SO_2 (tons/yr)		PM_{10} (tons/yr)		$PM_{2.5}$ (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
Roadways	-1	-2	-75	-99	-8	-10	0	-1	-21	-27	-6	-7
Aircraft	-2	-1	-16	-12	-15	-12	-2	-1	0	0	0	0
Power Plants	1	1	18	19	9	10	1	2	2	2	2	2
Direct Emissions (Fugitive dust from train movement)[2]												
SR 152 (North) to Road 13 Wye Alternative									15		2.2	
SR 152 (North) to Road 19 Wye Alternative									14		2.2	
Avenue 21 to Road 13 Wye Alternative									15		2.3	
SR 152 (North) to Road 11 Wye Alternative									14		2.1	
Total Emissions[3]												
SR 152 (North) to Road 13 Wye Alternative	-2	-2	-73	-92	-14	-12	-1	0	-4	-11	-2	-3
SR 152 (North) to Road 19 Wye Alternative	-2	-2	-73	-92	-14	-12	-1	0	-5	-12	-2	-3
Avenue 21 to Road 13 Wye Alternative	-2	-2	-73	-92	-14	-12	-1	0	-4	-11	-2	-3
SR 152 (North) to Road 11 Wye Alternative	-2	-2	-73	-92	-14	-12	-1	0	-5	-11	-2	-3

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system

[2] Direct dust emissions from train movement do not depend on ridership, so emissions are the same for both scenarios.

[3] The total includes the indirect and direct emissions.

CO = carbon monoxide
HSR = high-speed rail
N/A = not applicable
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
tpy = tons per year
VMT = vehicle miles traveled
VOC = volatile organic compound

Table 7-13 Summary of Regional Criteria Pollutant Emissions Changes due to Operation of the Central Valley Wye Alternatives – 2040 Future Baseline[1] (under the Medium and High Scenarios) (tons per year)

Element	VOC (tons/yr)		CO (tons/yr)		NOX (tons/yr)		SO2 (tons/yr)		PM10 (tons/yr)		PM2.5 (tons/yr)	
	M	H	M	H	M	H	M	H	M	H	M	H
Indirect Emissions												
On-Road Vehicles	-1	-1	-92	-102	-8	-10	-1	-1	-36	-34	-9	-8
Aircraft	-3	-2	-26	-15	-26	-14	-3	-2	-1	0	-1	0
Power Plants	1	1	21	23	11	12	2	2	2	3	2	2
Direct Emissions (Fugitive dust from train movement)[2]												
SR 152 (North) to Road 13 Wye Alternative									15		2.2	
SR 152 (North) to Road 19 Wye Alternative									14		2.2	
Avenue 21 to Road 13 Wye Alternative									15		2.3	
SR 152 (North) to Road 11 Wye Alternative									14		2.1	
Total Emissions[3]												
SR 152 (North) to Road 13 Wye Alternative	-3	-2	-97	-93	-23	-13	-2	-1	-19	-17	-6	-3
SR 152 (North) to Road 19 Wye Alternative	-3	-2	-97	-93	-23	-13	-2	-1	-20	-18	-6	-3
Avenue 21 to Road 13 Wye Alternative	-3	-2	-97	-93	-23	-13	-2	-1	-19	-17	-6	-3
SR 152 (North) to Road 11 Wye Alternative	-3	-2	-97	-93	-23	-13	-2	-1	-21	-17	-6	-4

Source: Author's compilation, 2017

[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system

[2] Direct dust emissions from train movement do not depend on ridership, so emissions are the same for both scenarios

[3] The total includes the indirect and direct emissions.

CO = carbon monoxide
N/A = not applicable
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VMT = vehicle miles traveled
VOC = volatile organic compound

7.3 Microscale Carbon Monoxide Analysis

A CO microscale hot-spot analysis is typically performed for intersections that could potentially cause a localized CO hot spot. For other sections of the HSR project, CO analyses have been conducted for intersections and parking structures associated with the HSR stations and heavy maintenance facilities (HMF).

However, the Central Valley Wye alternatives would not include stations or HMFs. In addition, the Central Valley Wye alternatives would not worsen traffic conditions at intersections along the alignment because the alignment and roadways would be grade-separated. Some roadways would be permanently closed or rerouted where HSR tracks would either transect or be near an existing roadway. Section 6.3 of the Merced to Fresno Section: Central Valley Wye Transportation Technical Report (Central Valley Wye Transportation Technical Report, discusses the level of service anticipated on roadways in the regional study area that would be closed permanently or modified by Central Valley Wye alternatives construction. As discussed in Section 6.3 of the Central Valley Wye Transportation Technical Report, all roadways would continue to operate at Level of Service A for the existing plus project conditions and at Level of Service C or better for the 2040 with project conditions. Therefore, a CO analysis is not necessary at intersections along the wye alternative alignments. Because the Central Valley Wye alternatives would not worsen traffic conditions at intersections in the regional study area, a CO microscale hot-spot analysis is not warranted.

7.4 Particulate Matter Analysis

Based on the projected No Project and Central Valley Wye alternatives VMT, the Central Valley Wye alternatives would reduce VMT in the design year (2040) conditions, resulting in PM_{10} and $PM_{2.5}$ reductions. For purposes of identifying and evaluating potential effects under NEPA and CEQA, analysts prepared a hot-spot analysis because the local study area is designated nonattainment for $PM_{2.5}$ and maintenance for PM_{10} and the Central Valley Wye alternatives are subject to localized PM_{10} and $PM_{2.5}$ hot-spot analysis.

In November 2015, the USEPA updated its Transportation Conformity Guidance for Quantitative Hot-Spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas (USEPA 2015f), which was used for this analysis. Although this analysis is normally associated with the transportation conformity rule, the HSR project is subject to the GC Rule. Notwithstanding the decision to use this analytical structure, additional analysis or associated activities required to comply with transportation conformity will be carried out only if discrete project elements become subject to those requirements in the future. In accordance with this guidance, if a project meets one of the following criteria, it is considered a project of air quality concern and a quantitative PM_{10}/$PM_{2.5}$ analysis is required.

- New or expanded highway projects that have a significant number of or significant increase in diesel vehicles—The Central Valley Wye alternatives are not a new highway project, nor would it expand an existing highway beyond its current capacity. The HSR would be electrically powered. The Central Valley Wye alternatives would not measurably affect traffic conditions on roadways that have been realigned to accommodate the HSR right-of-way because the roadways would be grade-separated, and it would not measurably affect truck volumes on the affected roadways. Furthermore, the Central Valley Wye alternatives would improve regional traffic conditions by reducing traffic congestion, increasing vehicle speeds, and reducing regional VMT within the Central Valley Wye alternatives area.
- Projects affecting intersections that are at Level of Service D, E, or F with a significant number of diesel vehicles or those that will degrade to Level of Service D, E, or F because of increased traffic volumes from a significant number of diesel vehicles related to the Central Valley Wye alternatives—The Central Valley Wye alternatives would not change the existing traffic mix at signalized intersections and would not result in increased traffic volumes. Although some roadways would be closed, realigned, or rerouted to accommodate the HSR right-of-way, traffic volumes in the regional study area are low, and affected intersections currently operate at and are projected to continue to operate at acceptable levels-of-service.

As discussed in Section 6.3 of the Central Valley Wye Transportation Technical Report, all roadways would operate at Level of Service A or better for the existing plus project conditions and Level of Service C or better for the 2040 plus project conditions. Therefore, the Central Valley Wye alternatives would not measurably increase the number of diesel vehicles at affected intersections.

- New bus and rail terminals and transfer points that have a significant number of diesel vehicles congregating at a single location—The Central Valley Wye alternatives would not include any rail or bus terminals or transfer points and would therefore would not affect diesel vehicles congregating at a single location. The trains used for the Central Valley Wye alternatives would be electric multiple units, powered by electricity, not diesel fuel.
- Projects in, or affecting, locations, areas, or categories of sites that are identified in the $PM_{2.5}$- or PM_{10}-applicable implementation plan or implementation plan submission, as appropriate, as sites of violation or possible violation—The RSA is not in an area identified as sites of violation or of possible violation in the USEPA-approved 2003 SIP, the USEPA-approved PM_{10} Maintenance Plan and Request for Redesignation, or the adopted 2012 and 2015 $PM_{2.5}$ Plans for San Joaquin Valley (SJVAPCD 2007b, SJVAPCD 2012b).

For these reasons, the Central Valley Wye alternatives would not be considered a project of air quality concern as defined by 40 C.F.R. Part 93.123(b)(1), and would not likely cause violations of PM_{10}/$PM_{2.5}$ NAAQS during its operation. Therefore, quantitative $PM_{2.5}$ and PM_{10} microscale hot-spot evaluations are not required. CAA 40 C.F.R. Part 93.116 requirements are therefore met without a quantitative hot-spot analysis. The Central Valley Wye alternatives would not cause an adverse effect on air quality for PM_{10}/$PM_{2.5}$ standards because, based on these criteria, it is not a project of air quality concern.

7.5 Odors

Sources of odor during construction would include diesel exhaust from construction equipment. All odors would be localized and generally confined to the immediate area surrounding the construction site. Construction of the Central Valley Wye alternatives would use typical construction techniques, and the equipment odors would be typical of most construction. These odors would be temporary and localized, and they would cease once construction activities were completed. Concrete batch plants, which would be required for construction, are not typically associated with offensive odors.

No potentially odorous emissions would be associated with the train operation because the trains would be powered from the regional electrical grid. Any minor odors that sensitive land uses would be exposed to as a result of operations of the Central Valley Wye alternatives would be less severe than the odors from other industrial and agricultural activities that would occur in these areas under the 2015 existing conditions or the 2029 or 2040 future conditions without the Central Valley Wye alternatives.

7.6 Mobile Source Air Toxics Analysis

In accordance with the FHWA's *Interim Guidance Update on Air Toxic Analysis in NEPA Documents,* released September 30, 2009 and updated on December 6, 2012 and again on October 18, 2016 (FHWA 2016), the qualitative assessment presented here is derived, in part, from a study conducted by FHWA entitled *A Methodology for Evaluating Mobile Source Air Toxic Emissions Among Transportation Project Alternatives* (FHWA 2011). It is provided as a basis for identifying and comparing the potential differences in MSAT emissions, if any, among the Central Valley Wye alternatives. The most recent update to the interim guidance discusses new analysis conducted using the MOVES2014a model.

There would be no difference in MSAT emissions among the Central Valley Wye alternatives because the regional change in vehicle emissions would be the same for all alternatives. Therefore, this analysis compares the Central Valley Wye alternatives to the 2015 existing baseline 2040 future baseline.

7.6.1 Regional Mobile Source Air Toxics Effects

Under the Central Valley Wye alternatives, the proposed HSR would use electric multiple units, with the power distributed to each train car via the overhead contact system. Operation of the electric multiple units would not generate combustion emissions; therefore, no toxic emissions would be expected from operation of the Central Valley Wye alternatives.

The Central Valley Wye alternatives would decrease regional VMT and MSAT emissions relative to the 2029 and 2040 future baselines. The availability of the HSR would reduce the number of individual vehicle trips on a regional basis. Because the Central Valley Wye alternatives would not substantially change the regional traffic mix, the amount of MSATs emitted from highways and other roadways within the regional study area would be proportional to the VMT. Because the regional VMT estimated for the Central Valley Wye alternatives would be less than the anticipated VMT in 2029 and 2040 without the Central Valley Wye alternatives, MSAT emissions from regional vehicle traffic would be less for the Central Valley Wye alternatives.

Even without the Central Valley Wye alternatives, emissions in 2029 and 2040 would likely be lower than present levels as a result of the USEPA's national control programs, which are projected to reduce annual MSAT emissions by over 90 percent between 2010 and 2050. Local conditions may differ from these national projections in terms of fleet mix and turnover, VMT growth rates, and local control measures. However, the magnitude of the USEPA-projected reductions is so great (even after accounting for VMT growth) that MSAT emissions in the regional study area are likely to be lower in the future in nearly all cases.

7.6.2 Local Mobile Source Air Toxics Effects

There would be no substantial potential MSAT emission sources directly related to HSR operation, because the Central Valley Wye alternatives would not include stations or maintenance facilities that would result in additional vehicle trips. Therefore, there would be no localized increases in MSAT emissions as a result of the Central Valley Wye alternatives.

7.7 Asbestos Effects

The Central Valley Wye alternatives would pass through Merced and Madera Counties, which the California Department of Conservation, Division of Mines and Geology, has designated as areas likely to contain NOA. However, the Department of Conservation has designated the specific areas of the counties through which the alignments would be constructed as areas not likely to contain NOA (CDMG 2000). Thus, Central Valley Wye alternatives operation would not likely encounter NOA.

7.8 Criteria Pollutant Construction Emissions

Construction activities associated with the Central Valley Wye alternatives would result in criteria pollutant emissions. This section quantifies and analyzes construction emissions. The effects associated with construction emissions would be reduced through Central Valley Wye alternatives construction practices, including the implementation of a dust control plan (AQ-IAMF#1). The Authority or its contractors would prepare the fugitive dust control plan and employ measures to minimize fugitive dust emissions by washing vehicles before exiting the construction site, watering unpaved surfaces, limiting vehicle travel speed, and suspending dust-generating activities when wind speed is in exceedance of 25 mph. The design of the Central Valley Wye alternatives would also minimize off-gassing emissions of VOCs that would occur from paints and other coatings by requiring the use of low-VOC paint and super-compliant or Clean Air paint that has a lower VOC content than that required by San Joaquin Valley Unified Air Pollution Control District Rule 4601 (AQ-IAMF#2).

Construction activities expected to occur during the same calendar year are summarized based on the construction schedule shown in Section 5.10.3, General Assumptions for Methodologies. Analysts compared Central Valley Wye alternatives emissions to the GC *de minimis* emission thresholds on a calendar-year basis; consequently, emissions can exceed thresholds for any calendar year in which emissions occur.

No future natural growth or other non-HSR-related improvements are included in the Central Valley Wye alternatives construction effects. Therefore, construction emissions presented in this analysis were used for effects compared against both existing conditions and the No Project Alternative.

The summary of construction emissions for the Central Valley Wye alternatives over the entire construction period is shown in Table 7-14 and takes into account the beneficial influence of the IAMFs, including the dust control measures specified in AQ-IAMF#1.

Table 7-14 Central Valley Wye Alternatives Construction Emissions–Total (tons)

Central Valley Wye Alternative	Emissions[1]					
	VOCs	CO	NOX	SO2	PM10[1]	PM2.5[1]
SR 152 (North) to Road 13	25	240	399	1	63	18
SR 152 (North) to Road 19	25	243	393	1	63	18
Avenue 21 to Road 13	25	242	414	1	62	18
SR 152 (North to Road 11)	25	239	389	1	62	18

Source: Author's compilation, 2017
[1] The PM_{10} and $PM_{2.5}$ emissions consist of the exhaust and fugitive dust emissions.
CO = carbon monoxide
NO_X = nitrogen oxide
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound

7.8.1 Construction Effects Summary

7.8.1.1 Construction Effects within the San Joaquin Valley Air Basin

Details of emissions from the Central Valley Wye alternatives are presented in Tables 7-15 through 7-18. Emissions presented for each alternative include annual emissions generated from within the SJVAB from all construction phases of the HSR and the regional roadway realignment. Emissions are shown for each year that construction would occur, include the major construction activities discussed in Section 5.10, Construction Phase, and take into account the beneficial influence of the IAMFs, including the dust control measures specified in AQ-IAMF#1. Tables 7-15 through 7-18 also show the SJVAPCD and GC thresholds and indicate whether Central Valley Wye alternatives construction emissions exceed these thresholds.

Table 7-15 Programmatic Construction Emissions: SR 152 (North) to Road 13 Wye Alternative (tons/year)

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
SJVAPCD annual CEQA significance thresholds[1]	10	N/A	10	N/A	15	15
Annual general conformity *de minimis* levels applicable to the SJVAB[2]	10	N/A	10	100	100	100
Year 2018						
Emissions (tons/year)	0.00	0.00	0.00	0.00	0.01	0.00
Exceeds SJVAPCD CEQA thresholds?	No	N/A	No	N/A	No	No
Exceeds GC threshold?	No	N/A	No	No	No	No
Year 2019						
Emissions (tons/year)	6.74	63.32	107.72	0.35	23.52	5.11
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2020						
Emissions (tons/year)	9.73	98.99	139.49	0.45	25.75	6.70
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2021						
Emissions (tons/year)	6.40	59.86	113.12	0.35	12.34	4.68
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
Year 2022						
Emissions (tons/year)	2.21	18.00	38.39	0.07	1.55	1.25
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Source: Author's compilation, 2017

[1] The SJVAPCD has significance thresholds for NO_X, ROG/VOC, PM_{10}, and $PM_{2.5}$. The SJVAPCD's 2002 GAMAQI does not have thresholds for CO or SO_X.

[2] The GC *de minimis* thresholds for criteria pollutants are based on the SJVAB federal attainment status. The SJVAB is considered in extreme nonattainment for the ozone NAAQS, is a nonattainment area for $PM_{2.5}$, and is a maintenance area for the CO NAAQS (Fresno, Kern, San Joaquin, and Stanislaus County urbanized areas only—no portions of the Central Valley Wye alternative alignments are in these maintenance areas that are subject to conformity requirements) and PM_{10} NAAQS. Although the SJVAB is in attainment for SO_X, because SO_X is a precursor for $PM_{2.5}$, the $PM_{2.5}$ GC *de minimis* thresholds was used.

[3] While the SJVAPCD's 2002 GAMAQI does not include quantitative thresholds for CO and SO_X, project emissions were evaluated against the SJVAPCD's 2015 GAMAQI and determined that they would not exceed those quantitative thresholds.

[4] PM_{10} and $PM_{2.5}$ emissions have incorporated the SJVAPCD Regulation VIII requirements and dust control measures the Authority committed to in the Statewide Program EIR/EIS.

CEQA = California Environmental Quality Act
CO = carbon monoxide
GAMAQI = *Guide for Assessing and Mitigating Air Quality Impacts*
GC = General Conformity
N/A = not applicable
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table 7-16 Programmatic Construction Emissions: SR 152 (North) to Road 19 Wye Alternative (tons/year)

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
SJVAPCD annual CEQA significance thresholds[1]	10	N/A	10	N/A	15	15
Annual general conformity *de minimis* levels applicable to the SJVAB[2]	10	N/A	10	100	100	100
Year 2018						
Emissions (tons/year)	0.00	0.00	0.00	0.00	0.01	0.00
Exceeds SJVAPCD CEQA thresholds?	No	N/A	No	N/A	No	No
Exceeds GC threshold?	No	N/A	No	No	No	No
Year 2019						
Emissions (tons/year)	6.57	62.60	99.80	0.32	23.19	5.08
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2020						
Emissions (tons/year)	9.63	98.67	133.86	0.42	25.62	6.74
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2021						
Emissions (tons/year)	6.56	61.22	114.98	0.32	12.39	4.88
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
Year 2022						
Emissions (tons/year)	2.48	20.17	43.95	0.08	1.74	1.41
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Source: Author's compilation, 2017

[1] The SJVAPCD has significance thresholds for NO_X, ROG/VOC, PM_{10}, and $PM_{2.5}$. The SJVAPCD's 2002 GAMAQI does not have thresholds for CO or SO_X.

[2] The GC *de minimis* thresholds for criteria pollutants are based on the SJVAB federal attainment status. The SJVAB is considered in extreme nonattainment for the ozone NAAQS, is a nonattainment area for $PM_{2.5}$, and is a maintenance area for the CO NAAQS (Fresno, Kern, San Joaquin, and Stanislaus County urbanized areas only—no portions of the Central Valley Wye alternative alignments are in these maintenance areas that are subject to conformity requirements) and PM_{10} NAAQS. Although the SJVAB is in attainment for SO_X, because SO_X is a precursor for $PM_{2.5}$, the $PM_{2.5}$ GC *de minimis* thresholds was used.

[3] While the SJVAPCD's 2002 GAMAQI does not include quantitative thresholds for CO and SO_X, project emissions were evaluated against the SJVAPCD's 2015 GAMAQI and determined that they would not exceed those quantitative thresholds.

[4] PM_{10} and $PM_{2.5}$ emissions have incorporated the SJVAPCD Regulation VIII requirements and dust control measures the Authority committed to in the Statewide Program EIR/EIS.

CEQA = California Environmental Quality Act
CO = carbon monoxide
GAMAQI = *Guide for Assessing and Mitigating Air Quality Impacts*
GC = General Conformity
N/A = not applicable
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table 7-17 Programmatic Construction Emissions: Avenue 21 to Road 13 Wye Alternative (tons/year)

Activities	VOC	CO^3	NO_X	$SO_2{}^3$	$PM_{10}{}^4$	$PM_{2.5}{}^4$
SJVAPCD annual CEQA significance thresholds[1]	10	N/A	10	N/A	15	15
Annual general conformity *de minimis* levels applicable to the SJVAB[2]	10	N/A	10	100	100	100
Year 2018						
Emissions (tons/year)	0.00	0.00	0.00	0.00	0.01	0.00
Exceeds SJVAPCD CEQA thresholds?	No	N/A	No	N/A	No	No
Exceeds GC threshold?	No	N/A	No	No	No	No
Year 2019						
Emissions (tons/year)	6.85	63.80	113.19	0.38	22.66	5.06
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2020						
Emissions (tons/year)	9.84	99.48	144.40	0.48	25.77	6.73
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2021						
Emissions (tons/year)	6.54	60.54	118.22	0.37	12.38	4.73
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
Year 2022						
Emissions (tons/year)	2.18	17.71	38.42	0.07	1.52	1.24
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Source: Author's compilation, 2017

[1] The SJVAPCD has significance thresholds for NO_X, ROG/VOC, PM_{10}, and $PM_{2.5}$. The SJVAPCD's 2002 GAMAQI does not have thresholds for CO or SO_X.

[2] The GC *de minimis* thresholds for criteria pollutants are based on the SJVAB federal attainment status. The SJVAB is considered in extreme nonattainment for the ozone NAAQS, is a nonattainment area for $PM_{2.5}$, and is a maintenance area for the CO NAAQS (Fresno, Kern, San Joaquin, and Stanislaus County urbanized areas only—no portions of the Central Valley Wye alternative alignments are in these maintenance areas that are subject to conformity requirements) and PM_{10} NAAQS. Although the SJVAB is in attainment for SO_X, because SO_X is a precursor for $PM_{2.5}$, the $PM_{2.5}$ GC *de minimis* thresholds was used.

[3] While the SJVAPCD's 2002 GAMAQI does not include quantitative thresholds for CO and SO_X, project emissions were evaluated against the SJVAPCD's 2015 GAMAQI and determined that they would not exceed those quantitative thresholds.

[4] PM_{10} and $PM_{2.5}$ emissions have incorporated the SJVAPCD Regulation VIII requirements and dust control measures the Authority committed to in the Statewide Program EIR/EIS.

CEQA = California Environmental Quality Act
CO = carbon monoxide
GAMAQI = *Guide for Assessing and Mitigating Air Quality Impacts*
GC = General Conformity
N/A = not applicable
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_2 = sulfur dioxide
VOC = volatile organic compound

Table 7-18 Programmatic Construction Emissions: SR 152 (North) to Road 11 Wye Alternative (tons/year)

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
SJVAPCD annual CEQA significance thresholds[1]	10	N/A	10	N/A	15	15
Annual general conformity *de minimis* levels applicable to the SJVAB[2]	10	N/A	10	100	100	100
Year 2018						
Emissions (tons/year)	0.00	0.00	0.00	0.00	0.01	0.00
Exceeds SJVAPCD CEQA thresholds?	No	N/A	No	N/A	No	No
Exceeds GC threshold?	No	N/A	No	No	No	No
Year 2019						
Emissions (tons/year)	6.66	63.00	104.21	0.34	22.75	4.93
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2020						
Emissions (tons/year)	9.66	98.67	136.32	0.44	25.50	6.57
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	Yes	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No
Year 2021						
Emissions (tons/year)	6.32	59.40	109.78	0.33	12.08	4.55
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Activities	VOC	CO[3]	NO_X	SO_2[3]	PM_{10}[4]	$PM_{2.5}$[4]
Year 2022						
Emissions (tons/year)	2.45	17.93	38.26	0.33	1.72	1.50
Exceeds SJVAPCD CEQA thresholds?	No	N/A	Yes	N/A	No	No
Exceeds GC threshold?	No	N/A	Yes	No	No	No

Source: Author's compilation, 2017
[1] The SJVAPCD has significance thresholds for NO_X, ROG/VOC, PM_{10}, and $PM_{2.5}$. The SJVAPCD's 2002 GAMAQI does not have thresholds for CO or SO_X.
[2] The GC *de minimis* thresholds for criteria pollutants are based on the SJVAB federal attainment status. The SJVAB is considered in extreme nonattainment for the ozone NAAQS, is a nonattainment area for $PM_{2.5}$, and is a maintenance area for the CO NAAQS (Fresno, Kern, San Joaquin, and Stanislaus County urbanized areas only—no portions of the Central Valley Wye alternative alignments are in these maintenance areas that are subject to conformity requirements) and PM_{10} NAAQS. Although the SJVAB is in attainment for SO_X, because SO_X is a precursor for $PM_{2.5}$, the $PM_{2.5}$ GC *de minimis* thresholds was used.
[3] While the SJVAPCD's 2002 GAMAQI does not include quantitative thresholds for CO and SO_X, project emissions were evaluated against the SJVAPCD's 2015 GAMAQI and determined that they would not exceed those quantitative thresholds.
[4] PM_{10} and $PM_{2.5}$ emissions have incorporated the SJVAPCD Regulation VIII requirements and dust control measures the Authority committed to in the Statewide Program EIR/EIS.
CEQA = California Environmental Quality Act
CO = carbon monoxide
GAMAQI = *Guide for Assessing and Mitigating Air Quality Impacts*
GC = General Conformity
N/A = not applicable
NAAQS = National Ambient Air Quality Standards
PM_{10} = particulate matter smaller than or equal to 10 microns in diameter
$PM_{2.5}$ = particulate matter smaller than or equal to 2.5 microns in diameter
SJVAB = San Joaquin Valley Air Basin
SJVAPCD = San Joaquin Valley Air Pollution Control District
SO_2 = sulfur dioxide
VOC = volatile organic compound

7.8.1.2 Construction Effects outside the San Joaquin Valley Air Basin from Material Hauling

Construction emissions included in the regional effects analysis considered emissions within the SJVAB. Rail would be constructed using ballast, sub-ballast, and concrete slabs. Concrete slab would be available within the SJVAB. The sub-ballast and ballast material could potentially be transported from areas outside the SJVAB. A preliminary emissions evaluation was conducted for transporting ballast materials from outside the SJVAB to the border of the air basin. Analysts considered six scenarios, representing a range of combinations of supply from the different quarries and different methods of hauling (either by truck to the nearest railhead and railway for the remainder of the distance, or by truck the entire distance). Analysts calculated emissions for all six scenarios as part of the material hauling analysis to provide a range of reasonable and potential outcomes.

Table 7-19 and Table 7-20 present the programmatic emissions for material hauling outside the air basin for the worst-case scenario, out of the six potential scenarios, compared with the GC *de minimis* thresholds and the CEQA thresholds, respectively. Detailed analysis and emission calculations for material hauling outside the SJVAB for all scenarios are provided in Appendix D. Because the conclusions of this Central Valley Wye Air Quality and Global Climate Change Technical Report and the Draft Supplemental EIR/EIS are generally consistent with or less severe than the conclusions in the Merced to Fresno Final EIR/EIS, the Central Valley Wye alternatives would not result in any additional pollutants exceeding the *de minimis* thresholds relative to the Merced to Fresno Final EIR/EIS. Thus, no further action is required to demonstrate the Central Valley Wye alternatives' compliance with GC. However, emissions are compared to the GC *de minimis* thresholds in Table 7-19 for informational purposes and to demonstrate the Central Valley Wye alternatives' consistency with the conclusions of the Merced to Fresno Final EIR/EIS.

Table 7-19 Worst-Case Annual Emissions in the San Francisco Bay Area Air Basin Compared to GC *de minimis* Thresholds

San Francisco Bay Area Air Basin	Emissions (tons per year)					
	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Worst-Case Scenario	9	31	1	1	< 1	1
GC *de minimis* threshold[1]	N/A	100	100	N/A	N/A	100

Source: Author's compilation, 2017
[1] N/A indicates that the area is in attainment for this pollutant; therefore, the threshold is not applicable.
CO = carbon monoxide
GC = General Conformity
N/A = not applicable
NO_X = nitrogen oxides
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds

Table 7-20 Worst-Case Daily Emissions in the San Francisco Bay Area Air Basin Compared to CEQA Daily Thresholds

San Francisco Bay Area Air Basin	Emissions (pounds per day)					
	CO	NO_X	$PM_{2.5}$	PM_{10}	SO_2	VOC
Worst-Case Scenario	166	571*	12	13	1	21
Bay Area AQMD Daily CEQA Thresholds[1]	N/A	54	54	82	N/A	54

Source: Author's compilation, 2017
* Exceeds the daily CEQA threshold
[1] N/A indicates that there is no CEQA daily threshold for this pollutant
AQMD = Air Quality Management District
CEQA = California Environmental Quality Act
CO = carbon monoxide
NO_X = nitrogen oxides
PM_{10} = particulate matter 10 microns or less in diameter
$PM_{2.5}$ = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compounds

The emissions results demonstrated that no scenarios would result in emissions that would exceed the GC *de minimis* thresholds in the SFBAAB.

Emissions could exceed the BAAMQD's CEQA thresholds for NO_X for all of the scenarios. NO_X emissions would be offset in the BAAMQD through the purchase of offsets.[6] Emissions in the BAAMQD from material hauling activities would be mitigated to a level of 10 tons per year or less. The amount of offsets required to mitigate effects would be a maximum of 21 tons in 2022, based on the worst-case emissions (Table 7-19), and the BAAMQD's annualized NO_X threshold of 10 tons per year.[7]

7.8.2 Health Risk Assessment and Other Localized Construction Effects

7.8.2.1 Guideway/Alignment Construction

Construction emissions have the potential to cause elevated criteria pollutant concentrations. These elevated concentrations may cause or contribute to exceedances of the NAAQS and CAAQS. Sensitive receptors (such as schools, residences, and health care facilities) are located near the construction areas in Chowchilla and Fairmead. During construction, sensitive receptors could be exposed to increased concentrations of toxic air contaminants, such as diesel particulate matter, which may present cancer risks. According to the OEHHA guidance, cancer risk is defined as the predicted risk of cancer (unitless) over a lifetime and is usually expressed as chances per million persons exposed (OEHHA 2015).

The increase in emissions associated with the guideway/alignment construction was added to the background concentration to estimate the ambient air pollutant concentration for comparison to the applicable NAAQS and CAAQS for all pollutants other than PM_{10} and $PM_{2.5}$. For PM_{10}, current District policy is to demonstrate compliance with the PM standards by comparing the project's predicted PM_{10} concentrations to the appropriate PM_{10} Significant Impact Levels (SIL). Because the $PM_{2.5}$ SILs were vacated, no analysis for $PM_{2.5}$ is necessary (Reed pers. comm.). Because most PM_{10} emissions are fugitive dust rather than exhaust, significance of PM_{10} emissions are evaluated by comparing predicted concentrations to the PM_{10} SIL for fugitive dust concentrations.

DPM is the primary TAC released from guideway/alignment construction activities. The modeled DPM concentrations were used in determining the total exposure dose and associated health effect. Specific details of the air dispersion modeling and health risk assessment are found in Appendix E.

According to the construction localized effect air dispersion modeling conducted, construction activities along the guideway/alignment would not exceed the applicable NAAQS and CAAQS or substantially contribute to further exacerbation of exceedances of PM_{10} standards.

7.8.2.2 Road Crossing Construction

Several road crossings would need to be modified to accommodate the HSR tracks. Building these road crossings would emit criteria pollutants and DPM, a TAC. Road crossings would be constructed at various locations along the alignment, and sensitive receptors may be located near these road crossing construction areas. These sensitive receptors could be exposed to health effects from elevated concentrations of criteria air pollutants and cancer risks associated with TACs.

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[6] Emissions presented in Table 7-20 are for the worst-case scenario only, which shows an exceedance of the BAAQMD CEQA threshold for NOx. However, all six scenarios analyzed would result in exceedances of the BAAQMD threshold for NOx, as shown in Appendix D.

[7] While the BAAQMD does not have an official annual NO_X threshold for construction, the established 54 pounds/day daily NO_X construction threshold is derived from an emissions rate of 10 tons/year. Both the rate of 10 tons/year and threshold of 54 pounds/day are based on the same federal permitting requirements; thus, a threshold of 10 tons/year is used in this analysis to determine the amount of NO_X offsets that would be required to mitigate material hauling emissions.

The increase in pollutant concentration associated with a road crossing was added to the background concentration to estimate the ambient air pollutant concentration for comparison to the applicable NAAQS and CAAQS for each road crossing for pollutants other than PM_{10}. PM_{10} concentrations were compared to the SIL. The modeled DPM concentrations were used in determining the total exposure dose and associated health effects Specific details of the air dispersion modeling and health risk assessment are found in Appendix E.

The concentration increase of criteria air pollutants associated with construction of the road crossings would not exceed the applicable NAAQS and CAAQS or substantially contribute to further exacerbation of exceedances of PM_{10} standards.

7.8.2.3 Concrete Batch Plant

Fugitive emissions generated from operation of concrete batch plants, which would produce concrete for the elevated structures (elevated rail) and retaining wall (retained-fill rail), are included in the total regional construction emissions for each Central Valley Wye alternative. These plants would be located along the alignment, although the potential locations of these are currently not known. The analysis conservatively assumed one concrete batch plant along the 2-mile segment, located at the intersection of the rail line and road crossing to model a worst-case scenario (because this would result in overlapping emissions from multiple features).

The batching operation is not expected to release criteria pollutants other than PM. However, it is expected to release several toxic metals that are components of the fugitive dust, including arsenic, beryllium, cadmium, hexavalent chromium, lead, and nickel. The portion of the PM emissions that is composed of these metals was based on SJVAPCD emission factors provided by the SJVAPCD for local concrete batch plants (SJVAPCD 2015e).

The increase in PM_{10} concentration associated with a batch plant was compared to the PM SIL to estimate if the batching operation would contribute significantly to an exceedance of the applicable air pollutant standards. The modeled metal concentrations were used in determining the total health effects from the combined features. Specific details of the air dispersion modeling and health risk assessment are included in Appendix E.

According to the construction localized effect air dispersion modeling, concrete batching activities would not substantially contribute to further exacerbation of exceedances of PM_{10} standards.

7.8.2.4 Combined Effect from Construction of All Features

In addition to the individual effects from the three features described in Section 7.8.2.1, Guideway/Alignment Construction; Section 7.8.2.2, Road Crossing Construction; and Section 7.8.2.3, Concrete Batch Plant, the total local effects from construction of the Central Valley Wye alternatives were analyzed to model a worst-case scenario. For criteria pollutants, the peak concentrations from each facility were summed and added to the background concentration to estimate the ambient air pollutant concentration for comparison to the applicable NAAQS and CAAQS. The peak PM_{10} concentrations from all sources combined, matched to occur at the same time and in the same location, were compared to the SIL.

According to the construction localized effect air dispersion modeling, the total of all construction activities would not exceed the applicable NAAQS and CAAQS or substantially contribute to further exacerbation of exceedances of PM_{10} standards. The results of the air dispersion modeling analysis for CO, SO_2, NO_2, and PM_{10} are shown in Tables 7-21, 7-22, 7-23, and 7-24, respectively. The health risk assessment concludes that the incremental increase in cancer risk associated with exposure to TAC emissions from construction equipment exhaust and concrete batching activities would not exceed the applicable cancer threshold of 20 in 1 million, nor would the acute or chronic noncancer hazard indices exceed the unit-less threshold of 1.0. Table 7-25 presents the health risk assessment results. The health risk values are based on a modeled scenario representative of all Central Valley Wye alternatives, consistent with methodology for other HSR sections. Emissions used in the analysis are representative of a typical 2-mile length of construction that is applicable to all of the Central Valley Wye alternatives. The health risk assessment also assumes that residential uses would be adjacent to the construction fence line, which is a worst-case scenario for any of the Central Valley Wye alternatives. Therefore, the localized pollutant concentrations and health impacts would be identical for all Central Valley Wye alternatives.

Table 7-21 Carbon Monoxide Concentration Effects from Construction Emissions – All Central Valley Wye Alternatives

Construction Area	Maximum Incremental Off-site 1-hour Average CO Concentration (µg/m3)	Background[2] 1-hour CO Concentration (µg/m3)	Total Off-site 1-hour CO Concentration (µg/m3)	NAAQS (µg/m3) equivalent	CAAQS (µg/m3) equivalent
Concrete Batch Plant	NA[1]	3,435	NA[1]	**40,000**	**23,000**
Road Crossings	197		3,632		
Rail Segment	286		3,721		
Combined[4]	484		3,919		
Construction Area	**Maximum Incremental Off-site 8-hour Average CO Concentration (µg/m³)**	**Background[3] 8-hour CO Concentration (µg/m³)**	**Total Off-site 8-hour CO Concentration (µg/m³)**	**NAAQS (µg/m³) equivalent**	**CAAQS (µg/m³) equivalent**
Concrete Batch Plant	NA[1]	2,748	NA[1]	**10,000**	**10,000**
Road Crossings	37		2,785		
Rail Segment	55		2,803		
Combined[4]	92		2,840		

Source: Author's compilation, 2017
[1] The concrete batch plant does not have any substantial exhaust emissions.
[2] The highest monitored 1-hour value from the Fresno, Hanford, or Bakersfield stations was used as the background concentration.
[3] The highest monitored 8-hour value from the Fresno or Garland stations was used as the background centration.
[4] "Combined" conservatively estimated the sum of worst-case concentrations from all features, irrespective of location.
CO = carbon monoxide
NAAQS = National Ambient Air Quality Standards
CAAQS = California Ambient Air Quality Standards
µg/m3 = micrograms per cubic meter

Table 7-22 Sulfur Dioxide Concentration Effects from Construction Emissions – All Central Valley Wye Alternatives

Construction Area	Maximum[1] Incremental Off-site 1-hour Average SO_2 Concentration (µg/m3)	Background[2,3] 1-hour SO_2 Concentration (µg/m3)	Total Off-site 1-hour SO_2 Concentration (µg/m3)	NAAQS (µg/m3) equivalent	CAAQS (µg/m3) equivalent
Concrete Batch Plant	NA[1]	19	NA[1]	**196**	**655**
Road Crossings	0.5		20		
Rail Segment	1.0		20		
Combined[5]	1.5		21		
Construction Area	**Maximum Incremental Off-site 24-hour Average SO_2 Concentration (µg/m³)**	**Background[3] 24-hour SO_2 Concentration (µg/m³)**	**Total Off-site 24-hour SO_2 Concentration (µg/m³)**	**NAAQS (µg/m³) equivalent**	**CAAQS (µg/m³) equivalent**
Concrete Batch Plant	NA[1]	11	NA[1]	NA	**105**
Road Crossings	0.0		11		
Rail Segment	0.1		11		
Combined[3]	0.1		11		

Source: Author's compilation, 2017
[1] The concrete batch plant does not have any substantial exhaust emissions.
[2] The highest monitored 24-hour value from the Fresno station was used as the background concentration. SO2 concentrations represented as the 1st highest from each averaging period (USEPA 2017b)
[3] "Combined" conservatively estimated the sum of worst-case concentrations from all features, irrespective of location.
SO_2 = sulfur dioxide
NAAQS = National Ambient Air Quality Standards
CAAQS = California Ambient Air Quality Standards
µg/m3 = micrograms per cubic meter

Table 7-23 Nitrogen Dioxide Concentration Effects from Construction Emissions – All Central Valley Wye Alternatives

Construction Area	8th Highest Max Daily Incremental Off-site 1-hour NO_2 Concentration (µg/m3)[1]	Background[2] 1-hour NO_2 Concentration (µg/m3)	Total Off-site 1-hour NO_2 Concentration (µg/m3)	NAAQS (µg/m3) equivalent	CAAQS (µg/m3) equivalent
Concrete Batch Plant	NA[3]	82	NA[1]	**188**	**339**
Road Crossings	39		121		
Rail Segment	68		149		
Combined	95		177		
Construction Area	**Maximum Incremental Off-site Annual Average NO_2 Concentration (µg/m^3) [4]**	**Background[5] Annual NO_2 Concentration (µg/m^3)**	**Total Off-site Annual NO_2 Concentration (µg/m^3)**	**NAAQS (µg/m^3) equivalent**	**CAAQS (µg/m^3) equivalent**
Concrete Batch Plant	NA[1]	12	NA[1]	**100**	**57**
Road Crossings	1		12		
Rail Segment	2		13		
Combined	3		14		

Source: Author's compilation, 2017

[1] NO_2 1-hour concentrations represented as the 5-year average of the 8th highest daily maximum value. An 80% conversion of NO_x to NO_2 is conservatively assumed per CAPCOA guidance (October 27, 2011. See http://www.valleyair.org/busind/pto/tox_resources/CAPCOANO2GuidanceDocument10-27-11.pdf.)

[2] Background 1-hour concentration based on the monitoring background values presented by SJVAPCD (SJVAPCD 2010). The highest value of the two local stations (Madera or Merced) was used as the 1-hour background concentration. It represents the 3-year average of the 98th percentile of the annual distribution of the daily 1-hour max ppb monitored 1-hour value.

[3] The concrete batch plant does not have any substantial exhaust emissions.

[4] Annual NO_2 concentrations represented as the 5-year period average conservatively assuming 100% conversion.

[5] Annual background concentration is the annual mean monitor value from the Madera Pump Yard station. NO_2 = nitrogen dioxide

NAAQS = National Ambient Air Quality Standards

CAAQS = California Ambient Air Quality Standards

µg/m3 = micrograms per cubic meter

Table 7-24 PM_{10} Concentration Effects from Construction Emissions – All Central Valley Wye Alternatives

Construction Area	Maximum Incremental Off-site 24-hour Average PM_{10} Concentration (µg/m3)	Significant Impact Level (SIL)[1] (µg/m3)
Concrete Batch Plant	1.3	10.4
Road Crossings	1.7	
Rail Segment	5.9	
Combined	7.5	
Construction Area	**Maximum Incremental Off-site Annual Average PM10 Concentration (µg/m^3)**	**Significant Impact Level (SIL)[1] (µg/m^3)**
Concrete Batch Plant	0.1	2.1
Road Crossings	0.1	
Rail Segment	0.3	
Combined	0.6	

Source: Author's compilation, 2017
[1] The background concentrations already exceed ambient air quality standards. Thus, the appropriate comparison is to determine if the project would contribute to further exceedances. The modeled concentrations show the incremental increase in concentration due to construction emissions.
PM_{10} = particulate matter greater than 10 microns in diameter
NAAQS = National Ambient Air Quality Standards
CAAQS = California Ambient Air Quality Standards
µg/m3 = micrograms per cubic meter

Table 7-25 Excess Cancer and Noncancer Maximum Health Risk Associated with Construction Emissions from All Features Combined – All Central Valley Wye Alternatives

Chemical	Max Cancer Risk (per million)[2]	Max Chronic Hazard Index[1]	Max Acute Hazard Index[1]
Aluminum	-	-	-
Arsenic	0.0	0.0	-
Barium	-	-	-
Beryllium	0.0	0.0	-
Cadmium	0.0	0.0	-
Carbon Monoxide	-	-	-
Chromium	-	-	-
Cobalt	-	-	-
Copper	-	-	-
Cr(VI)	0.0	0.0	-
Diesel Exhaust Particulate Matter	18.0	0.0	-
Lead	0.0	-	-
Manganese	-	-	-
Nickel	0.0	0.0	-
Nitrogen Dioxide	-	-	0.7

Chemical	Max Cancer Risk (per million)[2]	Max Chronic Hazard Index[1]	Max Acute Hazard Index[1]
PM_{10}	-	-	-
$PM_{2.5}$	-	-	-
Selenium	-	-	-
Sulfur Dioxide	-	-	0.0
Volatile Organic Compounds	-	-	-
Zinc	-	-	-
Total Risk at Most Affected Receptor	18.1	0.0	0.7
Risk Threshold	20.0	1.0	1.0

Source: Author's compilation, 2017

[1] Hazard indices are shown by pollutant contributions to the most affected organ system (respiratory). All NO_2 risks assume an 80% ambient ratio to NOx concentrations.

[2] Cancer risk represents the incremental increase in the number of cancers in a population of 1 million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways.

7.8.3 Asbestos and Lead-Based Paint

The demolition of asbestos-containing materials is subject to the limitations of the National Emission Standards for Hazardous Air Pollutants regulations and would require an asbestos inspection. The Authority would consult with the SJVAPCD's Compliance Division before demolition activities begin. Strict compliance with existing asbestos regulations would avoid effects from the demolition of asbestos-containing materials (SJVAPCD 2002).

The California Department of Conservation, Division of Mines and Geology, has designated Merced and Madera Counties, through which the Central Valley Wye alternatives would pass, as areas likely to contain NOA. However, the specific areas of the counties in which the alignments would be built are designated as areas not likely to contain NOA (CDMG 2000). Therefore, NOA would not likely be disturbed during construction. Nevertheless, analysts would conduct NOA surveys before any excavation starts.

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

8 GLOBAL CLIMATE CHANGE EFFECTS ANALYSIS

Using the methodologies described in Section 5, this section evaluates and discusses the effects of the Central Valley Wye alternatives pertaining to global climate change and GHGs.

8.1 Statewide and Regional Operational Emissions Analysis

Table 8-1 summarizes the statewide GHG emission changes (expressed in terms of CO_2e) resulting from the Central Valley Wye alternatives under the medium, and high ridership scenarios for the 2015 existing CEQA baseline and 2029 and 2040 future NEPA baselines. The analysis estimated the emission changes from reduced on-road VMT, reduced intrastate aircraft travel, and increased electrical demand. As Table 8-1 shows, the Central Valley Wye alternatives are predicted to have a beneficial effect on statewide GHG emissions relative to both the 2015 existing CEQA baseline and 2029 and 2040 future NEPA baselines, because it would result in a net reduction in GHG emissions.

Table 8-1 Estimated Statewide GHG Emission Changes due to the Central Valley Wye Alternatives[1] (under the Medium and High Scenarios)

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2015 Existing Baseline		
On-Road Vehicles	-1.1	-1.5
Aircraft	-0.7	-0.7
Power Plants	0.5	0.5
Total Statewide Net Emissions	-1.3	-1.6
2029 Future Baseline		
Roadways	-0.4	-0.3
Aircraft	-0.5	-0.5
Power Plants	0.4	0.4
Total Statewide Net Emissions	-0.5	-0.3
Year 2040 Future Baseline		
On-Road Vehicles	-0.5	-1.1
Aircraft	-1.0	-0.9
Power Plants	0.5	0.5
Total Statewide Net Emissions	-1.0	-1.5

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT = million metric tons

This analysis considers the GHG effects associated with the Central Valley Wye alternatives beyond 2020, consistent with EO B-30-15 (refer to Section 3.2.3.7), by assessing operational emissions in 2029 and 2040 for three baselines. Table 8-1 shows that the Central Valley Wye alternatives would result in GHG reductions relative to the 2029 and 2040 future baselines and would help the state reach the goal established in EO B-30-15—40 percent below 1990 levels. Based on the 1990 emissions of 431 MMT CO_2e, the State would need to reduce emissions by 172 MMT CO_2e to achieve the EO B-30-15 goal. The Central Valley Wye alternatives would reduce statewide GHG emissions by 1 to 1.5 MMT CO_2e in the design year (2040), depending on the ridership and segment scenario. These reductions correspond to an annual reduction of 0.6 to 0.9 percent of the 172 MMT CO_2e needed to achieve the EO B-30-15 goal.

Table 8-1 also shows the net change in emissions for the 2015 existing baseline would be a decrease in GHG emissions. Despite increases in power plant emissions from the Central Valley Wye alternatives plus all other statewide activity between 2015 and 2029 and 2040, total statewide GHG emissions in 2029 and 2040 would be less than the level of GHG emissions in 2015. As evident in Table 8-1, the primary factor for the net decrease in emissions is from decreases in on-road vehicle emissions due to advancements in vehicle emissions technology and the retirement of older, higher-emitting vehicles. Aircraft emissions would increase slightly with or without the Central Valley Wye alternatives because of growth in the state. Thus, the Central Valley Wye alternative's effect on GHG emissions would be beneficial with respect to both the 2015 existing baseline and the 2029 and 2040 future baselines.

8.1.1 On-Road Vehicles

The Central Valley Wye alternatives would reduce annual roadway VMT because travelers would use the HSR rather than drive (see Table 7-8 for VMT under the No Project Alternative and under the Central Valley Wye alternatives). The on-road vehicle emission analysis is based on projected VMT changes and associated average daily speed estimates, calculated for each affected county based on the ridership estimates presented in the HSR 2016 Business Plan (Authority 2016b). Analysts obtained GHG emission factors from EMFAC2014, using statewide parameters.

As shown in Table 8-1, the Central Valley Wye alternatives are predicted to decrease statewide on-road GHG emissions relative to both the 2015 existing CEQA baseline and 2029 and 2040 future NEPA baselines. On a county and regional level, Table 8-2 indicates the Central Valley Wye alternatives are predicted to result in a decrease in on-road GHG emissions relative to all baselines as well. As discussed previously, on-road vehicle emissions are expected to decrease in the future because of advancements in vehicle emissions technology and the retirement of older, higher-emitting vehicles. Thus, the reduction in GHG emissions from on-road vehicles as a result of the Central Valley Wye alternatives are demonstrated on county, regional, and statewide levels for both baselines.

Table 8-2 On-Road Vehicles Greenhouse Gas Emission Changes due to the Central Valley Wye Alternatives[1] (under the Medium and High Scenarios)

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2015 Existing Baseline		
Merced	-0.05	-0.06
Madera	-0.03	-0.04
Total Regional Net Emissions	-0.07	-0.10
2029 Future Baseline		
Merced	-0.02	-0.03
Madera	-0.02	-0.02
Total Regional Net Emissions	-0.04	-0.05

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2040 Future Baseline		
Merced	-0.03	-0.05
Madera	-0.02	-0.03
Total Regional Net Emissions	-0.05	-0.08

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT = million metric tons
VMT = vehicle miles traveled

8.1.2 Aircraft Emissions

Analysts calculated aircraft emissions by using the fuel consumption factors and emission factors from the CARB's 2000–2014 *Greenhouse Gas Emissions Inventory Technical Support Document* and the accompanying technical support document. The emission factor includes landing and take-off and cruise operations. Analysts calculated average aircraft GHG emissions based on the profile of intrastate aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the project section through the travel demand modeling analysis conducted for the project section, based on the ridership estimates presented in the Authority's 2016 Business Plan (Authority 2016b).

Refer to Table 7-8 for the number of flights in 2015, 2029, and 2040 with and without the Central Valley Wye alternatives. As shown in Table 8-3, the Central Valley Wye alternatives would reduce regional (San Joaquin Valley) and statewide emissions relative to the existing 2015 CEQA baseline and 2029 and 2040 future NEPA baselines.

Table 8-3 Aircraft Greenhouse Gas Emission Changes due to the Central Valley Wye Alternatives[1] (under the Medium and High Scenarios)

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2015 Existing Baseline		
Regional (San Joaquin Valley)	-0.02	-0.01
Total Statewide Net Emissions	-0.70	-0.67
2029 Future Baseline		
Regional (San Joaquin Valley)	-0.01	-0.01
Total Statewide Net Emissions	-0.46	-0.50

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2040 Future Baseline		
Regional (San Joaquin Valley)	-0.02	-0.01
Total Statewide Net Emissions	-0.97	-0.94

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide and regional emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT = million metric tons

8.1.3 Indirect Power Plant Emissions

The electrical demands due to propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities were calculated as part of the project design. Average GHG emission factors for each kilowatt-hour required were derived from USEPA eGRID2012 electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power. As shown in Table 8-4, the electrical requirements for the Central Valley Wye alternatives would increase statewide and regional indirect GHG emissions.

In addition, because of the state requirement that an increasing fraction (50 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, the emissions generated for the HSR system are expected to be lower in the future when compared to emissions estimated for this analysis.

Table 8-4 Power Plant Greenhouse Gas Emission Changes due to the Central Valley Wye Alternatives[1] (under the Medium and High Scenarios)

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2015 Existing Baseline		
Regional	0.05	0.05
Statewide	0.5	0.5
2029 Future Baseline		
Regional	0.04	0.04
Statewide	0.4	0.4

Element	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2040 Future Baseline		
Regional	0.05	0.05
Statewide	0.5	0.5

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in statewide and regional emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
MWh = megawatt-hour(s)
HSR = high-speed rail
MMT = million metric tons

8.1.4 Total Regional Operational Greenhouse Gas Emissions

A summary of the Central Valley Wye alternative's effects on regional GHG emissions, which include the emissions from vehicles, aircraft, and power plants, is shown in Table 8-5. The Central Valley Wye alternatives would reduce regional GHG emissions relative to the 2015 existing CEQA baseline and 2029 and 2040 future NEPA baselines. In addition, as shown in Table 8-1, the Central Valley Wye alternatives would result in a net reduction in GHG emissions statewide for all baselines.

Table 8-5 Summary of Regional GHG Emissions Changes due to Operation of the Central Valley Wye Alternatives[1] (under the Medium and High Scenarios)

Emission Sources	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
2015 Existing Baseline		
On-Road Vehicles	-0.07	-0.10
Aircraft	-0.02	-0.01
Power Plants	0.05	0.05
Total Regional Net Emissions	-0.06	-0.06
2029 Future Baseline		
Roadways	-0.04	-0.05
Aircraft	-0.01	-0.01
Power Plants	0.04	0.04
Total Regional Net Emissions	-0.01	-0.02
2040 Future Baseline		
On-Road Vehicles	-0.05	-0.08
Aircraft	-0.02	-0.01

Emission Sources	Change in CO_2e Emissions due to HSR (MMT/year)[2]	
	M	H
Power Plants	0.05	0.05
Total Regional Net Emissions	-0.03	-0.04

Source: Author's compilation, 2017
[1] Because the Central Valley Wye alternatives would not exist in isolation without the rest of the HSR system, this scenario also applies to the larger HSR system. Emissions in this table show the difference in regional emissions with and without the Central Valley Wye alternatives + HSR system
[2]Totals may not add up exactly due to rounding.
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
HSR = high-speed rail
MMT = million metric tons

8.2 Greenhouse Gas Construction Emissions

8.2.1 Construction Effects within the San Joaquin Valley Air Basin

GHG emissions generated from construction of the Central Valley Wye alternatives would be short term. However, because the time that CO_2 remains in the atmosphere cannot be definitively quantified due to the wide range of time scales in which carbon reservoirs exchange CO_2 with the atmosphere, there is no single value for the half-life of CO_2 in the atmosphere (IPCC 1997). Therefore, the duration that CO_2 emissions from a short-term project would remain in the atmosphere is unknown.

Table 8-6 shows construction activity emissions associated with the Central Valley Wye alternatives, consistent with the CEQ's guidance that a proposed action's direct and indirect GHG emissions be quantified (CEQ 2016). The total GHG construction emissions of the Central Valley Wye alternatives would be less than 0.02 percent of the total annual statewide GHG emissions.[8]

Table 8-6 Central Valley Wye Alternatives' CO_2e Construction Emissions (metric tons/year)[1,2]

Year	Central Valley Wye Alternative			
	SR 152 (North) to Road 13	SR 152 (North) to Road 19	Avenue 21 to Road 13	SR 152 (North) to Road 11
2018	< 1	< 1	< 1	< 1
2019	23,575	20,380	25,783	22,164
2020	28,151	25,203	30,285	26,786
2021	24,606	22,397	26,807	23,191
2022	4,967	5,627	4,967	4,833
Total	81,300	73,607	87,842	76,974
Amortized GHG Emissions (averaged over 25 years)				
CO_2 per year	3,252	2,944	3,514	3,079

[8] A GHG emissions inventory for the SJVAPCD was not available at the time of the release of this document, so the comparison was made to the most recent CARB emissions inventory, which estimated that the annual CO_2e emissions in California are about 442 million metric tons (CARB 2016c).

Year	Central Valley Wye Alternative			
	SR 152 (North) to Road 13	SR 152 (North) to Road 19	Avenue 21 to Road 13	SR 152 (North) to Road 11
Payback of GHG Emissions (months)[3]				
2015 Existing Baseline (Central Valley Wye alternatives in 2015 vs 2015 No Central Valley Wye alternatives)	< 1 month	< 1 month	< 1 month	< 1 month
2040 Future Baseline (Central Valley Wye alternatives in 2040 vs 2040 No Central Valley Wye alternatives)	< 1 to 1 month	< 1 to 1 month	< 1 to 1 month	< 1 to 1 month

Source: Author's compilation, 2017
Emission factors for CO_2 do not account for improvements in technology.
[1] Project life assumed to be 25 years.
[2] According to the USEPA, emissions of CH_4 and N_2O from passenger vehicles are much lower than emissions of CO_2, contributing in the range of 1 to 5 percent of the CO_2e emissions (USEPA 2011). Therefore, to account for the CH_4 and N_2O emissions, the CO_2 emissions from on-road construction vehicles were conservatively increased by 5 percent to calculate the CO_2e emissions. It was assumed that this approach for passenger vehicles is applicable to all emissions sources evaluated.
[3] Payback periods were estimated by dividing the GHG emissions during construction years by the annual GHG emission reduction during operation. See Table 8-1 and Table 8-2 for operational GHG emission-reduction data. The range in payback days represents the range of emissions changes based on the medium and high ridership scenarios.
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
GHG = greenhouse gas
USEPA = U.S. Environmental Protection Agency

Table 8-6 also shows the amortized GHG emissions during Central Valley Wye alternatives construction. The half-life of CO_2 is not defined, and other GHG pollutants such as N_2O can remain in the atmosphere for 120 years (IPCC 1997). To estimate the amortized GHG emissions conservatively, the Central Valley Wye alternatives life is conservatively assumed to be only 25 years (although the actual Central Valley Wye alternatives life would likely be much longer). The amortized GHG construction emissions for each of the Central Valley Wye alternatives would be less than 4,000 metric tons CO_2e per year, as Table 8-6 shows. The increase in GHG emissions generated during construction would be offset in a matter of months during operation by the net GHG reductions in operation (because of car and aircraft trips removed in the Merced-to-Fresno area).[9]

8.2.2 Material Hauling Outside the San Joaquin Valley Air Basin

The GHG emissions associated with material hauling outside the SJVAB would be short term. As shown in Table 8-7, total GHG emissions from the various material-hauling scenarios would be less than 14,000 metric tons of CO_2e. The total GHG construction emissions that would occur for material hauling outside of the SJVAB for the Central Valley Wye alternatives would be less than 0.003 percent of the annual statewide GHG emissions.[10] The detailed analysis of hauling emissions outside of the SJVAB are provided in Appendix D.

[9] The GHG emissions from construction will be partially paid back prior to operation since the Voluntary Emission Reduction Agreement (VERA) program will also have the co-benefit of reducing some GHG emissions, although this is not formally part of the VERA. The Authority will track these reductions, which will be included in both the GHG report to the legislature and the Sustainability Plan. This will result in some of the construction GHG emissions being paid back closer in time to their occurrence. Lastly, the Authority is developing a multifaceted urban forestry program that would directly offset construction GHG emissions in the Central Valley Wye, further reducing GHG impacts.

[10] Annual CO_2e emissions in California are about 442 million metric tons, based on the most recent inventory from the CARB (CARB 2016c).

Table 8-7 GHG Emissions from Material Hauling outside SJVAB

Scenarios	Worst-Case Scenario	
	CO_2 (metric tons/year)	CO_2e (metric tons/year)[1]
Scenario 1	4,272	4,497
Scenario 2	13,211	13,906
Scenario 3	3,685	3,879
Scenario 4	12,332	12,981
Scenario 5	3,823	4,025
Scenario 6	12,919	13,599

Source: Author's compilation, 2017
[1] According to the USEPA, emissions of CH_4 and N_2O from passenger vehicles are much lower than emissions of CO_2, contributing in the range of 1 to 5 percent of the CO_2e emissions (USEPA 2011). Therefore, to account for the CH_4 and N_2O emissions, the CO_2 emissions were conservatively increased by 5 percent to calculate the CO_2e emissions. It was assumed that this approach for passenger vehicles is applicable to these other mobile emissions sources.
GHG = greenhouse gas
CO_2 = carbon dioxide
CO_2e = carbon dioxide equivalent
SJVAB = San Joaquin Valley Air Basin

9 CUMULATIVE EFFECTS

The RSA for cumulative air quality is the SJVAB and the RSA for global climate change is the state of California and global atmosphere. Air quality and global climate change are inherently cumulative resources, because criteria pollutant and GHG emissions, once emitted, mix into the atmosphere and affect a larger area than an individual project site. Thus, this cumulative analysis does not consider individual cumulative projects in the vicinity of the Central Valley Wye alternatives; rather, it uses the same thresholds of significance as the project-level analysis due to the inherently cumulative nature of these resources.

9.1 Near- and Long-Term Operations

State: Even with the more stringent regulations on GHG emissions expected in the future, the projected growth in California may result in cumulative increases in GHG emissions. Increased GHG emissions from past, present, and planned future projects in the state would result in effects on global climate change. The Central Valley Wye alternatives statewide demand for electricity could result in indirect GHG emissions from power generation facilities. Although the Authority has adopted a policy to purchase renewable, clean-power energy sources, it cannot guarantee that only renewable energy is used to power the HSR system, because the PG&E power distribution network does not distribute energy based on energy sources. Therefore, GHG emissions may be associated with the provisions of energy to the HSR system. However, overall, the Central Valley Wye alternatives would decrease GHG emissions by reducing vehicle and aircraft trips and would also result in a net reduction in CO_2 emissions, as described in Section 8. This reduction in GHG emissions would more than offset the increase in GHG emissions associated with project facilities. Therefore, the Central Valley Wye alternatives would result in a net decrease in GHG emissions from operations.

Regional: Operation of the HSR would help the region attain air quality standards and plans by reducing the amount of regional vehicular traffic and providing an alternative mode of transportation. Because the Central Valley Wye alternatives would help to decrease emissions of all criteria pollutants and precursors (such as ROG and NO_X), it would result in a net benefit to regional air quality.

Local: Cumulative CO effects would not occur, because, as discussed in Section 7.3, Microscale Carbon Monoxide Analysis, roadways would be grade-separated and the Central Valley Wye alternatives would not affect intersections along the alignment.

9.2 Construction

Air quality construction effects associated with the Central Valley Wye alternatives would be above the SJVAPCD's mass emissions criteria pollutant significance thresholds.

State: As described in Section 7.8.1.1, Construction Effects within the San Joaquin Valley Air Basin, construction of the HSR would result in a one-time increase in GHG emissions. The emissions associated with construction of the HSR are anticipated to be offset in 1 month or less of train operations because of reduced passenger vehicle travel on roadways. Based on this short offset time period, the overall GHG effects (construction plus operation) would be negative and would therefore be consistent with AB 32 goals.

Regional: For criteria pollutants, the SJVAPCD has adopted a cumulative threshold of significance of 10 tons per year for ozone precursors (VOC and NO_X) and 15 tons per year for PM_{10} and $PM_{2.5}$. The SJVAPCD has determined that projects below these significance thresholds would not have a cumulatively considerable effect on air quality in the SJVAB, as they are consistent with the SJVAPCD's attainment strategy and would not prevent the SJVAPCD from achieving attainment.

Local: Emissions analysis at the local level includes the criteria pollutants PM_{10}, $PM_{2.5}$, NO_2, CO, and SO_2, and TACs. The construction of the Central Valley Wye alternatives would result in criteria pollutant and TAC emissions near the HSR guideway/alignment, road crossing, and concrete batch plant areas.

The cumulative NO_2 threshold is the more stringent of state and federal ambient air quality standards for hourly (188 µg/m^3) and annual (57 µg/m^3) concentrations. The cumulative CO threshold is the more stringent of the ambient air quality standards for 1-hour average (23,000 µg/m^3) and 8-hour average (10,000 µg/m^3) concentrations. The cumulative SO_2 threshold is the more stringent of the ambient air quality standards for 1-hour average (196 µg/m^3) and 24-hour average (105 µg/m^3) concentrations. Maximum concentrations for the Central Valley Wye alternatives would be less than these thresholds, as discussed in Section 7.8.2, Health Risk Assessment and Other Localized Construction Effects. Therefore, construction emissions would not cause or contribute to projected localized exceedances of the NO_2, CO, and SO_2 air quality standards.

For PM_{10}, the background concentrations in the SJVAB already exceed applicable ambient air quality standards. Therefore, the Central Valley Wye alternative's effects are evaluated by examining the incremental increase in PM_{10} concentration associated with Central Valley Wye alternatives emissions. If the incremental PM_{10} concentration increases are estimated to result in an increase in ambient concentrations less than the SJVAPCD SILs for 24-hour (10.4 µg/m^3) and annual (2.1 µg/m^3) concentrations, the Central Valley Wye alternatives would not contribute substantially to further exceedances of the ambient air quality standards. The Central Valley Wye alternatives design incorporates the enhanced dust control measures recommended by the SJVAPCD, which would decrease PM_{10} emissions and concentrations. Thus, the contribution of Central Valley Wye alternatives construction emissions to localized PM_{10} concentrations would not contribute substantially to further exceedances of the PM_{10} ambient air quality standard.

The SJVAPCD has established thresholds of significance for TACs that are protective of health. Because the established TAC significance thresholds are highly conservative, if TAC emissions are below these thresholds, the Central Valley Wye alternatives would not be expected to result in an adverse effect (SJVAPCD 2012a). Analysts compared cancer risks associated with TAC emissions from Central Valley Wye alternatives construction to the SJVAPCD CEQA threshold of 20 in 1 million to assess the level of effect, and compared chronic and acute hazard indices associated with Central Valley Wye alternatives construction emissions to the SJVAPCD unit-less CEQA threshold of 1.0. The HSR assessment of localized TAC health effects on sensitive receptors near construction work areas indicates that risks would be below the TAC risk thresholds of significance (see Section 7.8.2).

10 CONFORMITY ANALYSIS

Projects requiring approval or funding from federal agencies and that are in areas designated as nonattainment or maintenance for the NAAQS may be subject to the USEPA's Conformity Rule. The two types of federal conformity are transportation conformity and GC.

Conformity refers to conforming to, or being consistent with, SIP for compliance with the CAA. The USEPA's Conformity Rule requires SIP conformity determinations on transportation plans, programs, and projects before they are approved or adopted (i.e., eliminating or reducing the severity and number of violations of the NAAQS, and achieving expeditious attainment of such standards [40 C.F.R. § 93]). Federal activities, such as federally sponsored projects, may not cause or contribute to new violations of air quality standards, exacerbate existing violations, or interfere with timely attainment or required interim emission reductions toward attainment.

Transportation conformity applies to those projects that will have FHWA or Federal Transit Authority (FTA) funding or require FHWA/FTA approval. GC applies to those projects that will have funding or require approval from any federal agency other than FHWA/FTA.

The FRA and USEPA have determined that GC may be applicable to the Central Valley Wye alternatives. The lead agency for the Central Valley Wye alternatives is the FRA, and FHWA/FTA involvement is not anticipated other than incidental FHWA or FTA funding for joint-benefit components.

If the FHWA or FTA funds a component of the HSR, or if a minor action is required to approve the Central Valley Wye alternatives, such as the need for an FHWA-approved grade crossing, it is anticipated that this project element would be added to the affected area's Regional Transportation Improvement Program or RTP for transportation conformity purposes. However, conformity of HSR projects implementing sections of the overall HSR system would be addressed through application of the GC Rule and requirements.

10.1 General Conformity

To determine whether projects are subject to the GC determination requirements, the USEPA has established GC *de minimis* threshold values (in tons per calendar year) for each of the criteria pollutants for each type of federally designated nonattainment and maintenance area. If the emissions generated by construction or operation of a project (on an area-wide basis) are less than these threshold values, the effects of the Central Valley Wye alternatives are not considered to be significant, the GC Rule is not applicable, and no additional analyses are required. If the emissions are greater than these values, compliance with the GC Rule must be demonstrated.

GC requirements apply only to federally designated maintenance and nonattainment areas. The RSA is in an area federally designated as extreme nonattainment for the 8-hour O_3 standard, nonattainment for $PM_{2.5}$, and maintenance for PM_{10}. The applicability threshold values for this area, according to 40 C.F.R. Part 93, are 10 tons per year for VOCs, 10 tons per year for NO_X, and 100 tons per year for $PM_{2.5}$, PM_{10}, CO, and SO_2.

Because the regional emissions of the applicable pollutants are lower under the operational phase of the Central Valley Wye alternatives than under the No Project Alternative, only emissions generated during the construction phase need to be compared to these threshold values to determine whether the GC Rule is applicable. The Central Valley Wye alternatives design incorporates measures to reduce effects on air quality, including the implementation of a fugitive dust control plan (AQ-IAMF#1) and requiring the use of low-VOC paint (AQ-IAMF#2).

The construction-phase emissions are greater than the applicability threshold(s) for the following years and pollutants:

- NO_X for the years 2019–2022

As such, the Central Valley Wye alternatives must demonstrate compliance with the GC Rule before construction begins. Compliance with the GC Rule can be demonstrated in one or more of the following ways:

- By offsetting the project's construction-phase emissions for pollutant emissions that exceed the annual GC *de minimis* thresholds to net zero. For example, if the NOx threshold would be exceeded in 2019, the project would offset those emissions in that year to net zero.
- By showing that the construction-phase emissions are included in the area's emission budget for the SIP.
- By demonstrating that the state agrees to include the emission increases in the area's SIP without exceeding emission budgets.

A GC determination was prepared for the Merced to Fresno Final EIR/EIS, which concluded that GC compliance would be demonstrated because all construction pollutant emissions that exceed the *de minimis* thresholds (NO_X and VOC) have been and would continue to be fully offset to net zero. A separate GC determination has not been conducted for the Central Valley Wye alternatives because the conclusions of this Central Valley Wye Air Quality and Global Climate Change Technical Report and the Draft Supplemental EIR/EIS are generally consistent with or less severe than the conclusions in the Merced to Fresno Final EIR/EIS. Construction of both the Merced to Fresno section as analyzed in the Merced to Fresno Final EIR/EIS and the Central Valley Wye alternatives would result in NO_X emissions that would exceed the *de minimis* thresholds during multiple years of construction, but both would result in emissions below the *de minimis* thresholds for CO, PM_{10}, and $PM_{2.5}$. Additionally, the Central Valley Wye alternatives would not result in an exceedance of the VOC *de minimis* threshold. Thus, because the Central Valley Wye alternatives would not result in any additional pollutants exceeding the *de minimis* thresholds relative to the Merced to Fresno Final EIR/EIS, and the emissions of NO_X would continue to be fully offset to net zero, no further action is required to demonstrate the Central Valley Wye alternatives' compliance with GC. The offsets would be accomplished through a Voluntary Emission Reduction Agreement (VERA) between the Authority and the SJVAPCD. The requirement for the VERA would be imposed on the Central Valley Wye alternatives through the following mitigation measure:

AQ-MM#4: Offset Central Valley Wye Construction Emissions through an SJVAPCD VERA

The Authority and SJVAPCD would enter into a contractual agreement to mitigate the Central Valley Wye alternative's emissions by offsetting to net zero the Central Valley Wye alternative's actual emissions from construction equipment and vehicle exhaust emissions of VOC, NO_X, PM_{10}, and $PM_{2.5}$. The agreement would provide funds for the district's Emission Reduction Incentive Program (SJVAPCD 2011) to fund grants for projects that achieve emission reductions, with preference given to highly affected communities, thus offsetting project effects on air quality. Projects funded in the past include electrification of stationary internal combustion engines (such as agricultural irrigation pumps), replacement of old heavy-duty trucks with new, cleaner, more efficient heavy-duty trucks, and replacement of old farm tractors. The Authority would commit to reducing construction emissions for NO_X through the VERA program. To lower overall cost, the Authority would provide funding for the VERA program at the beginning of any funded construction phase, if feasible, to cover estimated construction emissions. At a minimum, funding would be provided so that mitigation/offsets would occur in the year of effect, or as otherwise permitted by 40 C.F.R. Part 93 § 93.163.

A VERA is a mitigation measure by which the project proponent (the Authority, in this case, in partnership with the FRA) would provide pound-for-pound offsets of emissions that exceed GC *de minimis* thresholds through a process that develops, funds, and implements emissions reduction projects. The SJVAPCD would serve as administrator of the emissions-reduction projects and verifier of the successful mitigation effort.

The SJVAPCD is obligated under the VERA to seek and implement projects that achieve emissions reductions, using the project proponent's funds. In implementing a VERA, the SJVAPCD verifies the actual emission reductions that have been achieved as a result of completed grant contracts, monitors the emission-reduction projects, and assures the enforceability of achieved reductions. The initial agreement is generally based on the projected maximum emissions that exceed thresholds as calculated by a district-approved Air Quality

Impact Assessment or the Draft Supplemental EIR/EIS; the agreement then requires the proponent to deposit funds sufficient to offset those maximum emissions exceedances. However, because the goal is to mitigate actual emissions, the district has designed adequate flexibility into these agreements such that the final mitigation is based on actual emissions related to the Central Valley Wye alternatives, on actual equipment used, hours of operation, and so on, which the proponent tracks and reports to SJVAPCD during construction. After the project is mitigated, the district certifies to the lead agency that the mitigation is completed. Thus, a VERA provides the lead agency with an enforceable mitigation measure that would result in fully offsetting emissions exceedances.

The SJVAPCD has reported that since 2005, it has entered into 17 VERAs with project proponents and achieved 1,393 tons of NO_X and PM_{10} reductions each year. It is the SJVAPCD's experience that implementation of a VERA is a feasible mitigation measure that effectively achieves actual emission reductions and would mitigate the Central Valley Wye alternatives to a net-zero air quality effect.

The Authority is negotiating a VERA with the SJVAPCD. Final approval and execution of the VERA by the Authority and the SJVAPCD is expected approximately concurrent with final approval of the GC determination.

10.2 Transportation Conformity

Transportation conformity is an analytical process required for all federally funded transportation projects but does not apply to the Central Valley Wye alternatives. Under the 1990 CAA Amendments, the U.S. Department of Transportation cannot fund, authorize, or approve federal actions to support programs or projects that are not first found to conform to the SIP for achieving the goals of the CAA requirements. Conformity with the CAA takes place at both the regional level and the project level.

The Central Valley Wye alternatives are not subject to the transportation conformity rule. However, if the Central Valley Wye alternatives requires future actions that meet the definition of a project element subject to transportation conformity, additional determinations and associated analysis would be completed as may be required.

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11.2 Persons and Agencies Consulted

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