Appendix J

SANTA CLARA NFL STADIUM PROJECT

AIR QUALITY ASSESSMENT

SANTA CLARA, CALIFORNIA

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INTRODUCTION

This report assesses potential air quality impacts resulting from the proposed construction and operation of a new National Football League (NFL) stadium in Santa Clara, California. The stadium would be constructed on a 22-acre site. The project site is bounded on the north by Tasman Drive, on the east by the Santa Clara Youth Soccer Park and the existing Marie P. DeBartolo Sports Centre, on the south by Silicon Valley Power's Northern Receiving Station and the City of Santa Clara's North Side Water Storage Tanks, and on the west by San Tomas Aquino Creek. The project would construct a 68,500-seat stadium, relocate an existing electrical substation, and construct a new surface parking and a parking garage. The stadium could be utilized to accommodate up to 75,000 seats during special events. New access and circulation improvements are also proposed.

A NFL stadium of this size is estimated to require 19,000 attendee parking spaces and 1,740 employee parking stalls. The proposed project site can not accommodate most of this parking, so off site parking would be required through the use of existing and planned parking facilities in the immediate project area. New parking facilities would include a proposed share parking structure north of Tasman Drive and proposed surface parking adjacent or close to the stadium. There is a large number of parking spaces used for the Great America Theme Park and surrounding businesses.

The NFL is encouraging any franchise proposing a new stadium in a large market (i.e., capable of supporting more than one team in a relatively close geographic area), such as the Bay Area, to evaluate shared use of the stadium by a second NFL team. There are currently no specific plans for use of the stadium by a second NFL team. Nevertheless, the air quality analysis evaluates impacts from two NFL teams using the stadium to comply with the proposed NFL recommendation. Given that teams typically play half of all pre-season and regular season games at home, the use of the stadium by two NFL teams could result in one NFL event at the stadium every week from the beginning of pre-season in August through the end of December for a minimum of 20 NFL events per year. This air quality analysis evaluates the possibility of two Bay Area NFL teams using the proposed new stadium as a home field.

This analysis evaluates the air quality impacts of the proposed project. The impact associated with the proposed development was evaluated in terms of operational and construction impacts to air quality. The primary focus of the air quality study was to evaluate future project-related emissions on regional air quality. This analysis was conducted following guidance provided by the Bay Area Air Quality Management District (BAAQMD)[1].

OVERALL 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 Federal Clean Air Act. The California Clean Air

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

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.

United States Environmental Protection Agency

The United States Environmental Protection Agency (USEPA) is responsible for enforcing the Federal CAA. The USEPA is also responsible for establishing the National Ambient Air Quality Standards (NAAQS). NAAQS are required under the 1977 Clean Air Act and subsequent amendments. The USEPA regulates emission sources that are under the exclusive authority of the federal government, such as aircraft, ships, and certain types of locomotives. The agency has jurisdiction over emission sources outside state waters (e.g., beyond the outer continental shelf) and establishes various emission standards, including those for vehicles sold in states other than California. Automobiles sold in California must meet the stricter emission standards established by CARB.

California Air Resources Board

In California, the California Air Resources Board (CARB), part of the California Environmental Protection Agency, is responsible for meeting the state requirements of the Federal Clean Air Act, administering the California Clean Air Act, and establishing the California Ambient Air Quality Standards (CAAQS). The California Clean Air Act requires all air districts in the State to endeavor to achieve and maintain CAAQS. CARB regulates mobile air pollution sources, such as motor vehicles. The agency is responsible for setting emission standards for vehicles sold in California and for other emission sources, such as consumer products and certain off-road equipment. CARB has established passenger vehicle fuel specifications and oversees the functions of local air pollution control districts and air quality management districts, which in turn administer air quality activities at the regional and county level. CARB also conducts or supports research into the effects of air pollution on the public and develops innovative approaches to reducing air pollutant emissions.

Bay Area Air Quality Management District

The Bay Area Air Quality Management District (BAAQMD) is primarily responsible for assuring that the National and State ambient air quality standards are attained and maintained in the Bay Area. BAAQMD is also responsible for adopting and enforcing rules and regulations concerning air pollutant sources, issuing permits for stationary sources of air pollutants, inspecting stationary sources of air pollutants, responding to citizen complaints, monitoring ambient air quality and meteorological conditions, awarding grants to reduce motor vehicle emissions, conducting public education campaigns, as well as many other activities. BAAQMD has jurisdiction over much of the nine-county Bay Area counties, including Santa Clara County.

National and State Ambient Air Quality Standards

The ambient air quality in a given area depends on the quantities of pollutants emitted within the area, transport of pollutants to and from surrounding areas, local and regional meteorological conditions, as well as the surrounding topography of the air basin. Air quality is described by the concentration of various pollutants in the atmosphere. Units of concentration are generally expressed in parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). The significance of a pollutant concentration is determined by comparing the concentration to an appropriate ambient air quality standard. The standards represent the allowable pollutant concentrations designed to ensure that the public health and welfare are protected, while including a reasonable margin of safety to protect the more sensitive individuals in the population.

As required by the Federal Clean Air Act, the National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: carbon monoxide (CO), nitrogen oxides (NO_x), ozone (O_3), respirable particulate matter (PM_{10}), fine particulate matter ($PM_{2.5}$), sulfur oxides, and lead. Pursuant to the California Clean Air Act, the State of California has also established ambient air quality standards. The California Ambient Air Quality Standards (CAAQS) are generally more stringent than the corresponding federal standards and incorporate additional standards for pollutants such as sulfates, hydrogen sulfide, vinyl chloride and visibility reducing particles. Both State and Federal standards are summarized in Table 1. The "primary" standards have been established to protect the public health. The "secondary" standards are intended to protect the nation's welfare and account for adverse air pollutant effects on soil, water, visibility, materials, vegetation and other aspects of the general welfare. Because CAAQS are more stringent than NAAQS, CAAQS are used as the comparative standard in this analysis.

Table 1: Ambient Air Quality Standards

Pollutant	Averaging Time	California Standards	National Standards [a]	
			Primary [b,c]	Secondary [b,d]
Ozone	8-hour	0.070 ppm	0.075 ppm	—
	1-hour	0.09 ppm	—[e]	Same as primary
Carbon monoxide	8-hour	9.0 ppm	9 ppm	—
	1-hour	20 ppm	35 ppm	—
Nitrogen dioxide	Annual	0.03 ppm	0.053 ppm	Same as primary
	1-hour	0.18 ppm	0.030 ppm	—
Sulfur dioxide	Annual	—	0.03 ppm	—
	24-hour	0.04 ppm	0.14 ppm	—
	3-hour	—	—	0.5 ppm
	1-hour	0.25 ppm	—	—
PM_{10}	Annual	20 $\mu g/m^3$	--[f]	Same as primary
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$	Same as primary
$PM_{2.5}$	Annual	12 $\mu g/m^3$	15 $\mu g/m^3$	
	24-hour	—	35 $\mu g/m^3$ [f]	
Lead	Calendar quarter	—	1.5 $\mu g/m^3$	Same as primary

	30-day average	1.5 µg/m^3	—	—

Notes:(a) Standards, other than for ozone and those based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.
(b) Concentrations are expressed first in units in which they were promulgated. Equivalent units given in parenthesis.
(c) Primary Standards: The levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implementation plan is approved by the EPA.
(d) Secondary Standards: The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
(e) The national 1-hour ozone standard was revoked by U.S. EPA on June 15, 2005. A new 8-hour standard was established in May 2008.
(f) The annual PM_{10} standard was revoked by U.S. EPA on September 21, 2006 and a new $PM_{2.5}$ 24-hour standard was established.

AIR QUALITY PLANNING

The BAAQMD and other agencies prepare clean air plans in response to the State and Federal Clean Air Acts. The City of Santa Clara also includes General Plan policies that encourage development that reduces air quality impacts. In addition, BAAQMD has developed CEQA Guidelines to assist local agencies in evaluating and mitigation air quality impacts.

Regional Clean Air Plans

2001 Ozone Attainment Plan

The Bay Area 2001 Ozone Attainment Plan was prepared by BAAQMD, the Metropolitan Transportation Commission (MTC), and the Association of Bay Area Governments (ABAG). This plan is a proposed revision to the Bay Area's part of the State Implementation Plan, or SIP to achieve the NAAQS for the 1-hour ozone standard. The plan was prepared in response to US EPA's partial approval and partial disapproval of the Bay Area's 1999 Ozone Attainment Plan. Although the U.S. EPA revoked the 1-hour NAAQS, commitments made in that plan along with emissions budgets remain valid until the region develops an attainment demonstration/maintenance plan for the 8-hour NAAQS for ozone. The U.S. EPA has determined that the region met the 1997 8-hour ozone standard. However, the region will be required to submit a maintenance plan and demonstration of attainment with a request for redesignation to U.S. EPA when the 8-hour ozone NAAQS is met. BAAQMD will likely not act on this submittal for a few years. In addition, the U.S. EPA's new, slightly more stringent, 8-hour standard was recently established. The U.S. EPA will be making new attainment designations based on that standard in about 3 years and eventually revoking the older standard. A Carbon Monoxide Maintenance Plan was approved in 1998 by EPA, which demonstrated how NAAQS for carbon monoxide standard would be maintained.

1991 Clean Air Plan

In 1991, BAAQMD, MTC and ABAG prepared the Bay Area 1991 Clean Air Plan or CAP. This air quality plan addresses the California Clean Air Act. Updates are developed approximately every three years. The plans are meant to demonstrate progress toward meeting the more stringent 1-hour ozone CAAQS. The latest update to the plan, which was adopted in January

2006, is called the *Bay Area 2005 Ozone Strategy*. This plan includes a comprehensive strategy to reduce emissions from stationary, area, and mobile sources. The plan objective is to indicate how the region would make progress toward attaining the stricter state air quality standards, as mandated by the California Clean Air Act. The plan is designed to achieve a region-wide reduction of ozone precursor pollutants through the expeditious implementation of all feasible measures. The plan proposes expanded implementation of transportation control measures (TCMs) and programs such as Spare the Air. Spare the Air is a public outreach program designed to educate the public about air pollution in the Bay Area and promote individual behavior changes that improve air quality. Some of these measures or programs rely on local governments for implementation. An update to the plan is currently being developed and should be available by 2009.

PM_{10} and PM2.5 Plans

The clean air planning efforts for ozone will also reduce PM_{10} and $PM_{2.5}$, since a substantial amount of this air pollutant comes from combustion emissions such as vehicle exhaust. In addition, BAAQMD adopts and enforces rules to reduce particulate matter emissions and develops public outreach programs to educate the public to reduce PM_{10} and $PM_{2.5}$ emissions (e.g., Spare the Night Program). SB 656 requires further action by CARB and air districts to reduce public exposure to PM_{10} and $PM_{2.5}$. Efforts identified by BAAQMD in response to SB656 are primarily targeting reductions in wood smoke emissions and adoption of new rules to further reduce NOx and particulate matter from internal combustion engines and reduce particulate matter from commercial charbroiling activities. BAAQMD recently adopted a rule addressing residential wood burning. The rule restricts operation of any indoor or outdoor fireplace, fire pit, wood or pellet stove, masonry heater or fireplace insert on specific days during the winter when air quality conditions are forecasted to exceed the NAAQS for $PM_{2.5}$. The rule would also limits excess visible emissions from wood burning devices and require clean burning technology for wood burning devices sold (or resold) or installed in the Bay Area. NOx emissions contribute to ammonium nitrate formation that resides in the atmosphere as particulate matter, so a reduction in NOx emissions would reduce wintertime $PM_{2.5}$ levels. The Bay Area experiences the highest PM_{10} and $PM_{2.5}$ in winter when wood smoke and ammonium nitrate contributions to particulate matter are highest.

PHYSICAL SETTING

Santa Clara is located in the southern portion of the San Francisco Bay Area Air Basin. The basin includes the counties of San Francisco, Santa Clara, San Mateo, Marin, Napa, Contra Costa, and Alameda, along with the southeast portion of Sonoma County and the southwest portion of Solano County. The local air quality regulatory agency responsible for this basin is the Bay Area Air Quality Management District (BAAQMD).

Climate and Topography

The project is located in the City of Santa Clara in Santa Clara Valley. The proximity of this location to both the Pacific Ocean and the San Francisco Bay has a moderating influence on the climate. The valley is bounded to the north by the San Francisco Bay and by mountains to the

east, south, and west. The surrounding terrain greatly influences winds in the valley, resulting in a prevailing wind that follows along the valley's northwest-southeast axis. 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. Wind data collected at Alviso and Mineta San José International Airport characterize wind flow at the project site. Winds are mostly from the north to northwest, occurring about 50 percent of the time. Wind flow from the southeast occurs about 25 percent of the time, with light and variable winds occurring the other 25 percent of the time. Wind speed on average is about 5 miles per hour.
Typical summer maximum temperatures for the region are in the 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 valley is approximately 15 to 20 inches per year, occurring mostly in the months of November through March.

Air quality standards for ozone traditionally are exceeded when relatively stagnant conditions occur for periods of several days during the warmer months of the year. Weak wind flow patterns combined with strong inversions substantially reduces normal atmospheric mixing. Key components of ground-level ozone formation are sunlight and heat; therefore, significant ozone formation only occurs during the months from late spring through early fall. Prevailing winds during the summer and fall can transport and trap ozone precursors from the more urbanized portions of the Bay Area. Meteorological factors make air pollution potential in the Santa Clara Valley quite high. The clear skies with relatively warm conditions that are typical in summer combine with transported and localized air pollutant emissions to elevate ozone levels. The surrounding mountains upslope and down slope flows may also recirculate pollutants already present, contributing to the buildup of air pollution. Light winds and stable conditions during the late fall and winter contribute to the buildup of particulate matter from motor vehicles, agriculture, and wood-burning fireplaces and stoves.

EXISTING AIR QUALITY CONDITIONS

Criteria Air Pollutants and Effect

Air quality studies generally focus on five pollutants that are most commonly measured and regulated: carbon monoxide (CO), ground level ozone, nitrogen dioxide (NO_2), sulfur dioxide (SO_2), and suspended particulate matter, i.e., PM_{10} and $PM_{2.5}$. In Santa Clara County, ozone and particulate matter are the pollutants of greatest concern since measured air pollutant levels exceed these concentrations at times.

Carbon Monoxide

Carbon monoxide, a colorless and odorless gas, interferes with the transfer of oxygen to the brain. It can cause dizziness and fatigue, and can impair central nervous system functions. Highest carbon monoxide concentrations measured in the South Bay Area have been well below the national and state ambient standards. Since the primary source of carbon monoxide in is automobiles, highest concentrations would be found near congested roadways that carry large volumes of traffic. Carbon monoxide emitted from a vehicle is highest near the origin of a trip and considerably lower when vehicles are operating in a hot-stabilized mode (usually five to ten minutes into a trip). However, this is different for vehicles of different ages, where older cars require a longer time to reach a hot-stabilized running mode. A vehicle sitting idle for over an hour is normally considered to return to a cold start mode. Vehicles near the origin of a trip are considered to be in Cold-Start mode. Vehicle operation on freeways is usually in a hot-stabilized mode so the individual emission rates are much lower than those encountered on arterial roadways leading to the freeway.

Ozone

While ozone serves a beneficial purpose in the upper atmosphere (stratosphere) by reducing ultraviolet radiation potentially harmful to humans, when it reaches elevated concentrations in the lower atmosphere it can be harmful to the human respiratory system and to sensitive species of plants. O_3 concentrations build to peak levels during periods of light winds, bright sunshine, and high temperatures. Short-term O_3 exposure can reduce lung function in children, make persons susceptible to respiratory infection, and produce symptoms that cause people to seek medical treatment for respiratory distress. Long-term exposure can impair lung defense mechanisms and lead to emphysema and chronic bronchitis. Sensitivity to O_3 varies among individuals, but about 20 percent of the population is sensitive to O_3, with exercising children being particularly vulnerable. O_3 is formed in the atmosphere by a complex series of photochemical reactions that involve "ozone precursors" that are two families of pollutants: oxides of nitrogen (NOx) and reactive organic gases (ROG). NO_x and ROG are emitted from a variety of stationary and mobile sources. While NO_2, an oxide of nitrogen, is another criteria pollutant itself, ROGs are not in that category, but are included in this discussion as O_3 precursors. The U.S. EPA recently established a new more stringent standard of 0.75 ppm for 8-hour exposures, based on a review of the latest new scientific evidence.

Nitrogen Dioxide

Nitrogen dioxide, a reddish-brown gas, irritates the lungs. Exposure to NO_2 can cause breathing difficulties at high concentrations. Clinical studies suggest that NO_2 exposure to levels near the current standard may worsen the effect of allergens in allergic asthmatics, especially in children. Similar to ozone, NO_2 is not directly emitted, but is formed through a reaction between nitric oxide (NO) and atmospheric oxygen. NO and NO_2 are collectively referred to as nitrogen oxides (NO_x) and are major contributors to ozone formation. NOx is emitted from combustion of fuels, with higher rates at higher combustion temperatures. NO_2 also contributes to the formation of PM_{10} (see discussion of PM_{10} below). Monitored levels in the Bay Area are well below ambient air quality standards.

Sulfur Oxides

Sulfur oxides, primarily SO_2, are a product of high-sulfur fuel combustion. The main sources of SO_2 are coal and oil used in power stations, in industries, and for domestic heating. SO_2 is an irritant gas that attacks the throat and lungs. It can cause acute respiratory symptoms and diminished ventilator function in children. SO_2 concentrations are at levels well below the state and national standards, but further reductions in emissions are needed to attain compliance with standards for PM_{10}, of which SO_2 is a contributor.

PM_{10} and $PM_{2.5}$

Respirable particulate matter (PM_{10}), and fine particulate matter ($PM_{2.5}$) consist of particulate matter that is ten microns or less in diameter and 2.5 microns or less in diameter, respectively. PM_{10} and $PM_{2.5}$ represent fractions of particulate matter that can be inhaled and cause adverse health effects. PM_{10} and $PM_{2.5}$ are a health concern, particularly at levels above the federal and State ambient air quality standards. $PM_{2.5}$ (including diesel exhaust particles) is thought to have greater effects on health because minute particles are able to penetrate to the deepest parts of the lungs. Scientific studies have suggested links between fine particulate matter and numerous health problems including asthma, bronchitis, acute and chronic respiratory symptoms such as shortness of breath and painful breathing. Children are more susceptible to the health risks of $PM_{2.5}$ because their immune and respiratory systems are still developing. Very small particles of certain substances (e.g., sulfates and nitrates) can also directly cause lung damage or can contain absorbed gases (e.g., chlorides or ammonium) that may be injurious to health. 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 miniscule and 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. The U.S. EPA recently adopted a new more stringent standard of 35 $\mu g/m^3$ for 24-hour exposures based on a review of the latest new scientific evidence. At the same time, U.S. EPA revoked the annual PM_{10} standard due to a lack of scientific evidence correlating long-term exposures of ambient PM_{10} with adverse health effects. Most stations in the Bay Area reported exceedances of the State standard on the same fall/winter days as reported in the South Bay. This indicates a regional air quality problem. The primary sources of these pollutants are wood smoke and local traffic. Meteorological conditions that are common during this time of the year result in calm winds and strong surface-based inversions that trap pollutants near the surface. The buildup of these pollutants is greatest during the evenings and early morning periods. The high levels of PM_{10} result in not only health effects, but also reduced visibility.

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.

Toxic Air Contaminants (TAC)

Besides the "criteria" air pollutants, there is another group of substances found in ambient air referred to as Hazardous Air Pollutants (HAPs) under the Federal Clean Air Act and Toxic Air Contaminants (TACs) under the California Clean Air Act. These contaminants tend to be localized and are found in relatively low concentrations in ambient air. However, they can result in adverse chronic health effects if exposure to low concentrations occurs for long periods. They are regulated at the local, State, and Federal level.

HAPs are the air contaminants identified by US EPA as known or suspected to cause cancer, serious illness, birth defects, or death. Many of these contaminants originate from human activities, such as fuel combustion and solvent use. Mobile source air toxics (MSATs) are a subset of the 188 identified HAPS. Of the 21 HAPs identified by EPA as MSATs, priority lists of six HAPs were identified that include: diesel exhaust, benzene, formaldehyde, acetaldehyde, acrolein, and 1,3-butadiene. While vehicle miles traveled in the United States is expected to increase by 64 percent over the period 2000 to 2020, emissions of MSATs are anticipated to decrease substantially as a result of efforts to control mobile source emissions (by 57 percent to 67 percent depending on the contaminant)[2].

California developed a program under the Tanner Toxics Act (AB 1807) to identify, characterize and control toxic air contaminants (TACs). Subsequently, AB 2728 incorporated all 188 HAPs into the AB 1807 process. TACs include all HAPs plus other contaminants identified by CARB. These are a broad class of compounds known to cause morbidity or mortality (cancer risk). 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). Chronic exposure to TACs can result in adverse health effects. Like criteria air pollutants, TACs are regulated at the regional, State, and Federal level.

Particulate matter from diesel exhaust is the predominant TAC in urban air and was estimated to represent about two-thirds of the cancer risk from TACs (based on the statewide average in 2000). According to 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 chemicals in diesel exhaust, such as benzene and formaldehyde, have been previously identified as TACs by CARB, and are listed as carcinogens either under State 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. Diesel particulate matter (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. The particles emitted by diesel engines are coated with chemicals, many of which have been identified by EPA as HAPs, and by CARB as TACs. Diesel engines emit particulate matter at a rate about 20 times greater than

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2 Federal Highway Administration, 2006. Interim Guidance on Air Toxic Analysis in NEPA Documents.

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.

Smoke from residential wood combustion can also be a source of TACs. Wood smoke is typically emitted during wintertime when dispersion conditions are poor. Localized high TAC concentrations can result when cold stagnant air traps smoke near the ground and, with no wind; the pollution can persist for many hours, especially in sheltered valleys during winter. Wood smoke also contains a significant amount of PM_{10} and $PM_{2.5}$. Wood smoke is an irritant and is implicated in worsening asthma and other chronic lung problems.

Air Monitoring Data

Air quality in the region is controlled by the rate of pollutant emissions and meteorological conditions. Meteorological conditions, such as wind speed, atmospheric stability, and mixing height may all affect the atmosphere's ability to mix and disperse pollutants. Long-term variations in air quality typically result from changes in air pollutant emissions, while frequent, short-term variations result from changes in atmospheric conditions. The San Francisco Bay Area is considered to be one of the cleanest metropolitan areas in the country with respect to air quality. BAAQMD monitors air quality conditions at over 30 locations throughout the Bay Area. There are several BAAMQD monitoring stations in San José, which are closest to this part of Santa Clara. Air pollutant concentrations measured at stations closest to the project area are shown in Table 2.

The pollutant of most concern in the Santa Clara area is ozone, since prevailing summertime wind conditions tend to cause a buildup of ozone in the Santa Clara Valley. Ozone levels measured in San Jose, exceeded the state ozone standard from 0 to 5 times in 2003-2007. In the last 5 years, the 8-hour national ozone standard was exceeded only once in 2006 during an extended heat wave. The new state 8-hour ozone standard was exceeded once in 2005, five times in 2006 and was not exceeded in 2007. Measured exceedances of the state PM_{10} standard have occurred between two and three measurement days each year in San Jose (estimated at 12 to 18 days). PM_{10} and $PM_{2.5}$ are measured every sixth day. Exceedances of the Federal $PM_{2.5}$ standard of 65 µg/m3 were not measured in San José; however, the new standard of 35 µg/m3 was exceeded on six measurement days during 2006 (estimated 36 days per year). The entire Bay Area, including San Jose, did not experience any exceedances of other air pollutants. Table 3 reports the number of days that an ambient air quality standard was exceeded at any of the stations in San José near the project and in the entire Bay Area.

Table 2: Highest Measured Air Pollutant Concentrations

Pollutant	Average Time	Measured Air Pollutant Levels 2003	2004	2005	2006	2007
San Jose						
Ozone (O_3)	1-Hour	**0.12** ppm	0.09 ppm	**0.11** ppm	0.12 ppm	0.080 ppm
	8-Hour	0.08 ppm	0.07 ppm	**0.08 ppm**	**0.09 ppm**	**0.07 ppm**
Carbon Monoxide (CO)	8-Hour	5.5 ppm	4.4 ppm	4.3 ppm	4.1 ppm	3.5 ppm
Nitrogen Dioxide (NO_2)	1-Hour	4.0 ppm	3.0 ppm	3.1 ppm	2.9 ppm	2.7 ppm
	Annual	NA	0.07 ppm	0.07 ppm	0.07 ppm	0.07 ppm
Respirable Particulate Matter (PM_{10})	24-Hour	NA	NA	0.019 ppm	0.018 ppm	0.017 ppm
	Annual	**60 ug/m^3**	**58 ug/m^3**	**54 ug/m^3**	**73 ug/m^3**	**69 ug/m^3**
Fine Particulate Matter ($PM_{2.5}$)	24-Hour	**23** ug/m^3	**23** ug/m^3	**22 ug/m^3**	**21 ug/m^3**	**22 ug/m^3**
	Annual	56 ug/m^3	52 ug/m^3	55 ug/m^3	**64 ug/m^3**	**58 ug/m^3**
Bay Area (Basin Summary)						
Ozone (O_3)	1-Hour	**0.12** ppm	**0.11** ppm	**0.12** ppm	**0.12** ppm	**0.12** ppm
	8-Hour	**0.10** ppm	**0.08** ppm	**0.09** ppm	**0.11 ppm**	**0.09 ppm**
Carbon Monoxide (CO)	8-Hour	4.0 ppm	3.4 ppm	3.1 ppm	2.9 ppm	2.7 ppm
Nitrogen Dioxide (NO_2)	1-Hour	0.09 ppm	0.07 ppm	0.07 ppm	0.11 ppm	0.07 ppm
	Annual	0.021ppm	0.019ppm	0.019ppm	0.018ppm	0.017ppm
Respirable Particulate Matter (PM_{10})	1-Hour	**60** ug/m^3	**65** ug/m^3	**81** ug/m^3	73 ug/m^3	**78** ug/m^3
	Annual	**25** ug/m^3	**26** ug/m^3	**24** ug/m^3	**23** ug/m^3	**26** ug/m^3
Fine Particulate Matter ($PM_{2.5}$)	24-Hour	56 ug/m^3	52 ug/m^3	55 ug/m^3	**75** ug/m^3	**58** ug/m^3
	Annual	12 ug/m^3	12 ug/m^3	12 ug/m^3	11 ug/m^3	11 ug/m^3

Source: BAAQMD Air Quality Summaries for 2003, 2004, 2005, 2006, and 2007.
Note: ppm = parts per million and ug/m^3 = micrograms per cubic meter
Values reported in bold exceed ambient air quality standard
NA = data not available.

Table 3: Annual Number of Days Exceeding Ambient Air Quality Standards

Pollutant	Standard	Monitoring Station	Days Exceeding Standard 2003	2004	2005	2006	2007
Ozone (O_3.)	NAAQS 1-hr	San Jose BAY AREA	0 1	0 0	X X	X X	X X
	NAAQS 8-hr	San Jose BAY AREA	0 7	0 0	0 1	1 12	0 1
	CAAQS 1-hr	San Jose BAY AREA	4 19	0 7	1 9	5 18	0 4
	CAAQS 8-hr	San Jose BAY AREA	-- --	-- --	1 9	5 22	0 9
Fine Particulate Matter (PM_{10})	NAAQS 24-hr	San Jose BAY AREA	0 0	0 0	0 0	0 0	0 0
	CAAQS 24-hr	San Jose BAY AREA	2 6	3 7	2 6	2 15	3 4
Fine Particulate Matter ($PM_{2.5}$)	NAAQS 24-hr*	San Jose BAY AREA	-- --	-- --	-- --	6 10	9 14
All Other (CO, NO_2, Lead, SO_2)	All Other	San Jose BAY AREA	0 0	0 0	0 0	0 0	0 0

* Based on standard of 65 $\mu g/m^3$ that was in place until September 21, 2006, then 35 $\mu g/m^3$ standard in 2006.
X = Standard revoked in 2004.
NA = data not available.

Attainment Status

Areas that do not violate ambient air quality standards are considered to have attained the standard. Violations of ambient air quality standards are based on air pollutant monitoring data and are judged for each air pollutant. The Bay Area as a whole does not meet State or Federal ambient air quality standards for ground level ozone and State standards for PM_{10} and $PM_{2.5}$.

Under the Federal CAA, U.S. EPA has classified the region as marginally nonattainment for the 1997 8-hour ozone standard. U.S. EPA required the region to attain the standard by 2007. As previously mentioned, U.S. EPA has determined that the Bay Area has met this standard, but a formal redesignation request and maintenance plan would have to be submitted before redesignation could be made. In May 2008, U.S. EPA lowered the 8-hour ozone standard from 0.08 to 0.075 ppm. Final designations based upon the new 0.075 ppm standard will be made by March 2010. In December 2008, U.S. EPA designated the entire Bay Area region as nonattainment for the 2006 24-hour $PM_{2.5}$ standard as recent monitoring data indicate levels slightly above the standard in San Jose and Vallejo. The federal nonattainment designation was to take place 90 days after the final designation announcement (i.e., in April 2009); however, President Obama ordered a suspension of new pending regulations when he took office. As a result, the effective date of the designation is unknown at this time. Most nonattainment areas would have until 2015 to attain the standards with some extensions to 2020 possible. The Bay Area has met the CO standards for over a decade and is classified attainment maintenance by the U.S. EPA. The U.S. EPA grades the region unclassified for all other air pollutants, which includes PM_{10}.

At the State level, the region is considered serious non-attainment for ground level ozone and non-attainment for PM_{10}. The region is required to adopt plans on a triennial basis that show progress towards meeting the State ozone standard. The area is considered attainment or unclassified for all other pollutants.

Sensitive Receptors

There are groups of people more affected by air pollution than others. CARB has identified the following who are most likely to be affected by air pollution: children under 14, the elderly over 65, athletes, and people with cardiovascular and chronic respiratory diseases. These groups are classified as sensitive receptors. Locations that may contain a high concentration of these sensitive population groups include residential areas, hospitals, daycare facilities, elder care facilities, elementary schools, and parks. The closest sensitive receptors to the proposed project are residences on Gianerra Street, located about 600 feet south of the stadium portion of the project. There may be some minor construction about 100 to 500 feet from these receptors to construct surface parking stalls.

AIR QUALITY IMPACTS AND MITIGATIONS

Thresholds of Significance

CEQA Guidelines prepared by BAAQMD are used to establish the significance criteria to judge the impacts caused by a project. The following are the significance criteria that are used to judge project impacts:

- A cumulatively considerable net increase of any criteria pollutant or a precursor to that pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors). This is judged by comparing direct and indirect project emissions to BAAQMD significance thresholds of 80 pounds per day for ROG, NOx, or PM_{10}. The BAAQMD does not have thresholds that directly address $PM_{2.5}$. The PM_{10} threshold was developed to address the State 24-hour PM_{10} standard. However, since PM_{10} particulates include $PM_{2.5}$, the PM_{10} threshold in this evaluation is considered to address $PM_{2.5}$. Meeting the State 24-hour PM_{10} standards is more of a challenge than the State or federal standards for $PM_{2.5}$.

- A substantial contribution to an existing or project violation of an ambient air quality standard would result if the project would cause an exceedance of the California Ambient

Air Quality Standard for carbon monoxide of 9.0 parts per million over an 8-hour averaging period:

- Expose sensitive receptors or the general public to substantial pollutant concentrations. This is evaluated by assessing the health risk in terms of cancer risk or hazards posed by the placement of new sources of air pollutant emissions near existing sensitive receptors or placement of new sensitive receptors near existing sources.
- Create or expose a substantial number of people to objectionable odors.
- Conflict with or obstruct implementation of the applicable air quality plan.

Impact 1: Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is non-attainment under an applicable Federal or State ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)? *Significant Impact*

The Bay Area is considered a non-attainment area for ground-level ozone under both the Federal Clean Air Act and the California Clean Air Act. The area is also considered non-attainment for respirable particulates or particulate matter with a diameter of less than 10 micrometers (PM_{10}), and particulate matter with a diameter of less than 2.5 micrometers ($PM_{2.5}$) under the California Clean Air Act. As part of an effort to attain and maintain ambient air quality standards for ozone and PM_{10}, BAAQMD has established thresholds of significance for air pollutants. These thresholds are for ozone precursor pollutants (reactive organic gases and nitrogen oxides) and PM_{10}.

The proposed project would construct a new NFL stadium that would host San Francisco 49er games. At least 10 NFL games would be hosted at this stadium each year, from August through December. There is the possibility that there could be up to 3 additional home games if the team were to make the playoffs and play all games at the stadium. A Super Bowl game is possible, but this would be atypical. These NFL games occur at Candlestick Park in San Francisco each season. The only new emissions of ozone precursor air pollutants and PM_{10} would result from differences in travel to the proposed new stadium versus to Candlestick Park. Attendance for these events are estimated at 68,500 people, as compared to 69,700 people at Candlestick Park.

NFL policy for a large market, such as the Bay Area, is to evaluate shared use of the stadium by a second NFL team. With shared use of the stadium, there would be a minimum of 20 NFL games at the stadium. The maximum number of games would be about 26 games, unless the unlikely event of a Super Bowl occurring the same season that both shared teams made the playoffs, and both had home field advantage through the playoffs. The team sharing the stadium could be the Raiders or an expansion team in the event that an existing NFL franchise moved out of the area. In any event, existing conditions include two NFL teams playing in the Bay Area: the 49ers at Candlestick Park and the Oakland Raiders at the Oakland Coliseum. Therefore, a reasonable worst-case air quality analysis would include these two teams playing at the proposed stadium.

The proposed stadium would also host non-NFL Football Events. These have not been specifically identified, but envisioned as college football games, soccer matches, X-Games, Moto-Cross events, festivals or car shows. A specific number of these events have not been identified, but a projection of 17 non-NFL football games annually is used for this analysis. Non-NFL football games are estimated to have attendances of 12,000 to 50,000 people. There would probably be a number of very small non-NFL football events with attendances of less than 500 people.

Daily and annual emissions associated with the proposed project were predicted and compared against the BAAQMD CEQA thresholds. The proposed project would change travel patterns on NFL game days and possibly add traffic on other days due to events such as concerts. This would lead to changes in emissions of air pollutants. Emissions of air pollutants associated with the project were predicted using travel forecasts and the State's mobile emission factor model (i.e., EMFAC2007). The primary source of emission would be from traffic associated with the proposed project.

NFL Football Games

Daily emissions caused by the project would be attributable to the difference in travel emissions between an NFL football game played at Candlestick Park and one played in Santa Clara at the proposed project site. Although football stadiums would have emissions from natural gas usage for cooking and water/space heating, these emissions are assumed to be similar at each stadium; therefore, they would not change with the proposed project.

The proposed project Transportation Plan trip generation estimates were used to model football game emission from both Candlestick Park and the proposed stadium in Santa Clara. Traffic estimates prepared for the proposed project were used in this analysis for both NFL-football games and non-NFL events. The traffic estimates include employee travel, attendees arriving by charter bus, and those arriving by transit.

The project site is well served by existing transit and includes pedestrian connections. Charter buses currently serve Candlestick Park and would be expected to serve the proposed stadium. Trip generation estimates for the project indicate 8% of fans use transit and 10% arrive by charter bus. Projections for the proposed stadium assume an increase in transit usage to 19% and a slight decrease in charter bus usage to 7%.

Trips to NFL football games are primarily made by autos, which include light-duty automobiles and light-duty trucks. Buses make up a small percentage of the trips. Emission rates were developed for the three vehicle classes using the EMFAC2007 model. Emission rates are speed dependent. Average travel distance and travel speed were developed assuming that trips are distributed similarly to the distribution of 49er season ticket holders. This distribution for 49er games was broken down by county since this information regarding season ticket holders was available. The EMFAC2007 model provided emissions rates for reactive organic gases (ROG), nitrogen oxides (NOx), particulate matter (i.e., PM_{10}) and carbon dioxide (CO_2). Emission estimates also include emissions associated with vehicle starts and ROG evaporative emissions.

Information regarding the origin of Oakland Raider fans was not available, so a detailed analysis of these trips could not be made. The Oakland Raiders also have a broad regional appeal, so trips would be made to the proposed project from all portions of the Bay Area and points further away. Given that the 49er and Raider stadiums are of similar distances from the proposed project, the changes in emissions associated with 49er games was applied to a second team playing at this stadium (the Oakland Coliseum is actually about 5 miles closer to the proposed project). That is, the difference in emissions between the 49ers playing at Candlestick or the proposed project was assumed to be similar to the difference of the Raiders playing at the proposed project instead of the Oakland Coliseum.

Build out of the project was anticipated to occur in 2012 at the earliest. The year of analysis is important to consider when modeling vehicle emissions. The vehicle emission rates for ROG and NOx are currently decreasing with each year and are predicted to decrease substantially between 2010 and 2020. For instance, NOx emission rates will decrease by 56 percent during that period because of improvements in vehicle emissions and retirement of older, more polluting, vehicles from the roadways.

PM_{10} emissions are comprised of running exhaust, tire and brake wear, and the entrainment of dust into the atmosphere from vehicles traveling on paved roadways. The contribution of tire and brake wear is small compared to the other particulate matter emission processes. Gasoline-powered engines have small rates of particulate matter emissions compared with diesel-powered trucks. Since much of the project traffic fleet is made up of light-duty gasoline-powered vehicles, a large portion of the PM_{10} emissions is from entrainment of roadway dust from vehicle travel. Silt loading values used were those that CARB uses for calculating paved roadway dust emissions for average vehicle traveling on collector roadways and freeways[3].

Daily emissions of ROG, NOx, and PM_{10} were calculated for a sold out football event at both Candlestick Park and the proposed project in Santa Clara. The difference in emissions between the two stadiums was compared with BAAQMD thresholds. Only travel-related emissions were used for comparing the differences between the two stadiums. Area source emissions associated with each facility were expected to be similar. Emissions associated with NFL football games are reported in Table 4. The calculations of daily emissions for NFL football games are provided in Attachment 1.

Table 4: NFL Game Daily Traffic Emissions in Pounds Per Day

	Modeled Daily Emissions in Pounds Per Day (lbs/day)			
Scenario[1]	**Attendance**	**Reactive Organic Gases (ROG)**	**Nitrogen Oxides (NOx)**	**Respirable Particulates (PM_{10})**
Candlestick Park	69,700	434	1,847	1,327
Proposed Project	68,500	459	2,000	1,388
- Difference	--	+25	+153	+61
BAAQMD Thresholds		*80*	*80*	*80*

[3] A factor of 0.027 grams silt per square meter was used based on data developed in 2006 for calculating area source emissions in the San Joaquin Valley Air Basin (*http://www.arb.ca.gov/ei/areasrc/PMSJVPavedRoadMethod2003.pdf*)

[1] These do not include area source emissions, primarily natural gas combustion from stadium operation that are assumed to be equivalent at both locations, and therefore, offset. Calculated NFL football game daily emissions were estimated at 1 pound of ROG, 12 pounds of NOx, and less than 0.1 pound of PM_{10}.

The proposed project would increase emissions of ROG, NOx and PM_{10}, as shown in Table 4. The changes in emissions would mostly result from changes in travel distance. The proposed project would cause an increase in NOx emissions that exceed the significance thresholds established by BAAQMD.

While these emissions were calculated for the differences between 49er games played at Candlestick Park and the proposed project, the differences for a second NFL team sharing the proposed project were assumed to be similar.

Non-NFL Football Events

It is anticipated that the proposed stadium would provide a venue for non-NFL events. These events would occur at various times throughout the year with most large events likely to occur outside the summer months to avoid conflicts with the Great America theme park. These events would have various attendances. Daily emissions from each of these possible events were modeled.

Emissions modeling was conducted in a similar manner as that for the NFL football events, except that each event was considered as new (not replacing an event that would occur at Candlestick Park) and travel distances would be considerably less, about 15 miles. Area source emissions, in the form of natural gas combustion for heating and cooking were included in these emissions calculations.

The EMFAC2007 model was used to develop emission rates for travel emissions. Since travel speeds would vary, composite trip emissions rates were developed from the BURDEN output for a vehicle mix that only included light-duty autos and light-duty trucks. Trip generation was based on estimated attendance for each event, using a vehicle occupancy rate equivalent to that used for NFL football games. The estimated number of trips generated for each of these events was based on a ratio of the estimated event attendance to the attendance for a NFL football game (i.e., 68,500 fans).

Natural gas emission rates were based on emission rates used in the URBEMIS2007 model. Natural gas consumption rates were also adjusted from those provided for NFL game events based on the difference in attendance.

Daily emissions of ROG, NOx, and PM_{10} were calculated for the various types of events that may occur. Predicted emissions were compared with BAAQMD thresholds. These emissions are shown in Table 5. The calculations of these emissions are also provided in Attachment 1.

Table 5: Non-NFL Event Emissions in Pounds Per Day

Scenario Event Type	Modeled Daily Emissions in Pounds Per Day (lbs/day) Attendance	Reactive Organic Gases (ROG)	Nitrogen Oxides (NOx)	Respirable Particulates (PM_{10})
X-Games (4-day Event)	50,000	188	173	315
Moto-Cross	42,500	160	147	268
International Soccer	40,000	150	139	252
Concert	37,500	141	130	236
College Football	37,500	141	130	236
Festival/Show	25,000	94	87	158
College Bowl Game	25,000	94	87	158
Car Shows	12,000	45	42	76
BAAQMD Thresholds		*80*	*80*	*80*

Non-NFL football game events associated with the project would have emissions that may exceed BAAQMD thresholds. The proposed project would increase emissions of ROG, NOx and PM_{10}, as shown in Table 5. ROG and NOx emissions for all events larger than about 20,000 attendees would exceed the significance thresholds established by BAAQMD. PM_{10} emissions would exceed the significance thresholds for all events larger than about 15,000 attendees.

Summary of Regional Air Pollutant Emissions

Table 6 summarizes new daily and annual emissions associated with the proposed stadium project. NFL football games are not considered to be new events, but events that would occur in a different part of the air basin, resulting in changes in regional air pollutant emissions due to changes in traffic. Non-NFL football game events were considered as new events in the air basin, although they may occur somewhere else in the air basin if the project is not constructed. The project description indicates that approximately 17 non-NFL football game events would occur annually. Annual emissions from these events were computed based on the daily emissions reported in Table 5. All but the X-Games were considered to be one-day events. The X-Games would be a 4-day event.

Table 6: Summary of Proposed Project Emissions – Daily and Annually

Scenario	Modeled Daily Emissions Reactive Organic Gases (ROG)	Nitrogen Oxides (NOx)	Respirable Particulates (PM_{10})
Daily Emissions			
-NFL Football Games	25 lbs/day	153 lbs/day	61 lbs/day
-Non-NFL Football Game Events	45 – 188 lbs/day	42 – 173 lbs/day	76 – 315 lbs/day
BAAQMD Thresholds	*80 lbs/day*	*80 lbs/day*	*80 lbs/day*

Annual Emissions			
-NFL Football Games (20 per year)	0.2 tons/year	1.6 tons/year	0.6 tons/year
-Non-NFL Football Game Events (17 per year)	1.4 tons/year	1.2 tons/year	2.3 tons/year
- Area Sources (natural gas usage)	0.0 tons/year	1.0 tons/year	0.0 tons/year
Annual Total	1.6 tons/year	3.8 tons/year	2.9 tons/year
BAAQMD Thresholds	*15 tons/year*	*15 tons/year*	*15 tons/year*

Stationary equipment that could emit air pollutants has not been identified at this point in the design. Equipment such as natural gas-fired boilers to produce steam for heating purposes and emergency generators powered by diesel engines are possible. These types of sources would require permits from the BAAQMD. The emissions from boilers have been accounted in the calculations provided above that account for expected natural gas combustion. Standby emergency generators (rated 50 horsepower or greater) would require permits from BAAQMD and are subject to emission standards established by CARB. Generator emissions are associated with routine testing. These sources would normally result in minor emissions, compared to those from traffic generation reported above. Sources of air pollutant emissions complying with all applicable BAAQMD regulations generally will not be considered to have a significant air quality impact. Stationary sources that are exempt from BAAQMD permit requirements because they fall below emission thresholds for permitting would not be considered to have a significant air quality impact.

The proposed project would result in daily emissions of NOx that would exceed the BAAQMD thresholds for all 20 pre-season and regular season NFL football games played at the proposed stadium. These emissions were predicted for the 1st year of operation, 2012. NOx emissions would decrease in the future, as vehicle emission rates decrease. On years that playoff games or the Super Bowl are played, additional days that NOx emissions exceed the BAAQMD thresholds would occur. However, the emissions from late season or playoff games would not significantly affect regional air quality. NOx contributes to ozone formation, which is a concern during late spring through early fall when abundant sunshine and warmer temperatures occur. However, the NFL football game events in summertime and early fall would have significant NOx emissions that would contribute to a build up of unhealthy ozone concentrations in downwind portions of the Bay Area. This would be a *significant impact.*

Non-NFL football game events with attendances of over 20,000 attendees would result in significant emissions of ozone precursors, ROG and NOx. These significant emissions are anticipated to occur on about 18 days of the year. Many of these days would likely occur outside of the ozone season because summertime events may conflict with parking availability associated with the Great America Theme Park. Since at least some events are likely in the ozone season, these emissions from non-NFL football game events are considered to be significant, since they may contribute to a build up of unhealthy ozone concentrations in downwind portions of the Bay Area. PM_{10} emissions would also be significant on 18 days of the year when these events are held. Unlike ROG and NOx, PM_{10} emissions could contribute to air quality problems during the fall and winter. These emissions would be considered *significant.*

The annual emissions from the proposed project, which also include natural gas consumption, were computed and compared against the BAAQMD thresholds. As shown in Table 6, these emissions would be well below the BAAQMD annual thresholds. The project is anticipated with have significant emission of ozone precursor pollutants or PM_{10} on up to 28 days annually. All other days of the year would have emission below the daily thresholds, as also indicated by the relatively low annual emissions.

Mitigation Measure AQ-1: Include measures for the proposed stadium to reduce air pollutant emissions.

- Develop a Transportation Demand Management program that would include financial incentives provided by the project to reduce automobile vehicle trips.
- Encourage use of public transit for events, through advertising and financial incentives
- Provide shuttle service between LRT and CalTrain stations.
- Bicycle amenities should be provided for the project. This would include secure bicycle parking for employees and attendees and safe bike lane connections.
- Provide onsite shower and locker room facilities for employee use.
- Enforce State law idling restrictions of trucks or buses and include signage indicating the restriction and associated fines.
- Where appropriate, provide 110- and 220-volt electrical outlets at loading docks to or areas where media operations occur to eliminate any idling of trucks or generators to operate auxiliary equipment.
- Provide exterior electrical outlets to encourage use of electrical landscape equipment.
- Implement a landscape plan that provides shade trees along pedestrian pathways.
- Implement "Green Building" designs, such a Leadership in Energy and Environmental Design (LEED) into buildings to increase energy efficiency, which would reduce the future energy demand caused by the project, and therefore, reduce air pollutant emissions indirectly.

Conclusion After Mitigation: The impact would remain significant and unavoidable, even with full implementation of the above mitigation measures. Direct and indirect emissions of ROG, NOx and PM_{10} associated with build out and operation of the stadium would have to be reduced by up to 120 percent or greater on days with the busiest non-NFL football game events to mitigate the significance of the impact. The effectiveness is also difficult to judge, because it would be dependent on the origin of the trips to each event. Therefore, this air quality impact can be reduced, but not fully mitigated through implementation of this mitigation measure.

Impact 2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation? *Less than significant*

Carbon monoxide emissions from traffic generated by the project would be the greatest pollutant concern at the local level. Congested intersections with a large volume of traffic have the greatest potential to cause high-localized concentrations of carbon monoxide. Measured carbon monoxide levels have been at healthy levels (i.e., below State and Federal standards) in the Bay Area since the early 1990s. As a result, the region has been designated as attainment for the standard. There is an ambient air quality monitoring station in central San Jose that measures carbon monoxide concentrations. The highest measured level over any 8-hour averaging period during the last three years is 3.1 parts per million (ppm).

In ambient air, carbon monoxide is a wintertime air pollutant with elevated levels under stable atmospheric conditions. These are characterized by very light winds and restricted vertical mixing due to the presence of strong surface or near-surface based temperature inversions. These temperature inversions are the presence of warm air trapped above colder air that crates a "lid" trapping air pollutants near the surface. These inversions are common in late winter when the sun has less of a heating effect to destabilize the lower atmosphere. These strong inversion develop in the evening, so highest carbon monoxide levels occur at night or in the early morning. Concentrations of carbon monoxide are much lower during the daytime. As a result, the greatest potential for the proposed project to affect carbon monoxide levels would occur during evening weekday traffic associated with an evening NFL football game.

The contribution of project-generated traffic on an evening weekday NFL football game to carbon monoxide levels was predicted following the screening guidance recommended by BAAQMD. Future carbon monoxide levels were predicted near these intersections for existing conditions and with the project in place using departure weekday evening traffic projections provided by Hexagon Transportation Consultants. The predicted levels were added to background levels to compute concentrations associated with the proposed project.

Carbon monoxide emission factors are developed and applied to traffic conditions. Emission factors used were calculated using the EMFAC2007 model, developed by the California Air Resources Board, with default assumptions for the San Francisco Bay Area during winter that include a temperature of 40 deg. F. A slow speed of 5 miles per hour was used that results in higher emission rates. The departure traffic conditions were used, because they would have the greatest cold start emissions. These are the higher emission rate associated with operation of a cold engine, where fuel combustion is less complete and catalytic converters that reduce pollutants are less effective. Cold start emissions were included, which assumed 40 percent of the vehicles were in cold-start mode (i.e., within 3 miles of their trip origin), these cars had been turned off for over 4 hours, and the start emissions are evenly distributed over the first 3 miles of a trip. This screening analysis included the number of through lanes in the intersection configuration with a receptor located at the edge of the roadway.

Traffic and emission factors are input to the screening procedure develop by BAAQMD. This procedure takes into account the dispersion potential of different roadways and receptor distances. Receptors were considered to be at the roadway right-of-way.

Results of this assessment are included in Table 5. Screening calculations are also provided in Attachment 1. Refined modeling using wider roadways that account for turn lanes would result in lower concentrations due to the increased mixing zone.

Table 5: Predicted Roadside Carbon Monoxide Concentrations

Description	Existing 2008	Background 2012	Project 2012	Future >2020
Great America Parkway and Mission College	5.7 ppm	5.4 ppm	5.5 ppm	6.0 ppm
Great America Parkway and Tasman Drive	5.0 ppm	4.8 ppm	6.3 ppm	4.9 ppm
Montague Expressway and Mission College	6.0 ppm	5.5 ppm	5.8 ppm	4.7 ppm
Great America Parkway and Route 237	5.1 ppm	5.0 ppm	6.2 ppm	4.8 ppm
Lawrence Expressway and Tasman Drive	5.5 ppm	5.2 ppm	5.7 ppm	4.5 ppm
Lawrence Expressway and U.S. 101 Ramps	8.5 ppm	7.3 ppm	7.5 ppm	5.3 ppm
BAAQMD Thresholds	*9.0 ppm (CAAQS)*			

The highest 8-hour concentration with the project in place (in 2012) is predicted to be 7.5 ppm over an 8-hour averaging period. This concentration would occur along Lawrence Expressway near U.S. 101 and includes the contribution of U.S. 101 traffic. The intersection where the project would have the greatest impact would be Great America Parkway and Tasman Drive, raising 8-hour carbon monoxide concentrations by 1.5 ppm. This represents the roadside concentration with future evening PM peak hour conditions, as reported by Hexagon Transportation Consultants. The results of this screening analysis indicate that project levels would be below the California ambient air quality standard (used to judge the significance of the impact) of 9.0 ppm; therefore, the impact is considered less than significant. Had levels been above the ambient air quality standards, a more refined analysis would have been conducted using the CALINE4 dispersion model and actual lane-receiver geometry.

Impact 3: Expose sensitive receptors to substantial pollutant concentrations (during project construction)? *Less than significant with mitigation*

The project would not be a permanent source of air pollution that would expose the public to substantial pollutant concentrations. The project is not located near a source of air pollution that could expose new sensitive receptors that are part of the project to substantial air pollutant emissions. However, project construction would result in temporary emissions of dust and diesel exhaust that could adversely affect nearby sensitive receptors.

Construction Dust

Dust would be generated during demolition, grading and construction activities. Most of the dust would result during grading activities. The amount of dust generated would be highly variable and is dependent on the size of the area disturbed, amount of activity, soil conditions and meteorological conditions. Typical winds during late spring through summer are from the north. Nearby land uses include recreation areas, commercial or offices, hotels, and the Great America theme park. Residences are located about 700 feet from the proposed stadium. These nearby active land uses could be adversely affected by dust generated during construction activities. In addition, construction dust emissions can contribute to regional PM_{10} emissions.

Demolition or relocation activities may require permits from BAAQMD if removal or disturbance of hazardous materials were to occur. For instance, the handling of asbestos containing materials is subject to BAAQMD Regulation 11 – *Hazardous Pollutants*, Rule 2 – *Asbestos Demolition, Renovation and Manufacturing*. Proper handling of these materials through implementation of BAAQMD rules and regulations would reduce exposure to TACs from this activity to a less-than-significant level.

Although grading and construction activities would be temporary, they would have the potential to cause both nuisance and health air quality impacts. PM_{10} is the pollutant of greatest concern associated with dust. If uncontrolled, PM_{10} levels downwind of actively disturbed areas could possibly exceed State standards. In addition, dust fall on adjacent properties could be a nuisance. If uncontrolled, dust generated by grading and construction activities represents a *significant* impact.

<u>Construction Equipment Exhaust</u>

Construction equipment and associated heavy-duty truck traffic generates diesel exhaust, which is a known Toxic Air Contaminant. BAAQMD has not developed any procedures or guidelines for identifying these impacts from temporary construction activities where emissions are transient. They are typically evaluated for stationary sources (e.g., large compression ignition engines such as generators) in health risk assessments over the course of lifetime exposures (i.e., 24 hours per day over 70 years). Diesel exhaust poses both a health and nuisance impact to nearby receptors. These construction activities would not be near sensitive receptors and are expected to occur during a relatively short time. Therefore, the impacts are considered to be less than significant if reasonable available control measures are applied.

Mitigation Measure AQ-2: Include measures to control dust emissions during construction.

Implementation of the measures recommended by BAAQMD and listed below would reduce the air quality impacts associated with grading and new construction to a *less- than-significant* level.

- Water all active construction areas at least twice daily and more often during windy periods. Active areas adjacent to residences should be kept damp at all times.

- Cover all hauling trucks or maintain at least two feet of freeboard.

- Pave, apply water at least twice daily, or apply (non-toxic) soil stabilizers on all unpaved access roads, parking areas, and staging areas.

- Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas and sweep streets daily (with water sweepers) if visible soil material is deposited onto the adjacent roads.

- Hydroseed or apply (non-toxic) soil stabilizers to inactive construction areas (i.e., previously-graded areas that are inactive for 10 days or more).

- Enclose, cover, water twice daily, or apply (non-toxic) soil binders to exposed stockpiles.

- Limit traffic speeds on any unpaved roads to 15 mph.

- Replant vegetation in disturbed areas as quickly as possible.

- Suspend construction activities that cause visible dust plumes to extend beyond the construction site.

- During renovation and demolition activities, removal or disturbance of any materials containing asbestos, lead paint or other hazardous pollutants will be conducted in accordance with BAAQMD rules and regulations.

- Designate a disturbance coordinator during construction activities. Prominently post a phone number for this person on the job site, and distribute this information to all nearby residents and businesses (within 750 feet). The coordinator shall respond to and remedy any complaints about dust, exhaust, or other air quality concerns. A log shall be kept of all complaints and how and when the problem was remedied.

Mitigation Measure AQ-3: Include measures to control diesel exhaust emissions during construction.

- Prohibit equipment with dirty emissions. The project shall ensure that emissions from all off-road diesel powered equipment used on the project site do not exceed 40 percent opacity for more than three minutes in any one hour. Any equipment found to exceed 40 percent opacity (or Ringelmann 2.0) shall be repaired immediately. This measure means that equipment with continuous dark emissions is in violation of the requirement.

- Reduce equipment and vehicle idle times. Signs shall be posted that indicate Diesel equipment standing idle for more than five minutes shall be turned off or operators would

- Reduce vehicle emissions. Properly tune and maintain equipment for low emissions.

Conclusion after mitigation: These measures would be consistent with measures recommended by the BAAQMD for construction period impacts that would reduce the impact to a *less-than-significant* level.

Impact 4: Create objectionable odors affecting a substantial number of people? *Less than significant*

During construction, the various diesel powered vehicles and equipment in use onsite would create localized odors. These odors would be temporary and not likely to be noticeable for extended periods of time much beyond the project's site boundaries. The potential for diesel odor impacts is therefore *less than significant.*

The preparation of food at the proposed stadium could result in odors that may be detected off site. When cooking odors are strong, there are different reactions from people. Some people find them objectionable, while others find them pleasant. The closest sensitive receptors that may notice these odors are the residences located about 700 feet south of the closest portion of the proposed project. The source of odors generated by on-site food preparation would be 700 to 1,500 feet from these residences. The distance between the on-site sources of cooking odors and residences is expected to be adequate for diluting odors from the proposed stadium. In addition, kitchen exhausts can be equipped with exhaust filtration systems or engineered to reduce odors.

Another source of odors that would occur on days with NFL football games are from fan barbeques that occur prior to games. These would occur in the parking lots and are part of activities referred to as tailgating. Barbeques from tailgating would occur most likely in parking lots located west of the project site. Most of the parking areas are located far enough away from the nearby residences (located 700 feet south of the proposed stadium) so that frequent odor complaints are not expected. However, portions of these parking areas are located just over 300 feet to the northwest of the residences. Depending on wind conditions and atmospheric stability, this could result in detectable odors at these residences. During occurrences of light northwest winds, barbeques within about 700 feet of the residences could result in odors that may cause complaints. Barbeque odors are likely to be one of the nuisances associated with having fans tailgating near residences. Numerous barbeque activities occurring within 700 feet of the residences would be considered to result in potential odor complaints. This would be a *significant impact.*

Mitigation Measure AQ-4: Develop a buffer between odor producing activities and existing residences.

- Reserve surface parking within 750 feet of residences for vehicles only. Prohibit tailgating within these areas.

- Designate a "disturbance coordinator" to investigate and respond to odor or air quality complaints. Provide the name and contact information for the disturbance coordinator to residents within 750 feet of the stadium or surface parking lots.

Impact 5: Conflict with or obstruct implementation of the applicable air quality plan?
Less than Significant with mitigation

The most current Clean Air Plan (CAP), the *2005 Bay Area Ozone Strategy*, was adopted by BAAQMD in 2006. This plan is based on population projections through 2020 compiled by the Association of Bay Area Governments (ABAG). The project proposes increased office uses on a site that currently is used in the same manner. The site is currently designated for Office/Research and Development or Planned Development in the City's General Plan. The project would demolish one building and construct new buildings to intensify the uses at the site. The project would not require a General Plan Amendment.

The proposed project would allow for the development of a NFL football stadium in addition to the parking garage, additional parking, and relocation of the nearby electrical substation. The proposed stadium would not affect population forecasts for the region. However, it could affect vehicle miles traveled, but only on an intermittent basis. The addition of the stadium is not expected to conflict with the regional clean air plan efforts.

Determining consistency with the Clean Air Plan also involves assessing whether Transportation Control Measures (TCMs) contained in the *2005 Bay Area Ozone Strategy* are implemented. The 2005 Ozone Strategy (i.e., BAAQMD's most recent Clean Air Plan) includes 20 transportation control measures, of which seven require participation at the local level. The latest set of adopted TCMs, which identify local governments as implementing agencies, are listed by BAAQMD CEQA Guidelines. TCMs that would apply to projects are designed to reduce motor vehicle travel by encouraging use of other transportation modes. For projects, these would include amenities that would encourage transit, bicycle and pedestrian modes of transportation. Parking strategies that discourage single-occupant vehicles trips are encouraged by BAAQMD.

The project cannot individually implement the listed TCMs that require local action; however, the City's General Plan policies should include all those measures that are consistent with the City's responsibility. There are measures that the project could implement to make TCMs more effective. The project description does not include specific project-specific measures or features that are consistent with all applicable TCMs identified in the *2005 Bay Area Ozone Strategy*. The project could conflict with regional clean air planning efforts due to increases in vehicles miles traveled that may occur. This would be a *significant impact*.

Mitigation Measure AQ-3: Include Mitigation Measure AQ-1, which would develop a Transportation Demand Management program that would promote transit use.

Santa Clara Stadium
Emissions Summary

NFL Football Game Events

Total Daily Emissions (lbs/day)

Event	Attendance	ROG	NOx	PM10	CO2
Sold Out Football Game	68,500	25	153	61	84,170

Total Daily Emissions (tons/year)

Number of Days Annually	ROG	NOx	PM10	CO2
10	0.1	0.8	0.3	420.8

Note: Natural gas consumption not included since these emissions would be offset from non-operation of Candlestick Park for NFL football games

Non NFL Football Game Events

Total Daily Emissions (lbs/day)

Event	Attendance	ROG	NOx	PM10	CO2
X-Games	50,000	369	491	326	497011
Moto-Cross	42,500	314	418	277	422460
International Soccer	40,000	295	393	260	397609
Concerts	37,500	277	369	244	372758
College Football	37,500	277	369	244	372758
Festivals/shows	25,000	184	246	163	248506
College Bowl Game	25,000	184	246	163	248506
Car shows	12,000	89	118	78	119283
Small Events	300	2	3	2	2982

Total Daily Emissions (tons/year)

Number of Days Annually	ROG	NOx	PM10	CO2
4	0.7	1.0	0.7	972.4
1	0.2	0.2	0.1	206.6
2	0.3	0.4	0.3	388.9
1	0.1	0.2	0.1	182.3
1	0.1	0.2	0.1	182.3
8	0.7	1.0	0.7	972.4
1	0.1	0.1	0.1	121.5
2	0.1	0.1	0.1	116.7
250	0.3	0.4	0.2	364.6
Total	2.7	3.5	2.3	3507.8

[1] Based on estimated 0.3 trips per attendee calcualted from 49er game trip generation estimates x 2 trips/event

[2] Assuming an average trip length of 15 miles

[3] Assuming vast majority of trips are light duty autos or light duty trucks

[4] Event natural gas usage scaled to football game using attendance

Total Annual Emissions (tons/day)

Type	ROG	NOx	PM10	CO2	Total CO2 Emissions	% of Total		With Offset Emissions	% of Total
NFL Football Games[1]	0.1	0.8	0.3	420.8	8299	49%		8299	55%
Non NFL Football Game Events	2.7	3.5	2.3	3507.8	3507.8	21%	70%	3508	23%
Natural Gas Usage	0.0	0.5	0.0	575.2	575.2	3%		575	4%
Electricity Usage				4493.9	4493.9	27%		2651	18%
Total	2.8	4.7	2.7	8997.7	16875.4			15033	

[1] Based on distances in travel for season ticket holders

Santa Clara Stadium

Construction CO_2 Emissions

Project Size:	22 acres	1.78 million square feet of floor area
Project Type:	Warehouse (closest URBEMIS2007 Land Use type)	
Construction Period:	May 2010 through Summer 2012	
Construction Phases Selected:	Fine Site Grading (site is generally flat)	
	Trenching	
	Paving	
	Building Construction	
	Architectual Coatings	

CO_2 Emissions (tpy)

2010	2066	2066	
2011	5434	5434	
2012	20	20	
Total amotized over 30 years:			251

Santa Clara Stadium

Natural Gas Emissions

Peak summer day use =	123,805	cf/day
Annual predicted usage =	9,593,951	cf/year

1 therm =	100,000 btu
1 cf	1025 btu
1 therm =	97.56 cf

Emission Rates[1,2]			Daily Emissions		Annual Emissions	
ROG	7.26	lbs/million ft^3	0.90	lbs	0.03	tons
NOx	100.00	lbs/million ft^3	12.38	lbs	0.48	tons
PM	0.18	lbs/million ft^3	0.02	lbs	0.00	tons
CO2	119906.00	lbs/million ft^3	14,844.96	lbs	575.19	tons

Notes:

[1] ROG, NOx and PM emission rates from URBEMIS2007

[2] CO2 emission rates from California Action Registry Reporting Protocol

Rate = 53.06 kg CO2/mbtu = 116.98 lbsCO2/mbtu = 11.698 lbs/therm

Santa Clara Stadium
Electricity Usage Emissions

Annual predicted usage =		19,710,000 kw-hours		
		19,710 mw-hours		
Emission Rate	PG&E 2005 certified rate		456 lb/Mw-hour	
	PG&E reported California rate		879 lb/Mw-hour	0.518771
	PG&E reported national rate		1363 lb/Mw-hour	0.334556

Calculated CO2 Annual Emissions

4,494 tons

Note: Silicon Valley Power does not report CO2 emissions for energy consumption.
Source: Local Government Operations Protocol for the quantification and reporting of Greenhouse Gas Emissions, Version 1.0 - CARB, CCAR, ICLEI. Sept.

Santa Clara Stadium

Vehicle Travel Emissions

Trip Generation

Autos & LDT Fans	18704		68,500 fans	
Autos & LDT Employees	1547			
Charter buses	114			
Buses Fans	289 ←		Qty	Capacity
Buses Employees	13 ←		13000	45
			580	45
Total autos & LDT	20251	98.0%		
Total buses	416	2.0%		
	20667			

Emission Factors grams/mi (2012)

	ROG	NOx	PM10	PM2.5	CO2
Auto		see EMFAC2007 Output			
LDT					
Bus					

Travel Distances and Speeds

Orgin (County, City)	%	Distance	Auto VMT	Bus VMT	Auto Speed	Bus Speed	Trip Minutes
Santa Clara, San José	19%	10	76954	1580	40	35	16
Central Valley, Altamont Pass	6%	45	109355	2245	50	45	53
San Francisco	11%	43	191574	3933	55	50	47
San Mateo, San Mateo	17%	25	172134	3534	55	50	27
Marin, San Rafael	6%	62	150667	3093	60	55	64
Sonoma, Santa Rosa	4%	98	158768	3260	60	55	100
Alameda, Oakland	3%	35	42527	873	55	50	37
Alameda, Pleasanton	3%	26	31592	649	50	45	32
Contra Costa, Walnut Creek	7%	45	127581	2619	55	50	47
Napa, Napa	1%	82	33212	682	55	50	92
Solano, Vallejo	2%	67	54273	1114	55	50	71
Sacramento, Fairfield	4%	75	121506	2495	60	55	77
South, Gilroy	3%	39	47387	973	55	50	42
Other, ???	15%	50	303765	6237	50	45	60
		Total VMT	1,621,295	33,287			

Travel Emissions - Summer Day

	Running Emissions						
Orgin (County, City)	ROGr	NOx	PM10	CO2	1-way ROGrl	ROGrl	Entrained Dust (PM10)
Santa Clara, San José	12.03	78.51	6.02	77012	6.05	12.10	59.96
Central Valley, Altamont Pass	15.56	120.02	8.29	109563	5.22	10.44	85.21
San Francisco	28.03	230.97	14.47	194453	8.38	16.75	149.27
San Mateo, San Mateo	25.18	207.53	13.00	174720	8.62	17.23	134.13
Marin, San Rafael	24.00	207.85	11.82	156561	6.07	12.14	117.40
Sonoma, Santa Rosa	25.29	219.02	12.46	164978	6.81	13.63	123.71
Alameda, Oakland	6.22	51.27	3.21	43166	2.44	4.89	33.14
Alameda, Pleasanton	4.50	34.67	2.40	31651	2.17	4.35	24.62
Contra Costa, Walnut Creek	18.67	153.82	9.63	129498	5.77	11.54	99.41
Napa, Napa	4.86	40.04	2.51	33711	2.58	5.16	25.88
Solano, Vallejo	7.94	65.43	4.10	55088	2.94	5.88	42.29
Sacramento, Fairfield	19.36	167.62	9.54	126259	5.25	10.49	94.68
South, Gilroy	6.93	57.13	3.58	48099	2.66	5.32	36.92
Other, ???	43.23	333.38	23.04	304341	12.91	25.82	236.69
sum	241.80	1967.28	124.06	1649098		155.75	1263.30

Trip/Hot Soak Emissions

Type	ROG	NOx	PM10	CO2
Start	52.84	33.14	0.40	10607.89
Hot Soak	8.21			

Total Summer Day Travel Emissions (lbs)

	ROG	NOx	PM10	CO2
	459	2,000	1,388	1,659,706
Difference between Candlestick	25	153	61	84,170

Annual CO2 (tons)
8299

Candlestick Stadium

Vehicle Travel Emissions

Trip Generation

Autos & LDT Fans	19050	
Autos & LDT Employees	1740	
Charter buses	161	
Buses Fans	121	
Buses Employees	6	
Total autos & LDT	20790	98.6%
Total buses	289	1.4%
Total vehicles	21079	

69,700 fans

Qty	Capacity
5450	45
290	45

Emission Factors grams/mi (2012)

	ROG	NOx	PM10	PM2.5	CO2
Auto		see EMFAC2007 Output			
LDT					
Bus					

Travel Distances and Speeds

Orgin (County, City)	%	Distance	Auto VMT	Bus VMT	Auto Speed	Bus Speed	Trip Minutes
Santa Clara, San José	19%	45	355509	4934	55	50	48
Central Valley, Altamont Pass	6%	57	142204	1974	55	50	64
San Francisco	11%	7	32017	444	35	30	12
San Mateo, San Mateo	17%	14	98960	1374	45	40	18
Marin, San Rafael	6%	33	82328	1143	55	50	37
Sonoma, Santa Rosa	4%	69	114761	1593	55	50	74
Alameda, Oakland	3%	20	24948	346	45	40	26
Alameda, Pleasanton	3%	45	56133	779	55	50	51
Contra Costa, Walnut Creek	7%	29	84407	1172	50	45	36
Napa, Napa	1%	53	22037	306	50	45	65
Solano, Vallejo	2%	39	32432	450	55	50	44
Sacramento, Fairfield	4%	53	88150	1223	55	50	56
South, Gilroy	3%	74	92308	1281	60	55	74
Other, ???	15%	50	311850	4328	50	45	60
		Total VMT	1,538,044	21,347			

Travel Emissions - Summer Day

Orgin (County, City)	ROGr	NOx	PM10	CO2	ROGrl	Entrained Dust (PM10)
Santa Clara, San José	45.88	215.35	24.55	330844	28.82	244.74
Central Valley, Altamont Pass	20.08	146.30	10.47	140802	11.84	107.00
San Francisco	11.10	130.73	4.49	49703	5.94	43.43
San Mateo, San Mateo	16.25	148.18	8.23	106583	11.89	85.59
Marin, San Rafael	13.55	151.58	6.78	90927	8.38	72.07
Sonoma, Santa Rosa	17.76	172.06	9.03	121226	9.63	94.52
Alameda, Oakland	4.08	36.82	2.07	26776	2.84	21.48
Alameda, Pleasanton	7.67	48.89	4.04	54333	5.71	40.90
Contra Costa, Walnut Creek	13.02	121.68	6.77	89214	9.38	70.77
Napa, Napa	3.40	31.70	1.77	23282	3.11	18.47
Solano, Vallejo	5.23	55.82	2.63	35272	3.72	27.80
Sacramento, Fairfield	13.63	131.82	6.93	93067	7.57	72.55
South, Gilroy	13.73	86.23	6.88	91068	7.60	66.72
Other, ???	44.19	336.81	23.58	311571	25.93	242.05
sum	229.56	1813.97	118.20	1564667	142.35	1208.08

Trip/Hot Soak Emissions

Type	ROG	NOx	PM10	CO2
Start	53.76	33.37	0.41	10869.23
Hot Soak	8.40			

Total Summer Day Travel Emissions

ROG	NOx	PM10	CO2
434	1,847	1,327	1,575,536

Annual CO2 (tons)
7878

Santa Clara Stadium

Non-49er Events

				Travel Emissions from Bay Area BURDEN (lbs)[3]				Area Source Emissions (natural gas consumption)[4]			
Event	Attendance	Estimated Trips[1]	Estimated VMT[2]	ROG	NOx	PM10	CO2	ROG	NOx	PM10	CO2
X-Games	50000	29700	445500	368	482	326	486176	1	9	0	10836
Moto-Cross	42500	25245	378675	313	410	277	413249	1	8	0	9210
International Soccer	40000	23760	356400	295	386	260	388941	1	7	0	8669
Concerts	37500	22275	334125	276	362	244	364632	0	7	0	8127
College Football	37500	22275	334125	276	362	244	364632	0	7	0	8127
Festivals/shows	25000	14850	222750	184	241	163	243088	0	5	0	5418
College Bowl Game	25000	14850	222750	184	241	163	243088	0	5	0	5418
Car shows	12000	7128	106920	88	116	78	116682	0	2	0	2601
Small Events	300	178.2	2673	2	3	2	2917	0	0	0	65
								4	49	0	58469

[1] Based on estimated 0.3 trips per attendee calcualted from 49er game trip generation estimates x 2 trips/event with 1% bus trips

[2] Assuming an average trip length of 15 miles

[3] Assuming vast majority of trips are light duty autos or light duty trucks

[4] Event natural gas usage scaled to football game using attendance

Total Daily Emissions (lbs/day)

Event	Attendance	ROG	NOx	PM10	CO2
X-Games	50000	**369**	**491**	**326**	**497011**
Moto-Cross	42500	**314**	**418**	**277**	**422460**
International Soccer	40000	**295**	**393**	**260**	**397609**
Concerts	37500	**277**	**369**	**244**	**372758**
College Football	37500	**277**	**369**	**244**	**372758**
Festivals/shows	25000	**184**	**246**	**163**	**248506**
College Bowl Game	25000	**184**	**246**	**163**	**248506**
Car shows	12000	**89**	**118**	**78**	**119283**
Small Events	300	**2**	**3**	**2**	**2982**

[1] Based on estimated 0.3 trips per attendee calcualted from 49er game trip generation estimates x 2 trips/event

[2] Assuming an average trip length of 15 miles

[3] Assuming vast majority of trips are light duty autos or light duty trucks

[4] Event natural gas usage scaled to football game using attendance

EMFAC2007 V Bay Area Summer Emission Factors
2012

Table 7 Estimated Travel Fractions

Pollutant Name   Temperature ALL Relative Humidity ALL

	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
%VMT	0.616	0.378	0	0.001	0.004	0	1
%TRIP	0.631	0.363	0	0.005	0.001	0	1
%VEH	63%	37%	0	0.001	0.001	0	1

Running Exhaust
Pollutant Name: Reactive Org Gases   Temperature: 80F Relative Humidity: 50%

MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	10.384	0	0	0.015
5	0.307	0.46	0	1.401	3.162	0	0.378
10	0.201	0.304	0	0.866	2.186	0	0.249
15	0.138	0.212	0	0.878	1.58	0	0.173
20	0.1	0.156	0	0.6	1.186	0	0.126
25	0.077	0.12	0	0.384	0.936	0	0.097
30	0.062	0.096	0	0.306	0.781	0	0.079
35	0.053	0.083	0	0.252	0.643	0	0.067
40	0.048	0.075	0	0.216	0.564	0	0.06
45	0.046	0.071	0	0.191	0.514	0	0.057
50	0.046	0.07	0	0.175	0.487	0	0.056
55	0.047	0.073	0	0.167	0.478	0	0.058
60	0.052	0.081	0	0.164	0.488	0	0.065
65	0.06	0.093	0	0.168	0.516	0	0.075

Pollutant Name: Carbon Monoxide   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	65.189	0	0	0.099
5	4.206	6.701	0	17.744	22.188	0	5.243
10	3.646	5.727	0	11.807	14.304	0	4.489
15	3.217	4.986	0	8.424	9.785	0	3.926
20	2.879	4.432	0	6.263	7.086	0	3.492
25	2.606	3.986	0	4.936	5.462	0	3.15
30	2.388	3.65	0	4.082	4.44	0	2.877
35	2.209	3.375	0	3.874	3.83	0	2.659
40	2.066	3.161	0	3.39	3.5	0	2.488
45	1.953	3.004	0	3.185	3.388	0	2.359
50	1.873	2.902	0	3.267	3.475	0	2.271
55	1.828	2.861	0	3.625	3.773	0	2.229
60	1.822	2.886	0	4.013	4.34	0	2.242
65	1.873	3.033	0	4.619	5.286	0	2.33

Pollutant Name: Oxides of Nitrogen   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	47.04	0	0	0.066
5	0.246	0.482	0	7.016	30.716	0	0.473
10	0.214	0.424	0	5.866	23.842	0	0.397
15	0.19	0.373	0	5.292	19.039	0	0.344
20	0.173	0.337	0	4.841	16.1	0	0.307
25	0.16	0.31	0	4.671	4.16	0	0.282
30	0.151	0.292	0	4.446	13.567	0	0.285
35	0.146	0.281	0	4.461	13.287	0	0.286
40	0.142	0.275	0	4.581	13.722	0	0.284
45	0.141	0.275	0	4.847	14.875	0	0.289
50	0.143	0.28	0	5.273	16.93	0	0.271
55	0.147	0.292	0	5.907	20.236	0	0.292
60	0.154	0.31	0	6.822	25.42	0	0.326
65	0.166	0.337	0	8.141	33.566	0	0.378

Pollutant Name: Carbon Dioxide   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	4366.313	0	0	8.139
5	1084.462	1337.571	0	1886.726	2946.462	0	1187.857
10	809.247	999.456	0	1666.643	2639.044	0	889.444
15	630.792	779.929	0	1379.623	2474.429	0	686.465
20	512.469	634.239	0	1264.532	2438.085	0	567.526
25	433.384	536.801	0	1193.004	2410.834	0	481.73
30	381.214	472.456	0	1148.443	2396.401	0	426.105
35	346.507	432.084	0	1127.638	2386.234	0	389.801
40	330.875	410.277	0	1107.514	2381.409	0	370.446
45	326.906	404.077	0	1103.617	2380.077	0	365.025
50	332.841	412.318	0	1109.276	2382.011	0	372.309
55	341.37	435.368	0	1125.462	2387.547	0	392.618
60	363.896	475.243	0	1156.023	2397.65	0	427.709
65	432.943	536.07	0	1203.641	2414.27	0	481.206

Pollutant Name: Sulfur Dioxide   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	0.043	0	0	0
5	0.01	0.013	0	0.018	0.026	0	0.011
10	0.008	0.01	0	0.016	0.024	0	0.009
15	0.006	0.008	0	0.013	0.024	0	0.007
20	0.005	0.006	0	0.012	0.023	0	0.006
25	0.004	0.005	0	0.011	0.023	0	0.005
30	0.004	0.005	0	0.011	0.023	0	0.004
35	0.003	0.004	0	0.011	0.023	0	0.004
40	0.003	0.004	0	0.011	0.023	0	0.004
45	0.003	0.004	0	0.011	0.023	0	0.004
50	0.003	0.004	0	0.011	0.023	0	0.004
55	0.003	0.004	0	0.011	0.023	0	0.004
60	0.004	0.005	0	0.011	0.023	0	0.004
65	0.004	0.005	0	0.012	0.023	0	0.005

Pollutant Name: PM10   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	0.586	0	0	0.001
5	0.049	0.096	0	0.412	0.821	0	0.071
10	0.032	0.065	0	0.321	0.586	0	0.047
15	0.022	0.044	0	0.256	0.446	0	0.032
20	0.016	0.032	0	0.206	0.347	0	0.024
25	0.012	0.024	0	0.174	0.279	0	0.018
30	0.01	0.02	0	0.148	0.233	0	0.015
35	0.008	0.017	0	0.13	0.201	0	0.012
40	0.007	0.015	0	0.116	0.18	0	0.011
45	0.007	0.014	0	0.106	0.167	0	0.01
50	0.007	0.014	0	0.098	0.16	0	0.01
55	0.007	0.014	0	0.096	0.159	0	0.011
60	0.008	0.016	0	0.093	0.164	0	0.012
65	0.009	0.018	0	0.093	0.174	0	0.013

Pollutant Name: PM10 - Tire Wear   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	0	0	0	0
5	0.008	0.008	0	0.012	0.009	0	0.008
10	0.008	0.008	0	0.012	0.009	0	0.008
15	0.008	0.008	0	0.012	0.009	0	0.008
20	0.008	0.008	0	0.012	0.009	0	0.008
25	0.008	0.008	0	0.012	0.009	0	0.008
30	0.008	0.008	0	0.012	0.009	0	0.008
35	0.008	0.008	0	0.012	0.009	0	0.008
40	0.008	0.008	0	0.012	0.009	0	0.008
45	0.008	0.008	0	0.012	0.009	0	0.008
50	0.008	0.008	0	0.012	0.009	0	0.008
55	0.008	0.008	0	0.012	0.009	0	0.008
60	0.008	0.008	0	0.012	0.009	0	0.008
65	0.008	0.008	0	0.012	0.009	0	0.008

Pollutant Name: PM10 - Brake Wear   Temperature: 80F Relative Humidity: 50%

Speed MPH	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
0	0	0	0	0	0	0	0
5	0.013	0.013	0	0.013	0.013	0	0.013
10	0.013	0.013	0	0.013	0.013	0	0.013
15	0.013	0.013	0	0.013	0.013	0	0.013
20	0.013	0.013	0	0.013	0.013	0	0.013
25	0.013	0.013	0	0.013	0.013	0	0.013
30	0.013	0.013	0	0.013	0.013	0	0.013
35	0.013	0.013	0	0.013	0.013	0	0.013
40	0.013	0.013	0	0.013	0.013	0	0.013
45	0.013	0.013	0	0.013	0.013	0	0.013
50	0.013	0.013	0	0.013	0.013	0	0.013
55	0.013	0.013	0	0.013	0.013	0	0.013
60	0.013	0.013	0	0.013	0.013	0	0.013
65	0.013	0.013	0	0.013	0.013	0	0.013

Summary Running Exhaust Emissions

	Autos				Buses			
MPH	ROGs	NOx	PM10	CO2	ROGs	NOx	PM10	CO2
30	0.0751	0.2026	0.0348	420.33	0.7610	13.6070	0.2560	2386.40
35	0.0639	0.1946	0.0320	410.52	0.6430	13.2870	0.2230	2386.23
40	0.0578	0.1804	0.0309	405.36	0.5640	13.7220	0.2020	2381.41
45	0.0544	0.1889	0.0305	403.82	0.5140	14.8750	0.1840	2380.06
50	0.0541	0.1929	0.0305	405.99	0.4870	16.9300	0.1820	2382.01
55	0.0561	0.1980	0.0305	411.82	0.4710	20.2360	0.1810	2387.54
60	0.0626	0.2109	0.0319	422.74	0.4840	25.4200	0.1860	2397.65

Summary Trip Emissions

Autos				Buses			
ROG	NOx	PM10	CO2	ROG	NOx	PM10	CO2
0.58	0.36	0.0011	8.20	0.8010	1.0710	0.0030	34.48

Entrained Roadway Dust Emissions

E= k(sL/2)^0.65 * (W/3)^1.5   Autos = 2.4 tons
Buses = 10 tons
Autos Buses   sR Loading 0.026 gm/m²*
0.000983 0.008842 lbs/m   k = 0.016
* 70% freeway (0.02 g/m**2) and 30% collector (0.036 g/m**2)

0.0248

Running Loss
Autos

Running Losses (ROG)

Start Emissions
Pollutant Name: Reactive Org Gases   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.044	0.056	0	0.306	0.118	0	0.049
10	0.074	0.093	0	0.52	0.188	0	0.084
20	0.132	0.165	0	0.917	0.267	0	0.148
30	0.184	0.23	0	1.271	0.358	0	0.208
40	0.231	0.289	0	1.582	0.436	0	0.289
50	0.273	0.341	0	1.849	0.506	0	0.306
60	0.308	0.386	0	2.086	0.561	0	0.344
120	0.421	0.536	0	2.6	0.674	0	0.473
180	0.471	0.586	0	2.866	0.717	0	0.527
240	0.499	0.63	0	2.807	0.76	0	0.560
300	0.526	0.666	0	2.963	0.801	0	0.589
360	0.563	0.699	0	3.096	0.841	0	0.619
420	0.579	0.732	0	3.232	0.88	0	0.849
480	0.606	0.766	0	3.366	0.918	0	0.677
540	0.63	0.797	0	3.493	0.955	0	0.706
600	0.656	0.828	0	3.618	0.99	0	0.733
660	0.678	0.858	0	3.736	1.025	0	0.76
720	0.702	0.888	0	3.849	1.064	0	0.786

Pollutant Name: Carbon Monoxide   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.397	0.548	0	4.077	1.177	0	0.471
10	0.67	0.938	0	7.202	1.739	0	0.801
20	1.19	1.672	0	13.083	2.786	0	1.427
30	1.674	2.356	0	18.408	3.787	0	2.008
40	2.123	2.99	0	23.233	4.662	0	2.548
50	2.538	3.572	0	27.542	5.461	0	3.043
60	2.914	4.103	0	31.336	6.164	0	3.494
120	4.484	6.399	0	43.039	8.602	0	5.379
180	5.429	7.612	0	44.886	9.047	0	6.425
240	5.777	8.084	0	46.103	9.478	0	6.826
300	6.098	8.517	0	47.661	9.886	0	7.191
360	6.388	8.91	0	49.211	10.3	0	7.525
420	6.644	9.266	0	50.781	10.681	0	7.826
480	6.873	9.581	0	52.363	11.066	0	8.083
540	7.071	9.854	0	53.958	11.431	0	8.327
600	7.241	10.087	0	55.58	11.78	0	8.528
660	7.379	10.286	0	57.175	12.116	0	8.697
720	7.487	10.456	0	58.801	12.438	0	8.832

Pollutant Name: Oxides of Nitrogen   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.168	0.28	0	0.868	0.258	0	0.212
10	0.191	0.317	0	1.485	0.383	0	0.243
20	0.234	0.383	0	2.358	0.606	0	0.299
30	0.27	0.438	0	3.07	0.788	0	0.346
40	0.299	0.482	0	3.62	0.928	0	0.383
50	0.32	0.515	0	4.008	1.027	0	0.41
60	0.334	0.539	0	4.236	1.086	0	0.428
120	0.36	0.566	0	4.284	1.09	0	0.449
180	0.35	0.563	0	4.234	1.086	0	0.448
240	0.347	0.559	0	4.213	1.079	0	0.444
300	0.343	0.553	0	4.181	1.071	0	0.44
360	0.338	0.545	0	4.14	1.06	0	0.433
420	0.332	0.534	0	4.091	1.047	0	0.425
480	0.324	0.521	0	4.033	1.032	0	0.415
540	0.315	0.506	0	3.967	1.014	0	0.404
600	0.306	0.489	0	3.893	0.996	0	0.391
660	0.293	0.47	0	3.81	0.973	0	0.376
720	0.28	0.449	0	3.719	0.948	0	0.36

Pollutant Name: Carbon Dioxide   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	11.234	13.748	0	7.29	2.389	0	12.12
10	13.331	0.39	0	12.774	3.886	0	14.431
20	17.913	22.146	0	23.844	6.186	0	19.47
30	23.016	28.529	0	34.363	8.67	0	26.064
40	28.639	35.542	0	44.901	12	0	31.216
50	34.782	43.182	0	56.466	13.539	0	37.922
60	41.447	51.452	0	66.81	16.817	0	46.186
120	88.569	110.814	0	110.686	26.286	0	97.269
180	102.288	128.344	0	129.892	30.507	0	111.124
240	114.812	141.806	0	147.865	34.477	0	124.757
300	127.142	157.106	0	164.804	38.197	0	138.166
360	139.278	172.17	0	180.71	41.669	0	151.364
420	151.22	186.917	0	195.363	44.892	0	164.326
480	162.968	201.409	0	208.922	47.867	0	177.072
540	174.821	216.843	0	221.328	50.582	0	189.596
600	186.88	229.622	0	232.8	53.089	0	201.899
660	197.046	243.344	0	242.74	55.289	0	213.98
720	208.016	256.809	0	251.745	57.275	0	225.839

Pollutant Name: Sulfur Dioxide   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
30	0	0	0	0.001	0	0	0
40	0	0	0	0.001	0	0	0
50	0	0	0	0.001	0	0	0
60	0	0.001	0	0.001	0	0	0
120	0.001	0.001	0	0.002	0	0	0.001
180	0.001	0.001	0	0.002	0	0	0.001
240	0.001	0.002	0	0.002	0	0	0.001
300	0.001	0.002	0	0.002	0.001	0	0.001
360	0.001	0.002	0	0.003	0.001	0	0.002
420	0.002	0.002	0	0.003	0.001	0	0.002
480	0.002	0.002	0	0.003	0.001	0	0.007
540	0.002	0.002	0	0.003	0.001	0	0.002
600	0.002	0.002	0	0.003	0.001	0	0.002
660	0.002	0.003	0	0.003	0.001	0	0.002
720	0.002	0.003	0	0.003	0.001	0	0.002

Pollutant Name: PM10   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.001	0.001	0	0.001	0	0	0.001
10	0.001	0.002	0	0.002	0	0	0.002
20	0.002	0.004	0	0.003	0.001	0	0.003
30	0.003	0.006	0	0.005	0.001	0	0.004
40	0.004	0.008	0	0.006	0.001	0	0.005
50	0.006	0.009	0	0.007	0.002	0	0.007
60	0.008	0.011	0	0.008	0.002	0	0.008
120	0.008	0.017	0	0.011	0.002	0	0.011
180	0.009	0.018	0	0.011	0.002	0	0.012
240	0.01	0.019	0	0.012	0.003	0	0.013
300	0.01	0.02	0	0.012	0.003	0	0.014
360	0.011	0.021	0	0.013	0.003	0	0.015
420	0.011	0.022	0	0.013	0.003	0	0.015
480	0.012	0.023	0	0.013	0.003	0	0.016
540	0.012	0.023	0	0.014	0.003	0	0.016
600	0.012	0.024	0	0.014	0.003	0	0.016
660	0.012	0.024	0	0.016	0.003	0	0.017
720	0.013	0.026	0	0.016	0.003	0	0.017

Table 4. Hot Soak Emissions (grams/trip)

Pollutant Name: Reactive Org Gases   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	MDT	HDT	UBUS	MCY	ALL
5	0.066	0.07	0	0.011	0.023	0	0.066
10	0.12	0.13	0	0.02	0.043	0	0.123
20	0.206	0.223	0	0.036	0.074	0	0.211
30	0.266	0.266	0	0.045	0.096	0	0.272
40	0.288	0.313	0	0.049	0.103	0	0.296

Table 6. Evaporative Running Loss Emissions (grams/minute)

Pollutant Name: Reactive Org Gases   Temperature: 80F Relative Humidity: ALL

Time min	LDA	LDT	Composite	UBUS	MCY	ALL
1	0.019	0.478	0.18483	0.191	0	0.184
2	0.021	0.244	0.10351	0.101	0	0.106
3	0.024	0.166	0.07728	0.071	0	0.079
4	0.027	0.132	0.06566	0.066	0	0.067
5	0.029	0.11	0.05897	0.048	0	0.06
10	0.033	0.069	0.04632	0.03	0	0.047
15	0.034	0.067	0.04251	0.024	0	0.043
20	0.034	0.063	0.04103	0.021	0	0.041
25	0.034	0.06	0.03982	0.019	0	0.04
30	0.033	0.048	0.03856	0.019	0	0.038
35	0.032	0.046	0.03718	0.018	0	0.037
40	0.031	0.044	0.03581	0.018	0	0.036
45	0.03	0.042	0.03444	0.017	0	0.036
50	0.029	0.041	0.03344	0.017	0	0.033
55	0.027	0.038	0.03144	0.016	0	0.032
60	0.026	0.037	0.03007	0.016	0	0.03

Title : Santa Clara Stadium
Version : Emfac2007 V2.3 Nov 1 2006
Run Date : 2009/01/23 13:42:12
Scen Year: 2012 -- All model years in the range 1968 to 2012 selected
Season : Summer
Area : San Francisco Air Basin Average
I/M Stat : Enhanced Interim (2005) -- Using I/M schedule for area 43 San Francisco (SF)
Emissions: Tons Per Day

Entrained Roadway Dust Emissions

E= k(sL/2)0.65 * (W/3)1.5

Autos	Buses		Autos =	2.4 tons
			Buses =	10 tons
Autos	Buses		silt Loading	0.025 gm/mile*
0.000663	0.005642	lbs/mi	k =	0.016

* 70% freeway (0.02 g/mi) and 30% collector (0 035 g/mi)

	LDA-TOT	LDT1-TOT	LDT2-TOT	MDV-TOT	LHDT1-TC	LHDT2-TC	MHDT-TO	HHDT-TO	OBUS-TO	SBUS-TO	UB-TOT	MH-TOT	MCY-TOT	ALL-TOT	LDA & LDT Rate lbs/mi	Rate gm/mi
Vehicles	3013520	701908	1039850	344389	47200	32507	52574	20120	4283	5318	5105	33585	169573	5469940		
VMT/1000	93552	22624	34914	12384	1957	1171	2770	3073	214	215	623	379	1375	175250		
Trips	18872600	4312630	6531220	2175960	1318460	788673	1669610	170541	154101	21274	20421	3360	339111	36378000		
Reactive Organic (	53%	13%	20%	7%	1%	1%	2%	2%	0%	0%	0%	0%	1%			
Run Exh	7.36	3.67	3.35	1.31	0.39	0.47	0.75	3.09	0.08	0.1	0.66	0.2	4.56	26.01		
Idle Exh	0	0	0	0	0.05	0.03	0.04	0.36	0	0.02	0	0	0	0.5		
Start Ex	6.44	2.05	2.61	1.12	0.39	0.36	0.86	0.33	0.11	0.01	0.01	0	0.72	15.02		
Total Ex	13.8	5.73	5.96	2.43	0.83	0.86	1.64	3.79	0.2	0.13	0.67	0.2	5.28	41.54	0.000392935	
Diurnal	4.74	1.64	1.5	0.38	0	0	0	0	0	0	0	0.01	0.74	9.02		
Hot Soak	4.91	1.53	1.53	0.4	0.05	0.07	0.04	0.01	0	0	0	0	0.21	8.76		
Running	10.11	5.59	5.49	1.36	0.54	0.82	0.47	0.09	0.05	0.01	0.01	0.01	0.69	25.24		
Resting	3.39	1.17	1.13	0.31	0	0	0	0	0	0	0	0.01	0.49	6.5		
Total	36.95	15.66	15.62	4.88	1.43	1.75	2.16	3.89	0.25	0.14	0.69	0.23	7.41	91.06		
	15.02	7.12	7.02	1.76	0.59	0.89	0.51	0.1	0.05	0.01	0.01	0.01	0.9	34	0.00043348	ROG
															0.000826415	0.37519228
Carbon Monoxide Emissions																
Run Exh	238.22	108.98	119.16	42.95	4.11	4.71	9.52	17.09	1.14	1.35	4.16	5.47	50.39	607.26		
Idle Exh	0	0	0	0	0.31	0.17	0.26	1.16	0.03	0.12	0	0	0	2.05		
Start Ex	66.89	23.97	29.81	11.31	4.3	3.99	10.92	4.86	1.67	0.1	0.13	0.05	3.27	161.29		
Total Ex	305.11	132.95	148.97	54.26	8.72	8.87	20.71	23.12	2.85	1.56	4.29	5.52	53.66	770.6		
Oxides of Nitrogen Emissions																
Run Exh	19.12	9.62	13.54	5.53	2.51	3.08	19.24	40.08	1.37	2.09	11.96	0.95	1.79	130.89		
Idle Exh	0	0	0	0	0.04	0.04	0.34	4.02	0.02	0.21	0	0	0	4.67		
Start Ex	5.58	1.66	3.55	1.44	1.85	1.11	1.29	0.59	0.27	0.01	0.02	0	0.11	17.48		NOx
Total Ex	24.7	11.28	17.08	6.98	4.4	4.23	20.87	44.7	1.66	2.31	11.98	0.95	1.9	153.04	**0.001082888**	0.49163111
Carbon Dioxide Emissions (000)																
Run Exh	43.59	12.93	20.25	9.8	1.85	1	4.2	6.04	0.28	0.34	1.66	0.32	0.23	102.49		
Idle Exh	0	0	0	0	0.01	0.01	0.02	0.24	0	0.01	0	0	0	0.3		
Start Ex	1.51	0.42	0.65	0.29	0.05	0.03	0.03	0	0	0	0	0	0.02	3.01		CO2
Total Ex	45.1	13.35	20.9	10.1	1.92	1.04	4.25	6.28	0.29	0.35	1.66	0.32	0.25	105.8	**1.09130333**	495.451712
PM10 Emissions																
Run Exh	1.14	0.38	1.01	0.37	0.04	0.04	0.59	1.43	0.03	0.08	0.2	0.01	0.05	5.38		
Idle Exh	0	0	0	0	0	0	0	0.04	0	0	0	0	0	0.05		
Start Ex	0.12	0.04	0.1	0.03	0	0	0	0	0	0	0	0	0.01	0.3		
Total Ex	1.26	0.42	1.11	0.4	0.05	0.05	0.6	1.48	0.03	0.08	0.2	0.01	0.05	5.73	3.69587E-05	PM10
															6.74005E-05	0.030599824
TireWear	0.82	0.2	0.31	0.11	0.03	0.02	0.04	0.12	0	0	0.01	0.01	0.01	1.66		
BrakeWr	1.29	0.31	0.48	0.17	0.03	0.02	0.04	0.1	0	0	0.01	0.01	0.01	2.47		
Total	3.38	0.93	1.9	0.68	0.1	0.08	0.67	1.69	0.04	0.08	0.21	0.02	0.07	9.86	3.04418E-05	
Lead	0	0	0	0	0	0	0	0	0	0	0	0	0	0		
SOx	0.44	0.13	0.2	0.1	0.02	0.01	0.04	0.06	0	0	0.02	0	0	1.03		
Fuel Consumption (000 gallons)																
Gasoline	4664.85	1368.31	2163.32	1041.66	169.25	77.22	40.29	10.41	7.25	2.44	7.28	27.04	36.04	9615.36		
Diesel	5.74	18.8	2.09	1.61	25.18	27	349.37	557.86	19.89	29.5	143.42	6.2	0	1186.68		

Santa Clara Football Stadium
CARBON MONOXIDE ANALYSIS

PM Peak Hour
Assumes worst case of all intersections based on total volume, LOS and project traffic contribution

	Traffic Volume				Total 8-Hour CO Concentration			
Intersection Link	Existing (2008)	Approved Background	Project	Cumulative with Project	Existing (2008)	Approved Background	Project	Cumulative with Project
3 Int 3: GreatAmerica Pkwy & Tasman					5.0	4.8	6.3	4.9
Great America (8 lane)*	2,239	3,174	5,907	6,873				
Tasman (4 lane)	1,810	1,998	3,477	3,833				
	Increase with project =		181.4%					
8 Int 8: GreatAmerica Pkwy & Mission College					5.7	5.4	5.5	6.0
Great America (6 lane)*	3,343	4,559	4,181	10,192				
Mission College (4 lane)	1,481	1,554	3,389	8,327				
	Increase with project =		123.8%					
21 Bowers & Augustine					5.4	5.0	5.4	4.6
Bowers 6l	3,206	4,043	4,804	6,595				
Augustine 4l	770	1,114	1,114	1,208				
	Increase with project =		114.8%					
23 Bowers & Central Expressway					6.0	5.2	5.4	4.4
Bowers 6l	3,587	3,982	4,011	4,677				
Central Expwy 6l	2,271	2,758	3,462	4,493				
	Increase with project =		110.9%					
27 Bowers & El Camino					5.7	5.3	5.3	4.2
Bowers 4l	2,435	3,114	3,114	3,322				
El Camino 6l	1,624	1,805	2,295	2,627				
	Increase with project =		110.0%					
69 San Tomas Expwy & Monroe					6.3	5.4	5.6	4.5
San Tomas 8l	4,402	4,892	5,161	6,217				
Monroe 4l	1,123	1,214	1,214	1,347				
	Increase with project =		104.4%					
70 San Tomas Expwy & Walsh					6.3	5.4	5.5	4.6
San Tomas 8l	4,502	4,953	5,222	6,455				
Walsh 4l	785	793	793	1,370				
	Increase with project =		104.7%					
71 San Tomas Expwy & Scott					6.8	5.9	6.1	4.8
San Tomas	5,135	5,888	6,233	7,380				
Scott	1,113	1,387	1,387	2,005				
	Increase with project =		104.7%					
72 Mission College & Montague Expressway**					6.0	5.5	5.8	4.7
Montague Expressway (10 Lane)*	5,272	6,547	7,094	8,776				
Mission College (4 Lane)	1,699	1,978	2,789	3,511				
	Increase with project =		115.9%					
73 De La Cruz & Montague Expressway					5.9	5.5	5.7	4.7
Montague Expressway (8 Lane)	3,842	5,061	5,524	7,146				
De La Cruz (4 Lane)	1,117	1,137	1,137	1,157				
	Increase with project =		107.5%					
85 North First & Tasman					4.4	4.3	4.6	3.9
Tasman (6 lane eq)	1,557	2,091	2,610	3,098				
N. First (6 lane eq)	1,268	2,599	2,761	3,039				
	Increase with project =		114.5%					
87 Zanker Rd & Tasman					4.6	4.7	4.9	4.1
Tasman (6 lane eq)	1,958	2,938	3,457	3,956				
Zanker (6 lane eq)	1,267	2,223	2,223	2,561				
	Increase with project =		110.1%					
89 Cisco Way & Tasman					4.8	4.3	4.5	3.8
Tasman (6 lane eq)	2,250	2,486	3,005	3,222				
Cisco (2 Lane)	836	838	838	838				
	Increase with project =		115.6%					
96 Great America (S) & Route 237					5.1	5.0	6.2	4.8
Great America 6l	1,458	2,365	4,702	5,487				
Ramps 2l	582	1,007	1,752	2,241				
Freeway	7,368	8,000	8,000	8,000				
105 Lawrence Expwy & Tasman					5.5	5.2	5.7	4.5
Lawrence 8l	3,125	4,071	4,761	5,231				
Tasman 6l	1,381	1,783	2,814	3,553				
	Increase with project =		129.4%					
108 Lawrence Expwy & Elko					4.4	4.2	4.4	3.9
Lawrence (6 Lane)	1,912	2,496	2,960	3,517				
Elko (2 Lane)	453	456	456	673				
109 Lawrence Expwy & Sandia/Lakehaven					5.7	5.3	5.6	4.4
Lawrence (6 Lane)	3,626	4,590	5,197	5,646				
Sandia/Lakehaven (2 Lane)	894	916	1,032	1,075				
110 Lawrence Expwy & US 101 North					8.5	7.3	7.5	5.3
Lawrence (6 Lane)	4,834	6,030	6,372	6,791				
US 101 Ramps	1,550	1,762	1,904	1,964				
Freeway	13,324	14,000	14,000	14,000				
117 McCarthy & Tasman					4.7	4.4	4.7	3.9
Tasman 6l	2,027	2,469	2,988	3,427				
McCarthy 4l	1,139	1,637	1,637	2,008				
125 Abel & Calaveras					5.7	5.2	5.5	4.4
Calaveras 6l	3,480	4,142	4,872	5,687				
Abel 4l	1,231	1,492	1,492	1,589				
126 Milpitas Blvd & Calaveras					5.9	5.4	5.7	4.5
Calaveras 6l	3,636	4,571	5,301	5,908				
Milpitas 4l	1,458	1,574	1,574	1,760				

* Indicates primary roadway (due to higher volume)
** Note that Montague is an 8-lane facility with turn lanes so edge of road receptor is = to a 6-lane facilty at 25-foot distance

Emission Factors (EMFAC2002 - 5mph)			
Santa Clara County			
LOS E or F (5mph)	2008	(5 mph)	11.500 g/mi
|	2012	(5 mph)	7.670 g/mi
|	2015	(5 mph)	3.750 g/mi
V			

Background CO Levels -	1-Hour	8-Hour
	5	3

Year	Speed	Exhaust	Start	3-5pm Start Composite Rate	8-10pm Departure Composite Rate
2008	5	9.453	15.37	11.50	13.55
2012	5	6.141	11.472	7.67	9.20
2020	5	2.909	6.3	3.75	4.59

Assumptions: Peak 3-5 PM Hour
- 5mph - congested conditions
- 3-5 PM Peak hour near trip origins, so 40% in cold start mode
- Each vehicle in cold start had rested an average of 300 min before trip
- Cold start emissions assume to last evenly over 3 miles

Assumptions: Peak 3-5 PM Hour
- 5mph - congested conditions
- 3-5 PM Peak hour near trip origins, so 80% in cold start mode
- Each vehicle in cold start had rested an average of 300 min before trip
- Cold start emissions assume to last evenly over 3 miles

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Urbemis 2007 Version 9.2.4

Combined Annual Emissions Reports (Tons/Year)

File Name: U:\I&R Docs\08-046 Stadium Project Santa Clara\AQ Data\UrbemisConstruction.urb924

Project Name: Santa Clara Football Stadium

Project Location: Santa Clara County

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (tons/year unmitigated)	1.17	9.50	13.87	0.02	9.05	0.43	9.48	1.90	0.39	2.30	2,066.24
2011 TOTALS (tons/year unmitigated)	4.39	18.80	34.67	0.05	0.21	0.80	1.01	0.07	0.72	0.80	5,433.81
2012 TOTALS (tons/year unmitigated)	16.96	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.15

Construction Unmitigated Detail Report:

CONSTRUCTION EMISSION ESTIMATES Annual Tons Per Year, Unmitigated

ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2

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2010	1.17	9.50	13.87	0.02	9.05	0.43	9.48	1.90	0.39	2.30	2,066.24
Fine Grading 05/01/2010-07/01/2010	0.21	1.72	0.92	0.00	8.98	0.09	9.07	1.88	0.08	1.96	163.80
Fine Grading Dust	0.00	0.00	0.00	0.00	8.98	0.00	8.98	1.88	0.00	1.88	0.00
Fine Grading Off Road Diesel	0.21	1.72	0.86	0.00	0.00	0.09	0.09	0.00	0.08	0.08	158.76
Fine Grading On Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Fine Grading Worker Trips	0.00	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.04
Trenching 06/01/2010-07/01/2010	0.02	0.20	0.11	0.00	0.00	0.01	0.01	0.00	0.01	0.01	20.89
Trenching Off Road Diesel	0.02	0.20	0.09	0.00	0.00	0.01	0.01	0.00	0.01	0.01	19.72
Trenching Worker Trips	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.17
Asphalt 07/01/2010-09/01/2010	0.10	0.47	0.27	0.00	0.00	0.04	0.04	0.00	0.03	0.03	43.67
Paving Off-Gas	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Paving Off Road Diesel	0.06	0.39	0.21	0.00	0.00	0.03	0.03	0.00	0.03	0.03	28.63
Paving On Road Diesel	0.01	0.08	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.18
Paving Worker Trips	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.86
Building 09/01/2010-12/31/2011	0.85	7.10	12.58	0.02	0.07	0.30	0.37	0.02	0.27	0.30	1,837.88
Building Off Road Diesel	0.18	1.03	0.63	0.00	0.00	0.07	0.07	0.00	0.07	0.07	99.41
Building Vendor Trips	0.40	5.62	3.87	0.01	0.04	0.21	0.25	0.01	0.19	0.20	1,069.82
Building Worker Trips	0.27	0.46	8.08	0.01	0.03	0.02	0.05	0.01	0.01	0.03	668.65

2011	4.39	18.80	34.67	0.05	0.21	0.80	1.01	0.07	0.72	0.80	5,433.81
Building 09/01/2010-12/31/2011	2.29	18.80	34.64	0.05	0.21	0.80	1.01	0.07	0.72	0.80	5,431.32
Building Off Road Diesel	0.49	2.84	1.81	0.00	0.00	0.20	0.20	0.00	0.19	0.19	293.71
Building Vendor Trips	1.08	14.72	10.64	0.03	0.11	0.54	0.65	0.04	0.49	0.53	3,160.85
Building Worker Trips	0.72	1.24	22.19	0.02	0.10	0.05	0.15	0.03	0.04	0.08	1,976.76
Coating 12/01/2011-09/05/2012	2.10	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.49
Architectural Coating	2.09	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.49
2012	16.96	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.15
Coating 12/01/2011-09/05/2012	16.96	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.15
Architectural Coating	16.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coating Worker Trips	0.01	0.01	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.15

<u>Phase Assumptions</u>

Phase: Fine Grading 5/1/2010 - 7/1/2010 - Default Fine Site Grading Description

Total Acres Disturbed: 81.63

Maximum Daily Acreage Disturbed: 20.41

Fugitive Dust Level of Detail: Default

20 lbs per acre-day

On Road Truck Travel (VMT): 0

Off-Road Equipment:

1 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day

1 Graders (174 hp) operating at a 0.61 load factor for 8 hours per day

1 Rubber Tired Dozers (357 hp) operating at a 0.59 load factor for 8 hours per day

2 Scrapers (313 hp) operating at a 0.72 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 8 hours per day

1 Water Trucks (189 hp) operating at a 0.5 load factor for 8 hours per day

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Phase: Trenching 6/1/2010 - 7/1/2010 - Type Your Description Here

Off-Road Equipment:

2 Excavators (168 hp) operating at a 0.57 load factor for 8 hours per day

1 Other General Industrial Equipment (238 hp) operating at a 0.51 load factor for 8 hours per day

1 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 0 hours per day

Phase: Paving 7/1/2010 - 9/1/2010 - Default Paving Description

Acres to be Paved: 20.41

Off-Road Equipment:

1 Pavers (100 hp) operating at a 0.62 load factor for 8 hours per day

2 Paving Equipment (104 hp) operating at a 0.53 load factor for 6 hours per day

2 Rollers (95 hp) operating at a 0.56 load factor for 6 hours per day

Phase: Building Construction 9/1/2010 - 12/31/2011 - Default Building Construction Description

Off-Road Equipment:

1 Cranes (399 hp) operating at a 0.43 load factor for 7 hours per day

3 Forklifts (145 hp) operating at a 0.3 load factor for 8 hours per day

1 Generator Sets (49 hp) operating at a 0.74 load factor for 8 hours per day

3 Tractors/Loaders/Backhoes (108 hp) operating at a 0.55 load factor for 7 hours per day

1 Welders (45 hp) operating at a 0.45 load factor for 8 hours per day

Phase: Architectural Coating 12/1/2011 - 9/5/2012 - Default Architectural Coating Description

Rule: Residential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Residential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Interior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250

Rule: Nonresidential Exterior Coatings begins 1/1/2005 ends 12/31/2040 specifies a VOC of 250