

*Appendix N*

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***SANTA CLARA NFL STADIUM PROJECT  
GREENHOUSE GAS ASSESSMENT  
SANTA CLARA, CALIFORNIA***

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## INTRODUCTION

This report assesses potential greenhouse gas emissions resulting from the proposed construction and operation of a new National Football League (NFL) stadium in Santa Clara, California. The project would construct a 68,500-seat stadium, relocate an existing electrical substation, and construct 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.

The proposed project would construct a new NFL stadium that would host San Francisco 49er games that currently are played in San Francisco. 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 NFL football games emissions of greenhouse gases would result from differences in travel to the proposed new stadium versus to Candlestick Park. Attendance for these events is estimated at 68,500 people, as compared to 69,700 people at Candlestick Park. Emissions from NFL 49er football games already occur, but would change due to the change in traffic patterns associated with the location of the proposed stadium.

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 analysis evaluates the possibility of two Bay Area NFL teams using the proposed new stadium as a home field.

The proposed stadium would accommodate other events that are considered be new and result in new emissions of greenhouse gases. 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. X-Games last 4 days, so up to 20 event days per year were projected. 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.

This analysis evaluates the emissions of greenhouse gases from the proposed project. These emissions could lead to globally cumulative effects on climate. Global climate change refers to changes in the Earth's weather including temperature, precipitation, and wind patterns. The purpose of the analysis is to provide information for the project environmental studies in an

attempt to identify potential impacts the project may have on global warming caused by anthropogenic emissions. At the time of this writing, there are no adopted methods to identify project impacts to global warming. However, there appears to be a consensus that projects should attempt to quantify their GHG emissions and evaluate the project to ensure that it would not conflict with any adopted plans to reduce GHG emissions.

## **Global Warming**

Global temperatures are affected by naturally occurring and anthropogenic-generated (generated by mankind) atmospheric gases, such as water vapor, carbon dioxide, methane, and nitrous oxide.<sup>1</sup> Gases that trap heat in the atmosphere are called greenhouse gases (GHG). Solar radiation enters the earth's atmosphere from space, and a portion of the radiation is absorbed at the surface. The earth emits this radiation back toward space as infrared radiation. Greenhouse gases, which are mostly transparent to incoming solar radiation, are effective in absorbing infrared radiation and redirecting some of this back to the earth's surface. As a result, this radiation that otherwise would have escaped back into space is now retained, resulting in a warming of the atmosphere. This is known as the greenhouse effect. The greenhouse effect, maintains a habitable climate. Natural processes and human activities emit GHGs. Emissions from human activities, such as electricity production, motor vehicle use and agriculture are elevating the concentration of GHGs in the atmosphere, and are reported to have led to a trend of unnatural warming of the earth's natural climate, known as global warming or climate change. Other than water vapor, the GHGs contributing to global warming include the following gases:

- Carbon dioxide, primarily a byproduct of fuel combustion.
- Nitrous oxide is a byproduct of fuel combustion and also associated with agricultural operations such as fertilization of crops.
- Methane is commonly created by off-gassing from agricultural practices (e.g. keeping livestock) and landfill operation.
- Chlorofluorocarbons were widely used as refrigerants, propellants and cleaning solvents but their production has been mostly reduced by international treaty.
- Hydrofluorocarbons are now used as a substitute for chlorofluorocarbons in refrigeration and cooling.
- Perfluorocarbons and sulfur hexafluoride emissions are commonly created by industries such as aluminum production and semiconductor manufacturing.

Gases in the atmosphere can contribute to the greenhouse effect both directly and indirectly. Direct effects occur when the gas itself absorbs outgoing radiation. Indirect effects occur when gases cause chemical reactions that produce other GHGs or prolong the existence of other GHGs. The Global Warming Potential concept is used to compare the ability of each GHG to trap heat in the atmosphere relative to carbon dioxide (CO<sub>2</sub>), which is the most abundant GHG. CO<sub>2</sub> has a GWP of 1, expressed as CO<sub>2</sub>e. Other GHGs, such as methane and nitrous oxide are

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<sup>1</sup> IPCC, 2007: Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change (Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds.)). Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA. Available at: <http://www.ipcc.ch/>.

commonly found in the atmosphere, but at much lower concentrations. However, the GWP for methane is 21, while nitrous oxide has a GWP of 310. Other trace gases such as chlorofluorocarbons (CFCs) and hydro chlorofluorocarbons (HCFCs), which are halocarbons that contain chlorine, have much greater GWPs. Fortunately these gases are found at much lower concentrations and many are being phased out as a result of global efforts to reduce destruction of stratospheric ozone. In the United States, CO<sub>2</sub> emissions account for about 85% of the CO<sub>2</sub>e emissions, followed by methane at about 8% and nitrous oxide at about 5%<sup>2</sup>.

The world's leading climate scientists have reached consensus that global climate change is underway, is "very likely" caused by humans, and hotter temperatures and rises in sea level "would continue for centuries," no matter how much humans control future emissions. A report of the Intergovernmental Panel on Climate Change (IPCC) - an international group of scientists and representatives concludes "The widespread warming of the atmosphere and ocean, together with ice-mass loss, support the conclusion that it is extremely unlikely that global climate change of the past 50 years can be explained without external forcing, and very likely that it is not due to known natural causes alone."<sup>3</sup>

Human activities have exerted a growing influence on some of the key factors that govern climate by changing the composition of the atmosphere and by modifying vegetation. The concentration of carbon dioxide in the atmosphere has increased from the burning of coal, oil, and natural gas for energy production and transportation and the removal of forests and woodlands around the world to provide space for agriculture and other human activities. Emissions of other greenhouse gases, such as methane and nitrous oxide, have also increased due to human activities. Since the Industrial Revolution (i.e., about 1750), global atmospheric concentrations of CO<sub>2</sub> have risen about 36 percent, due primarily to the combustion of fossil fuels<sup>4</sup>.

The IPCC predicts a temperature increase of between two and 11.5 degrees Fahrenheit (F) (1.1 and 6.4 degrees Celsius) by the end of the 21<sup>st</sup> century under six different scenarios of emissions and carbon dioxide equivalent concentrations.<sup>5</sup> Sea levels are predicted to rise by 0.18 to 0.59 meters (seven to 23 inches) during this time, with an additional 3.9 to 7.8 inches possible depending upon the rate of polar ice sheets melting from increased warming. The IPCC report states that the increase in hurricane and tropical cyclone strength since 1970 can likely be attributed to human-generated greenhouse gases.

## Regulatory Context for Global Climate Change

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<sup>2</sup> *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2006*. U.S. EPA. April 15, 2008.

<sup>3</sup> *Climate Change 2007 - The Physical Science Basis Contribution of Working Group I to the Fourth Assessment Report of the IPCC*. February 2, 2007. (<http://ipcc-wg1.ucar.edu/wg1/wg1-report.html>]

<sup>4</sup> IPCC. 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> ]

<sup>5</sup> IPCC. 2007: Summary for Policymakers. In: *Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*. (<http://www.ipcc.ch/pdf/assessment-report/ar4/wg1/ar4-wg1-spm.pdf> ]

Global climate change resulting from greenhouse gas emissions is an emerging environmental concern being raised and discussed at the international, national, and statewide level. At each level, agencies are considering strategies to control emissions of gases that contribute to global warming.

### U.S. EPA

The United States Participates in the United Nations Framework Convention on Climate Change (UNFCCC). While the United States signed the Kyoto Protocol, which would have required reductions in GHGs, the Congress never ratified the protocol. The federal government chose voluntary and incentive-based programs to reduce emissions and has established programs to promote climate technology and science. In 2002, the United States announced a strategy to reduce the greenhouse gas intensity of the American economy by 18 percent over the 10-year period from 2002 to 2012. To date, the U.S. EPA has not regulated GHGs under the Clean Air Plan (note that a 2007 Supreme Court ruling held that the U.S. EPA can regulate GHG emissions)<sup>6</sup>.

As part of the commitments to UNFCCC, the U.S. EPA has developed inventory of anthropogenic emissions by sources and removals by sinks of all greenhouse gases. This inventory is periodically updated, with the latest update being 2008<sup>7</sup>. EPA reports that total U.S. emissions have risen by 14.7 percent from 1990 to 2006, while the U.S. gross domestic product has increased by 59 percent over the same period. A 1.1 percent decrease was noted from 2005 to 2006, which is reported to be attributable to: (1) climate conditions, (2) reduced use of petroleum products for transportation, and (3) increased use of natural gas over other fuel sources. The inventory notes that the transportation sector emits about 33 percent of CO<sub>2</sub> emissions, with 60 percent of those emissions coming from personal automobile use. Residential uses, primarily from energy use, accounted for 20 percent of CO<sub>2</sub> emissions.

As a part of U.S. EPA's responsibility to develop and update an inventory of U.S. GHG emissions and sinks, EPA compared trends of other various U.S. data. Over the period 1990 to 2006, GHG emissions grew at a rate of about 0.9% per year. Population growth was slightly higher at 1.1%, while energy and fossil fuel consumption were more closely related at 1.0%. GDP and energy generation grew at much higher rates.

### State of California

The State of California is concerned about GHG emissions and their effect on global climate change. The State recognizes that "there appears to be a close relationship between the concentration of greenhouse gases in the atmosphere and global temperatures" and that "the

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<sup>6</sup> On April 2, 2007, the United States Supreme Court issued a 5-4 decision in *Massachusetts v. EPA*, which holds that the U.S. Environmental Protection Agency has authority under the Clean Air Act to regulate greenhouse gas emissions from new vehicles. The U.S. EPA had previously argued it lacked legal authority under the Clean Air Act to regulate greenhouse gases. The majority opinion of the Supreme Court decision noted that greenhouse gases meet the Clean Air Act's definition of an "air pollutant," and the EPA has the statutory authority to regulate the emission of such gases from new motor vehicles.

<sup>7</sup> *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2006*. U.S. EPA. April 15, 2008.

“evidence for climate change is overwhelming.” The effects of climate change on California, in terms of how it would affect the ecosystem and economy, remain uncertain. The State has many areas of concern regarding climate change with respect to global warming. According to the 2006 Climate Action Team Report<sup>8</sup> the following climate change effects and conditions can be expected in California over the course of the next century:

- A diminishing Sierra snowpack declining by 70 percent to 90 percent, threatening the state’s water supply;
- Increasing temperatures from eight to 10.4 degrees Fahrenheit (F) under the higher emission scenarios, leading to a 25 to 35 percent increase in the number of days ozone pollution levels are exceeded in most urban areas;
- Coastal erosion along the length of California and sea water intrusion into the Sacramento River Delta from a four-to 33-inch rise in sea level. This would exacerbate flooding in already vulnerable regions;
- Increased vulnerability of forests due to pest infestation and increased temperatures;
- Increased challenges for the state’s important agricultural industry from water shortages, increasing temperatures, and saltwater intrusion into the Delta; and
- Increased electricity demand, particularly in the hot summer months.

California emissions of GHG gases or CO<sub>2</sub> equivalent emissions was estimated at 484 million metric tons of equivalent CO<sub>2</sub> emissions (MMTCO<sub>2</sub>e), which is about seven percent of the emissions from the entire United States<sup>9</sup>. It is estimated that the United States contributes up to 35 percent of the world’s CO<sub>2</sub> equivalent emissions. Transportation is the largest source of GHG emissions in California, contributing about 40 percent of the emissions. Electricity generation is second at over 20 percent, but California does import electricity during the summer bringing energy sources up to about 25 percent. Industrial activities account for about 20 percent of the State’s emissions. Transportation is the largest source of greenhouse gas emissions in California, followed by industrial sources and electric power generation.<sup>10</sup> On a per-person basis, greenhouse gas emissions are lower in California than most other states; however, California is a populous state and the second largest emitter of greenhouse gases in the United States and one of the largest emitters in the world.<sup>11</sup>

Under a “business as usual” scenario, emissions of GHG in California are estimated to increase to approximately 600 MMTCO<sub>2</sub>e by 2020. CARB Staff has estimated the 1990 statewide emissions level to be 427 MMTCO<sub>2</sub>e; therefore, requiring a reduction of almost 30 percent in emissions by 2020 to meet the AB32 goal.

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<sup>8</sup> California Environmental Protection Agency. 2006. *Climate Action Team Report to Governor Schwarzenegger and the Legislature*. ([http://www.climatechange.ca.gov/climate\\_action\\_team/reports/2006-04-03\\_FINAL\\_CAT\\_REPORT.PDF](http://www.climatechange.ca.gov/climate_action_team/reports/2006-04-03_FINAL_CAT_REPORT.PDF))

<sup>9</sup> California Air Resources Board. 2008. *Climate Change Draft Scoping Plan*. June.

<sup>10</sup> California Environmental Protection Agency. 2006. *Climate Action Team Report to Governor Schwarzenegger and the Legislature*. ([http://www.climatechange.ca.gov/climate\\_action\\_team/reports/2006-04-03\\_FINAL\\_CAT\\_REPORT.PDF](http://www.climatechange.ca.gov/climate_action_team/reports/2006-04-03_FINAL_CAT_REPORT.PDF))

<sup>11</sup> California Legislative Analyst’s Office. 2006. *Analysis of the 2006-07 Budget Bill (Governor’s Climate Change Initiative)*. ([http://www.lao.ca.gov/analysis\\_2006/resources/res\\_04\\_anl06.html](http://www.lao.ca.gov/analysis_2006/resources/res_04_anl06.html))

*State of California Executive Order S-3-05*

In June 2005, the Governor of California signed Executive Order S-3-05 which identified Cal/EPA as the lead coordinating State agency for establishing climate change emission reduction targets in California. A “Climate Action Team”, a multi-agency group of state agencies, was set up to implement Executive Order S-3-05. Under this order, the state plans to reduce greenhouse gas emissions to 80 percent below 1990 levels by 2050. Greenhouse gas emission reduction strategies and measures to reduce global warming were identified by the California Climate Action Team in 2006.<sup>12</sup>

*Assembly Bill (AB) 32—The California Global Warming Solutions Act of 2006*

In 2006, the governor of California signed AB 32, the Global Warming Solutions Act, into legislation. The Act requires that California cap its greenhouse gas emissions at 1990 levels by 2020. This legislation requires CARB to establish a program for statewide greenhouse gas emissions reporting and monitoring/enforcement of that program. CARB recently published a list of discrete greenhouse gas emissions reduction measures that can be implemented immediately. CARB is also required to adopt rules and regulations to achieve the maximum technologically feasible and cost-effective greenhouse gas emission reductions. CARB’s Early Action Plan identified regulations and measures that could be implemented in the near future to reduce GHG emissions.

Much of the measures to reduce GHG emissions from transportation will come from CARB. AB 1493, the Pavley Bill, directed CARB to adopt regulations to reduce emissions from new passenger vehicles. CARB’s AB32 Early Action Plan, released in 2007, included a strengthening of the Pavley regulation for 2017 and included a commitment to develop a low carbon fuel standard (LCFS). Current projections indicate that with implementation of a strengthened Pavley Regulation, including LCFS, California will still fall short of the 1990 Level targets for transportation emission reductions. A recent denial of a waiver to implement an LCFS by the U.S. EPA and pending legal challenges by the automotive industry could further complicate the schedule to achieve emission reduction targets. CARB is considering additional actions to reduce mobile source emissions that will be released in late 2008.

CARB is targeting other sources of emissions. The main measures to reduce GHG emissions will be contained in the AB32 Scoping Plan. A draft of that plan was released in June 2008 and was recently approved on December 11, 2008. This plan includes a range of GHG reduction actions. Central to the draft plan is a cap and trade program covering 85 percent of the state's emissions. This program will be developed in conjunction with the Western Climate Initiative, comprised of seven states and three Canadian provinces, to create a regional carbon market. The plan also proposes that utilities produce a third of their energy from renewable sources such as wind, solar and geothermal, and proposes to expand and strengthen existing energy efficiency programs and building and appliance standards. The plan also includes full implementation of

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<sup>12</sup> California Environmental Protection Agency. 2006. *Climate Action Team Executive Summary Climate Action Team Report to Governor Schwarzenegger and the California Legislature.* ([http://www.climatechange.ca.gov/climate\\_action\\_team/reports/2006-04-03\\_FINAL\\_CAT\\_REPORT\\_EXECSUMMARY.PDF](http://www.climatechange.ca.gov/climate_action_team/reports/2006-04-03_FINAL_CAT_REPORT_EXECSUMMARY.PDF))



the Pavley standards to provide a wide range of less polluting and more efficient cars and trucks to consumers who will save on operating costs through reduced fuel use. It also calls for development and implementation of the Low Carbon Fuel Standard, which will require oil companies to make cleaner domestically produced fuels. The regulatory process to implement the plan begins in 2009. The details in regulating emissions and developing targeted fees to administer the program will be developed through this process. This will last two years and measures must be enacted by 2012.

*Senate Bill 97—Modification to the Public Resources Code*

Pursuant to Senate Bill 97, the Governor's Office of Planning and Research (OPR) is in the process of developing CEQA guidelines addressing GHGs. OPR is required to "prepare, develop, and transmit" the guidelines to the Resources Agency on or before July 1, 2009. In June 2008, OPR issued interim guidance for addressing climate change through CEQA. OPR recommends that each agency develop an approach to addressing GHG emissions that is based on best available information. The approach includes three basic steps: (1) identify and quantify emissions; (2) assess the significance of the emissions; and (3) if emissions are significant, identify mitigation measures or alternatives that will reduce the impact to a less than significant level. At this time, both the City of Santa Clara and the BAAQMD have not identified a significance threshold for GHG emissions.

At the direction of the Governor's Office of Planning and Research, CARB is currently developing statewide interim thresholds of significance for greenhouse gas emissions. CARB is focusing on common project types that, collectively, are responsible for substantial greenhouse gas emissions – specifically industrial, residential, and commercial projects. The ongoing workshops have been planned to discuss further development of concepts introduced in its Preliminary Draft Staff Proposal on Recommended Approaches for Setting Interim Significance Thresholds for Greenhouse Gases under the California Environmental Quality Act (CEQA).

*California's Energy Efficiency Standards for Residential Buildings, Title 24, Part 6, of the California Code of Regulations*

The Energy Efficiency Standards for Residential Buildings were established in 1978 in response to a legislative mandate to reduce California's energy consumption. The standards are updated periodically to allow consideration and possible incorporation of new energy efficiency technologies and methods. The 2005 Standards went into effect October 1, 2005. Projects that apply for a building permit on or after this date must comply with the 2005 Standards. The 2008 Standards are currently being developed and will go into effect in 2009.

*Senate Bill 375—California's Regional Transportation and Land Use Planning Efforts*

Recently, California enacted legislation (SB 375) to expand the efforts of AB 32 by controlling indirect GHG emissions caused by urban sprawl. SB 375 would develop emissions-reduction goals around which regions can apply to planning activities. SB 375 provides incentives for local governments and developers to implement new conscientiously planned growth patterns. This includes incentives for creating attractive, walkable and sustainable communities and

revitalizing existing communities. The legislation also allows developers to bypass certain environmental reviews under CEQA if they build projects consistent with the new sustainable community strategies. Development of more alternative transportation options that would reduce vehicle trips and miles traveled along with traffic congestion would be encouraged. SB 375 enhances CARB's ability to reach the AB 32 goals by directing the agency to develop regional GHG emission reduction targets to be achieved from the transportation sector for 2020 and 2035. CARB would work with the metropolitan planning organizations (e.g., ABAG and MTC) to align their regional transportation, housing and land use plans to reduce vehicle miles travelled and demonstrate the region's ability to attain its greenhouse gas reduction targets. A similar process is used to reduce transportation emissions of ozone precursor pollutants in the Bay Area.

#### *California's Heavy Duty Vehicle GHG Emissions Reduction Measure*

On December 12, 2008 (one day after adopting the AB32 Climate Action Plan), CARB adopted the Heavy Duty Vehicle Greenhouse Gas Emission Reduction measure that requires long-haul truckers to install fuel efficient tires and aerodynamic devices on their trailers. This measure will reduce GHG emissions through improved fuel economy.

#### **Global Climate Change Impacts**

Given the global scope of climate change and the large quantity of greenhouse gas emissions, the challenge under CEQA is for a Lead Agency to present information on the possible impacts of a project on global warming in a way that is meaningful to the decision making process. Under CEQA, there are two essential questions: would a project increase or substantially contribute to an environmental impact *or* would the project be subject to impacts from the environment associated with global climate change.

Accordingly, projects can both contribute to global climate change and be exposed to impacts from global climate change, and mitigation measures can be identified to minimize project impacts to and from global climate change.

#### Thresholds of Significance

Under State Senate Bill (SB) 97 (August 2007), the State Office of Planning and Research (OPR) is to certify and adopt guidelines for evaluation of the effects of greenhouse gas emissions and mitigation of those effects by January 1, 2010. Neither CEQA nor the CEQA Guidelines currently provide any methodology for analysis of greenhouse gases. The Lead Agency has not adopted its own standards of significance for global climate change impacts. Therefore, in lieu of OPR guidance or locally adopted thresholds, a primarily qualitative approach will be used to evaluate possible impacts for this project.

At this time, for a project to be a substantial source of new greenhouse gas emissions it would have to meet the following criteria:

- result in a net increase in greenhouse gas emissions, in terms of carbon dioxide equivalents, that could substantially impede local, regional or statewide efforts to reduce overall greenhouse gas emissions to 1990 levels.

**Impact: The project will result in emission of greenhouse gases that could cumulatively contribute to global warming or climate change.**

Carbon dioxide, the primary man-made greenhouse gas of concern, would be generated by the proposed project primarily from mobile sources and energy usage. Thresholds of significance have not been developed for projects to evaluate their contribution to global warming. Currently, neither CARB, BAAQMD, nor the City of Santa Clara, have established regulations, guidance, methodologies, or other means that would require the implementation of measures that would reduce GHG emissions from projects. The Governor's OPR has recently recommended that lead agencies quantify emissions, assess the significance, and mitigate significant emissions. The Governor's OPR is currently considering changes to CEQA that would require projects to quantify emissions and assess the consistency of projects with any adopted plans that would reduce GHG emissions. The BAAQMD encourages projects to reduce GHG emissions.

Emissions associated with the development of the proposed project were calculated. The California Air Pollution Control Officers Association (CAPCOA) has provided guidance for calculating project emissions.<sup>13</sup> Emissions from area sources, mobile sources and electricity usage are recommended by CAPCOA. For this assessment, area sources are considered the emissions associated with on-site natural gas combustion used for heating (of water or space) or cooking. Mobile source emissions are considered those associated with travel to and from the project site. Indirect emissions are those from electricity consumption.

Although there are emissions of methane and nitrous oxide, which are more potent GHGs, these emissions are very small compared to CO<sub>2</sub> (i.e., less than three percent equivalent CO<sub>2</sub>). As a result, these emissions were not calculated.

#### Construction

Project construction would involve emissions associated with equipment and vehicles used to construct the project as well as emissions associated with manufacturing materials used to construct the project. The URBEMIS2007 model can be used to estimate the emissions associated with construction equipment and vehicle activity. However, there are no reliable methods to estimate construction-related emissions associated with the manufacturing of project materials.

The URBEMIS2007 model was used to estimate construction-related emissions. A stadium project does not fit any of the land use inputs to URBEMIS2007. A large warehouse type structure was assumed with a floor area approximated based on the usable areas of the project depicted in the drawings. An approximate 700 foot by 1,000 foot structure with 4 to 9 levels was calculated to result in about 1.8 million square feet of floor area. This calculation did not include the field in the center of the structure. Construction phases included fine site grading (the site is

<sup>13</sup>

*CEQA & Climate Change*, California Air Pollution Control Officers Association, January 2008.

relatively flat), trenching, paving, building construction, and application of architectural coatings. This activity was assumed to extend over three calendar years, with a majority of the activity occurring in the 2<sup>nd</sup> year of construction. Emissions are shown in Table 1.

**Table 2**  
**Annual CO2 Construction Emissions from the Proposed NFL Stadium Project in Santa Clara**

Source Type	Basis for Calculation	Scenario	Annual Emissions (in tons per year)
Construction	URBEMIS2007 Construction Module	Year 1	2,066
		Year 2	5,434
		Year 3	20
		Total	7,520

#### Area Sources

Area source emissions, in the form of natural gas combustion for heating and cooking were computed. A portion of these emissions were considered to be offset by the existing Candlestick Park stadium, which would not host 49er games with the proposed project. The applicant provided natural gas usage estimates for the new stadium. The natural gas usage rates are based on gas for hot water and cooking along with space heating for winter months. About 9,600,000 cubic feet of natural gas are projected for annual use. The California Climate Action Registry General Reporting Protocol reports the natural gas emission rate at 53.06 kilograms per million British Thermal Units (Mbtu), which is equivalent to 119,906 pounds per million cubic feet. CO2 emissions from annual project natural gas usage would be 575.2 tons, with about 41% of those emissions associated with NFL football games.

#### Mobile Sources

Mobile sources would primarily include travel to events. Light-duty automobiles (i.e., passenger cars that include pickup trucks and SUVs) would comprise or make up most of these trips. Buses would make up a small portion of the trips, about 1.5 to 2%. However, diesel buses have emission rates that are 10 to 100 times greater than passenger vehicles, so they would contribute to project emissions. Emissions were modeled for two types of events: NFL football games and non-NFL football game events (e.g., college football, soccer matches, or concerts).

The proposed project Transportation Plan trip generation estimates were used to model football game emissions 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.

Vehicle emission rates were developed for the three vehicle classes using California's EMFAC2007 model. Emission rates are speed dependent. Emission estimates include running exhaust emissions and emissions associated with vehicle starts. Vehicle starts result in excess emissions due to incomplete fuel combustion. These rates were applied to the quantity of vehicle miles traveled by each vehicle type and the number of vehicle starts.

#### *NFL Football Games*

NFL football games played in Santa Clara would not be considered new emissions, because these events already occur at Candlestick Park in San Francisco. Travel patterns would change with the proposed project. To forecast changes in air pollutant and GHG emissions, the change in travel patterns was predicted. Emissions were calculated for the first year of operation, assuming that the distribution of attendees would be similar to that of the 49ers season ticket holders. Emissions from travel to Candlestick Park and the proposed project were computed. These calculations included changes in average trip length, average speed and travel time. Also, the change in attendance and travel modes was incorporated. For instance, the proposed project anticipates slightly less automobile trips, but slightly more bus trips. The possibility of a second NFL team sharing the stadium was evaluated by doubling the emissions from NFL games. This assumes that a second NFL team would also replace existing emissions from NFL games currently played in the Bay Area.

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 indicate that 8% of Candlestick Park 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%.

#### *Non-NFL Game 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.

The EMFAC2007 model was used to develop emission rates for travel emissions. Since travel speeds would vary, composite trip emission rates were developed from the BURDEN output OF EMFAC2007 for a vehicle mix that only included light-duty autos and light-duty trucks and 1% buses. 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).

Indirect Source Emissions

Indirect emissions are considered those that are associated with the generation of electricity provided to the project. The project applicant estimates 19,710,000-kilowatt hours of electricity usage. The electricity provider would probably be Silicon Valley Power or PG&E. Silicon Valley Power does not publish a certified emission rate CO2. PG&E, which probably offers a similar mix of energy sources, has a certified 2006 emission rate of 456 pounds of CO2 per each 1,000-kilowatt hours of electricity produced<sup>14</sup>. It should be noted that the PG&E rate is about 52% of the statewide average emission rate for electricity production and 35% of the national average.

The results reported in **Table 1** are based primarily on a “business-as-usual” scenario, where current emission rates would apply. This will not likely be the case as AB 32 will require GHG emission reductions in all sectors. Transportation emission rates will likely decrease due to increased fuel efficiency and lower carbon content in fuels. The EMFAC2007 model does not reflect future fuel efficiency very well. Fuel efficiency is regulated by the U.S. Department of Transportation. CARB has proposed regulations that address climate change, which require a waiver from the U.S. EPA. U.S. EPA has in the past granted waivers for California to control emissions of air pollutants from motor vehicles sold in California and appears poised to grant this waiver to California and other States. Current new fuel standards would increase light-duty automobile and light-duty truck fuel efficiency by 10 miles per gallon (to 35 miles per gallon for cars sold in 2020). The waiver California has requested would increase fuel efficiency standards for 2016 and 2020. These standards would apply to new vehicles sold, and therefore, would gradually effect the overall fleet as these new vehicles replace older vehicles. The CO2 emissions estimates for vehicle travel do not accurately reflect future conditions. It is likely that CO2 emissions with a more fuel-efficient vehicle fleet would be less.

**Table 2**  
**Annual CO2 Emissions from the Proposed NFL Stadium Project in Santa Clara**

Source Type	Basis for Calculation	Scenario	Annual Emissions (in tons per year)
Area Source	Natural gas usage and CCAR emission rates	NFL Games at Candlestick Park	(~235.8)
		NFL Games at Proposed Stadium	235.8
		Other Events	339.4
Mobile Sources	Traffic projections and EMFAC2007 Emission Factor Model	NFL Games at Candlestick Park (10)	(7,878)
		NFL Games at Proposed Stadium (10)	8,299

<sup>14</sup> CARB, CCAR, ICLEI. 2008. Local Government Operations Protocol for the quantification and reporting of Greenhouse Gas Emissions, Version 1.0 -. Sept. 2008.

		NFL Games at Oakland Coliseum or similar (10)	(7,878)
		NFL Games at Proposed Stadium (10)	8,299
		Non-NFL Football Game Events (20 days)	3,508
Electricity Usage	Estimated electricity usage rate and 2005 certified PG&E CO2 emissions rates	Annual Usage at proposed Stadium	4,494
Construction	URBEMIS2007	Total construction emissions amortized over 30-year period	251
<b>Total</b>			<b>9,759</b>

Source: Illingworth & Rodkin, 2009.

The largest majority of GHG emissions associated with the project would come from motor vehicle use. Under the “business as usual” condition, vehicle travel associated with the project would make up about 70% of the project GHG emissions. These emissions include projected use of transit and charter buses.

Energy usage (natural gas and electricity usage combined) would generate about 30 percent of the proposed project GHG emissions. It should be noted that electricity emissions for NFL football games, about 41% of the energy usage emissions, would not be new. These emissions currently occur at Candlestick Park. About 41% of the emissions that occur from natural gas usage are estimated to be part of NFL football games that would move to the project site from Candlestick Park. Such estimates for electricity usage were not available, so current electricity usage emissions associated with games at Candlestick Park were not deducted from the project estimates. However, the 41% value were applied to electricity emissions, then new emissions from energy usage would be about 2,651 tons per year or 18% of the total emissions.

Features that reduce energy consumption and waste can be included in new development that would reduce emissions. These would include energy-efficient construction methods, inclusion of solar photovoltaic panels to produce energy, solar water heaters, passive solar design, appropriate landscape and water recycling systems. For example, Energy Star rated buildings have CO2 emissions that are about 25% lower than existing buildings of similar size and use<sup>15</sup>.

At this point, the project has identified preliminary design features that would reduce GHG emission from energy usage. In addition, the project would be subject to City building code requirements that are likely to change in the near future to include energy efficiency designs.

<sup>15</sup> Energy Star – U.S. EPA and U.S. Department of Energy - [http://www.energystar.gov/index.cfm?c=evaluate\\_performance.bus\\_portfoliomanager\\_carbon](http://www.energystar.gov/index.cfm?c=evaluate_performance.bus_portfoliomanager_carbon)

For example, the State plans strengthening of Title 24 energy efficiency standards for new construction. The project would reduce GHG emissions through the following measures:

- The project proposes to develop and implement a Transportation Demand Management (TDM) program that would include project specific measures to reduce project generated single-occupant vehicle trips and vehicle miles traveled (this would be consistent with mitigation measures to incorporate BAAQMD clean air plan TCMs);
- The project would include green and cool roofs (with high solar reflectance index) and would meet energy conservation standards enacted by the State and the City when building plans are developed;
- Photovoltaic panels are proposed to cover an area of about 20,000 square feet;
- Controllable and programmable lighting control systems will be utilized;
- HVAC systems will meet the latest ASHRAE standards (55-2004) and will utilize controllable and programmable thermal control systems;
- The project would be subject to the City's construction and demolition ordinance that requires diversion of 50% of waste generated from development of the site. The project proposes to divert and/or salvage 75% of non-hazardous construction waste; and
- The project would include dual plumbing to incorporate recycled water that is available for use in landscape irrigation, toilets/urinals, and other non-potable water requirements. The water could be used for landscaping.

As previously discussed, there are no formally recognized methods under CEQA for quantifying GHG emissions from a proposed project, and no standards or thresholds in place to evaluate potential impacts on global climate change from a proposed project. Currently, compliance with AB32 is the State's plan to achieve reductions in GHG emissions to 1990 levels. This will not be an easy task, as the State is expected to experience population growth that would include increased vehicle usage and energy demand. As a result, long-term emissions would require substantial reductions to achieve the AB 32 goals. Reducing building energy use would further reduce potential GHG emissions. The following avoidance measure should be required to ensure that the project properly reduced GHG emissions from building energy usage:

**Mitigation Measure GHG-1:** The project shall prove compliance with all applicable City policies and ordinances to reduce energy use and greenhouse gas emissions to the satisfaction of the Director of Planning and Inspection prior to the issuance of a building permit. City policies and ordinances could require the following:

- Identify building LEED energy standards;



- Install solar and wind power systems, solar and tankless hot water heaters, and energy-efficient heating ventilation and air conditioning.
- Require the facility to earn the applicable Energy-Star rating from U.S. EPA;
- Develop landscaping that provides shade trees for buildings and includes drought tolerant landscaping or includes irrigation systems that use recycled or gray water.