Appendix E

Health Risk Assessment

DRAFT

Human Health Risk from Freeway Traffic to Residents at Harvest in Tracy

prepared for:

Harvest in Tracy

August 2016

prepared by:

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1. BACKGROUND AND SUMMARY

1.1 Project Description

Harvest in Tracy is a proposed apartment community located in Tracy, California. The Harvest theme will reference Tracy's and the site's agricultural heritage by providing a landscaping palette, amenities, and event programming that incorporate edible orchard groves; community gardens; and healthy, sustainable living.

1.2 Health Risk Assessment

As part of the environmental review for the Harvest in Tracy project, a health risk assessment (HRA) was performed. The purpose of this health risk assessment was to evaluate the potential health risk to residents of Harvest in Tracy from emissions from vehicles on nearby Highway I-205 and West Grant Line Road.

The HRA was prepared following San Joaquin Valley Air Pollution Control District risk assessment procedures, which in turn are based on guidance from California's Office of Environmental Health Hazard Assessment (OEHHA) for health risk assessments. This guidance provides a consistent, conservative methodology for estimating the potential cancer risk, chronic health risk, and acute health risk from exposure to toxic chemicals.

Emissions from vehicles were estimated using EMFAC, the computer model developed by the California Air Resources Board (CARB) to estimate vehicle emissions for air quality planning purposes.

Dispersion of vehicle emissions was modeled using AERMOD, the preferred model for calculating ambient air quality impacts from emission sources.

Health risk was calculated using the pollutant concentrations from AERMOD and CARB's Hotspots Analysis Reporting Program (HARP).

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2. RISK ASSESSMENT

The purpose of this HRA is evaluate the impacts that emissions of toxic air contaminants from traffic on roads close to Harvest in Tracy could have on long-term residents of the development. This process involves several steps, as outlined below.

- Characterization of emissions: The quantity of emissions of toxic air contaminants from vehicles was calculated, the spatial distribution of those emissions was determined, and the release characteristics were determined (see Figure 2-1).

- Dispersion modeling: Using an approved computer model and meteorological data from a nearby weather station, dispersion of the emissions was modeled. The result of the modeling is an estimate of the maximum and average concentration of each toxic air contaminant at receptors located around the Harvest in Tracy property (see Figure 2-2).

- Health impact characterization: The maximum lifetime cancer risk, the chronic Hazard Index, and the acute Hazard Index were calculated using a Health Risk Assessment computer tool developed by California air districts that incorporates OEHHA toxicity information.

Figure 2-1
Road Segments

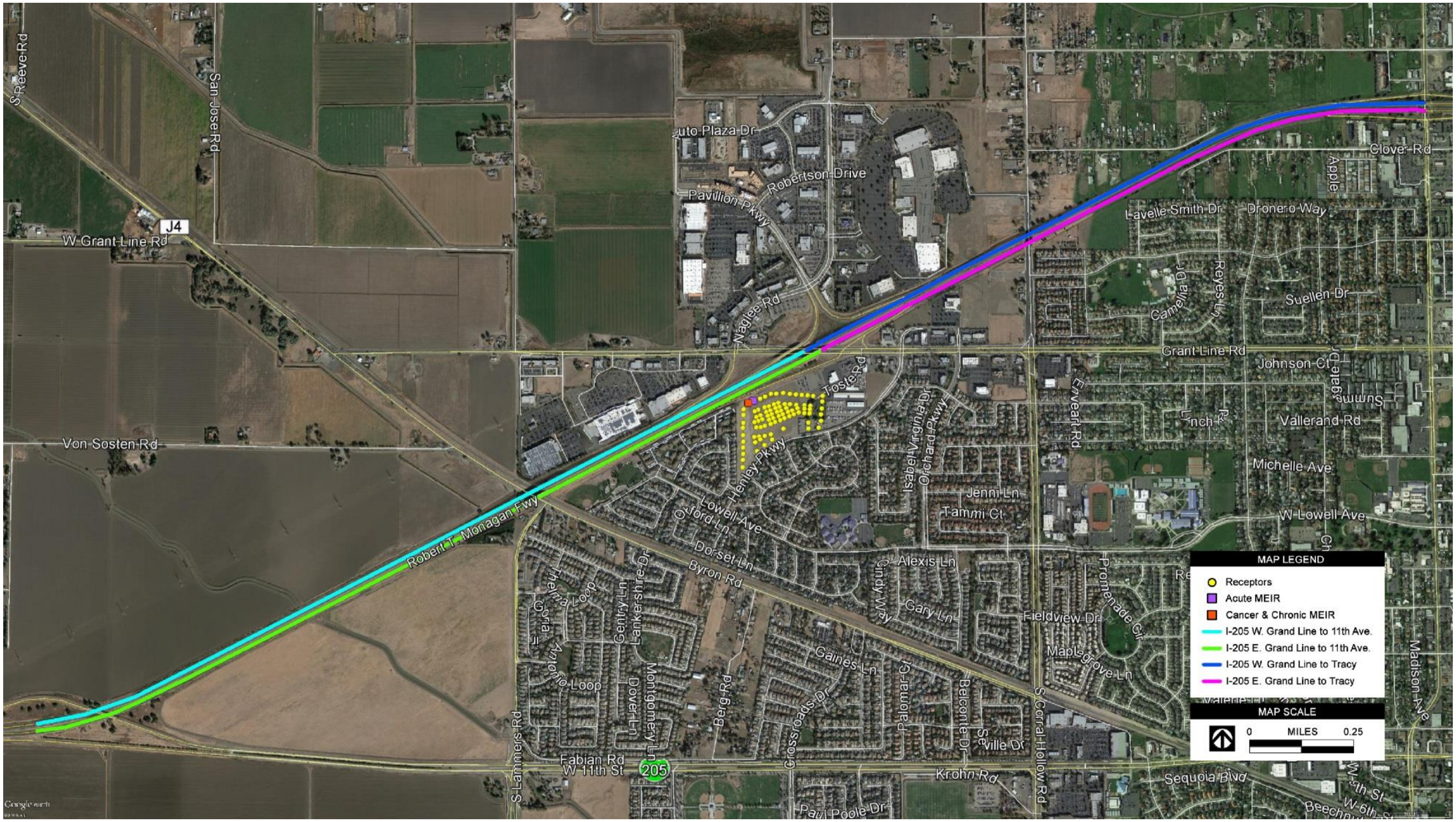
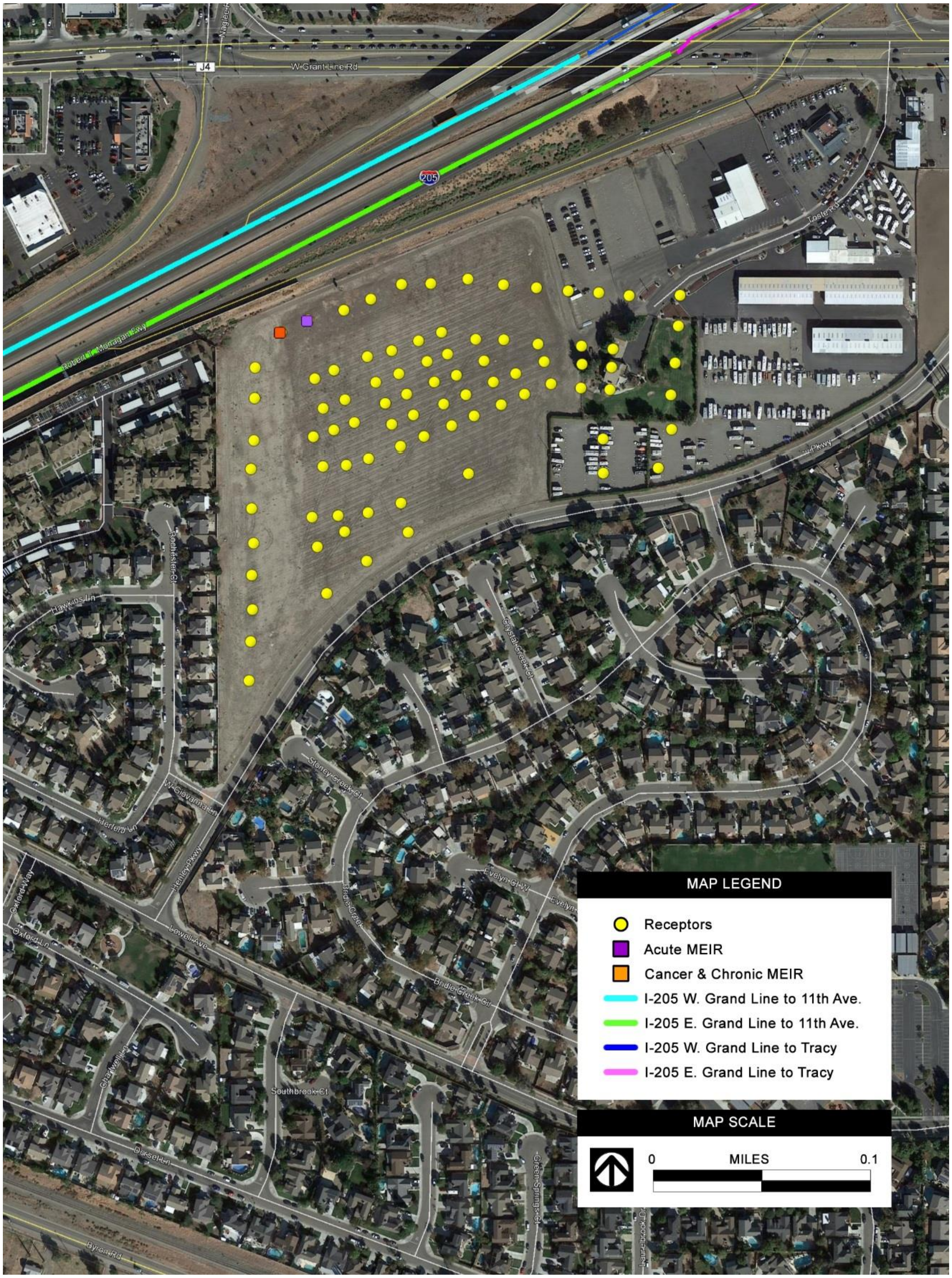


Figure 2-2
Receptor Locations



2.1 Characterization of Emissions

Emission rates for Reactive Organic Gases (ROG) and PM_{10} were obtained from CARB's EMFAC Web Database. The "emission rates" option was selected for the region of San Joaquin County to determine the annual average emission rates for all vehicle categories and all fuels (in units of grams/vehicle-mile). The option was selected to calculate emission rates based on the aggregated model year of the fleet in the analysis year of 2018, the earliest year that permanent residents will be onsite.

The emission rates generated by EMFAC for each vehicle category were then aggregated into four composite emission rates representing "cars" and "trucks" fueled by gasoline and diesel. As discussed later, the car-truck differentiation was used for establishing the source release parameters in AERMOD. The "cars" category was formed as the aggregate of light-duty automobiles (LDA), light-duty trucks (LDT1 and LDT2), and motorcycles (MCY). The "trucks" category was formed as the aggregate of medium duty vehicles (MDV), medium-heavy duty trucks (MHDT), heave heavy-duty trucks (HHDT), urban busses (UBUS), school busses (SBUS), other busses (OBUS), and motor homes (MH).

For diesel vehicles, the PM_{10} emission rates were equated to diesel particulate matter (DPM), which is a surrogate for all mobile source air toxics (MSATs)—both gaseous and particulate—contained in diesel exhaust for health risk assessment purposes. Therefore, no additional MSAT emission rates were derived for diesel vehicles.

For gasoline vehicles, MSAT emission rates were determined based on the assumptions and speciation profiles contained in the U.S. Environmental Protection Agency's (EPA's) Motor Vehicle Emissions Simulator (MOVES) model. The speciation profiles were determined by performing a MOVES run representing the aggregate model year of gasoline-fueled cars and trucks operating in San Joaquin County for the 2017 calendar year (similar to the EMFAC runs). Further information on the derivation of speciation profiles is contained in the MOVES technical documentation.

The speciation profiles were determined as (1) the ratio of MSAT-to-VOC (for organic toxics); (2) the ratio of both MSAT-to-VOC and MSAT-to-PM (for PAHs, which are partitioned in both the solid and gaseous phases); and (3) the direct emission rate of dioxins, furans, and metals. Where the MSAT emission rates were determined as ratios of VOC and PM, the respective ratios were applied to the EMFAC emission rates of gasoline cars and trucks.

The fuel-specific MSAT emission rates for cars and trucks were then aggregated to determine a unit emission rate "per car" and "per truck." This was done by multiplying the fuel-specific emission rates by the fraction of total VMT contributed by each fuel. The resulting emission rates in grams/vehicle-mile include DPM (representing the contribution from diesel vehicles), and all other MSATs (representing the contribution of gasoline vehicles).

The mass emissions of each MSAT were determined by multiplying the aggregated MSAT emission rates for cars and trucks (in gram/vehicle-mile) by the length of each roadway link (in miles) included in the model and the applicable traffic volumes provided by the project proponent. The annual average daily traffic volumes (AADT) in units of vehicles/day were multiplied by 365 to determine the annual emission rates as needed for modeling annually averaged ambient concentrations. The daily average AADT counts were divided by 24 to determine the hourly average emission rates. Diurnal profiles for the traffic volumes were determined by performing a MOVES run representing the aggregate model year of cars and trucks operating in San Joaquin County for the 2017 calendar year. The diurnal profiles were then used in the subsequent AERMOD runs, to capture the diurnal patterns of the traffic sources and quantify the peak hour emissions. The results are presented in Table 2-1.

2.2 Dispersion Modeling

The dispersion modeling analysis was performed using AERMOD (American Meteorological Society/EPA Regulatory Model, Version 15181) to compute plume dispersion characteristics. AERMOD is a steady-state Gaussian air dispersion model that can be used to calculate pollutant concentrations from a wide variety of sources associated with an industrial complex out to a distance of 50 km. The AERMOD model allows the selection of a number of options that affect model output. The regulatory default AERMOD model options were selected for this analysis.

MM5[1] derived AERMET data (e.g., hourly wind speed and direction, temperature) for Tracy during the period 2004-2008 were obtained from the District's modeling website. Both the surface data and upper air data were extracted from the MM5 data at Tracy site, which is approximately 10 miles southeast from the project site.

Exhaust emissions for cars and trucks were modeled separately as line volume sources, with a release height of 1.3 meters, and 3.4 meters for cars and trucks, respectively.[2]

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[1] MM5 is short for the "Fifth-generation Penn State/NCAR Mesoscale Model."

[2] EPA Training Course: Project Level Training for Quantitative-PM Hot-Spot Analyses, Using AERMOD for PM Hot-Spot Analyses, *www3.epa.gov/otaq/stateresources/transconf/training3day.htm*

Table 2-1
Harvest in Tracy − Emissions from Road Segments

Road Name		I205 East Grant Line to Tracy Road				I205 West Grant Line to Tracy Road				I205 West Grant Line to 11 avenue				I205 East Grant Line to 11 avenue			
Sources		Trucks		Cars		Trucks		Cars		Trucks		Cars		Trucks		Cars	
ADTs (Average Daily Traffics)		8,282		41,423		8,266		41,344		7,490		37,460		7,713		38,577	
Pollutant ID	Pollutant Names	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)	Annual Average (lbs/year)	Hourly Average (lbs/hour)
75070	Acetaldehyde	5.81E+00	6.63E-04	2.18E+01	2.49E-03	5.95E+00	6.79E-04	2.24E+01	2.55E-03	6.69E+00	7.64E-04	2.52E+01	2.87E-03	7.04E+00	8.04E-04	2.65E+01	3.02E-03
107028	Acrolein	3.79E-01	4.32E-05	1.42E+00	1.62E-04	3.88E-01	4.43E-05	1.46E+00	1.66E-04	4.36E-01	4.98E-05	1.64E+00	1.87E-04	4.59E-01	5.24E-05	1.72E+00	1.97E-04
1017	Arsenic Compounds	2.35E-02	9.79E-04	1.26E-01	5.25E-03	2.41E-02	1.00E-03	1.29E-01	5.38E-03	2.71E-02	1.13E-03	1.45E-01	6.05E-03	2.85E-02	1.19E-03	1.53E-01	6.37E-03
71432	Benzene	2.17E+01	2.47E-03	8.15E+01	9.31E-03	2.22E+01	2.53E-03	8.35E+01	9.53E-03	2.49E+01	2.85E-03	9.39E+01	1.07E-02	2.63E+01	3.00E-03	9.88E+01	1.13E-02
106990	1,3-Butadiene	1.57E+00	1.79E-04	5.99E+00	6.83E-04	1.61E+00	1.83E-04	6.13E+00	7.00E-04	1.81E+00	2.06E-04	6.90E+00	7.87E-04	1.90E+00	2.17E-04	7.26E+00	8.29E-04
18540299	Chromium 6+	1.23E-04	5.11E-06	6.58E-04	2.74E-05	1.26E-04	5.23E-06	6.74E-04	2.81E-05	1.41E-04	5.88E-06	7.58E-04	3.16E-05	1.49E-04	6.19E-06	7.97E-04	3.32E-05
1086	Dioxins	5.47E-09	2.28E-10	2.94E-08	1.22E-09	5.61E-09	2.34E-10	3.01E-08	1.25E-09	6.30E-09	2.63E-10	3.38E-08	1.41E-09	6.64E-09	2.77E-10	3.56E-08	1.48E-09
1080	Furans	2.07E-08	8.64E-10	1.11E-07	4.64E-09	2.13E-08	8.85E-10	1.14E-07	4.75E-09	2.39E-08	9.95E-10	1.28E-07	5.34E-09	2.51E-08	1.05E-09	1.35E-07	5.62E-09
100414	Ethyl benzene	1.02E+01	1.17E-03	3.86E+01	4.40E-03	1.05E+01	1.20E-03	3.95E+01	4.51E-03	1.18E+01	1.34E-03	4.44E+01	5.07E-03	1.24E+01	1.41E-03	4.68E+01	5.34E-03
50000	Formaldehyde	8.87E+00	1.01E-03	3.32E+01	3.79E-03	9.09E+00	1.04E-03	3.40E+01	3.88E-03	1.02E+01	1.17E-03	3.83E+01	4.37E-03	1.08E+01	1.23E-03	4.03E+01	4.60E-03
110543	Hexane	1.12E+01	1.27E-03	4.09E+01	4.67E-03	1.14E+01	1.30E-03	4.19E+01	4.78E-03	1.28E+01	1.47E-03	4.71E+01	5.38E-03	1.35E+01	1.54E-03	4.96E+01	5.66E-03
1128	Lead Compounds	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
7439965	Manganese Compounds	1.36E-02	5.66E-04	7.29E-02	3.04E-03	1.39E-02	5.80E-04	7.47E-02	3.11E-03	1.57E-02	6.52E-04	8.40E-02	3.50E-03	1.65E-02	6.87E-04	8.84E-02	3.68E-03
7439976	Mercury Compounds	4.09E-06	1.70E-07	2.19E-05	9.13E-07	4.19E-06	1.74E-07	2.25E-05	9.36E-07	4.71E-06	1.96E-07	2.53E-05	1.05E-06	4.96E-06	2.06E-07	2.66E-05	1.11E-06
1634044	MTBE	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00	0.00E+00
91203	Naphthalene	1.16E+00	4.85E-02	4.31E+00	1.80E-01	1.19E+00	4.97E-02	4.42E+00	1.84E-01	1.34E+00	5.58E-02	4.96E+00	2.07E-01	1.41E+00	5.88E-02	5.23E+00	2.18E-01
7440020	Nickel Compounds	1.53E-02	6.39E-04	8.22E-02	3.43E-03	1.57E-02	6.54E-04	8.42E-02	3.53E-03	1.75E-02	7.36E-04	9.47E-02	3.95E-03	1.86E-02	7.74E-04	9.97E-02	4.15E-03
56553	Benzo(a)anthracene	2.99E-03	1.25E-04	1.12E-02	4.68E-04	3.07E-03	1.28E-04	1.15E-02	4.80E-04	3.45E-03	1.44E-04	1.29E-02	5.39E-04	3.63E-03	1.51E-04	1.36E-02	5.68E-04
50328	Benzo(a)pyrene	1.23E-01	5.14E-03	4.93E-02	2.05E-03	1.26E-01	5.27E-03	5.05E-02	2.10E-03	1.42E-01	5.92E-03	5.67E-02	2.36E-03	1.50E-01	6.23E-03	5.97E-02	2.49E-03
205992	Benzo(b)fluoranthene	6.22E-02	2.59E-03	3.20E-02	1.33E-03	6.38E-02	2.66E-03	3.28E-02	1.37E-03	7.17E-02	2.99E-03	3.69E-02	1.54E-03	7.55E-02	3.14E-03	3.88E-02	1.62E-03
207089	Benzo(k)fluoranthene	6.22E-02	2.59E-03	3.20E-02	1.33E-03	6.38E-02	2.66E-03	3.28E-02	1.37E-03	7.17E-02	2.99E-03	3.69E-02	1.54E-03	7.55E-02	3.14E-03	3.88E-02	1.62E-03
218019	Chrysene	4.49E-02	1.87E-03	2.90E-02	1.21E-03	4.60E-02	1.92E-03	2.97E-02	1.24E-03	5.17E-02	2.15E-03	3.34E-02	1.39E-03	5.44E-02	2.27E-03	3.51E-02	1.46E-03
53703	Dibenzo(a,h)anthracene	2.14E-02	8.92E-04	7.07E-02	2.95E-03	2.19E-02	9.14E-04	7.25E-02	3.02E-03	2.47E-02	1.03E-03	8.15E-02	3.39E-03	2.60E-02	1.08E-03	8.58E-02	3.57E-03
193395	Indeno(1,2,3,c,d)pyrene	1.25E-01	5.22E-03	4.95E-02	2.06E-03	1.28E-01	5.35E-03	5.07E-02	2.11E-03	1.44E-01	6.01E-03	5.70E-02	2.37E-03	1.52E-01	6.33E-03	6.00E-02	2.50E-03
100425	Styrene	5.13E-01	5.85E-05	1.93E+00	2.21E-04	5.25E-01	6.00E-05	1.98E+00	2.26E-04	5.90E-01	6.74E-05	2.23E+00	2.54E-04	6.22E-01	7.10E-05	2.35E+00	2.68E-04
108883	Toluene	4.58E+01	5.23E-03	1.73E+02	1.97E-02	4.72E+01	5.39E-03	1.77E+02	2.02E-02	5.28E+01	6.02E-03	1.99E+02	2.27E-02	5.55E+01	6.34E-03	2.10E+02	2.39E-02
1330207	Xylene	3.72E+01	4.25E-03	1.40E+02	1.60E-02	3.81E+01	4.35E-03	1.44E+02	1.64E-02	4.29E+01	4.89E-03	1.62E+02	1.85E-02	4.51E+01	5.15E-03	1.70E+02	1.94E-02
9901	Diesel PM	4.28E+02	4.88E-02	6.78E+00	7.74E-04	4.38E+02	5.00E-02	6.95E+00	7.93E-04	4.92E+02	5.62E-02	7.81E+00	8.92E-04	5.18E+02	5.92E-02	8.22E+00	9.38E-04

2.3 Health Impact Characterization

The HRA modeling was conducted using CARB's Hotspots Analysis Reporting Program (HARP2, Air Dispersion & Risk Tool Version dated 16088).

The health risk assessment was conducted following the San Joaquin Valley Air Pollution Control District Health Risk Assessment Guidelines.[3] These guidelines are used by the District to evaluate the health impacts from new and existing sources of toxic air contaminants. Listed below are the risk assessment options that were used in the modeling.

- The residential cancer risk estimates are based on 70-year exposures. (OEHHA guidance recommends 30-year exposure; 70-year exposure is more conservative, and overestimates the exposure expected for a residential community comprised of rental units.)

- Deposition velocity – 0.05 m/sec. This is used to calculate the rate toxic air contaminants that are in particulate form deposit on the soil. These contaminants may then be taken up through ingestion of soil or home-grown produce.

- Pathways considered for residential exposure include inhalation, soil ingestion, dermal absorption, homegrown produce, and mother's milk.

- A "mixed" climate was assumed for the dermal exposure pathway.

2.4 Results

The results of the health risk assessment are summarized in Table 2-2.

Table 2-2
Health Risk Assessment Results

Cancer Risk at MEIR	160 in a million
Chronic Hazard Index at MEIR	0.035
Acute Hazard Index at MEIR	9.2
Note: MEIR is Maximally Exposed Individual, Residential	

[3] Update to District's Risk Management Policy to Address OEHHA's Revised Risk Assessment Guidance Document, Final Staff Report, San Joaquin Valley Unified Air Pollution Control District. Available at *www.valleyair.org/busind/pto/staff-report-5-28-15.pdf*.

2.4.1 Cancer Risk

The increased cancer risk to the maximally exposed individual from vehicle emissions is 160 in a million. DPM is the dominant contributor to this risk and is emitted by vehicles with diesel engines. The risk is calculated based on emissions from the projected traffic volumes and fleet makeup for 2018. However, as the truck fleet turns over and old engines are replaced by newer, cleaner ones, DPM emissions are expected to decline significantly.

2.4.2 Chronic Hazard Index

The chronic hazard index for the maximally exposed individual is 0.035. DPM is the dominant contributor to this impact. As noted above, DPM is emitted by vehicles with diesel engines. The hazard index is calculated based on emissions from the projected traffic volumes and fleet makeup for 2018.

The toxicity values for DPM are based on rat studies. These studies indicate that chronic exposures to DPM may affect the respiratory system.

2.4.3 Acute Hazard Index

The chronic hazard index for the maximally exposed individual is 9.2. Nickel is the dominant contributor to this impact. Nickel is emitted by gasoline engines. The hazard index is calculated based on emissions from the projected traffic volumes and fleet makeup for 2018.

The toxicity values for nickel are based on mouse studies. These studies indicate that acute exposures to nickel may affect the immune system.

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