485 SOUTH MONROE RESIDENTIAL AIR QUALITY COMMUNITY RISK ASSESSMENT
SAN JOSE, CALIFORNIA

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INTRODUCTION

This report presents the results of an environmental air quality evaluation of a proposed residential and commercial development project in San Jose, California. The air quality evaluation is limited in scope in that it evaluates the impacts of nearby air pollution sources upon future residential development at the site. The proposed project is located on an 8.2 acre site that would include 104 residential town homes in nineteen 3-story buildings and a 90,000 square foot office building. The City would develop a park on project-dedicated land at the site. The project would include a General Plan amendment to change the land use designation from Regional Commercial and Office to High-Density Residential and Medium High-Density Residential.

The site is bounded by South Monroe Street to the east, Dudley Avenue and parking lots to the west, existing residences to the north of the proposed residential development, parking lots to the north of the proposed office building, and to the south of the site is Interstate 280 (I-280). Santana Park is to the south of the proposed residential development, between the residences and I-280. Farther to the east, about 850 feet from the site is Interstate 880 (I-880), and to the southeast from the site is the interchange of I-280 and I-880/Highway 17. The traffic on these nearby freeways are a substantial source of air pollutant emissions. In particular are emissions of diesel particulate matter (DPM), which is an air toxic contaminant (TAC) due to its potential to cause cancer, organic TACs from all vehicles, as well as fine particulate matter with a diameter of 2.5 microns or less ($PM_{2.5}$), which is a regulated air pollutant. This assessment describes the potential impacts from air pollutants emitted along I-280 and I-880 on proposed residential and commercial areas of the project in terms health effects of DPM, organic TACS, and from $PM_{2.5}$.

SETTING

Regulatory Setting

The Federal Clean Air Act governs air quality in the United States. In addition to being subject to federal requirements, air quality in California is also governed by more stringent regulations under the California Clean Air Act. At the Federal level, the United States Environmental Protection Agency (USEPA) administers the Clean Air Act (CAA). The California Clean Air Act is administered by the California Air Resources Board (CARB) at the State level and by the Air Quality Management Districts at the regional and local levels. The Bay Area Air Quality Management District (BAAQMD) regulates air quality at the regional level, which includes the nine-county Bay Area.

Community Air Contaminants and their Health Effects

<u>Fine Particulate Matter ($PM_{2.5}$)</u>

Particulate matter pollution consists of very small particles suspended in the air, which can include smoke, soot, dust, salts, acids, and metals. Particulate matter also forms when industry and gaseous pollutant undergo chemical reactions in the atmosphere. Respirable particulate matter (PM_{10}) and fine particulate matter ($PM_{2.5}$) represent fractions of particulate matter. PM_{10} refers to particulate matter less than 10 microns in diameter and $PM_{2.5}$ refers to particulate matter

that is 2.5 microns or less in diameter. Major sources of $PM_{2.5}$ results primarily from diesel fuel combustion (from motor vehicles, power generation, industrial facilities), residential fireplaces, and wood stoves. PM_{10} include all $PM_{2.5}$ sources as well as emissions from dust generated by construction, landfills, and agriculture; wildfires and brush/waste burning, industrial sources, windblown dust from open lands, and atmospheric chemical and photochemical reactions. PM_{10} and $PM_{2.5}$ pose a greater health risk than larger-size particles, because these tiny particles can penetrate the human respiratory system's natural defenses and damage the respiratory tract increasing the number and severity of asthma attacks, cause or aggravate bronchitis and other lung diseases, and reduce the body's ability to fight infections. Whereas, larger particles tend to collect in the upper portion of the respiratory system, $PM_{2.5}$ are so tiny that they can penetrate deeper into the lungs and damage lung tissues. Suspended particulates also damage and discolor surfaces on which they settle, as well as produce haze and reduce regional visibility.

Toxic Air Contaminants

Toxic air contaminants (TAC) are a broad class of compounds known to cause morbidity or mortality (usually because they cause cancer) and include, but are not limited to, the criteria air pollutants listed above. 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., diesel particulate matter 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. DPM emitted by diesel-fueled engines was found to comprise much of that risk. DPM can be distributed over large regions, thus leading to widespread public exposure. 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 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, CARB's 1998 action was specific to DPM, which accounts for much of the cancer-causing potential from diesel exhaust. California has adopted a comprehensive diesel risk 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.

CARB has adopted and implemented a number of regulations for stationary and mobile sources to reduce emissions of DPM. Several of these regulatory programs affect medium and heavy

duty diesel trucks that represent the bulk of DPM emissions from California highways. These regulations include the solid waste collection vehicle (SWCV) rule, in-use public and utility fleets, and the heavy-duty diesel truck and bus regulations.

In December 2008 the CARB approved a new regulation to reduce emissions of DPM and nitrogen oxides from existing on-road heavy-duty diesel fueled vehicles[1]. The regulation requires affected vehicles to meet specific performance requirements between 2011 and 2023, with all affected diesel vehicles required to have 2010 model-year engines or equivalent by 2023. These requirements are phased in over the compliance period and depend on the model year of the vehicle.

Non-diesel vehicles also emit TACs, primarily in the form of organic compounds. A fraction of the total organic gas (TOG) emissions from vehicles are TACs. Organic compounds that have been identified as TACs associated with the emissions from vehicles include acetaldehyde, benzene, 1,3-butadiene, ethyl benzene, formaldehyde, hexane, naphthalene, toluene, and xylenes. These TACS are emitted from vehicle exhaust and from evaporative emissions that emanate from hoses, fittings or canisters, while the vehicle is being operated.

Buffer Zones

The BAAQMD recommends that general plans include buffer zones to separate sensitive receptors from sources of air toxic contaminants and odors. In April 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. Unlike industrial or stationary sources of air pollution, siting of new sensitive receptors does not require air quality permits, but could create air quality problems. The primary purpose of the handbook is to highlight the potential health impacts associated with proximity to common air pollution sources, so that those issues are considered in the planning process. CARB makes recommendations regarding the siting of new sensitive land uses near freeways, truck distribution centers, dry cleaners, gasoline dispensing stations, and other air pollution sources. These "advisory" recommendations include setbacks of 500 feet between new residences and freeways. The setbacks are based primarily on modeling information and are not reflective of site-specific conditions in San Jose. Siting of new sensitive land uses within these recommended distances may be possible, but only after site-specific studies are conducted to identify the actual health risks. 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.

BAAQMD Significance Thresholds

The BAAQMD adopted “Thresholds of Significance” for local community risk and hazard impacts that apply to both the siting of a new source and to the siting of a new receptor. Local community risk and hazard impacts are associated with TACs and $PM_{2.5}$ because emissions of these pollutants can have significant health impacts at the local level[2].

[1] http://www.arb.ca.gov/msprog/onrdiesel/onrdiesel.htm
[2] Note that the new thresholds of significance for community risk impacts to new receptors do not officially become

Project Impacts

If emissions of TACs or $PM_{2.5}$ exceed any of the Thresholds of Significance listed below, the proposed project would result in a significant impact.

- Non-compliance with a qualified risk reduction plan; or,
- An excess cancer risk level of more than 10 in one million, or a non-cancer (i.e., chronic or acute) hazard index greater than 1.0 would be a cumulatively considerable contribution;
- An incremental increase of greater than 0.3 micrograms per cubic meter ($\mu g/m^3$) annual average $PM_{2.5}$ would be a cumulatively considerable contribution.

Cumulative Impacts

According to BAAQMD, a project would have a cumulative considerable impact if the aggregate total of all past, present, and foreseeable future sources within a 1,000 foot radius from the fence line of a source, or from the location of a receptor, plus the contribution from the project, exceeds the following:

- Non-compliance with a qualified risk reduction plan; or,
- An excess cancer risk levels of more than 100 in one million or a chronic non-cancer hazard index (from all local sources) greater than 10.0; or
- 0.8 µg/m3 annual average PM2.5.

Since the City of San Jose does not have a qualified risk reduction plan and the project would be located near several freeways, an analysis of TAC and $PM_{2.5}$ impacts upon sensitive receptors is necessary. Portions of I-280 and I-880 are within 1,000 feet of the proposed development and were included in the analysis.

PROJECT IMPACTS

Since identifying diesel particulate matter as a toxic air contaminant, the CARB has conducted studies to identify existing health effects from exposure to DPM. The CARB identified the average year 2000 statewide potential cancer risks at 540 excess cases per million people[3]. The potential risk near high volume freeways was found to be much higher. The risk is predicted to decrease in the future due to plans to reduce diesel particulate matter emissions from a variety of sources. The 2000 CARB report predicts an average statewide risk at 360 excess cancer cases per million people in 2020. Modeling information compiled by BAAQMD indicates that the cancer risk in the San Jose area in the vicinity of the project is about 100 to 250 excess cases per million people[4].

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effective until January 1, 2011.

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

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

Project-Level Air Contaminant Exposure

Analysis of Site-Specific TAC Cancer Risk

This analysis involved the development of future DPM and organic TAC emissions for traffic on I-280 and I-880 using the latest version of the CARB EMFAC2007 emission factor model with defaults for Santa Clara County. EMFAC2007 is the most recent version of the CARB motor vehicle emission factor model. DPM emissions are predicted by the model to decrease in the future. However, the current version of EMFAC2007 does not incorporate the effects of the recent on-road diesel vehicle regulations, which will substantially reduce DPM emissions even further. The requirements for diesel trucks are phased in for future years and depend on the model year of the trucks. Since this analysis assesses the risk of proposed residences to future exposures, the lower future emissions were taken into account. The diesel truck age distribution used in the EMFAC2007 model was adjusted to reflect the effects of the new regulations.

CARB recently adopted new regulations that will require on-road diesel trucks to be retrofitted with particulate matter controls or replaced to meet new 2010 engine standards that have much lower DPM and $PM_{2.5}$ emissions. This regulation will substantially reduce these emissions between 2011 and 2023, with the greatest reductions occurring in 2013 through 2015. While new trucks and buses will meet strict federal standards, this measure is intended to accelerate the rate at which the fleet either turns over so there are more cleaner vehicles on the road, or is retrofitted to meet similar standards. With this regulation, older, more polluting trucks would be removed from the roads much quicker. CARB anticipates a 68 percent reduction in $PM_{2.5}$ (including DPM) emission from trucks in 2014 with this regulation.

The requirements for diesel trucks are phased in for future years and depend on the model year of the trucks. Since this analysis assesses the risk of proposed residences to future exposures, the lower future emissions were taken into account. The diesel truck age distribution used in the EMFAC2007 model was adjusted to reflect the effects of the new regulations. The EMFAC2007 results were then adjusted to the traffic volume and mix on I-280 and I-880 reported by Caltrans[5]. Average daily traffic volumes were assumed to increase by 1 percent per year to account for future traffic conditions.

Emission factors were developed for 2012, 2015, and 2020, using the calculated mix of cars and trucks on I-280 and I-880. For emission year 2012, which would apply to the project during years 2012 – 2014, model years (MY) 1998 – 2012 were used to calculate emissions with EMFAC2007. For emission year 2015, which would apply to years 2015 – 2019, MYs 2005 – 2015 were used to calculate emissions with EMFAC2007. For emission year 2020, which would apply to years 2020 forward, MYs 2007 – 2020 were used to calculate emissions with EMFAC2007. The DPM emission calculations and emission factors are shown in Tables 1 and 2 for vehicles on I-280 and I-880, respectively.

Emissions of total organic compounds were also calculated for 2012, 2015, and 2020 using the EMFAC2007 model. These TOG emissions were then used in the modeling of organic TACs. TOG emissions from both exhaust and from running evaporative loses from all vehicle types were calculated using EMFAC2007 default model values for Santa Clara County along with the

[5] Caltrans, *2008 Average Annual Daily Truck Traffic on the California State Highway System*. September 2009.

traffic volumes and vehicle mixes for I-280 and I-880. The model year adjustments for diesel vehicles, discussed above, were not used when calculating TOG emissions. The TOG emission calculations and emission factors are shown in Tables 3 and 4 for I-280 and I-880 traffic, respectively.

Hour by hour traffic counts for a one-week period made by Caltrans at I-280 were used to distribute all freeway traffic for appropriate hours. These counts were for all traffic. Truck traffic was assumed to follow the same pattern as all traffic[6]. This was also assumed for weekends; however, lower levels of commerce should result in fewer truck trips. Specific data to support an assumption of even lower truck traffic levels on weekends were not available. Overall Saturday traffic volumes were found to be 90% of average weekday volumes and Sunday volumes were found to be 75% of weekday traffic. 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. These distributions were used for traffic on both I-280 and I-880. Weekday and weekend traffic distributions are shown in Table 5. Traffic data for future years were not available, so traffic was assumed to increase at a rate of about 1% per year through 2020, which is consistent with ABAG's population projections in Projections 2005.

Dispersion modeling of DPM and organic TAC emissions was conducted using the CAL3QHCR model, which is recommended by the BAAQMD for this type of analysis. A five-year set of hourly meteorological data for the Mineta San Jose Airport obtained from the BAAQMD was used in the modeling. Other inputs to the model included road geometry, hourly traffic volumes, and the DPM and TOG emission factors. An aerial view showing the project site and roadway links used for the modeling is shown in Figure 1. Modeling receptors representing planned residential units and office building are shown in Figure 2.

Based on the modeling, the maximum long-term concentrations of DPM and organic TACs in the proposed residential development would occur in the southeast corner of the residential area (receptor No. 105 in Figure 2) and the maximum concentrations for the office building would occur in the southeast corner of the building (receptor No. 100 in figure 2). TAC concentrations are slightly lower at 2nd story or higher receptors.

Using the modeled long-term average DPM concentrations, the individual cancer risks were computed using the most recent methods recommended by BAAQMD[7] and the California Office of Environmental Health Hazard Assessment (OEHHA)[8], which assume almost continuous exposure over a 70-year lifetime. Details of the cancer risk calculations are shown in Tables 6 and 7 for residential and worker (office building) exposures, respectively. Over the course of a 70-year lifetime exposure, the maximum incremental residential cancer risk at this site is calculated as an increase of 7.0 excess cancer cases per million people. It should be noted that the cancer risk calculations reflect use of the BAAQMD's most recent cancer risk calculation method, adopted in January 2010, which applies a Cancer Risk Adjustment Factor of 1.7 to the cancer risks for residential exposures to account for age sensitivity exposure to toxic air contaminants. For worker exposure, the maximum incremental residential cancer risk at the

[6] This assumption was confirmed through a personal conversation with Gary Black of Hexagon Transportation Consultants on 8/24/2007.

[7] BAAQMD, *Air Toxics NSR Program Health Risk Screening Analysis (HSRA) Guidelines*, January 2010.

[8] OEHHA 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines, The Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments.* Office of Environmental Health Hazard Assessment. August 2003.

proposed office building is calculated as an increase of 0.8 excess cancer cases per million people. This analysis computes cancer risk based on lifetime exposure to I-280 and I-880 traffic (i.e., almost constant exposure over a 70-year period for residents and exposure for 8 hours per day for 40 years of a 70-year exposure period for office workers). This type of assessment is recommended by BAAQMD, while noting that exposures could be less.

Under the BAAQMD CEQA Guidelines, an incremental risk of greater than 10 cases per million for a 70-year exposure duration at the Maximally Exposed Individual or MEI would result in a significant impact. Based on the air quality modeling discussed above, cancer risks for both residential and worker exposures at the proposed project are expected to be less than 10 cases per million. Since the maximum incremental cancer risks predicted for the proposed project are less than ten in a million, the potential health risks may be considered *less than significant*.

Hazard Impacts

Potential non-cancer health effects due to chronic exposure to DPM were not estimated since the concentration threshold for non-cancer effects is considerably higher than concentrations that would result in significant cancer risks that were described above. The chronic inhalation reference exposure level (REL) for DPM is 5 $\mu g/m^3$. The DPM air quality assessment predicted a maximum annual exposure of 0.027 $\mu g/m^3$, which is several orders of magnitude lower than the REL. Thus, the Hazard Index (HI), which is the ratio of the annual DPM concentration to the REL, would be much lower than significance criterion of a HI greater than 1.0.

For the organic TACs from vehicles, the BAAQMD has developed toxicity weighted chronic non-cancer RELs for the mix of organic TACs in the TOG from tailpipe exhaust emissions and from evaporative losses[9]. These chronic RELs are 283.8 $\mu g/m^3$ for tailpipe emissions and 120 $\mu g/m^3$ for evaporative losses. The air quality assessment predicted a maximum annual TOG concentration of 1.0 $\mu g/m^3$ from exhaust emissions and 0.5 $\mu g/m^3$ for evaporative emissions. These concentrations are many orders of magnitude below their respective RELs. As such, the HIs for these organic TACs would much lower than 1.0. The total HI for all compounds (DPM and organic TACs) would also be much lower than the significance criterion of a HI greater than 1.0.

$PM_{2.5}$ Impacts

In addition to evaluating the health risks from TACs, potential impacts from $PM_{2.5}$ emissions from traffic on I-280 and I-880 were evaluated. $PM_{2.5}$ concentrations from I-280 and I-880 traffic were modeled. To evaluate potential non-cancer health effects due to $PM_{2.5}$ exposure, the BAAQMD had adopted a significance threshold of an annual average $PM_{2.5}$ concentration greater than 0.3 $\mu g/m^3$.

The same basic modeling approach that was used for assessing TAC impacts was used in the modeling of $PM_{2.5}$ concentrations from I-280 and I-880. $PM_{2.5}$ emissions from all vehicles were used, rather than just the diesel powered vehicles, because all vehicle types (i.e., gasoline and diesel powered) emit $PM_{2.5}$

[9] BAAQMD, *Recommended Methods for Screening and Modeling Local Risks and Hazards*, May 2010.

The assessment involved, first, calculating $PM_{2.5}$ emission rates from traffic traveling on I-280 and I-880. Then, dispersion modeling using emission factors and traffic volumes was conducted. The dispersion model provides estimated annual $PM_{2.5}$ concentrations at receptors representative of living areas (sensitive land uses) at the project site and at the proposed office building. $PM_{2.5}$ emissions were calculated using the EMFAC2007 model for the mix of traffic on I-280 and I-880 for 2012, 2015, and 2020. Hourly traffic volumes were also calculated in the same manner as discussed earlier for the TAC modeling. The emission rate calculations are shown in Tables 3 and 4. The dispersion modeling of I-280 and I-880 traffic using the CAL3QHCR model also used the five years of meteorological data from the Mineta San Jose Airport and the same receptor locations that were used with the TAC modeling.

In the proposed residential development the maximum annual average $PM_{2.5}$ concentration occurred in the southeast corner of the residential area (receptor No. 105 in Figure 2) and the maximum concentration for the proposed office building occurred in the southeast corner of the building (receptor No. 100 in Figure 2). Annual average $PM_{2.5}$ concentrations were calculated as the average of the concentrations from the five years of meteorological data used for the modeling over all of the emission years (2012, 2015, and 2020). Table 8 summarizes the maximum average annual $PM_{2.5}$ concentrations for each emissions year (2012, 2015, and 2020) and the overall long term average concentration. The maximum long term average annual concentrations in the residential and commercial areas were 0.13 $\mu g/m^3$ and 0.15 $\mu g/m^3$, respectively. Concentrations at all other receptor locations in the project site would be less than the highest value. These concentrations are lower than the BAAQMD $PM_{2.5}$ threshold of greater than 0.3 $\mu g/m^3$.

Cumulative Air Contaminant Exposure

Other existing or planned sources of air contaminant exposure that could increase the cancer risk, hazard or $PM_{2.5}$ concentrations are not present. This analysis used anticipated cumulative traffic conditions. Therefore, the cumulative risk to new residents at this site would be less than significant.

Figure 1: Project Area and Modeling Roadway Links

Figure 2: Receptor Locations Used for Modeling

Table 1 – Interstate 280 Traffic Data and Diesel PM Emission Factors

Analysis Year = ***2012***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2012 Number Vehicles (vech/day)	2012 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	111,725	116,194	0.00%	0	0.02000	65	0.00
LDT	62,695	65,203	0.64%	418	0.0200	65	8.36
MDT	2,673	2,780	4.49%	125	0.0195	60	2.44
HDT	2,907	3,023	93.33%	2822	0.2278	55	642.85
Total	180,000	187,200	-	3,365	-	-	654
Diesel Vech Avg DPM EF					**0.19427**		
Mix Avg DPM EF					0.00349		
Increase From 2008		1.04					
Vehicles/Direction		93,600		1682			
Vehicles/Hour/Direction		3,900		**70.1**			

Analysis Year = ***2015***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2015 Number Vehicles (vech/day)	2015 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	117,413	125,632	0.00%	0	0.00000	65	0.00
LDT	57,007	60,997	0.00%	0	0.0000	65	0.00
MDT	2,673	2,860	5.00%	143	0.0125	60	1.79
HDT	2,907	3,110	94.29%	2933	0.1251	55	366.86
Total	180,000	192,600	-	3,076	-	-	369
Diesel Vech Avg DPM EF					**0.11986**		
Mix Avg DPM EF					0.00191		
Increase From 2008		1.07					
Vehicles/Direction		96,300		1538			
Vehicles/Hour/Direction		4,013		**64.1**			

Analysis Year = ***2020***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2020 Number Vehicles (vech/day)	2020 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	115,685	129,567	0.00%	0	0.00000	65	0.00
LDT	58,735	65,784	0.00%	0	0.0000	65	0.00
MDT	2,673	2,994	6.76%	202	0.0088	60	1.78
HDT	2,907	3,256	93.94%	3059	0.0829	55	253.56
Total	180,000	201,600	-	3,261	-	-	255
Diesel Vech Avg DPM EF					**0.07831**		
Mix Avg DPM EF					0.00127		
Increase From 2008		1.12					
Vehicles/Direction		100,800		1630			
Vehicles/Hour/Direction		4,200		**67.9**			

Traffic Data Year = ***2008***

CalTrans 2008 AADT Data		Total	Truck by Axle			
	Total	Truck	2	3	4	5
280 A San Jose, Jct. Rtes. 880/17	180000	5,580	2,673	971	268	1,668
		3.10%	2.13%	0.77%	0.21%	1.33%

Traffic Increase per Year (%) = ***1.0%***

Table 2 – Interstate 880 Traffic Data and Diesel PM Emission Factors

Analysis Year = ***2012***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2012 Number Vehicles (vech/day)	2012 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	95,853	99,687	0.00%	0	0.02000	65	0.00
LDT	53,788	55,940	0.64%	359	0.0200	65	7.17
MDT	2,482	2,581	4.49%	116	0.0195	60	2.26
HDT	1,877	1,952	93.33%	1822	0.2278	55	415.08
Total	154,000	160,160	-	2,297	-	-	425
Diesel Vech Avg DPM EF					**0.18485**		
Mix Avg DPM EF					0.00265		
Increase From 2008		1.04					
Vehicles/Direction		80,080		1148			
Vehicles/Hour/Direction		3,337		**47.8**			

Analysis Year = ***2015***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2015 Number Vehicles (vech/day)	2015 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	100,733	107,784	0.00%	0	0.00000	65	0.00
LDT	48,908	52,331	0.00%	0	0.0000	65	0.00
MDT	2,482	2,656	5.00%	133	0.0125	60	1.66
HDT	1,877	2,008	94.29%	1894	0.1251	55	236.88
Total	154,000	164,780	-	2,026	-	-	239
Diesel Vech Avg DPM EF					**0.11771**		
Mix Avg DPM EF					0.00145		
Increase From 2008		1.07					
Vehicles/Direction		82,390		1013			
Vehicles/Hour/Direction		3,433		**42.2**			

Analysis Year = ***2020***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2020 Number Vehicles (vech/day)	2020 Percent Diesel	Number Diesel	Avg. DPM EF (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions (g/mi)
LDA	99,250	111,160	0.00%	0	0.00000	65	0.00
LDT	50,391	56,438	0.00%	0	0.0000	65	0.00
MDT	2,482	2,780	6.76%	188	0.0088	60	1.65
HDT	1,877	2,102	93.94%	1975	0.0829	55	163.72
Total	154,000	172,480	-	2,163	-	-	165
Diesel Vech Avg DPM EF					**0.07647**		
Mix Avg DPM EF					0.00096		
Increase From 2008		1.12					
Vehicles/Direction		86,240		1081			
Vehicles/Hour/Direction		3,593		**45.1**			

Traffic Data Year = ***2008***

CalTrans 2008 AADT Data		Total	Truck by Axle			
	Total	Truck	2	3	4	5
880 A San Jose, Jct. Rte. 280	154000	4,358	2,482	669	219	989
		2.83%	56.95%	15.35%	5.03%	22.69%

Traffic Increase per Year (%) = ***1.0%***

Table 3 – Interstate 280 Traffic Data & PM2.5 and TOG Emission Factors

Analysis Year = ***2012***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2012 Number Vehicles (vech/day)	Emission Factors: Exhaust PM2.5 (g/VMT)	Emission Factors: Exhaust TOG (g/VMT)	Emission Factors: Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions: Exhaust PM2.5 (g/mi)	Total Vehicle Emissions: Exhaust TOG (g/mi)	Total Vehicle Emissions: Running* TOG (g/mi)
LDA	109,761	114,151	0.0080	0.0770	0.037	65	913	8790	4215
LDT	64,659	67,245	0.0171	0.1250	0.062	65	1152	8406	4147
MDT	2,673	2,780	0.0166	0.0918	0.042	60	46	255	116
HDT	2,907	3,023	0.2644	0.4602	0.008	55	799	1391	25.6
Total	180,000	187,200	-	-	-	-	2,911	18,842	8,504
Mix Avg Emission Factor			**0.01555**	**0.10065**	**0.04543**				
Increase From 2008		1.04							
Vehicles/Direction		93,600							
Vehicles/Hour/Direction		**3,900**							

Analysis Year = ***2015***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2015 Number Vehicles (vech/day)	Emission Factors: Exhaust PM2.5 (g/VMT)	Emission Factors: Exhaust TOG (g/VMT)	Emission Factors: Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions: Exhaust PM2.5 (g/mi)	Total Vehicle Emissions: Exhaust TOG (g/mi)	Total Vehicle Emissions: Running* TOG (g/mi)
LDA	110,108	117,815	0.0080	0.0480	0.029	65	943	5655	3371
LDT	64,312	68,814	0.0177	0.0873	0.055	65	1221	6008	3751
MDT	2,673	2,860	0.0174	0.0745	0.041	60	50	213	117
HDT	2,907	3,110	0.1965	0.3328	0.006	55	611	1035	20.0
Total	180,000	192,600	-	-	-	-	2,824	12,911	7,260
Mix Avg Emission Factor			**0.01466**	**0.06703**	**0.03769**				
Increase From 2008		1.07							
Vehicles/Direction		96,300							
Vehicles/Hour/Direction		**4,013**							

Analysis Year = ***2020***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2020 Number Vehicles (vech/day)	Emission Factors: Exhaust PM2.5 (g/VMT)	Emission Factors: Exhaust TOG (g/VMT)	Emission Factors: Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions: Exhaust PM2.5 (g/mi)	Total Vehicle Emissions: Exhaust TOG (g/mi)	Total Vehicle Emissions: Running* TOG (g/mi)
LDA	109,783	122,957	0.0080	0.0260	0.022	65	984	3197	2724
LDT	64,637	72,393	0.0179	0.0476	0.044	65	1299	3445	3194
MDT	2,673	2,994	0.0180	0.0507	0.038	60	54	152	114
HDT	2,907	3,256	0.1311	0.2136	0.005	55	427	696	16.3
Total	180,000	201,600	-	-	-	-	2,763	7,489	6,048
Mix Avg Emission Factor			**0.01370**	**0.03715**	**0.03000**				
Increase From 2008		1.12							
Vehicles/Direction		100,800							
Vehicles/Hour/Direction		**4,200**							

Traffic Data Year = ***2008***

CalTrans 2008 AADT Data		Total	Truck by Axle			
280 A San Jose, Jct. Rtes. 880/17	180000	5,580	2,673	971	268	1,668
		3.10%	47.90%	17.40%	4.80%	29.89%
	% of Total	3.10%	1.49%	0.54%	0.15%	0.93%

Traffic Increase per Year (%) = ***1.0%***

*** Based on engine run time (min) =** ***30***

Table 4 – Interstate 880 Traffic Data & PM2.5 and TOG Emission Factors

Analysis Year = ***2012***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2012 Number Vehicles (vech/day)	Emission Factors Exhaust PM2.5 (g/VMT)	Emission Factors Exhaust TOG (g/VMT)	Emission Factors Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions Exhaust PM2.5 (g/mi)	Total Vehicle Emissions Exhaust TOG (g/mi)	Total Vehicle Emissions Running* TOG (g/mi)
LDA	94,168	97,934	0.0080	0.0770	0.037	65	783	7541	3616
LDT	55,473	57,692	0.0171	0.1250	0.062	65	989	7212	3558
MDT	2,482	2,581	0.0166	0.0918	0.042	60	43	237	108
HDT	1,877	1,952	0.2644	0.4602	0.008	55	516	898	16.5
Total	154,000	160,160	-	-	-	-	2,331	15,888	7,299
Mix Avg Emission Factor			**0.01455**	**0.09920**	**0.04557**				
Increase From 2008		1.04							
Vehicles/Direction		80,080							
Vehicles/Hour/Direction		**3,337**							

Analysis Year = ***2015***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2015 Number Vehicles (vech/day)	Emission Factors Exhaust PM2.5 (g/VMT)	Emission Factors Exhaust TOG (g/VMT)	Emission Factors Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions Exhaust PM2.5 (g/mi)	Total Vehicle Emissions Exhaust TOG (g/mi)	Total Vehicle Emissions Running* TOG (g/mi)
LDA	94,465	101,078	0.0080	0.0480	0.029	65	809	4852	2892
LDT	55,176	59,038	0.0177	0.0873	0.055	65	1047	5154	3218
MDT	2,482	2,656	0.0174	0.0745	0.041	60	46	198	109
HDT	1,877	2,008	0.1965	0.3328	0.006	55	395	668	12.9
Total	154,000	164,780	-	-	-	-	2,297	10,872	6,232
Mix Avg Emission Factor			**0.01394**	**0.06598**	**0.03782**				
Increase From 2008		1.07							
Vehicles/Direction		82,390							
Vehicles/Hour/Direction		**3,433**							

Analysis Year = ***2020***

Vehicle Type	2008 CalTrans Number Vehicles (vech/day)	2020 Number Vehicles (vech/day)	Emission Factors Exhaust PM2.5 (g/VMT)	Emission Factors Exhaust TOG (g/VMT)	Emission Factors Running TOG (g/VMT)	Vehicle Speed (mph)	Total Vehicle Emissions Exhaust PM2.5 (g/mi)	Total Vehicle Emissions Exhaust TOG (g/mi)	Total Vehicle Emissions Running* TOG (g/mi)
LDA	94,187	105,489	0.0080	0.0260	0.022	65	844	2743	2337
LDT	55,454	62,109	0.0179	0.0476	0.044	65	1114	2955	2740
MDT	2,482	2,780	0.0180	0.0507	0.038	60	50	141	106
HDT	1,877	2,102	0.1311	0.2136	0.005	55	276	449	10.5
Total	154,000	172,480	-	-	-	-	2,283	6,288	5,194
Mix Avg Emission Factor			**0.01324**	**0.03646**	**0.03011**				
Increase From 2008		1.12							
Vehicles/Direction		86,240							
Vehicles/Hour/Direction		**3,593**							

Traffic Data Year = ***2008***

CalTrans 2008 AADT Data		Total	Truck by Axle			
880 A San Jose, Jct. Rte. 280	154000	4,358	2,482	669	219	989
		2.83%	56.95%	15.35%	5.03%	22.69%
	% of Total	2.83%	1.61%	0.43%	0.14%	0.64%

Traffic Increase per Year (%) = ***1.0%***

*** Based on engine run time (min) =** ***30***

Table 5 – Average Hourly Traffic Volume Distributions
Interstate 280 and Interstate 880

End Hour	Hourly Vehicle Volume Distributions	
	Weekdays	Weekends
1	0.90%	2.02%
2	0.51%	1.39%
3	0.46%	1.10%
4	0.38%	0.71%
5	0.60%	0.62%
6	1.66%	0.95%
7	4.04%	1.68%
8	5.92%	2.82%
9	6.32%	4.02%
10	5.77%	4.77%
11	5.13%	5.74%
12	5.31%	6.27%
13	5.68%	6.76%
14	5.84%	7.10%
15	6.21%	6.88%
16	6.94%	7.05%
17	7.07%	7.10%
18	7.20%	6.68%
19	6.28%	6.16%
20	5.07%	5.51%
21	4.31%	4.55%
22	3.75%	4.04%
23	2.88%	3.40%
24	1.78%	2.68%
Daily	100%	100%

Table 6 - CAL3QHCR Risk Modeling Parameters and Maximum Residential Cancer Risk in Project Area

485 South Monroe Maximum Residential Cancer Risks

Receptor Information

Number of Receptors	115
Receptor Height =	1.8 m
Receptor distances =	5 - 25 m

Meteorological Conditions

San Jose Airport Hourly Met Data	1992 - 1995 & 1997
Land Use Classification	urban
Wind speed =	variable
Wind direction =	variable

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 (µg/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-day)	A (-)	Exposure (hr/day)	Exposure (days/week)	Exposure (week/year)	EF (days/yr)	ED (Years)	AT (days)
Residential (70-Year)	302	1	24	7	50	350	70	25,550
Worker	149	1	8	5	49	245	40	25,550

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

Cancer Risk (per million) = Inhalation Dose x CRAF x CPF x 10^6
= URF x Cair

Where: CPF = Cancer potency factor (mg/kg-day)$^{-1}$
CRAF = Cancer Risk Adjustment Factor
URF =Unit risk factor (cancer risk per µg/m^3)

Unit Risk Factors for DPM and Organic TACs from Vehicle TOG Exhaust & Evaporative Emissions

Exposure Type	CPF (mg/kg-day)$^{-1}$	CRAF (-)	*DPM*	Exhaust TOG TACs	Evaporative TOG TACs
Residential (70-Yr Exposure)	1.10E+00	1.7	541.5	3.08	0.18
Worker (40-Yr Exposure)	1.10E+00	1.0	62.9	0.36	0.02

Maximum Residential Cancer Risk Calculations During Project Operation

Meteorological Data Year	Maximum DPM Concentration (µg/m^3)			Maximum Exhaust TOG Concentration (µg/m^3)			Maximum Evaporative TOG Concentration (µg/m^3)		
	2012	2015	2020	2012	2015	2020	2012	2015	2020
1992	0.0258	0.0145	0.0093	0.8336	0.5646	0.3204	0.3826	0.3235	0.2645
1993	0.0293	0.0165	0.0105	0.9466	0.6410	0.3639	0.4344	0.3672	0.3004
1994	0.0285	0.0161	0.0102	0.9214	0.6240	0.3542	0.4229	0.3575	0.2924
1995	0.0273	0.0154	0.0098	0.8829	0.5980	0.3394	0.4052	0.3426	0.2801
1997	0.0253	0.0142	0.0091	0.8176	0.5538	0.3143	0.3753	0.3173	0.2594
Average	0.0272	0.0153	0.0098	0.8804	0.5963	0.3384	0.4041	0.3416	0.2794
Cancer Risk[a]	14.7	8.3	5.3	2.7	1.8	1.0	0.07	0.06	0.05
70-yr Cumulative Risk[b]	5.78			1.15			0.05		

Total Risk From All TACs = 7.0 per million

Notes:
Receptor Heights = 1.8 m
Maximum cancer risk occurs near southeast corner of the residential area (Receptor No. 100).
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.

Table 7 - CAL3QHCR Risk Modeling Parameters and Maximum Worker Cancer Risk in Project Area

485 South Monroe Maximum Worker Cancer Risks

Receptor Information

Number of Receptors	115
Receptor Height =	1.8 m
Receptor distances =	5 - 25 m

Meteorological Conditions

San Jose Airport Hourly Met Data	1992 - 1995 & 1997
Land Use Classification	urban
Wind speed =	variable
Wind direction =	variable

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 (µg/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-day)	A (-)	Exposure (hr/day)	Exposure (days/week)	Exposure (week/year)	EF (days/yr)	ED (Years)	AT (days)
Residential (70-Year)	302	1	24	7	50	350	70	25,550
Residential (30-Year)	302	1	24	7	50	350	30	25,550
Student (9-Year)	302	1	24	7	50	350	9	25,550
Worker	149	1	8	5	49	245	40	25,550

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

Cancer Risk (per million) = Inhalation Dose x CRAF x CPF x 10^6
= URF x Cair

Where: CPF = Cancer potency factor (mg/kg-day)$^{-1}$
CRAF = Cancer Risk Adjustment Factor
URF =Unit risk factor (cancer risk per µg/m^3)

Unit Risk Factors for DPM and Organic TACs from Vehicle TOG Exhaust & Evaporative Emissions

Exposure Type	CPF (mg/kg-day)$^{-1}$	CRAF (-)	*DPM*	Exhaust TOG TACs	Evaporative TOG TACs
Residential (70-Yr Exposure)	1.10E+00	1.7	541.5	3.08	0.18
Residential (30-Yr Exposure)	1.10E+00	1.7	232.1	1.32	0.08
Residential (9-Year)	1.10E+00	3	122.9	0.70	0.04
Worker (40-Yr Exposure)	1.10E+00	1.0	62.9	0.36	0.02

Maximum Worker Cancer Risk Calculations During Project Operation

Meteorological Data Year	Maximum DPM Concentration (µg/m^3) 2012	2015	2020	Maximum Exhaust TOG Concentration (µg/m^3) 2012	2015	2020	Maximum Evaporative TOG Concentration (µg/m^3) 2012	2015	2020
1992	0.0258	0.0145	0.0093	0.9615	0.6509	0.3687	0.4413	0.3729	0.3044
1993	0.0293	0.0165	0.0105	1.0962	0.7420	0.4205	0.5031	0.4251	0.3471
1994	0.0285	0.0161	0.0102	1.0687	0.7235	0.4099	0.4905	0.4145	0.3383
1995	0.0273	0.0154	0.0098	1.0245	0.6936	0.3928	0.4702	0.3974	0.3243
1997	0.0253	0.0142	0.0091	0.9401	0.6364	0.3604	0.4315	0.3646	0.2975
Average	0.0272	0.0153	0.0098	1.0182	0.6893	0.3905	0.4673	0.3949	0.3223
Cancer Risk[a]	1.7	1.0	0.6	0.4	0.2	0.1	0.01	0.01	0.01
70-yr Cumulative Risk[b]	0.67			0.15			0.01		

Total Risk From All TACs = 0.8 per million

Notes:
Receptor Heights = 1.8 m
Maximum cancer risk occurs near southeast corner of the proposed office building (Receptor No. 105).
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.

Table 8 – Maximum Annual $PM_{2.5}$ Concentrations

Location	Maximum Average Annual $PM_{2.5}$ Concentrations ($\mu g/m^3$)			
	2013	**2015**	**2020**	**Average**
Residential Area	0.129	0.126	0.123	**0.13**
Office Building	0.149	0.146	0.142	**0.15**