APPENDIX E: LOCALIZED IMPACTS FROM CONSTRUCTION

1 INTRODUCTION

The High Speed Rail (HSR) project would include several different types of construction activities that would occur in numerous locations along the project footprints of the Central Valley Wyes alternatives. Because the Central Valley Wye alternatives have lengths ranging from 51-55 miles, it is not practical to analyze the entire construction phase as a whole. Furthermore, it is unlikely that emissions beyond a short localized distance would influence one another for the sake of localized air quality impacts[1] and health risk assessments. Based on the construction activities, the following construction work areas were evaluated for the potential to cause localized air quality impacts:

- Concrete batch plant
- Road crossings
- Rail segment
- Combined area of all the above construction work areas

Each of these types of construction sites was evaluated independently of each other and also in combination. This report describes the methods used to develop construction emission rates, perform air dispersion modeling of construction emissions, and estimate associated health risk impacts. Air dispersion modeling results were used to predict the ambient impacts of criteria pollutant emissions and evaluate these impacts with respect to the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS). Health risk calculations were performed to evaluate the incremental cancer risks, and acute and chronic non-cancer health impacts on generic, individual resident receptors located at the perimeter of the construction work areas.

[1] Ozone and its precursors are classified as regional impacts due to the atmospheric transport and chemical conversions that take place over long distances and time scales. Therefore, they are not analyzed in terms of localized impacts. Furthermore, the project would be offsetting to net zero any ozone precursor emissions above the General Conformity Rule de minimis thresholds under the VERA entered with the San Joaquin Air Pollution Control District (SJVAPCD). Per SJVAPCD guidance (SJVAPCD 2002), emissions offset through a VERA are deemed to reduce the project emissions to less than significant.

2 POLLUTANTS OF CONCERN

Criteria pollutants and toxic air contaminants (TACs)[2] were assessed for localized impacts.

The following criteria pollutants were considered in this analysis of potential localized impacts[3]:

- Carbon Monoxide (CO)
- Nitrogen Dioxide (NO_2)
- Particulate matter smaller than or equal to 10 microns (PM_{10})
- Sulfur Dioxide (SO_2)

Note that current District policy is to demonstrate compliance with the PM standards by comparing the Central Valley Wye alternative's predicted PM_{10} concentrations to the appropriate PM_{10} Significant Impact Levels (SILs), which are:

- Non-Fugitive (Point Sources)
  - 5.0 µg/m^3 for the 24-hour average
  - 1.0 µg/m^3 for annual average
- Fugitive Sources (Area or Volume)
  - 10.4 µg/m^3 for the 24-hour average
  - 2.1 µg/m^3 for annual average

Because the $PM_{2.5}$ SILs were vacated, no analysis for $PM_{2.5}$ is included here other than total emissions.[4] In addition, as there are no non-fugitive (point) sources associated with construction activities, only the fugitive SILs were used in this analysis.

Non-criteria TACs were also analyzed for potential localized impacts. Sources of TACs include construction equipment exhaust and fugitive dust from concrete batch plant processes. The California Air Resources Board (CARB) and the California Office of Environmental Health Hazard Assessment (OEHHA) have identified TACs that may be emitted from these sources. Construction equipment exhaust may contain diesel particulate matter (DPM), and fugitive dust emissions from concrete batch plants may contain a number of toxic pollutants (in particular, heavy metals with various toxicities). DPM has been identified by CARB as a TAC based on its potential to cause cancer and other adverse health problems, including respiratory illnesses, and increased risk of heart disease. Heavy metals associated with concrete batch plant emissions present potential carcinogenic and non-carcinogenic health risks.[5] Finally, some criteria pollutants also pose acute and chronic health risks (such as NO_2), and are analyzed for both health impacts and relative to air quality standards.

Analyses were conducted that considered chronic (long-term) carcinogenic, chronic non-carcinogenic, and acute (short-term) health risks. These analyses were conducted following SJVAPCD and OEHHA modeling guidance.

---

[2] TACs (sometimes referred to as hazardous air pollutants[HAP]) are non-criteria pollutants that pose health impacts.

[3] Ozone and its precursors (reactive organic gases [ROG] or volatile organic compounds [VOC] and oxides of nitrogen [NOx]) are classified as regional impacts due to the atmospheric transport and chemical conversions that take place over long distances and time scales. Therefore, they are not analyzed in terms of localized impacts.
Lead (Pb) emissions are not considered because the mass emissions are negligible and thus unlikely to exceed the ambient air quality standards. Lead is quantified as part of the TACs since it has health toxicity factors.

[4] Email from Glenn Reed to: Shannon Hatcher, Thursday, September 17, 2015 11:26 AM. Subject: RE: PM SILs.

[5] Note that current analyses do not associate any combustion emissions, including DPM, with the Batch Plants, as combustion activities would not occur with batching activities.

3 MODELED CONSTRUCTION SITES

As described in Section 1.0, the following construction features were evaluated for the potential to cause localized air quality impacts:

- Construction of the Rail Segment
- Construction of Road over or under crossings
- Operation of Concrete Batch Plants (CBP) to support construction

A brief description of the approach and study area for each construction feature is provided below. More detailed modeling source parameters are provided in Section 5.0. In addition to analysis for each of these three construction features, an analysis was also conducted for potential impacts from overlapping features. To capture maximum impact while allowing for the currently unknown location of features and the generic approach used here, all three features were considered to be co-located and the impacts reported are the total of all three features combined. **Construction of the Rail Segment –** The construction emissions associated with the construction of the Rail Segment include several different phases such as mobilization, demolition, earth moving, land clearing, track construction at grade, and elevated structures. For the Rail Segment, it would not be practical to analyze construction of the entire 51-55 mile alignment as a whole. Therefore, for localized impacts, the analysis evaluated construction of a 2-mile long portion of the track. It was assumed that emissions from construction of other portions of the alignment beyond this distance would not substantially contribute to localized impacts.

Construction of Road over or under crossings – There are multiple road over and under crossings that would be constructed, and each would vary widely in terms of size and shape. For this analysis, a representative construction area was modeled based on the range of sizes and lengths of the proposed road crossings. One road crossing is assumed for the representative 2-mile long portion of track modeled. This is based on the number of crossings throughout the Wyes and the total length of track.

Operation of Concrete Batch Plants (CBP) to support construction – Concrete Batch Plants may be located at various locations near the alignment. The current design does not provide site details or locations for the CBPs, as these have not yet been determined. Therefore, CBP modeled work areas were conservatively sized based on preliminary production capacity estimates.

The location of each feature is currently unknown. To capture maximum total impact from all features together, modeling was conducted with all three features co-located. The rail line and road crossings are assumed to be perpendicular. The CBP is assumed to be located at the intersection of these two features to maximize emissions density. Because various receptors may be located along the alignment, the combined features were conservatively modeled with receptors located immediately adjacent to and along the perimeter of the combined work area for assessment of air quality impacts. For the assessment of health risks, residential receptors also surround the alignment, but with a 25 meter setback from the construction area to better represent residences. In both cases, a network of grid receptors are used, with 25 meters spacing between the receptors.

4 EMISSIONS AND EMISSION RATES

4.1 Emissions from Construction Activities

The California High-Speed Rail Delivery Partner (RDP) presented annual emissions by construction activity (e.g., mobilization, demolition, earthmoving, land clearing) and a corresponding emissions schedule for each year of construction in the period from 2018 to 2032 that represents activity for a generic, representative 2-mile segment of construction activity.

These construction areas and associated construction activities are shown in Table 1. Emissions from these construction activities are also shown in the table.

Table 1 Total Construction Emissions for 2-Mile Rail Segment, 2018-2032 (Short Tons)

Construction Work Area	Construction Activity	Short Tons, 2018-2032						
		CO Totals	NO_x Totals	PM_{10} Totals	$PM_{2.5}$ Totals	VOC Totals	SO_2 Totals	DPM_{10} Totals
Rail Segment	Mobilization	0.26	0.36	0.03	0.02	0.03	0.00	0.02
	Demolition	0.07	0.06	0.04	0.01	0.01	0.00	0.00
	Land Clearing	0.31	0.53	0.11	0.02	0.04	0.00	0.02
	Earth Moving	2.34	3.26	0.92	0.16	0.26	0.01	0.14
	Track at Grade	0.17	0.53	0.02	0.02	0.03	0.00	0.02
	Track Elevated	0.29	0.51	0.02	0.02	0.04	0.00	0.02
	Elevated Structures	1.92	2.58	0.14	0.12	0.20	0.01	0.11
	Demobilization	0.34	0.30	0.02	0.02	0.03	0.00	0.01
	PPSS	0.02	0.02	0.00	0.00	0.00	0.00	0.00
	SPSS	0.06	0.07	0.00	0.00	0.01	0.00	0.00
	TPSS	0.03	0.04	0.00	0.00	0.00	0.00	0.00
	Total	**5.80**	**8.26**	**1.31**	**0.39**	**0.65**	**0.02**	**0.36**
Road Crossing	Road Crossing	2.17	2.12	0.15	0.11	0.20	0.01	0.13
Batch Plant	Concrete Batch Plants	-	-	0.05	0.05	-	-	-

[1] The emissions used in this analysis are from on-site construction equipment exhaust, except as noted for PM10 and PM2.5.
[2] The PM10 and PM2.5 emissions are from on-site construction equipment exhaust and fugitive dust, except for the batch plant, which is fugitive dust only.
[3] The Rail Segment emissions presented here represent emissions from construction of the entire alignment
[4] The Road Crossing emissions presented here represent emissions from construction of all road crossings along the alignment
[5] The Concrete Batch Plant emissions presented here represent emissions from all concrete batch plants

CO = carbon monoxide
NO_X = nitrogen oxides
PM10 = particulate matter 10 microns or less in diameter
PM2.5 = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
DPM = diesel particulate matter
HMF = heavy maintenance facility
MOWF = maintenance of way facility

4.2 Emissions for Modeled Construction Work Areas

The emissions shown in Table 1 are aggregated summaries of the monthly emission schedule supplied by RDP covering the duration of the construction period. The monthly resolved emissions were applied to the representative construction work areas for use in air dispersion modeling. For the Rail Segment, Concrete Batch Plants, and Road Crossings, the modeled construction work area only accounts for the representative 2-mile portion of the total construction activity.

The provided emissions schedule occurs over an extended period of time, from 2018-2032. However, all the activity for the 2-mile segment occurs over a shorter period, 2019-2022. All dispersion analyses supporting both the air quality and HRA results were conducted with a single year's emissions values. Each analyzed construction year was modeled with five meteorological years of data. Each relied on monthly totals of equipment exhaust and dust emissions of PM_{10}. DPM is taken as the exhaust portion of PM_{10}, with the understanding that all equipment is diesel-fueled. Table 2 shows the annual emissions for each construction work area and year modeled.

Finally, the concrete batch plant fugitive dust contains several metals that are classified as having carcinogenic and non-carcinogenic health impacts. These metals include arsenic, beryllium, cadmium, chromium, and lead. The emissions of these metals from the concrete batch plant were based on the characterized fugitive PM emissions, and a speciation factor for each metal appropriate for concrete batching. The speciation factors were determined as the portion of the PM emissions composed of these metals based on SJVAPCD-provided emission factor analysis for local concrete batch plants (SJVAPCD 2015a).

Table 2 Annual Construction Emissions used in Modeling, tons

Construction Work Area	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_2	VOC	DPM	Arsenic	Beryllium	Cadmium	Lead	Manganese	Nickel	Selenium	Aluminum	Chromium total	Copper	Hexavalent Chromium	Zinc	Barium	Cobalt
2019																					
Rail Segment	1.81	2.58	0.63	0.13	0.01	0.21	0.11	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Road Crossing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2020																					
Rail Segment	3.09	4.21	0.61	0.20	0.01	0.33	0.19	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Road Crossing	2.17	2.12	0.15	0.11	0.01	0.20	0.13	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBP	-	-	0.05	0.05	-	-	-	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2021																					
Rail Segment	0.03	0.04	0.00	0.00	0.00	0.00	0.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Road Crossing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2022																					
Rail Segment	0.87	1.43	0.07	0.06	0.00	0.11	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Road Crossing	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CBP	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

[1] The emissions used in this analysis are from on-site construction equipment exhaust, except as noted for PM_{10} and $PM_{2.5}$.
[2] The PM_{10} and $PM_{2.5}$ emissions are from on-site construction equipment exhaust and fugitive dust.
CO = carbon monoxide
NO_X = nitrogen oxides
PM10 = particulate matter 10 microns or less in diameter
PM2.5 = particulate matter 2.5 microns or less in diameter
SO_2 = sulfur dioxide
VOC = volatile organic compound
DPM = diesel particulate matter
HMF = heavy maintenance facility
MOWF = maintenance of way facility

5 DISPERSION MODELING

As the construction activities of the Central Valley Wye alternatives have the potential to cause adverse health impacts, detailed dispersion modeling analyses were conducted to determine whether these impacts would be substantial. The USEPA's AERMOD atmospheric dispersion model was used to simulate physical conditions and predict pollutant concentrations near the construction work areas. This allowed for an analysis of the localized impacts of these construction emissions.

AERMOD is generally used to estimate impacts from point source emissions from stacks as well as emissions from volume and area sources. The model accepts actual hourly meteorological observations and directly estimates hourly and average concentrations for various time periods. The detailed information on the methodology and data used to conduct the air dispersion modeling is summarized below.

5.1 Inputs

Model and Inputs: AERMOD (version 15181) was used to conduct the modeling analysis.

All calculation inputs are identical between the simulations used in the chronic health risk assessments and for air quality (those used for comparison of the NAAQS and CAAQS) except for receptor placement, as discussed previously. There are two exceptions. First, for PM_{10} analysis and comparison to the SILs, a different release height was used to better represent fugitive sources (discussed below). Second, all pollutants were treated uniformly, and modeled with a single simulation using a "generic" form pollutant, which was then scaled to actual concentrations of the pollutant based on the emissions shown in Table 2. However, for NO_2 and PM_{10} air quality simulations, pollutant specific simulations were conducted. For NO_2 this allowed AERMOD to compute the concentration in the form required by the standard. For both NO_2 and PM_{10}, this allowed the model to directly compute peak total concentrations that are paired in space and time in a manner that is more refined than the sums of peak concentrations from individual features.

Only model default ("DFAULT") options are included in the analysis, other than the use of flat terrain ("FLAT"), the "FASTAREA" computation method, and the adjusted u-star ("ADJ_U*") option to accommodate SJVAPCD-processed meteorological data and adjust the surface friction velocity under low-wind/stable conditions. AERMOD's rural dispersion algorithm was used in the analysis.

Meteorological Data: AERMOD requires meteorological data as input into the model. These are typically processed using AERMET, a pre-processor to AERMOD. AERMET requires surface meteorological data, upper air meteorological data and surface parameter data. The SJVAPCD has meteorological datasets that have been processed using AERMET and incorporate the ADJ_U* option noted above. SJVAPCD provided these for use in this modeling (Garner 2015).

All features here were analyzed using the SJVAPCD preprocessed meteorological data provided for the Merced station. That dataset includes Merced Municipal Airport (WBAN 23257) for surface observations and Oakland Metropolitan Airport (WBAN 23230) for upper air data. Five years of meteorological data from 2009 through 2013 were used in all cases.

Terrain: It was assumed that the terrain within and adjacent to the Central Valley Wye alternatives project footprints was flat, and therefore no terrain data was used.

Receptors: Receptors were modeled using a network of discrete receptors. As noted above, all sources were modeled together to conservatively estimate impacts. The rail line and road crossing are assumed to be perpendicular. A grid of receptors was created in each of the four quadrants outlined by the intersecting rail line and road crossing footprints. For criteria air pollutant concentration analyses, modeling was conducted with receptors placed at the edge of the construction area "fenceline". Receptor spacing of 25 meters and receptor heights of 1.2 meters were used in all cases. The health risk analyses used the same grid as air quality analyses, but the closest receptors were set back 25 meters from the construction area was used to represent residential locations, following guidance from the SJVAPCD. Given the limited design information currently available, no discrete sensitive receptors were included in the analysis and no spatial averaging of results by receptor was conducted. Consistent with HARP guidance, all receptors were modeled at a ("flagpole") height of 1.2 meters.

Source Parameters: All construction work areas were modeled as area sources. All facilities were assumed to have an exhaust release height of 3 meters, following guidance from SJVAPCD. The Concrete Batch Plant, used a release height of 4 meters, again per direction from SJVAPCD. Fugitive PM10 from the rail segment and road crossing were modeled as a surface release. In all cases, an initial vertical dimension of 1 meter was applied (SMAQMD 2013). A summary of model source parameters is shown in Table 3. Sources were modeled using the rural land use option.

Note that the rail line in this area follows multiple directions. To capture the varying angle between predominant winds and rail line, two configurations were considered for the rail line: one oriented north-south and one oriented east-west. To be conservative, results presented here are only for the direction with the more conservative concentrations.

Table 3 AERMOD Model Source Parameters

Construction Work Area	Source Type	Size of Modeled Area[1]	Release Height (meters)
Rail Segment	Area	3200 m x 52 m	3 (exhaust) 0 (dust)
Road Crossings	Area	1600 m x 150 m	3 (exhaust) 0 (dust)
Concrete Batch Plant	Area	80.6 m x 80.6 m	4

[1] Sizes of modeled areas are shown as dimensions of length and width where the modeled work area is a rectangular shape.
m = meters

All emissions are assumed to occur from 8 AM – 5 PM, Monday through Friday. Additionally, a refined, monthly schedule of emissions provided by RDP was included in the emissions profile. All sources were modeled using the "MHRDOW" profile. For all pollutants other than NO_2 and PM_{10}, the magnitude of the emission scaling factor is based on the provided emission profile, but normalized such that total annual emissions equal 31,536 kg/year, which is equivalent to a uniform 1 g/s emission rate for all hours of the year to facilitate scaling of model results to final concentrations. NO_2 and PM_{10} were modeled with their predicted emissions. (No scaling was applied.)

5.2 Output Options

The dispersion model can provide results for different averaging time periods, such as hourly, daily, and annual. The averaging times used for the ambient air quality standards and concentration thresholds are different for each pollutant. To compare the model results to the applicable ambient air quality standards and thresholds, criteria pollutant concentrations were calculated as outlined below. In all cases except 1-hour NO_2 and PM_{10}, the pollutant-specific concentrations are determined by multiplying the unit-based concentrations (χ/Q) by the pollutant specific emissions (Q).

- Particulate Matter: The highest 1st high 24-hour average and the annual average PM_{10} concentrations across all receptors were calculated with AERMOD. No background PM_{10} values are included. The resulting concentrations were compared to the PM_{10} SILs, as described previously. For the 24-hour average, the 1st high 24-hour average value based on the concatenated 5 years of meteorological data is used. For the annual average, the period average of the concatenated 5 years of meteorological data is used.

- Nitrogen Dioxide: The 1-hour average concentration was calculated using the multi-year average of the maximum 8th highest 1-hour daily maximum value for each year, consistent with the statistical description of the ambient air quality standard. The annual average concentration was calculated using the period average of the concatenated 5 years of meteorological data. Annual results were scaled from the unit-based concentrations since no special processing is required. In order to convert the nitrogen oxides (NOx) emissions to NO_2 concentrations, the EPA default 80% conversion ratio was assumed (CAPCOA 2011).
  - Carbon Monoxide: The 1-hour and 8-hour averages were calculated and used for comparison to the standards. The reported values represent the highest 1st high 1-hour and 8-hour concentrations for the concatenated 5 years of meteorological data. Results were scaled from the unit-based concentrations. Reported combined total concentrations are conservatively estimated as the sum of worst case concentrations from all features, irrespective of location.
  - Sulfur Dioxide: The 1-hour and 24-hour averages were calculated and used for comparison to the standards. The reported values represent the highest 1st high 1-hour and 24-hour concentrations for the concatenated 5 years of meteorological data. Results were scaled from the unit-based concentrations. Reported combined total concentrations are conservatively estimated as the sum of worst case concentrations from all features, irrespective of location.

Attachment 1 includes all AERMOD output files for the simulations described here.

6 COMPARISON TO THE AMBIENT AIR QUALITY STANDARDS

In order to determine if the incremental concentrations associated with construction emissions would cause or contribute to exceedances of the NAAQS and CAAQS, the appropriate background concentrations for all attainment pollutants are required. For a given pollutant, the appropriate background concentration is added to the incremental concentration estimated from the air dispersion modeling. If the combined value exceeds the NAAQS or CAAQS of that pollutant, then the emissions could contribute to exceedances (SJVAPCD 2002). The background concentrations were based on the SJVAPCD reported monitoring background values where available. For pollutants and averaging times that did not have reported background values from the SJVAPCD, the most representative recent monitor values reported by EPA or ARB near the high speed rail alignment were conservatively used. The values used are:

- Fresno-Garland for 1- and 8-hour CO; and for 24-hour SO_2
- Madera-Pump Yard for annual NO_2
- SJVAPCD-processed 1-hour NO_2 (Merced-S Coffee Avenue) and SO_2 (Fresno-1st Street)

Tables 4 through 6 show the estimated maximum NO_2, CO, and SO_2 ambient air concentrations for each of the construction work areas, including conservative background concentrations, for all of the work areas are below the NAAQS and CAAQS.

Pre-construction concentrations of PM_{10} and $PM_{2.5}$ in the San Joaquin Valley Air Basin exceed their respective ambient air quality standards. Total PM_{10} is therefore evaluated in accordance with the SJVAPCD recommended significant impact level (SIL) for fugitive PM_{10} emissions (Reed 2015). If the Central Valley Wye alternative’s incremental increase in PM_{10} concentration is below the SJVAPCD’s SIL, the Central Valley Wye alternatives would not cause or contribute significantly to exceedances of the ambient air quality standards. Table 7 shows the incremental increase in PM_{10} concentration for each of the work areas. As shown in this table, PM_{10} increases would not exceed the SIL values for the 24-hour or annual averaging periods. Because the $PM_{2.5}$ SILs were vacated, no analysis for $PM_{2.5}$ is necessary. (Reed 2015). Note that no exhaust emissions are associated with the Batch Plant, so only the fugitive SILs are considered. Fugitive SILs are also used for the rail line segments and road crossings since the vast majority of PM emissions from those features are fugitive.

Table 4 Carbon Monoxide Concentrations from Construction Emissions

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		

Notes:

[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
µg/m³ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standard
CAAQS = California Ambient Air Quality Standard
NA = not applicable

Table 5 Sulfur Dioxide Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-site 1-hour Average SO_2 Concentration (µg/m^3)	Background[2] 1-hour SO_2 Concentration (µg/m^3)	Total Off-site 1-hour SO_2 Concentration (µg/m^3)	NAAQS (µg/m^3) equivalent	CAAQS (µg/m^3) equivalent
Concrete Batch Plant	NA[1]	19	NA[1]	196	655
Road Crossings	0.5		20		
Rail Segment	1.0		20		
Combined[4]	1.5		21		
Construction Area	**Maximum Incremental Off-site 24-hour Average SO_2 Concentration (µg/m^3)**	**Background[3] 24-hour SO_2 Concentration (µg/m^3)**	**Total Off-site 24-hour SO_2 Concentration (µg/m^3)**	**NAAQS (µg/m^3) equivalent**	**CAAQS (µg/m^3) equivalent**
Concrete Batch Plant	NA[1]	11	NA[1]	NA	105
Road Crossings	0.0		11		
Rail Segment	0.1		11		
Combined[4]	0.1		11		

[1] The concrete batch plant does not have any substantial exhaust emissions.
[2] Background 1-hour concentration based on the monitoring background values presented by SJVAPCD (SJVAPCD 2010).
[3] The highest monitored 24-hour value from the Fresno or Garland stations was used as the background concentrations
[4] SO2 concentrations represented as the 1st highest from each averaging period
[5] "Combined" conservatively estimated the sum of worst case concentrations from all features, irrespective of location. SO2 = sulfur dioxide
µg/m^3 = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standard
CAAQS = California Ambient Air Quality Standard
NA = not applicable
SJVAPCD = San Joaquin Valley Air Pollution Control District

Table 6 Nitrogen Dioxide Concentrations from Construction Emissions

Construction Area	8th Highest Max Daily Incremental Off-site 1-hour NO_2 Concentration (µg/m³) [4]	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[1]	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/m³) [5]**	**Background[3] Annual NO_2 Concentration (µg/m³)**	**Total Off-site Annual NO_2 Concentration (µg/m³)**	**NAAQS (µg/m³) equivalent**	**CAAQS (µg/m³) equivalent**
Concrete Batch Plant	NA[1]	12	NA[1]	100	57
Road Crossings	1		12		
Rail Segment	2		13		
Combined	3		14		

[1] The concrete batch plant does not have any substantial exhaust emissions.
[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] Annual background concentration is the annual mean monitor value from the Madera Pump Yard station.
[4] NO2 1-hour concentrations represented as the 5-year average of the 8th highest daily maximum value. An 80% conversion of NOx to NO2 is conservatively assumed per CAPCOA guidance (October 27, 2011. See http://www.valleyair.org/busind/pto/tox_resources/CAPCOANO2GuidanceDocument10-27-11.pdf.)
[5] Annual NO2 concentrations represented as the 5 year period average conservatively assuming 100% conversion.NO_2 = nitrogen dioxide
µg/m³ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standard
CAAQS = California Ambient Air Quality Standard
NA = not applicable
SJVAPCD = San Joaquin Valley Air Pollution Control District

Table 7 Particulate Matter Concentrations from Construction Emissions

Construction Area	Maximum Incremental Off-site 24-hour Average PM10 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/m³)**	**Significant Impact Level (SIL)[1] (µg/m³)**
Concrete Batch Plant	0.1	2.1
Road Crossings	0.1	
Rail Segment	0.3	
Combined	0.6	

[1] The background concentrations already exceed ambient air quality standards. Thus, the appropriate comparison is to determine if the Central Valley Wye alternatives would contribute to further exceedances. The modeled concentrations show the incremental increase in concentration due to construction emissions.
[2] Current District policy is to demonstrate compliance with the PM standards by comparing the Central Valley Wye alternative's predicted PM10 concentrations to the appropriate PM10 Significant Impact Levels (SILs). Because the PM2.5 SILs were vacated, no analysis for PM2.5 is necessary. The District's PM10 SILs are 5.0 µg/m³ 24-hour average and 1.0 µg/m³ annual average for point source emissions and 10.4 µg/m3 24-hour average and 2.08 µg/m³ annual average for fugitive sources. (Email from Glenn Reid to Shannon Hatcher, 9/17/2015)
Exceedances of the SILs shown in bold.
Mitigation is only needed for the concrete batch plant. Other construction areas do not exceed the SILs before mitigation.
PM10 = particulate matter 10 microns or less in diameter
µg/m³ = micrograms per cubic meter
SIL = Significant Impact Level
SJVAPCD = San Joaquin Valley Air Pollution Control District

7 HEALTH IMPACTS

TACs can result in a variety of health impacts. Health impacts are typically classified as carcinogenic or non-carcinogenic. The severity of these adverse health impacts from TACs are typically based on the amount of exposure to the TAC. The ARB's HARP2 model (version 16217) (CARB 2016) was used to estimate the health impacts from exposure to both carcinogenic and non-carcinogenic pollutants emitted from construction of the combined rail line and road crossing segments and batch plant. Carcinogenic health impacts are typically represented as the estimated excess lifetime cancer risk. SJVAPCD considers an excess cancer risk of 20 in a million or greater to be significant when computed with ARB's revised HARP2 model (SJVAPCD 2015b). Non-carcinogenic health impacts are measured as a hazard index. SJVAPCD considers a hazard index of 1 or greater to be significant (SJVAPCD 2002).

7.1 Inputs

A multipathway health risk assessment was conducted with HARP2 in accordance with SJVAPCD guidance. The exposure parameters used for estimating excess lifetime cancer risks and chronic non-cancer Hazard Index (HI) for all potentially exposed populations in the HARP2 model are consistent with updated risk assessment guidelines from OEHHA. Specific characterizations are as follows.

Air Dispersion: All air dispersion was conducted with AERMOD, as described in Section 5. As described there, a refined schedule of emissions was provided that allowed characterization of emissions at monthly resolution. A separate simulation was made for each construction year to accommodate this resolution. An additional simulation was conducted for acute risk calculation that used uniform release of emissions at all days and times to identify worst case hourly impacts.

Ground level concentrations (GLC): HARP2 was used to scale the files output from the AERMOD simulations described above to GLCs. The emission values used are consistent with those in Table 2. A HARP simulation is conducted for each construction year using that year's AERMOD-predicted concentrations, which incorporate each year's unique emissions schedule. This creates a unique set of GLCs for each year, for each pollutant, for all receptors, totaled over the three construction features.

Risk analysis: HARP2 was used to conservatively assess cancer risk under the scenario described as follows. A unique HARP simulation was conducted for each construction year to determine the multi-pathway, total cancer risk from all modeled pollutants for a one-year duration for a child whose age increases in time and is paired with the annual construction emissions. For example, a child in the third trimester is exposed to one year of emissions corresponding to the first year of construction; a child one year of age is exposed to one year of emissions corresponding to the second year of construction; and so on throughout the construction period. All cancer risk calculations include OEHHA-derived intake rates (i.e., 95th percentile intake rates for the two dominant exposure pathways. The following exposure pathways were included: inhalation, soil ingestion, dermal, mother's milk, homegrown produce, beef, dairy cows, pigs, chickens, and egg. A 0.02 m/s deposition rate is assumed for the non-inhalation pathway. All other inputs are HARP2 defaults. For the oral pathway for farmed products, the "households that farm" scenario was selected to represent the community. The total cancer risk was calculated as the sum of the risk from the individual years of construction.

HARP was similarly used to determine the acute and chronic noncancer risks. However, for those cases only a single year is considered, that with the highest emissions.

Attachment 2 includes all HARP summary files for the simulations described here.

7.2 Risk Characterization

SJVAPCD generally categorizes potential health impacts from TACs into two groups: carcinogenic (cancer causing) and non-carcinogenic (non-cancer causing) effects. The following sections describe how these risks are characterized and calculated.

7.2.1 Carcinogenic Effects

Excess lifetime cancer risks are estimated as the upper-bound incremental probability that an individual would develop cancer over a lifetime as a direct result of exposure to potential carcinogens. The estimated risk is expressed as a unitless probability. The cancer risk attributed to a chemical is calculated by multiplying the chemical intake or dose at the human exchange boundaries (e.g., lungs) by the chemical-specific cancer potency factor (CPF). Cancer risk age sensitivity factors (ASF) are included to account for an "anticipated special sensitivity to carcinogens" of infants and children. CPFs and ASFs currently recommended by OEHHA in their 2015 Health Risk Guidelines and included in HARP2 are used throughout this analysis.

7.2.2 Non-Carcinogenic Effects

The potential for exposure to result in chronic non-cancer effects is evaluated by comparing the estimated annual average air concentration to the chemical-specific non-cancer chronic reference exposure levels (RELs). When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient (HQ). To conservatively evaluate the potential for adverse chronic non-cancer health effects from simultaneous exposure to multiple chemicals, the HQs for all chemicals are summed for each target organ system, yielding a Hazard Index (HI). Conservatively, Hazard Indices are reported here for the most impacted organ system.

7.3 Health Risk Assessment Results

For cancer impacts a threshold of 20 excess cancers in a million is used. For chronic and acute HI a threshold of 1.0 is used. Tables 9 and 10 show the values at the maximally exposed individual (MEI) location. In all cases, this is the individual resident receptor immediately adjacent to the perimeter of the facility. Note that no particular sensitive receptor locations are modeled for any work area. No spatial averaging or mitigation is included.

Table 8 Excess Cancer and Noncancer Maximum Health Risk Associated with Construction Emissions from All Features Combined

Chemical	Max Cancer Risk (per million)	Max Chronic HI[1]	Max Acute HI[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 PM	18.0	0.0	-
Lead	0.0	-	-
Manganese	-	-	-
Nickel	0.0	0.0	-
Nitrogen Dioxide	-	-	0.7
PM10	-	-	-
PM25	-	-	-
Selenium	-	-	-
Sulfur Dioxide	-	-	0.0
VOC	-	-	-
Zinc	-	-	-
Total Risk at Most Impacted Receptor	18.1	0.0	0.7
Risk Threshold	20.0	1.0	1.0

[1] Hazard Indices (HI) are shown by pollutant contributions to the most impacted organ system (respiratory). All NO2 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 one million. Risks are cumulative of inhalation, dermal, soil, mother's milk, and crop pathways. "

8 CONCLUSIONS

The Central Valley Wye alternatives was evaluated to determine whether the emissions associated with construction would result in localized adverse air quality impacts. These impacts were assessed by evaluating the increased pollutant concentrations as well as conducting a health risk assessment. This evaluation used prototypical work areas to conservatively allocate emissions and model the air dispersion of emissions from construction activities. Mitigation is not currently included in any results other than standard operating procedures for dirt handling.

It is estimated that incremental cancer risk and noncancer health impacts from the combined construction of the road crossings, rail alignment, and supporting concrete batching operations would be minor for residents near the construction area.

It is further estimated that no exceedance of any local-scale air quality threshold would occur due to the combined construction of the rail line, road crossings, and supporting concrete batching.

9 ATTACHMENTS

Attachment 1 includes all AERMOD output files for the simulations described here.

Attachment 2 includes all HARP summary output files for the simulations described here.

10 REFERENCES

California Air Pollution Control Officers Association (CAPCOA). 2011. Modeling Compliance of The Federal 1-Hour NO2 NAAQS. Available: <http://www.valleyair.org/busind/pto/tox_resources/CAPCOANO2GuidanceDocument10-27-11.pdf>. Accessed: October 7, 2016.

California Air Resources Board (CARB). 2016. "Air Dispersion Modeling and Risk Tool (ADMRT)". Last Updated: August 4, 2016. Available: <https://www.arb.ca.gov/toxics/harp/admrt.htm>. Accessed October 6, 2016.

Garner, David. 2015. Senior Air Quality Specialist, San Joaquin Valley Unified Air Pollution Control District. Personal communication to provide the SJVAPCD's "ADJ_U*" data, with Seth Hartley, ICF, November 20, 2015.

Office of Environmental Health Hazard Assessment (OEHHA). 2015. Air Toxics Hot Spots Program: Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments. February 2015. Available: <http://oehha.ca.gov/media/downloads/crnr/2015guidancemanual.pdf>. Accessed: October 3, 2016.

Reed, Glenn. 2015. Senior Air Quality Specialist, San Joaquin Valley Unified Air Pollution Control District. Personal communication regarding significant impact levels for PM10 with Shannon Hatcher, ICF, September 17, 2015.

Reed, Glenn. 2015. Senior Air Quality Specialist, San Joaquin Valley Unified Air Pollution Control District. Personal communication regarding batch with Shannon Hatcher, ICF, October 21, 2015.

Sacramento Metropolitan Air Quality Management District. 2013. Dispersion Modeling Of Construction-Generated PM10 Emissions. Available: <http://airquality.org/LandUseTransportation/Documents/Ch3PMDispersionModelingGuidanceFINAL7-2013.pdf >. Accessed: October 7, 2016.

San Joaquin Valley Air Pollution Control District (SJVAPCD). 2002. Guide for Assessing and Mitigating Air Quality Impacts. January 10. Available: <https://www.valleyair.org/transportation/CEQA%20Rules/GAMAQI%20Jan%202002%20Rev.pdf>. Accessed: October 10, 2016.

———. 2010. Procedure for Determining NO2 Monitor Background values (Design Values) for Use in Calculating NAAQS Compliance. http://www.valleyair.org/busind/pto/Tox_Resources/NO2%20background%20Values.pdf.

———. 2015a. Concrete Batch Plant operations, Cement Silos or Fly Ash Silos PM10 emissions. Available: <http://www.valleyair.org/busind/pto/emission_factors/Criteria/Toxics/Asphalt%20Concrete%20Cement%20Fly%20Ash%20Minerals/Concrete%20Batch%20Plant.xls>. Accessed: October 6, 2016.

———. 2015b. APR – 1906 Framework for Performing Health Risk Assessments. http://www.valleyair.org/policies_per/Policies/apr-1906.pdf (accessed October 6, 2016.).