Rosemary Street Residential – San Jose, CA DPM Air Quality Study

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Introduction

This report evaluates potential exposures of planned new residences from diesel particulate matter emitted by Interstate 880 traffic. Rosemary Street Housing project proposes to develop a mix of senior and multi-family residential uses at a site adjacent to I-880 near First Street. The project site is located along the north side of Interstate 880 in San Jose, California, and is currently developed with commercial and light industrial land uses. The majority of the existing buildings on site are vacant. The project would remove the existing buildings and develop up to 97 senior and 207 family affordable housing units. Since the project involves the development of sensitive receptors (residences), exposure to existing sources of toxic air contaminants was assessed using guidelines from the California Air Resources Board (CARB) and the BAAQMD. This analysis was conducted following guidance for evaluating environmental air quality impacts provided by the Bay Area BAAQMD[1].

Diesel Particulate Matter (DPM)

Toxic air contaminants (TACs) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer). TACs are found in ambient air, especially in urban areas, and are caused by industry, agriculture, fuel combustion, and commercial operations (e.g., dry cleaners). TACs are typically found in low concentrations, even near their source (e.g., benzene near a freeway). Because chronic exposure can result in adverse health effects, TACs are regulated at the regional, state, and federal level.

Diesel exhaust is the predominant TAC in urban air and is estimated to represent about two-thirds of the cancer risk from TACs (based on the statewide average). According to the CARB, diesel exhaust is a complex mixture of gases, vapors and fine particles. This complexity makes the evaluation of health effects of diesel exhaust a complex scientific issue. Some of the chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by the CARB, and are listed as carcinogens either under the state's Proposition 65 or under the federal Hazardous Air Pollutants programs.

CARB reports that recent air pollution studies have shown an association that diesel exhaust and other cancer-causing toxic air contaminants emitted from vehicles are responsible for much of the overall cancer risk from TACs in California. Particulate matter emitted from diesel-fueled engines (diesel particulate matter or DPM) was found to make up much of that risk. In 1998, CARB formally identified DPM as a TAC. DPM is of particular concern since it can be distributed over large regions, thus leading to widespread public exposure. The particles emitted by diesel engines are coated with chemicals, many of which have been identified by EPA as hazardous air pollutants, and by CARB as TACs. Diesel engines emit particulate matter at a rate about 20 times greater than comparable gasoline engines. The vast majority of diesel exhaust particles (over 90 percent) consist of $PM_{2.5}$, which are the particles that can be inhaled deep into the lung. Like other particles of this size, a portion will eventually become trapped within the lung possibly leading to adverse health effects. While the gaseous portion of diesel exhaust also contains TACs, the CARB's 1998 action was specific to DPM that accounts for much of the cancer-causing potential from diesel exhaust. California has adopted a comprehensive diesel risk

[1] BAAQMD CEQA Guidelines for Assessing Air Quality Impacts from Projects and Plans, 1996, revised 1999.

reduction program to reduce DPM emissions 85 percent by 2020. The U.S. EPA and CARB adopted low sulfur diesel fuel standards in 2006 that reduce diesel particulate matter substantially.

Climate and Topography

The project is located in San Jose, which lies at the northern part of the Santa Clara Valley. The climate is affected by the proximity to both the Pacific Ocean and San Francisco Bay, which has a moderating influence. The Pacific Ocean and the Bay cool the air that it comes in to contact with during warm weather and warms the air during cold weather. During the afternoon and early evening, a north-northwesterly sea breeze often flows from the Bay through the valley, and a light south-southeasterly drainage flow often occurs during the late evening and early morning hours. Winds from the northwest are most common. In late fall and winter, southeasterly flow is common. Typical summer maximum temperatures for the region are in the upper 70's to low 80's, while winter maximum temperatures are in the high 50's or low 60's. Minimum temperatures usually range from the high 50's in the summer to the upper 30's and low 40's in the winter. Rainfall in the area occurs mostly during the months of November through March.

Air Quality Impacts from Exposure to DPM

Thresholds of Significance

CEQA Guidelines prepared by the BAAQMD are used to establish the significance criteria to assess the impacts caused by the project. Air quality impacts caused by development of the project were addressed in the North San Jose Area Development Policy Environmental Impact Report. However, air quality impacts, such as exposure of new residences to TACs were not addressed site specifically for residential projects. For this type of impact, the BAAQMD has established criteria to assess the significance as follows:

- Would the project expose sensitive receptors or the general public to substantial pollutant concentrations? This includes exposure of proposed sensitive receptors to an air pollution source that would result in a probability of contracting cancer that exceeds 10-in-one million.

Potential Impact: ***Expose future residences to substantial pollutant concentrations?*** *Less than Significant*

The project would locate new residences near a freeway, which is a source of air pollution. DPM emitted from diesel-fueled vehicles may pose a health concern. In 2005, CARB released the final version of the Air Quality and Land Use Handbook, which is intended to encourage local land use agencies to consider the risks from air pollution prior to making decisions that approve the siting of new sensitive receptors (e.g., schools, homes or daycare centers) near sources of air pollution. The proposed project would be located within 500 feet of Interstate 880. CARB recommends that new residential construction be setback 500 feet from freeways to avoid chronic health effects from traffic air pollution exposure. However, CARB acknowledges that land use agencies have to balance other siting considerations such as housing and transportation needs, economic development priorities and other quality of life issues. Diesel particulate matter emitted from trucks is the primary pollutant of concern. The recommendation is general and does not distinguish between different types of freeways in California or the prevailing dispersion conditions that are site specific.

Background Risk

Since identifying DPM as a toxic air contaminant, CARB has conducted studies to identify existing health effects from exposure to DPM. CARB identified the average year 2000 statewide potential cancer risks at 540 excess cases per million people[2]. This risk is based on statewide exposure to DPM and accounts for both outdoor and indoor exposure. The potential risk near high volume freeways was found to be much higher. This risk is predicted to decrease in the future due to plans to reduce diesel particulate matter emissions from a variety of sources. The average statewide risk is expected to decrease to 360 excess cancer cases per million people by 2020. Modeling information compiled by CARB indicates that the 2001 cancer risk in San Jose at the project site is about 500 excess cases per million people and would be reduced to 100 to 250 cases by 2010, assuming major components of the diesel reduction plan are implemented in a timely manner[3].

Analysis of Site-Specific DPM Cancer Risk

Future concentrations of DPM from local freeway traffic were predicted at the project site. The chronic health risk associated with almost continuous exposure to these concentrations was computed and compared against BAAQMD significance thresholds.

This analysis involved the prediction of DPM emissions from traffic using the latest version of the CARB EMFAC2007 emission factor model with defaults for Santa Clara County. The emission factors were then used in the Cal3qhcr dispersion model to predict average DPM concentrations and compute the resulting health risks. All freeway segments within one-quarter mile of the project were included in the analysis.

EMFAC2007 is the recent version of the CARB motor vehicle emission factor model, released in November 2006. The model predicts that DPM emissions will decrease in the future and this was taken into account by modeling future years and weighting the average concentration. The horizon year used in this analysis was 2030 (assuming emission rates and traffic do not change beyond 2030). The EMFAC2007 results were adjusted to the traffic mix on the roadways. Annual average daily traffic volume and truck mix for Interstate 880 was based on information reported by Caltrans[4]. The emission factors are speed dependent. Heavy-duty truck speeds were assumed to be 55 mph, medium duty-truck speeds were 60 mph, and light-duty vehicles were assumed to be 65 mph. Emission factors were developed for 2010, 2015, 2020, 2025, and 2030 using the calculated mix of diesel-fueled vehicles.

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[2] -California Air Resources Board, Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel Fueled Engines and Vehicles, 2000.

[3] -California Air Resources Board http://www.arb.ca.gov/toxics/cti/hlthrisk/cncrinhl/riskmapviewfull.htm

[4] -Caltrans, Based on 2005 Average Annual Daily Truck Traffic on the California State Highway System - http://www.dot.ca.gov/hq/traffops/saferesr/trafdata/

Caltrans publishes traffic reports for the State Highway System, which provide annual average daily volumes for all traffic and truck traffic, broken down by the number of axles. Medium-duty trucks are two axle trucks, while heavy-duty trucks are those with 3 to 5 axles. The EMFAC2007 model provides a countywide breakdown of heavy-duty vehicle types and technology classes that were applied to this analysis. Heavy-duty truck types include light heavy-duty1, light heavy-duty 2, medium heavy-duty, and heavy heavy-duty trucks. Technology classes for heavy trucks include non-catalyst gasoline, catalyst gasoline, and diesel. Again, the specific breakdown of these truck technology types are based on EMFAC2007 default values for Santa Clara County. EMFAC2007 indicates a majority of heavy-duty trucks are diesel fueled.

Hour by hour traffic counts for a one-week period made by Caltrans at Interstate 280 near the Interstate 880 interchange were used to distribute traffic for appropriate hours. These counts were for all traffic. Truck traffic was assumed to follow the same hourly pattern as all traffic for weekday periods. Lower levels of commerce result in fewer truck trips during the weekends. To account for weekend truck traffic, day-by-day distribution of traffic by type was obtained from the nearest count station operated by Caltrans. This station is at I-880 in Hayward near Industrial Parkway. Using two weeks of traffic counts made in May of 2006, Saturday traffic volumes were found to be 33% of average weekday volumes and Sunday volumes were found to be 20% of weekday volumes. These adjustments were applied to the daily distribution of traffic. Hour by hour traffic profiles were developed for a typical weekday, a Saturday and a Sunday. Traffic data for future years were not available, so traffic was assumed to increase at a rate of about 1% per year through 2030, which is consistent with ABAG's population projections in Projections 2005.

The Cal3qhcr dispersion modeling of DPM emissions from the freeways used a 5-year set of meteorological data for Mineta San Jose International Airport that was obtained from BAAQMD. Other inputs to the model included geometry, traffic volumes, and the DPM emission factors described above. A view showing the project and roadway links are shown in Figure 1. Modeling receptors representing planned residential units are shown in Figure 2. Modeling inputs and results are also included as Attachment 1.

The maximum individual cancer risks were computed using the methods recommended by the California Office Of Environmental Health Hazard Assessment (OEHHA) that assume almost continuous exposure over a 70-year lifetime for residences. This results in DPM unit risk factors of 318.6 for 70-year residential exposure. The residential unit risk factor is applied to the time weighted average DPM concentration expressed in microgram per cubic meter ($\mu g/m^3$) to calculate the residential cancer risk. The cancer risk for 9-year and 30-year exposures was also computed for informational purposes.

The analysis included the conservative assumption that exposure to DPM will be almost continuous for a 70-year period beginning in 2010. Lower future vehicle emission rates that have been established by regulations through 2006 were taken into account. Future regulatory actions not yet adopted that would continue to lower emissions rates were not included. CARB's diesel reduction plan[5] includes proposed regulatory actions developed in 2000 that are intended to substantially decrease emissions of DPM. CARB has implemented many of the control

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[5] CARB. 2000, <u>Risk Reduction Plan to Reduce Particulate Matter Emissions from Diesel-Fueled Engines and Vehicles</u>. October

measures outlined in the plan and most of those actions are reflected in the EMFAC2007 model runs. Additional measures will be adopted in the near future, which were not included in the emission factors. Such measures include a proposed regulation to reduce DPM emissions from in-use on-road diesel-fueled vehicles. This regulation would require truck fleet owners to either retrofit or phase out older engines over time.

U.S. EPA considers 9 years to be the estimate of average residence time, 30-years to be the high-end of residence time and 70-years to be representative of lifetime exposure. The average residency exposure of 9 years should take into account children, which have a higher intake rate based on body weight. OEHHA recommends the 70-year lifetime exposure period for determining residential cancer risks[6]. This recommendation is accepted by BAAQMD and required for use in risk assessments, including those conducted for CEQA only purposes. This 70-year exposure period would ensure that a person residing in the vicinity of the freeway for a lifetime would be included in the evaluation. The lifetime (or 70-year exposure) has been the historical benchmark for comparing facility impacts on sensitive receptors. OEHHA recognizes that although it is not likely that most people will reside at a single residence for 70 years, it is common that people will spend their entire lives in a major urban area. While residing in urban areas it is quite possible to be exposed to the emissions of other sources at the next residence. According to OEHHA, exposure durations of 9-years and 30-years may also be evaluated as supplemental information to show the range of cancer risk based on residency periods.

The maximum concentrations of DPM and resulting health risk occur at proposed residences near the southeast corner of the site and generally decrease towards the northwest (i.e., away from the freeway). The maximally exposed residences would have annual DPM concentrations that are predicted to be up to 0.08 $\mu g/m^3$ in 2010 and decrease to about 0.02 by 2030. Concentrations are similar or slightly lower at 2nd story or higher receptors. The range of health risks computed using 9-, 30-, and the 70-year exposure periods are summarized in Table 1. Over the course of a 70-year lifetime exposure, the incremental risk at maximally exposed proposed residences would be 10 excess cancer cases per million people. Exposures over 9- and 30-year periods would result in lower health risks. The BAAQMD considers an incremental risk of greater than ten cases per million at the Maximally Exposed Individual or MEI (in this case being proposed residences near I-880) for a 70-year exposure period to result in a significant impact. Since the predicted risk does not exceed 10 in one million, the impact is considered *less than significant*.

Table 1 Maximum computed cancer risks due to exposure to freeway traffic for different exposure periods

Exposure Type	Maximum Computed Cancer Risk Per million
70-year lifetime*	10
30-year Adult	6
9-year Adult (and Child)	3 (5)
* BAAQMD policy is to judge impacts based on 70-year exposure	

[6] OEHHA. 2003. Air Toxics Hot Spots Program Risk Assessment Guidelines - The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August.

Figure 1 Aerial view showing roadway links and project site used in DPM modeling (approximate)

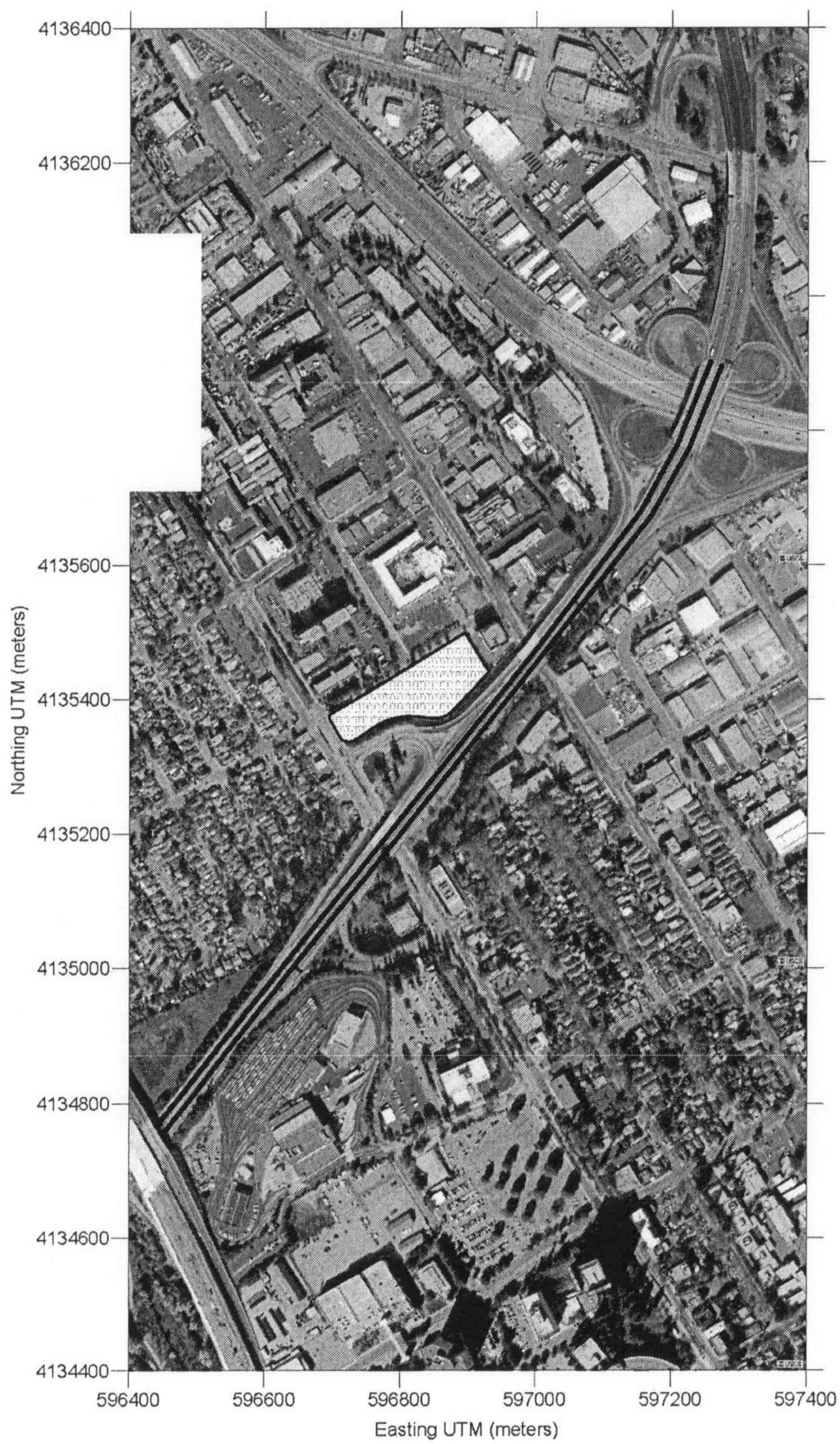
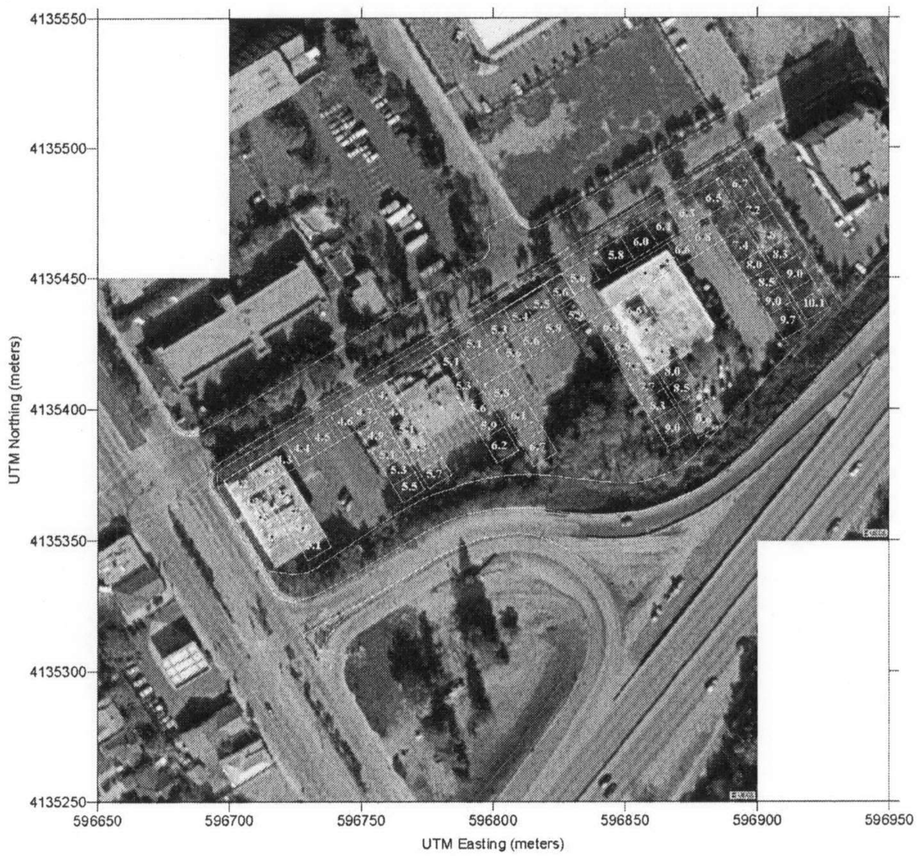


Figure 2 Aerial view showing modeling receptors and the corresponding 70-year health risk in terms of excess cancer cases per million people equally exposed



Attachment 1
DPM Modeling Inputs and Results

DPM Risk Modeling Parameters and Maximum Cancer Risk for Proposed Rosemary Lane Development

Receptor Information

Number of Receptors	73	
Receptor Height =	5.9 feet	(1.8 meters)
Receptor distances =	variable	

Meteorological Conditions

San Jose Airport: 1992,1993, 1994, 1996, 1997 Hourly Met Data

Land Use Classification	Urban	
Stability class =	variable	
Wind speed =	variable	
Wind direction =	variable	
Surface roughness =	100	cm

Cancer Risk Calculation Method

Inhalation Dose = C_{air} x DBR x A x EF x ED x 10^{-6} / AT

Where: C_{air} = concentration in air ($\mu g/m^3$)
DBR = daily breathing rate (L/kg body weight-day)
A = Inhalation absorption factor
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time period over which exposure is averaged.
10^{-6} = Conversion factor

Inhalation Dose Factors

Exposure Type	Value[1]					
	DBR (L/kg BW -	A (-)	Exposure (hr/day)	EF (days/yr)	ED (Years)	AT (days)
Residential (70-Year)	302	1	24	350	70	25,550
Residential (30-Year)	302	1	24	350	30	25,550
Residential (9-year)	302	1	24	350	9	25,550
Residential-Child	581	1	24	350	9	25,550
Off-Site Worker	149	1	8	245	40	25,550

[1] Default values recommended by OEHHA & Bay Area Air Quality Management District

Cancer Risk (per million) = CPF x Inhalation Dose x 1.0E6
= URF x Cair

Where: CPF = Cancer potency factor $(mg/kg\text{-}day)^{-1}$
URF =Unit risk factor (cancer risk per $\mu g/m^3$)

Diesel Particulate Matter Unit Risk Factors

Exposure Type	CPF (mg/kg-day	URF *(Risk/million/µg/m³)*
Residential (70-Yr Exposure)	1.10E+00	318.5
Residential (30-Yr Exposure)	1.10E+00	136.5
Residential (9-Yr Exposure)	1.10E+00	41.0
Residential (9-Yr Exposure)	1.10E+00	78.8
Off-Site Worker	1.10E+00	62.87

MEI Cancer Risk Calculations

Meteorological Data Year	Maximum DPM Concentration (ug/m³)						30-Year Exposure Adult	9-Year Exposure Adult	9-Year Exposure Child
	2010	2015	2020	2025	2030				
1992	0.0786	0.0506	0.0348	0.0275	0.0230				
1993	0.0886	0.0570	0.0392	0.0310	0.0259				
1994	0.0883	0.0567	0.0391	0.0309	0.0258				
1995	0.0815	0.0524	0.0361	0.0285	0.0239				
1997	0.0752	0.0483	0.0333	0.0263	0.0220				
Average	**0.0824**	**0.0530**	**0.0365**	**0.0289**	**0.0241**		**0.0415**	**0.0693**	**0.0693**
Cancer Risk[a]	26.3	16.9	11.6	9.2	7.7				
70-yr Cumulative Risk[b]			10				6	3	5

Notes:
Maximum concentrations occur at Receptor No. 68 (southeast corner of property)
Receptor Height = 1.8 m
a Cancer risk (per million) calculated assuming constant 70-year exposure to concentration for year of analysis.
b Cumulative cancer risk (per million) calculated assuming variable exposure over a 70-year period due to decreased concentrations over time.