APPENDIX G

AIR QUALITY

THIS PAGE INTENTIONALLY LEFT BLANK

AIR QUALITY AND GREENHOUSE GAS TECHNICAL REPORT IN SUPPORT OF THE ENVIRONMENTAL IMPACT REPORT

July 2011

Prepared for:

Charles M. Schulz – Sonoma County Airport
Santa Rosa, California

Prepared by:

Landrum & Brown, Incorporated

THIS PAGE INTENTIONALLY LEFT BLANK

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS CONTINUED

LIST OF TABLES

CHAPTER 1
INTRODUCTION

The purpose of this Air Quality Technical Report is to provide supporting documentation for the Environmental Impact Report (EIR) being prepared by Sonoma County for the improvement projects proposed for the Charles M. Schulz - Sonoma County Airport (STS or Airport). STS is owned and operated by Sonoma County, California. STS has two runways; Runway 14/32 that measures 5,115 feet long and 150 feet wide and Runway 1/19 that measures 5,002 feet long and 100 feet wide.

The objective of this air quality analysis is to provide the information necessary to determine whether the Proposed Project would have the potential to cause significant adverse air quality impacts in Sonoma County. A detailed glossary of terms is provided in **Attachment 1**. In addition to the Proposed Project, future conditions without the Proposed Project (No Project) were modeled for comparison.

1.1 SONOMA COUNTY AIR QUALITY STATUS

STS is located in Sonoma County, which is included in the Federal San Francisco Bay Intrastate Air Quality Region.[1] The region does not currently meet the Federal eight-hour standard for healthful levels of ozone and has been designated by the U.S. Environmental Protection Agency (USEPA) as a marginal nonattainment area for ozone.[2] Further, USEPA has determined the County exceeds the 24-hour standard for emissions of fine particulate matter ($PM_{2.5}$). In the past Sonoma County was been designated as nonattainment for Carbon Monoxide (CO) but in April 1998 the Bay Area was redesignated to attainment and now operates under a maintenance plan in order to prevent emissions from reaching an unhealthy level.

Two air pollution control districts have jurisdiction in Sonoma County, the Northern Sonoma County Air Pollution Control District (NSCAPCD) and the Bay Area Air Quality Management District (BAAQMD). STS is located within the jurisdiction of the BAAQMD. California maintains more stringent standards than the USEPA (the California Ambient Air Quality Standards) to which the County must adhere. Sonoma County has been designated by the BAAQMD as nonattainment for the eight-hour and one-hour standards for ozone, the annual arithmetic mean and the twenty four-hour standards for coarse particulate matter (PM_{10}), and the annual arithmetic mean standard for $PM_{2.5}$.[3]

The BAAQMD is responsible for assuring the National Ambient Air Quality Standards (NAAQS) and the CAAQS are attained. Under the California Environmental Quality Act (CEQA) it must be demonstrated that the Proposed Project would not violate any air quality standard (Federal or District) and that it may not contribute substantially to an existing or projected air quality violation.

---

1 USEPA, 40 CFR Part 81, Section 81.21, *San Francisco Bay Intrastate Air Quality Control Region*, January 16, 1981.
2 USEPA website, http://www.epa.gov/oar/oaqps/greenbk, accessed April 2011.
3 BAAQMD website, http://hank.baaqmd.gov/plNAir_quality/ambient_air_quality.htm, accessed April 2011.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 2
REGULATORY OVERVIEW

This air quality assessment was conducted in accordance with the guidelines provided in the most recent versions of the *Air Quality Procedures for Civilian Airports & Air Force Bases,*[4] FAA Order 5050.4B[5], *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, and *BAAQMD CEQA Air Quality Guidelines*,[6] which together with the guidelines of FAA Order 1050.1E,[7] *Environmental Impacts: Policies and Procedures*, constitute compliance with all the relevant provisions of NEPA, California Environmental Quality Act (CEQA), and the Clean Air Act (CAA), including the 1990 Amendments.

2.1 NATIONAL AMBIENT AIR QUALITY STANDARDS

The CAA, including the 1990 Amendments, provides for the establishment of standards and programs to evaluate, achieve, and maintain acceptable air quality in the U.S. Under the CAA, the USEPA established a set of standards, or criteria, for six pollutants determined to be potentially harmful to human health and welfare. The USEPA considers the presence of the following six criteria pollutants to be indicators of air quality:

- Ozone (O_3);
- Carbon monoxide (CO);
- Nitrogen dioxide (NO_2);
- Particulate matter (PM_{10} and $PM_{2.5}$);[8]
- Sulfur dioxide (SO_2); and,
- Lead (Pb).

A description of the criteria pollutants is found in **Attachment 1**. The standards for the criteria pollutants, known as the NAAQS, are summarized in **Table 2-1**. For each criteria pollutant, the USEPA established primary standards intended to protect public health, and secondary standards for the protection of other aspects of public welfare, such as preventing materials damage, preventing crop and vegetation damage, and assuring good visibility. Areas of the country where air pollution levels consistently exceed these standards may be designated nonattainment by the USEPA.

4 FAA, *Air Quality Procedures for Civilian Airports & Air Bases*, April 1997; and Addendum, September 2004.

5 FAA Order 5050.4B, *National Environmental Policy Act (NEPA) Implementing Instructions for Airport Actions*, April 28, 2006.

6 Bay Area Air Quality Management District, California Environmental Quality Act Air Quality Guidelines, June 2010.

7 FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, June 8, 2004.

8 PM_{10} and $PM_{2.5}$ are airborne inhalable particles that are less than ten micrometers (coarse particles) and less than 2.5 micrometers (fine particles) in diameter, respectively.

A nonattainment area is a homogeneous geographical area[9] (usually referred to as an air quality control region) that is in violation of one or more NAAQS and has been designated as nonattainment by the USEPA as provided for under the CAA. Some regulatory provisions, for instance, the CAA conformity regulations, apply only to areas designated as nonattainment or maintenance.

Table 2-1
NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

POLLUTANT	AVERAGING PERIOD	PRIMARY STANDARDS	SECONDARY STANDARDS
Sulfur Dioxide (SO_2)	Annual Arithmetic Mean 24-Hour Average 1-Hour Average 3-Hour Average	0.03 PPM (80 µg/m^3) 0.14 PPM (365 µg/m^3) .75 PPB None	None None None 0.50 PPM (1,300 µg/m^3)
Particulate Matter (PM_{10})	24-Hour Average	150 µg/m^3	Same as Primary
Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean (1997 Std)[a] 24-Hour Average (2006 Std)[a]	15 µg/m^3 35µg/m^3	Same as Primary
Carbon Monoxide (CO)	8-Hour Average 1-Hour Average	9 PPM (10 mg/m^3) 35 PPM (40 mg/m^3)	None
Ozone (O_3)	8-Hour Average (1997 Std)[b] 8-Hour Average (2008 Std)[b] 1-Hour Average (revoked)[c]	0.084 PPM 0.075 PPM 0.12 PPM	Same as Primary
Nitrogen Dioxide (NO_2)	1-Hour Daily Maximum[d] Annual Arithmetic Mean	0.080-0.100 PPM[d] 0.053 PPM (100 µg/m^3)	Same as Primary
Lead (Pb)	Rolling 3-Month Average[e]	0.15 µg/m^3	Same as Primary
	3-Month Arithmetic Mean[e]	1.5 µg/m^3	

Notes: PPB is parts per billion; PPM is parts per million; Std is Standard.
µg/m^3 is micrograms per cubic meter.
mg/m^3 is milligrams per cubic meter (for CO only)

[a] 71 FR 61144 (October 17, 2006) lowered the 24-hour $PM_{2.5}$ standard to 35 µg/m^3 and retained the 1997 annual $PM_{2.5}$ standard at 15 µg/m^3. EPA issued attainment status designations for the 24-Hour average 35 µg/m^3 standard on December 22, 2008. EPA has designated the Bay Area as nonattainment for the 24 -Hour 35 µg/m^3 PM2.5 standard.

[b] 69 FR 23858 (April 30, 2004) designated the nonattainment areas for the 8-hour ozone standard of 0.08 PPM, including Sonoma County California (Classified as Subpart 2/Marginal). 69 FR 34080-34085 (June 18, 2004) Amended April 30, 2004 Notice. 62 FR 38894 (July 18, 1997) proposed the 1997 8-hour average ozone standard at 0.08 PPM. 73 FR 16436 (March 27, 2008) lowered the 8-hour ozone standard to 0.075 PPM and revised the 1997 standard to three decimal places, 0.084 PPM.

[c] The national 1-hour ozone standard was revoked by U.S. EPA on June 15, 2005.

[d] 74 FR 34404 (July 15, 2009) proposes a new one-hour standard for NO_2 in the range of 80 parts per billion (PPB) or 0.080 PPM to 0.100 PPM and solicits comments in the Federal Register notice.

[e] 73 FR 66964 (November 12, 2008) revises the standard to a rolling 3-month average of 0.15 µg/m^3. Previous standard of 1.5 µg/m^3 remains in effect until November 2009. Nonattainment areas will be designated by USEPA by January 2012; states must meet the new standard by January 2017.

Sources: USEPA, 40 CFR Part 50.4 through Part 50.13, *National Primary and Secondary Ambient Air Quality Standards* (July 1, 2008).
71 FR 61144, *Final Rule National Ambient Air Quality Standards for Particulate Matter* (October 17, 2006); revisions to the standards for PM_{10} and $PM_{2.5}$.
73 FR 16436, *Final Rule National Ambient Air Quality Standards for Ozone* (Thursday, March 27, 2008).
73 FR 66964 (November 12, 2008) and USEPA *Fact Sheet: Final Revisions to the National Ambient Air Quality Standards for Lead*, available at http://www.epa.gov/air/lead/pdfs/20081015pbfactsheet.pdf BAAQMD website Air Quality Standards and Attainment Statushttp://hank.baaqmd.gov/plNAir_quality/ambient_air_quality.htm

9 A homogeneous geographical area, with regard to air quality, is an area, not necessarily bounded by state lines, where the air quality characteristics have been shown to be similar over the whole area. This may include several counties, encompassing more than one state, or may be a very small area within a single county.

A maintenance area describes the air quality designation of an area previously designated nonattainment by the USEPA and subsequently redesignated attainment after emissions are reduced. Such an area remains designated as maintenance for a period up to 20 years at which time the state can apply for redesignation to attainment, provided that the NAAQS were sufficiently maintained throughout the maintenance period.

2.2 CALIFORNIA AMBIENT AIR QUALITY STANDARDS

The CAA requires the USEPA to set the NAAQS for the nation; however, the CAA permits states to adopt additional or more stringent standards as needed. The California Air Resources Board (CARB) established such standards, or criteria, for the same six pollutants as the NAAQS. These standards known as California Ambient Air Quality Standards (CAAQS) are summarized in **Table 2-2**. Areas of the state where air pollution levels consistently exceed these standards may be designated nonattainment by CARB.

Table 2-2
CALIFORNIA AMBIENT AIR QUALITY STANDARDS (CAAQS)

POLLUTANT	AVERAGING PERIOD	STANDARD
Carbon Monoxide (CO)	8-Hour Average 1-Hour Average	9 PPM 20 PPM
Lead (Pb)	30-Day Average	1.5 µg/m^3
Nitrogen Dioxide (NO_2)	Annual Arithmetic Mean 1-Hour Average	0.18 PPM 0.030 PPM
Particulate Matter (PM_{10})	Annual Arithmetic Mean 24-Hour Average	20 µg/m^3 50 µg/m^3
Particulate Matter ($PM_{2.5}$)	Annual Arithmetic Mean	12 µg/m^3
Ozone (O_3)	8-Hour Average 1-Hour Average	0.070 PPM 0.09 PPM
Sulfur Dioxide (SO_2)	24-Hour Average 1-Hour Average	0.04 PPM 0.25 PPM

Notes: PPM is parts per million; Std is Standard.
µg/m^3 is micrograms per cubic meter.
Sources: CARB Website, *Ambient Air Quality Standards*, accessed at http://www.arb.ca.gov/research/aaqs/aaqs2.pdf, April 2011.

2.3 CLEAN AIR ACT CONFORMITY REGULATIONS

When a Federal action would not cause annual net emissions that equal or exceed the relevant *de minimis* thresholds for the pollutants of concern, the action would not apply under the General Conformity Rule and further analysis to prepare a General Conformity Determination would not be required. Further, the USEPA has determined that an action with *de minimis* annual net emissions would not cause an exceedence of the NAAQS, a dispersion analysis to show compliance to the NAAQS would not be required.[10] Under these circumstances, no further analysis under the CAA or NEPA would be required.

[10] FAA, *Air Quality Procedures for Civilian Airports and Air Force Bases*, April 1997, quoted from Section 2.5.1, *National Ambient Air Quality Standards* (*NAAQS) Assessment*, "If the action is in a nonattainment or maintenance area and exempt or presumed to conform under conformity requirements, it is assumed that a NAAQS assessment is not required for an airport or air base action since it is unlikely the action's pollutant concentrations would exceed the NAAQS."

The USEPA promulgated the conformity regulations on November 24, 1993[11] to assist Federal agencies in complying with the State Implementation Plan by specifying rules for two categories of Federal actions: transportation actions and general actions. The two rules have separate and distinct applicability and evaluation requirements. Transportation conformity applies to highway and transit projects, and general conformity regulations apply to all other Federal actions that are not transportation projects, such as airport improvement projects.

2.4 STATE IMPLEMENTATION PLAN

According to the CAA, each state must provide the USEPA with a State Implementation Plan (SIP). The SIP must include a strategy for air quality improvement in local areas for each criteria pollutant that exceeds the NAAQS. The SIP must also include a plan to maintain acceptable air quality in areas that do not exceed the NAAQS.

The California SIP is made up of a series of plans for each of the major air basins in the state. The plan applicable to STS is the Final Bay Area 2010 Clean Air Plan[12] which was adopted on September 15, 2010. The 2010 Bay Area Clean Air Plan updated the Bay Area 2005 Ozone Strategy in accordance with the requirements of the California Clean Air Act to implement "all feasible measures" to reduce ozone. The Bay Area 2010 Clean Air Plan (CAP) provides a comprehensive plan to improve air quality, protect public health, and protect the climate. The plan proposes a control strategy to reduce four types of air pollutants – ozone, particulate matter (PM), air toxics, and greenhouse gases – in a multi-pollutant framework.

Any airport project should show consistency with the locally adopted air plan to avoid impacts under CEQA. More importantly, any airport project receiving Federal funding must show conformity with the current air plan that has been approved by the USEPA to receive those funds. The local air plan contains assumptions about population, housing, the transportation network, and the associated regional air emissions. Additionally, the local air plan contains measures and actions that will be implemented to meet the region's air emission goals. Any airport project needs to be consistent with these plans and contain the relevant actions to be considered consistent and in conformity with the SIP.

2.5 GENERAL CONFORMITY RULE APPLICABILITY

The General Conformity Rule under the CAA establishes minimum values, referred to as the *de minimis* thresholds, for the criteria and precursor pollutants[13] for the purpose of:

- Identifying Federal actions with project-related emissions that are clearly negligible (*de minimis*);
- Avoiding unreasonable administrative burdens on the sponsoring agency, and;
- Focusing efforts on key actions that would have potential for significant air quality impacts.

The *de minimis* rates vary depending on the severity of the nonattainment area and further depend on whether the general Federal action is located inside an ozone transport region.[14]

[11] 58 FR 62188, dated November 24, 1993.

[12] Bay Area Air Quality Management District. Final Bay Area Clean Air Plan. September 15, 2010.

[13] Precursor pollutants are pollutants that are involved in the chemical reactions that form the resultant pollutant. Ozone precursor pollutants are NO_x, VOC, and SO_2, whereas $PM_{2.5}$ precursor pollutants include NO_x, VOC, SO_x, and ammonia (NH_3).

California is located outside the ozone transport region. An evaluation relative to the General Conformity Rule (the Rule), published under 40 CFR Part 93,[15] is required only for general Federal actions that would cause emissions of the criteria or precursor pollutants, and are:

- Federally-funded or Federally-approved;
- Not a highway or transit project[16];
- Not identified as an exempt project[17] under the CAA;
- Not a project identified on the approving Federal agency's Presumed to Conform list;[18] and,
- Located within a nonattainment or maintenance area.

Otherwise, if the action is demonstrated to cause emissions that are *de minimis*, the Federal action is not applicable under the Rule.

The Proposed Project at STS meets all these conditions and is, therefore, subject to evaluation under the CAA General Conformity Rule. When the action requires evaluation under the General Conformity regulations, the net total direct and indirect emissions due to the Federal action may not equal or exceed the relevant *de minimis* thresholds unless:

- An analytical demonstration is provided that shows the emissions would not exceed the NAAQS; or
- Net emissions are accounted for in the SIP planning emissions budget; or
- Net emissions are otherwise accounted for by applying a solution prescribed under 40 CFR Part 93.158.

The Federal *de minimis* thresholds established under the CAA are given in **Table 2-3.** The Proposed Project would occur in Sonoma County, which is designated nonattainment for ozone and $PM_{2.5}$, as well as, being designated as maintenance for CO. Conformity to the *de minimis* thresholds is relevant only with regard to those pollutants and the precursor pollutants for which the area is nonattainment or maintenance. Notably, there are no *de minimis* thresholds to which a Federal agency would compare ozone emissions. This is because ozone is not directly emitted from a source. Rather, ozone is formed through photochemical reactions involving emissions of the precursor pollutants[19] NO_x and VOC in the presence of abundant sunlight and heat. Therefore, emissions of ozone on a project level are evaluated based on the rate of emissions of the ozone precursor pollutants, NO_x, and VOC.

Although $PM_{2.5}$ is sometimes emitted directly, fine particle emissions can form resulting from chemical reactions involving emissions of the $PM_{2.5}$ precursor pollutants NO_x, VOC, SO_x, and

---

14 The Ozone Transport Region (OTR) is a single transport region for ozone (within the meaning of Section 176A(a) of the CAA), comprised of the States of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia, as given at Section 184 of the CAA.

15 USEPA, 40 CFR Part 93, Subpart B, *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*, July 1, 2006.

16 Highway and transit projects are defined under Title 23 U.S. Code and the Federal Transit Act.

17 The STS Proposed Project is not listed as an action exempt from a conformity determination pursuant to 40 CFR Part 93.153(c). An exempt project is one that the USEPA has determined would clearly have no impact on air quality at the facility, and any net increase in emissions would be so small as to be considered negligible.

18 The FAA Presumed to Conform list was published in the Federal Register on February 12, 2007 (72 FR 6641-6656) and includes airport projects that would not require evaluation under the General Conformity regulations.

19 In ozone maintenance areas SO_2 may be considered a precursor pollutant. The airport is included in an ozone nonattainment area, where the USEPA has not designated SO_2 as a precursor pollutant.

ammonia (NH_3).[20] Therefore, the net emissions of $PM_{2.5}$ and the precursor pollutants SO_x, NO_x, and VOC would be evaluated with regard to General Conformity.

As such, the pollutants of concern for the project proposed at STS are CO, Ozone (VOC and NO_X,), $PM_{2.5}$, and SO_X. If the evaluation of the Proposed Project at STS were to show that any of these thresholds could potentially be equaled or exceeded on an annual basis, additional, more detailed analysis to demonstrate conformity would be required, which is referred to as a General Conformity Determination.[21] Conversely, if the General Conformity evaluation were to show that none of the relevant thresholds were equaled or exceeded, the Proposed Project at STS would be presumed to conform under the CAA and NEPA.

Table 2-3
FEDERAL *DE MINIMIS* THRESHOLDS

CRITERIA AND PRECURSOR POLLUTANTS	TYPE AND SEVERITY OF NONATTAINMENT AREA	TONS PER YEAR THRESHOLD
Ozone (VOC or NO_x)[1]	Serious nonattainment Severe nonattainment Extreme nonattainment Other areas outside an ozone transport region	50 25 10 100
Ozone (NO_x)[1]	Marginal and moderate nonattainment inside an ozone transport regions[2] Maintenance	100 100
Ozone (VOC)[1]	Marginal and moderate nonattainment inside an ozone transport region[2] Maintenance within an ozone transport region[2] Maintenance outside an ozone transport region[2]	50 50 100
Carbon monoxide (CO)	All nonattainment & maintenance	100
Sulfur dioxide (SO_2)	All nonattainment & maintenance	100
Nitrogen dioxide (NO_2)	All nonattainment & maintenance	100
Coarse particulate matter (PM_{10})	Serious nonattainment Moderate nonattainment and maintenance	70 100
Fine particulate matter ($PM_{2.5}$) (VOC, NO_x, NH_3, and SO_x)[3]	All nonattainment and maintenance	100
Lead (Pb)	All nonattainment and maintenance	25

Notes: Federal thresholds that are shaded are applicable to this project.
Code of Federal Regulations (CFR), Title 40, *Protection of the Environment*.
USEPA defines *de minimis* as emissions that are so low as to be considered insignificant and negligible.
Volatile organic compounds (VOC); Nitrogen oxides (NO_x); Ammonia (NH_3); Sulfur oxides (SO_x).

1 The rate of increase of ozone emissions is not evaluated for a project-level environmental review because the formation of ozone occurs on a regional level and is the result of the photochemical reaction of NO_x and VOC in the presence of abundant sunlight and heat. Therefore, USEPA considers the increasing rates of NO_x and VOC emissions to reflect the likelihood of ozone formation on a project level.

2 An OTR is a single transport region for ozone, comprised of the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, and the Consolidated Metropolitan Statistical Area that includes the District of Columbia.

3 For the purposes of General Conformity applicability, VOC's and NH_3 emissions are only considered $PM_{2.5}$ precursors in nonattainment areas where either a State or USEPA has made a finding that the pollutants significantly contribute to the $PM_{2.5}$ problem in the area. In addition, NO_X emissions are always considered a $PM_{2.5}$ precursor unless the State and USEPA make a finding that NO_X emissions from sources in the State do not significantly contribute to $PM_{2.5}$ in the area. Refer to 74 FR 17003, April 5, 2006.

Sources: USEPA, 40 CFR Part 93.153(b)(1) & (2), March 25, 2008.
USEPA, 40 CFR Part 51.853, March 25, 2008.

20 Emissions of NH_3 are generally associated with commercial animal agriculture, including feeding operations. Therefore, emissions of NH_3 were not included in this analysis.

21 40 CFR Part 93.153.

2.8 BAAQMD THRESHOLDS

In addition to the thresholds with respect to General Conformity, the Proposed Project would be limited by thresholds found in **Table 2-4** identified by the BAAQMD in their recently updated Air Quality Guidelines[22]. Should the emissions caused by the Proposed Project exceed the annual or daily thresholds, it would be considered to have a significant air quality impact.

Table 2-4
BAAQMD THRESHOLDS

POLLUTANTS	Tons/Year	Pounds/Day
Reactive Organic Gases (ROG)	10	54
Nitrogen Oxides (NO_X)	10	54
Coarse Particulate Matter (PM_{10})	15	82
Fine Particulate Matter ($PM_{2.5}$)	10	54

Note: Reactive organic gases (ROG) are a subset of total organic gases (TOG), where TOG is multiplied by the fraction of reactive organic gases (FROG) to obtain ROG. The EDMS computer program provides an accounting of TOG, the larger set of organic gases, versus ROG. Therefore, for the purposes of this analysis, TOG will be assumed to reflect ROG.
Source: BAAQMD, CEQA Air Quality Guidelines, June 2010.

The BAAQMD has thresholds of significance for construction emissions. If daily maximum construction emissions exceed the applicable thresholds provided in **Table 2-5**, the Proposed Project would likely result in a significant cumulative impact.

Table 2-5
BAAQMD THRESHOLDS FOR CONSTRUCTION

POLLUTANTS	Daily Maximum Emissions Pounds/Day
Reactive Organic Gases (ROG)	54
Nitrogen Oxides (NO_X)	54
Coarse Particulate Matter (PM_{10})	82
Fine Particulate Matter ($PM_{2.5}$)	54

Note: The daily maximum emission thresholds for PM10 and PM2.5 applies to construction exhaust emissions only.
Source: BAAQMD, CEQA Air Quality Guidelines, June 2010.

The BAAQMD also has thresholds of significance for greenhouse gas (GHG) emissions in the CEQA Guidelines. If annual emissions of operational-related GHGs would exceed 1,100 metric tons per year of CO_2e, the proposed project would result in a significant cumulative impact.
Toxic air contaminants (TACs) are not included in the California Ambient Air Quality Standards (CAAQS) but they are considered hazardous to human health. The BAAQMD has developed thresholds to determine if a project's emissions of TACs would be a considered to result in a significant impact. The Risk and Hazard threshold for an individual project is an incremental

[22] Bay Area Air Quality Management District, CEQA Air Quality Guidelines. June 2010.

increase (i.e., over baseline conditions) excess cancer risk level of more than 10 in one million, or a non-cancer (i.e., chronic or acute) risk greater than 1.0 Hazard Index (HI) from a single source.

2.9 CEQA THRESHOLDS

Appendix G of the *CEQA Guidelines* contains a list of effects that will normally be considered significant to climate and air quality. These include:

- A project that will "violate any ambient air quality standard or contribute substantially to an existing or projected air quality violation,"
- A project that conflicts "with or obstruct[s] implementation of the applicable air quality plan,"
- A project that results "in a cumulatively considerable net increase in 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),"
- A project that exposes "sensitive receptors to substantial pollutant concentrations,"
- A project that creates "objectionable odors affecting a substantial number of people."

Appendix G of the *CEQA Guidelines* also addresses GHG emissions. The *CEQA Guidelines* indicate that a project could have a significant impact if it would:

- Generate greenhouse gas emissions, either directly or indirectly, that may have a significant impact on the environment,
- Conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of greenhouse gases.

CHAPTER 3
ASSESSMENT METHODOLOGY

This section describes the methodology used to calculate emissions of the criteria and precursor pollutants as well as GHG emissions and hazardous air pollutants.

3.1 WEATHER

The FAA-required and USEPA-approved Emissions and Dispersion Modeling System version 5.1.3 (EDMS) was used for estimating emissions from airport-specific sources. The calculation of emissions from aircraft assumes that aircraft operate only within the mixing layer, below the mixing height, where the emissions may influence ground-based pollutant concentrations. The mixing height, combined with the angle of approach (usually 3 degrees above the horizon) and the departure angle, determines the total time an aircraft operates during approach and climbout.

In order to properly estimate the emissions inventories, information regarding the weather must be obtained, particularly the mixing height, temperature, barometric pressure, wind direction, ceiling height and visibility. For this air quality analysis at STS, the closest weather station with mixing height data was determined to be at Oakland, California.[23] The mixing height for the Oakland station used for this analysis is 2,254 feet.

3.2 AIRCRAFT

At all airports, the number of aircraft operations directly affects emissions. **Table 3-1** shows the annual operations by aircraft category for the 2009 Existing Conditions, the 2015 No Project Alternative, the 2015 Proposed Project, the 2030 No Project Alternative, and the 2030 Proposed Project.

For the existing baseline (2009) there are a total of 90,660 annual operations. Operations from the piston type of aircraft made up approximately 89 percent of the total.

Table 3-1
ANNUAL OPERATIONS BY AIRCRAFT CATEGORY 2009, 2015, AND 2030

	Annual Operations				
Aircraft Category	**2009**	**2015 No Project Alternative**	**2015 Proposed Project**	**2030 No Project Alternative**	**2030 Proposed Project**
Jet	6,120	11,928	11,928	18,580	18,580
Piston	80,654	125,556	125,556	148,476	148,476
Helicopter	3,886	5,725	5,725	6,729	6,729
TOTAL	**90,660**	**143,209**	**143,209**	**173,785**	**173,785**

Source: Mead & Hunt Aviation Forecasts, 2011.

23 USEPA, Mixing Heights, Wind Speeds, and Potential for Urban Air Pollution throughout the contiguous United States, AP-101, January 1972, Table B-1 *Mean Seasonal and Annual Morning and Afternoon Mixing Heights and Wind Speeds for NOP [no precipitation] and All Cases*.

In 2015 there would be 143,209 annual operations, an approximate 58 percent increase from the baseline. Operations from the piston type of aircraft made up approximately 88 percent of the total. In 2030 there would be 173,785 annual operations, an approximate 91 percent increase from the baseline. Operations from the piston type of aircraft made up approximately 85 percent of the total.

In order to properly estimate emissions, the landing take-off cycles (LTOs) of each particular aircraft is needed. An LTO consists of the approach, landing roll, taxi to and from the gate/terminal/or parking area, idle time, takeoff, and climbout. An LTO is defined as one arrival operation and one departure operation. Therefore, 90,660 annual operations in 2009 would equal 45,330 LTOs.

From the aircraft category a representative aircraft that operated at STS was selected and then entered into EDMS with the corresponding LTOs. **Table 3-2** shows the Annual LTOs per aircraft for each year in the study.

Table 3-2
LTOs BY AIRCRAFT

Representative Aircraft	2009	2015 No Project Alternative	2015 Proposed Project	2030 No Project Alternative	2030 Proposed Project
Jet					
Boeing 737-700	15	15	15	730	730
Cessna 650 Citation III	187	276	276	324	324
Bombardier Challenger 600	312	461	461	541	541
Bombardier CRJ-200	0	0	730	0	0
Cessna 500 Citation I	350	516	516	606	606
Cessna 500 Citation I	53	78	78	91	91
Cessna 750 Citation X	262	385	385	453	453
Bombardier CRJ-900-ER	0	0	0	1,825	1,825
Bombardier CRJ-900	0	0	0	0	730
Dornier 328 Jet	13	19	19	23	23
Embraer 120 Brasilia	6	9	9	11	11
Embraer ERJ145	15	23	23	27	27
Embraer ERJ190	0	1,460	730	1,460	730
Dassault Falcon 20	134	198	198	232	232
Gulfstream II	8	13	13	15	15
Gulfstream II-B	73	107	107	126	126
Gulfstream IV-SP	152	224	224	263	263
Gulfstream V-SP	44	65	65	76	76
Israel IAI-1125 Astra	140	207	207	243	243
Bombardier Learjet 25	24	36	36	42	42
Bombardier Learjet 35	334	492	492	579	579
Mitsubishi MU-300 Diamond	937	1,381	1,381	1,623	1,623
SubTotal	*3,059*	*5,965*	*5,965*	*9,290*	*9,290*

Table 3-2
LTOs BY AIRCRAFT, *Continued*

Representative Aircraft	2009	2015 No Project Alternative	2015 Proposed Project	2030 No Project Alternative	2030 Proposed Project
Piston					
Raytheon Beech Baron	6,803	10,699	10,699	12,536	12,536
Lockheed C-130 Hercules	25	37	37	50	50
Cessna 172 Skyhawk	2,670	3,934	3,934	4,624	4,624
Cessna 182	1,456	10,196	10,196	11,935	11,935
Cessna 206	3,538	5,215	5,215	6,129	6,129
Cessna 208	838	1,236	1,236	1,452	1,452
Cessna 206 Turbo	1,231	1,814	1,814	2,133	2,133
Cessna 441 Conquest II	926	1,364	1,364	1,603	1,603
Raytheon King Air 100	1,941	2,862	2,862	3,363	3,363
Bombardier de Havilland Dash 8 Q400	1,755	2,555	2,555	3,650	3,650
Cessna 172 Skyhawk	10,961	18,046	18,046	21,099	21,099
Cessna 182	6,369	2,145	2,145	2,521	2,521
Rockwell OV-10 Bronco	371	546	546	642	642
Piper PA-30 Twin Comanche	36	53	53	62	62
Piper PA-31 Navajo	179	265	265	312	312
Shorts 330	1,229	1,811	1,811	2,128	2,128
SubTotal	*40,328*	*62,778*	*62,778*	*74,239*	*74,239*
Helicopter					
Augusta A-109	462	680	680	800	800
Bell 206 Jet Ranger	22	32	32	37	37
Bell 407	433	638	638	750	750
Bell 407	21	31	31	37	37
Robinson R44 Raven	969	1,428	1,428	1,678	1,678
Sikorsky UH-60 Blackhawk	36	53	53	62	62
SubTotal	*1,943*	*2,862*	*2,862*	*3,364*	*3,364*
Total LTOs	**45,330**	**71,605**	**71,605**	**86,893**	**86,893**

Source: Mead & Hunt Aviation Forecasts, 2011 and L&B Analysis, 2011.

The forecast shows a change to the jet fleet mix between the 2015 No Project Alternative and 2015 Proposed Project, and between the 2030 No Project Alternative and 2030 Proposed Project. However, the Proposed Project would not increase the total number of aircraft operations beyond what is forecasted for the No Project Alternative. Increases of aircraft operations in the future would be the result of the natural growth of the Airport.[24]

[24] The Proposed Project in 2015 includes operations of the Candair Regional Jet CRJ 200 as substitutes for half of the Embraer190 aircraft. The Proposed Project in 2030 includes operations of the Candair Regional Jet CRJ 900 as substitutes for half of the Embraer190 aircraft.

3.3 TAXI TIMES

Although an increase in aircraft operations would not occur as a result of the Proposed Project as compared to the No Project Alternative, there would be a potential increase in annual emissions as a result of the proposed runway extensions in the Proposed Project. The proposed extensions would increase taxi distance and taxi time, and therefore, total emissions from aircraft operations.

The average taxi in and taxi out time is dependent on the airfield configuration. In order to calculate taxi time, seven reference points were used to represent the various aircraft parking areas including Apron Area A, Apron Area B, Apron Area C1, Apron Area C2, Apron Area D, Apron Area E, and Apron Area F. The apron areas were named consistent with the Airport Layout Plan. The distance between the reference points and each runway end was then measured, using the most direct taxiway path.

Based on the assumption that the average taxi speed was 10 miles per hour, the total time required for aircraft to traverse the taxiways to reach the existing and proposed runway ends from their reference points was developed. Average taxi-in/taxi-out time was calculated by multiplying runway end utilization percentages (i.e., the percentage of time each runway end is used for arrivals and departures) by the number of aircraft operations assumed to use the reference points. The average taxi-in time and taxi–out time was then applied to each aircraft for the calculation of the emissions inventory.

The Proposed Project would have an increased taxi time over the No Project Alternative because the extension of the runway with the implementation of the Proposed Project increases the distance from the apron areas to the runway ends.

3.4 FUEL CONSUMPTION

Emissions from fuel storage and handling were based on annual fuel consumption. Annual fuel usage data for Jet A fuel and one hundred octane low lead (100LL) Aviation Gasoline (AvGas) was provided by Kaiser Air and the Sonoma Jet Center for the 2009 Existing Conditions. Fuel throughputs for future No Project Alternative analysis years were projected using the growth in aircraft operations. The future No Project Alternative and Proposed Project alternatives would have the same number of jet and piston aircraft operations and therefore would consume the same amount of Jet A and AvGas.

3.5 GROUND SUPPORT EQUIPMENT

Ground support equipment (GSE) is used to service aircraft between flights. Typical GSE includes equipment such as aircraft tractors, belt loaders, and fuel trucks that support airport operations. GSE can be modeled in EDMS using two different methods: assignment to an aircraft (by LTO cycle) and by equipment population. For this analysis the GSE operating at STS was modeled in EDMS by equipment population. For a population of GSE, the annual GSE emissions are the product of the emission factor for the given pollutant, horsepower, load factor, annual usage and population. Data relating to the type and number of GSE, fuel type, age, and the annual usage in hours for the existing conditions was obtained from Kaiser Air and the Sonoma Jet Center and is presented in **Table 3-3**. Future conditions in 2015 and 2030 were projected assuming the increase in GSE usage at the Airport would be directly related to projected increases in aircraft annual operations.

Figure 3-1, Aircraft Parking Areas

THIS PAGE INTENTIONALLY LEFT BLANK

Table 3-3
GROUND SUPPORT EQUIPMENT
2009, 2014, AND 2030 ANNUAL USAGE IN HOURS

EDMS ID	Type	Fuel	Year	2009 (hrs)	2015 NP (hrs)	2015 PP (hrs)	2030 NP (hrs)	2030 PP (hrs)
Kaiser T1	Aircraft Tractor	Diesel	2006	206	325	325	395	395
Kaiser T2	Aircraft Tractor	Unleaded	1978	182	287	287	349	349
Kaiser T3	Aircraft Tractor	Unleaded	--	60	95	95	115	115
Kaiser L1	Belt Loader	Unleaded	--	480	758	758	920	920
Kaiser GPU	Ground Power Unit	Diesel	--	294	464	464	564	564
Kaiser Lift	Fork Lift	Propane	--	30	47	47	58	58
Kaiser Lift-45	Lift	Unleaded	1988	20	32	32	38	38
Kaiser 216	Jet A Fuel Truck	Diesel	1999	800	1,264	1,264	1,534	1,534
Kaiser 217	Jet A Fuel Truck	Diesel	1992	400	632	632	767	767
Kaiser 106	AvGas Fuel Truck	Diesel	2003	500	787	787	922	922
Kaiser 107	AvGas Fuel Truck	Diesel	2003	200	315	315	369	369
Kaiser Followme	Service Truck	Unleaded	2008	600	948	948	1,150	1,150
Kaiser Large Push	Aircraft Tractor	Electric	1999	80	126	126	153	153
Kaiser Large Small	Aircraft Tractor	Electric	--	80	126	126	153	153
Kaiser Large Small	Aircraft Tractor	Electric	2001	80	126	126	153	153
Sonoma Jet Center	AvGas Fuel Truck	Diesel	--	724	1,140	1,140	1,336	1,336
Sonoma Jet Center	AvGas Fuel Truck	Diesel	--	724	1,140	1,140	1,336	1,336
Sonoma Jet Center	Jet A Fuel Truck	Diesel	2001	452	713	713	866	866
Sonoma Jet Center	Jet A Fuel Truck	Diesel	--	452	713	713	866	866

Note: Note: NP = No Project Alternative PP= Proposed Project
-- Indicates data was not available.
Horizon uses all electrical equipment. Horizon and Kaiser electric equipment were not included in EDMS.
Source: Kaiser Air, Sonoma Jet Center, and L&B Analysis, 2011.

3.6 GROUND ACCESS VEHICLES

3.6.1 Ground Access Vehicles on Roadways

Data relating to motor vehicles traversing the Airport's access roadways were obtained from Sonoma County Department of Transportation and Public Works. Emissions were determined from ground access vehicles traveling on Airport Boulevard west of Skylane Boulevard and North Laughlin Road and vehicles traveling into and out of the Airport's short-term and long-term parking lots. Future vehicle traffic volumes on Airport Boulevard were projected assuming the increase in the number of vehicles arriving and departing the Airport would be directly related to projected increases in aircraft annual operations. The average daily traffic on Airport Boulevard is provided in **Table 3-4**.

Table 3-4
AVERAGE DAILY TRAFFIC ON ROADWAYS

Average Daily Traffic (ADT)	2009	2015	2030
Airport Boulevard	4,019	6,348	7,704

Note: Totals represent West Bound and East Bound traffic.
Source: Mark Crane, P.E. California Registered Traffic Engineer (#1381) Crane Transportation Group and L&B Analysis, 2011.

The distance traveled by each ground access vehicle west bound on Airport Boulevard from the intersection of Skylane Boulevard and North Laughlin Road was determined to be 0.31 miles. The distance traveled by each ground access vehicle east bound on Airport Boulevard was determined to be 0.34 miles. Vehicle Miles Traveled (VMTs) provided in **Table 3-5** were determined using the average daily traffic count on Airport Boulevard and the distance.

Table 3-5
VEHICLE MILES TRAVELED PER DAY ON ROADWAYS

	2009	2015	2030
Airport Boulevard	2,612	4,126	5,007

Source: Mark Crane, P.E. California Registered Traffic Engineer (#1381) Crane Transportation Group and L&B Analysis, 2011.

3.6.2 Ground Access Vehicles in Parking Lots

Data relating to motor vehicles traveling in the Airport's parking lots was obtained from Sonoma County Department of Transportation and Public Works. Emissions were determined from ground access vehicles traveling in the short-term and long-term lots. The average daily traffic in the short-term and long-term lots are provided in **Table 3-6**.

Table 3-6
AVERAGE DAILY TRAFFIC IN PARKING LOTS

Average Daily Traffic (ADT)	2009	2015	2030
Short-Term Lot	114	181	219
Long-Term Lot	61	97	117

Note: Totals represent traffic in the short term and long term parking lots.
Source: Mark Crane, P.E. California Registered Traffic Engineer (#1381) Crane Transportation Group and L&B Analysis, 2011.

To develop a conservative emissions estimate, the distance traveled by ground access vehicles in parking lots was determined by measuring the distance from the entrance of the parking lot to the last parking place and then to the exit. The distance traveled for each ground access vehicle in the short-term parking lot was determined to be 0.13 miles. The distance traveled by each ground access vehicle in the long-term parking lot was determined to be 0.32 miles. VMTs were determined using the average daily traffic count in parking lots and the distance. Future vehicle traffic volumes in parking lots were projected assuming the increase in the

number of vehicles at the Airport would be directly related to projected increases in aircraft annual operations. Therefore, there would be no difference between the Proposed Project and the No Project Alternative for the same future year.

Table 3-7
VEHICLE MILES TRAVELED PER DAY IN PARKING LOTS

	2009	2015	2030
Short-Term Lot	14.9	23.5	28.5
Long-Term Lot	20	31	38

Source: Mark Crane, P.E. California Registered Traffic Engineer (#1381) Crane Transportation Group and L&B Analysis, 2011.

3.6.3 EMFAC2007

EDMS utilizes the computer model Mobile6.2 to develop emissions from ground access vehicles. Emissions are determined using the speed of the vehicles on roadways and in parking lots. CARB has developed the EMFAC2007 program to calculate on-road vehicle emission rates based on California specific regulations. Therefore the emission factors provided in **Table 3-8** from EMFAC2007 were used in the EDMS model to calculate on-road vehicular emissions. The output files used to determine the emissions factors are provided in **Attachment 3**.

Table 3-8
EMFAC2007 EMISSION FACTORS (Grams per Mile)

2009							
Vehicle Type	Speed (MPH)	CO	TOG	NOX	SOX	PM-10	PM-2.5
Parking Lots	10	6.988	0.597	0.746	0.008	0.05	0.046
Roadway	25	4.604	0.27	0.564	0.004	0.02	0.018
2015							
Type	Speed (MPH)	CO	TOG	NOX	SOX	PM-10	PM-2.5
Parking Lots	10	3.731	0.297	0.431	0.008	0.05	0.047
Roadway	25	2.599	0.133	0.319	0.004	0.02	0.018
2030							
Type	Speed (MPH)	CO	TOG	NOX	SOX	PM-10	PM-2.5
Parking Lots	10	1.426	0.119	0.151	0.008	0.051	0.047
Roadway	25	1.069	0.055	0.112	0.004	0.019	0.018

Note: Emission factors for running exhaust emissions were used in the analysis.
CO: Carbon Monoxide
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Source: EMFAC2007 and Landrum & Brown Analysis, 2011.

3.7 STATIONARY SOURCES

The primary sources of natural gas consumption at STS include the terminal building and the Fixed Base Operators (Sonoma Jet Center and Kaiser Air). The existing facilities are heated by natural gas boiler and cooled by electric chiller. Stationary sources modeled in EDMS for this analysis included the natural gas boiler, an emergency generator, and six fuel storage tanks (four for Jet A fuel and two for Avgas). The fuel throughputs were converted to kiloliters and input into EDMS. Future fuel storage tank usage was projected using the increases in aircraft annual operations.

No new buildings or hangars are proposed by 2015; therefore, emissions from the boiler and emergency generator would be the same in the future years. This analysis does not include the projects identified as programmatic level of detail being proposed because specific information regarding construction for these future projects is not available.

3.8 PARTICULATE MATTER EMISSIONS FACTORS

EDMS does not contain particulate matter emissions factors for all aircraft. Therefore, as recommended by the FAA, emissions factors from the USEPA's AP42 Table II-1-9 were used in the calculations of PM_{10} and $PM_{2.5}$ emissions when no EDMS emission factors were available.[25]

3.9 LEAD EMISSIONS

The primary source of lead (Pb) emissions at STS would be the combustion of AvGas in small piston-engine general aviation aircraft. Turbine aircraft were considered to use Jet A and therefore had no lead emissions. Single-and multi-engine aircraft were considered to use 100LL Avgas. EDMS does not currently calculate lead emissions from piston-powered aircraft; thus, it is not a readily available tool for determining airport lead inventories related to aircraft operations. The USEPA's *Lead Emissions from the use of leaded Aviation Gasoline in the US Technical Support Document* was used as the basis to determine lead emissions at STS for the existing conditions and the various alternatives.[26]

The USEPA's methodology requires as input the number of operations of piston-engine aircraft, fuel consumption rates by aircraft during the LTO, the concentration of lead in the fuel, and the retention of lead in the engine and oil. Using national averages, USEPA estimated for the National Emissions Inventory (NEI) that aircraft at STS emitted 0.3 tons of lead per year during the LTO. However, for this air quality analysis specific data was available concerning the fleet mix percentages of aircraft and specific times in mode at STS.

3.10 ROG vs. TOG

Reactive organic gases (ROG) are a subset of total organic gases (TOG). The EDMS computer program provides an accounting of TOG, the larger set of organic gases, versus ROG. Therefore, for the purposes of this analysis, TOG will be assumed to reflect ROG.

---

25 USEPA. *AP 42 Supplement A to Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources*. Table II-1-9 Emission factors per aircraft per landing/takeoff cycle-civil aircraft. January 1991.

26 USEPA. *Lead Emissions from the Use of Leaded Aviation Gasoline in the United States*. Technical Support Document . EPA420-R-08-020. October 2008.

3.11 Toxic Air Contaminants

According to the BAAQMD[27], toxic air contaminants (TACs) are a defined set of airborne pollutants that may pose a present or potential hazard to human health. A wide range of sources, from industrial plants to motor vehicles, emit TACs. TACs can be emitted directly and can also be formed in the atmosphere through reactions among different pollutants. TACs are the California state term for hazardous air pollutants (HAPs). The U.S. Environmental Protection Agency (USEPA) currently identifies 188 compounds as HAPS or TACs under the Clean Air Act.

The California Air Resources Board (*CARB)* has identified 21 TACs in addition to the USEPA's list of TACs. TACs are emitted by a wide range of sources from industrial plants to households. Since it is not practical to eliminate all TACs from our lives, these compounds are regulated through risk management programs. These programs are designed to ensure that the risk of adverse health effects from exposures to TACs is not significant.

The health effects associated with TACs are quite diverse and generally are assessed locally, rather than regionally. TACs can cause long-term health effects such as cancer, birth defects, neurological damage, asthma, bronchitis or genetic damage; or short-term acute affects such as eye watering, respiratory irritation (a cough), running nose, throat pain, and headaches. For evaluation purposes, TACs are separated into carcinogens and non-carcinogens based on the nature of the physiological effects associated with exposure to the pollutant. Carcinogens are assumed to have no safe threshold below which health impacts would not occur, and cancer risk is expressed as excess cancer cases per one million exposed individuals, typically over a lifetime of exposure. Non-carcinogenic substances differ in that there is generally assumed to be a safe level of exposure below which no negative health impact is believed to occur. These levels are determined on a pollutant-by-pollutant basis. Acute and chronic exposure to non-carcinogens is expressed as a hazard index (HI), which is the ratio of expected exposure levels to an acceptable reference exposure levels.

A health risk assessment was conducted to determine potential TAC impacts due to the Proposed Project. The results are provided in the Health Risk Assessment Technical Report.

[27] Bay Area Air Quality Management District, *BAAQMD CEQA Air Quality Guidelines*. Appendix C. June 2010.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 4
EXISTING CONDITIONS

An emission inventory was prepared for the Existing Conditions (2009) using EDMS Version 5.1.3. The model estimates the rate of emissions of the criteria and precursor pollutants in short tons per year[28].

The primary sources of air emissions at airports are aircraft, ground support equipment (GSE), stationary sources, and ground access vehicles traveling on roadways and in parking facilities. The results of the emission inventory are provided in **Table 4-1**. The greatest overall emission contribution comes from aircraft operations. Emissions of Pb, PM_{10} and $PM_{2.5}$ are also produced primarily by aircraft engines.

Table 4-1
EXISTING CONDITIONS (2009) EMISSIONS INVENTORY

EMISSION SOURCES	**ANNUAL EMISSIONS** (tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Aircraft	669.92	23.28	25.17	6.80	2.27	10.45	10.45	0.50
GSE	14.65	0.51	0.56	2.06	0.17	0.12	0.12	NA
APUs	0.58	0.02	0.02	0.14	0.03	0.02	0.02	NA
GAV in Parking Facilities	0.49	0.04	0.04	0.05	0.00	0.00	0.00	NA
GAV on Roadways	4.84	0.84	0.28	0.59	0.00	0.02	0.02	NA
Stationary Sources	10.39	3.13	4.02	12.79	0.08	0.96	0.96	NA
TOTAL	**700.87**	**27.81**	**30.10**	**22.44**	**2.55**	**11.58**	**11.58**	**0.50**

APU: Auxiliary Power Units
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
GSE: Ground Service Equipment
GAV: Ground Access Vehicles
Total emissions may not sum exactly due to rounding.
NA = Not applicable
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

4.1 GREENHOUSE GAS EMISSIONS

According to most international reviews, aviation emissions comprise a small but potentially important percentage of human-made GHGs and other emissions that contribute to global warming.

[28] The short ton is a unit of weight equal to 2,000 pounds. In the U.S. the short ton is often just called a ton without distinguishing it from the metric ton. (1 short ton = 0.907184 metric tons)

GHGs are gases that trap heat in the earth's atmosphere. Both naturally occurring and human-made GHGs primarily include water vapor (H_2O), carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). Sources that require fuel or power at an airport are the primary sources that would generate GHGs. Aircraft are probably the most often cited air pollutant source, but they produce the same types of emissions as ground access vehicles.

Different chemical species that are emitted such as CO_2, CH_4, and N_2O have a different effect on climate. The equivalency method is a way to show relative impacts on climate change of different chemical species. Carbon dioxide equivalents (CO_2e) were calculated using global warming potential (GWP)[29] factors provided by the Intergovernmental Panel on Climate Control's Fourth Assessment Report.[30] CO_2e are reported in annual metric tons.

In order to determine the total CO_2 equivalent all emissions sources were summed for each pollutant. Totals for each pollutant were converted from short to metric tons (1 short ton = 0.907184 metric tons) and then multiplied by the Global Warming Potential provided in the IPCC Fourth Assessment Report. The results are provided in **Table 4-2**.

Table 4-2
EXISTING CONDITIONS (2009) CO_2 EQUIVALENT

Metrics	**Annual Metric Tons**		
	CO_2	**CH_4**	**N_2O**
Aircraft	5,217.76	1.62	0.13
GAV	355.60	0.02	0.00
Stationary Sources	13.58	0.00	0.00
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	5,586.94	40.88	41.13
Total	**5,668.96**		

GAV: Ground Access Vehicles
GWP: Global Warming Potential
CO_2e: Carbon Dioxide equivalent
CO_2: Carbon Dioxide
CH4: Methane
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.
Source: IPCC Fourth Assessment Report and L&B Analysis, 2011.

29 Global Warming Potentials (GWPs) are one type of simplified index based upon radiative properties that can be used to estimate the potential future impacts of emissions of different gases upon the climate system in a relative sense. GWP are based on a number of factors, including the radiative efficiency (infrared-absorbing ability) of each gas relative to that of carbon dioxide, as well as the decay rate of each gas (the amount removed from the atmosphere over a given number of years) relative to that of carbon dioxide.

30 Transportation Research Board, ACRP Report 11 Guidebook on Preparing Airport Greenhouse Gas Emissions Inventories, Appendix D Methods for Calculating CO_2 Equivalencies, 2009.

CHAPTER 5
CONSTRUCTION

Construction of the Proposed Project would cause short-term and temporary emissions due to the use of construction equipment. An inventory of emissions from the use of construction equipment associated with the Proposed Project was prepared using the latest version of the computer model URBEMIS (URBEMIS 2007, version 9.2.4). The URBEMIS output files used to determine the construction emissions are provided in **Attachment 3**.

Based on the preliminary schedule, the Proposed Project would take approximately 2½ years and would be completed in two phases.[31] The actual construction schedule would be developed after FAA/Sonoma County approval and final engineering is complete.

This construction analysis is focused on those projects that would be implemented by 2015. Projects to be implemented between 2016 and 2030are only identified at a programmatic level of detail and specific information regarding construction for these future projects is not available. The projects to be implemented between 2016 and 2030 will undergo additional environmental review once plans are developed to a project level of detail.

5.1 PHASE I (DURATION APPROXIMATELY 19 MONTHS)

The elements of Phase I include the following:

- Extend Runway 1/19 from 5,002 feet to 5,202 feet (200-foot extension). Includes relocation and addition of runway signs and marking of pavement.
- Remove the 25-foot-wide paved shoulders on each side of Runway 1/19 and replace with porous pavement.
- Add runway edge lights to Runway 1/19.
- Construct a new partial parallel taxiway (Taxiway V) with edge lights and standard signage.
- Reconstruct and widen Taxiway B to accommodate aircraft in Category C. Includes addition of edge lights and standard signage.
- Remove the segment of Taxiway D that connects to Runway 1/19 and regrade the site.
- Construct a connecting taxiway to the new end of Runway 19 and to Taxiway Y.
- Construct a 200-foot long blast pad beyond the new end of Runway 19.
- Place about 1,050 feet of Redwood Creek into a culvert.
- Place the high-water ditch that hydrologically connects Redwood Creek to a segment of Ordinance Creek into a culvert.
- Construct a standard (1,000-foot-long by 500-foot-wide) graded Runway Safety Area (RSA) beyond the end of Runway 14.
- Temporarily cover or disturb land used for haul roads, staging and spoils areas created in support of construction of runway safety enhancements.
- Create two storm water basins (one north of Taxiway A and one north of Runway 1/19).
- Acquire three parcels of land needed for construction of RSA and realignment of access road around the end of Runway 14.

[31] Mead & Hunt Table D-1 Phase I and Table D-2 Phase II Project Elements. Details Regarding the Two Phases of Construction of the Proposed Project. 2011.

Each of these project elements in Phase I were defined according to the corresponding URBEMIS tasks. URBEMIS tasks include construction activities such as mass site grading, fine site grading, paving and trenching. For this analysis one project element may include multiple URBEMIS tasks. For example, the project element to extend Runway 1/19 from 5,002 feet to 5,202 feet included mass site grading, fine site grading, paving and trenching.

In order to calculate construction emissions, the total project area to be disturbed was estimated for the various project elements. The maximum area to be disturbed per day was also estimated based upon 25% of total area being disturbed at any one time.[32] URBEMIS automatically estimates the number and type of construction equipment based on the maximum daily acreage disturbed.

Final engineering for the Proposed Project is not complete. Therefore, the quantity of construction materials likely to be involved in the construction of the Proposed Project was based on preliminary estimates.[33]

5.2 PHASE II (DURATION APPROXIMATELY 11 MONTHS)

The elements of Phase II include the following:

- Extend Runway 14/32 from 5,115 feet to 6,000 feet (885-foot extension). Includes extension of runway edge lights, runway signs, and marking of pavement.
- Extend Taxiway Y to connect to the new end of Runway 14 and construct a bypass taxiway where this taxiway connects to the runway end. Includes extension of taxiway edge lights, taxiway signs, and marking of pavement.
- Construct a 200-foot-long blast pad off the end of Runway 14. Includes marking of pavement.
- Construct a replacement run-up apron at the northeast corner of the intersection of Taxiways Y and A.
- Remove existing run-up apron and taxiways in that portion of Taxiway A between Runway 14/32 and Taxiway Y, and that portion of Taxiway Y between its intersection with Taxiway A and Runway 14/32.
- Construct a new taxiway between Runway 14/32 and Taxiway Y to replace the portion of Taxiway A that is to be removed.
- Relocate access roads outside of new RSAs. Pave relocated access roads.
- Remove trees and bushes to provide required airspace clearance for approaches to Runway 14.
- Temporarily cover or disturb land used for haul roads, staging and spoils areas created in support of construction of runway safety enhancements.
- Relocate the localizer antenna and equipment building, extend power to the new site, and construct a standby generator.
- Extend Taxiway D to its intersection with the end of Runway 32.
- Remove the eastern segment of Taxiway D.

---

32 Sacramento Metropolitan Air Quality Management District (SMAQMD) recommends estimating "maximum daily acreage disturbed" at 25 percent of the total acreage unless the project is less than 10 acres. For projects that are less than 10 acres, SMAQMD assumes the contractor will actually construct the whole site concurrently. Therefore, for those projects, "maximum daily acreage disturbed" should equal total project acreage.

33 Preliminary estimates of cut / fill needed for the Proposed Project based on 25% Design from Mead & Hunt.

Each of these project elements in Phase II were defined according to the corresponding URBEMIS tasks. Similar to Phase I project elements were defined as mass site grading, fine site grading, paving and trenching.

In order to calculate construction emissions, the total project area to be disturbed was estimated for the project elements. The maximum area to be disturbed per day was also estimated based upon 25% of total area being disturbed at any one time.[34] URBEMIS automatically estimates the number and type of construction equipment based on the maximum daily acreage disturbed.

Final engineering for the Proposed Project is not complete. Therefore, the quantity of construction materials likely to be involved in the construction of the Proposed Project was based on preliminary estimates.[35]

5.3 CONSTRUCTION EMISSIONS

The maximum daily construction emissions for Phase I and Phase II of the Proposed Project are provided in **Table 5-1*.***

Table 5-1
MAXIMUM DAILY CONSTRUCTION EMISSIONS

Construction Phase	MAXIMUM DAILY EMISSIONS (pounds per day)			
	ROG	NOX	PM_{10}	$PM_{2.5}$
BAAQMD Threshold	**54**	**54**	**82**	**54**
Phase 1	6.14	47.54	2.54	2.34
Phase 2	5.34	41.18	2.11	1.94

ROG: Reactive Organic Gases
NOx: Nitrogen Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Note: The daily maximum emissions for PM10 and PM2.5 are for construction exhaust emissions only.
Source: URBEMIS ver 9.2.4, L&B Analysis, 2011.

Based on the maximum daily emission thresholds, the construction activity associated with the Proposed Project would not exceed maximum daily BAAQMD thresholds for significance.

[34] Sacramento Metropolitan Air Quality Management District (SMAQMD) recommends estimating “maximum daily acreage disturbed” at 25 percent of the total acreage unless the project is less than 10 acres. For projects that are less than 10 acres, SMAQMD assumes the contractor will actually construct the whole site concurrently. Therefore, for those projects, “maximum daily acreage disturbed” should equal total project acreage.

[35] Preliminary estimates of cut /fill needed for the Proposed Project based on 25% Design from Mead & Hunt.

For disclosure purposes, the annual construction emissions for Phase I and Phase II of the Proposed Project are provided in **Table 5-2*.***

Table 5-2
ANNUAL GHG CONSTRUCTION EMISSIONS INVENTORY

Year	ANNUAL EMISSIONS (tons per year)
	CO_2
2012	333.58
2013	506.37
2014	446.66

CO: Carbon monoxide
CO_2: Carbon dioxide (BAAQMD threshold of 1,110 represents metric tons)
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM_{10}: Course particulate matter
$PM_{2.5}$: Fine particulate matter
Pb: Lead
Total emissions may not sum exactly due to rounding.
NA=Not applicable
Note: PM10 and PM2.5 values are for exhaust emissions only. 2012 only includes emissions from July 2012 to December 2012.
Source: URBEMIS ver 9.2.4, L&B Analysis, 2011.

Based on the annual emission thresholds provided in **Chapter 2**, the construction activity associated with the Proposed Project would not exceed annual CAA or BAAQMD thresholds for significance.

While the construction activity due to the Proposed Project would not exceed CAA or BAAQMD thresholds for significance, fugitive dust would be generated during project construction which has the potential to affect open space areas and adjacent and nearby properties.

To avoid any potential impacts from fugitive dust, the County shall implement the following basic construction mitigation measures recommended by the FAA and BAAQMD:

- All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
- All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
- All visible mud or dirt track-out onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
- All vehicle speeds on unpaved roads shall be limited to 15 mph.
- All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible.
- Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
- Idling times shall be minimized either by shutting equipment off when not in use or reducing the maximum idling time to 5 minutes (as required by the California airborne

toxics control measure Title 13, Section 2485 of California Code of Regulations [CCR]). Clear signage shall be provided for construction workers at all access points.

- All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- A publicly visible sign shall be posted on the project site with the telephone number and person to contact at the Lead Agency regarding dust complaints. This person shall respond and take corrective action within 48 hours of receiving a compliant. The Air District's phone number shall also be visibly displayed to ensure compliance with applicable regulations.
- Exposing the minimum area of erodible earth.
- Applying temporary mulch with or without seeding.
- Using water sprinkler trucks.
- Using covered haul trucks.
- Using dust palliatives or penetration asphalt on haul roads.
- Using plastic sheet coverings.

THIS PAGE INTENTIONALLY LEFT BLANK

CHAPTER 6
MODELING RESULTS

6.1 FUTURE CONDITIONS: 2015 NO PROJECT ALTERNATIVE

Airport physical conditions for the 2015 No Project Alternative are assumed to be unchanged and therefore consistent with the 2009 Existing Conditions. However, with or without the development of a runway alternative, air traffic is projected to increase each year and the number of annual aircraft operations will be higher as compared to 2009 Existing Conditions. As such, the higher number of annual aircraft operations in the future would increase emissions due to aircraft as compared to 2009 Existing Conditions.

The inventory for the 2015 No Project Alternative provided in **Table 6.1-1,** shows the greatest overall emission contribution comes from aircraft operations. Emissions of Pb, PM_{10} and $PM_{2.5}$ are also produced primarily by aircraft engines.

Table 6.1-1
NO PROJECT ALTERNATIVE (2015) EMISSIONS INVENTORY

EMISSION SOURCES	**ANNUAL EMISSIONS** (tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Aircraft	1,041.92	35.22	38.17	17.95	4.34	17.84	17.84	0.77
GSE	24.18	0.83	0.91	3.27	0.24	0.22	0.21	NA
APUs	1.16	0.06	0.06	0.43	0.08	0.08	0.08	NA
GAV in Parking Facilities	0.42	0.04	0.03	0.05	0.00	0.01	0.01	NA
GAV on Roadways	4.31	0.88	0.22	0.53	0.01	0.03	0.03	NA
Stationary Sources	10.39	3.59	4.48	12.79	0.08	0.96	0.96	NA
TOTAL	**1,082.38**	**40.62**	**43.88**	**35.01**	**4.75**	**19.13**	**19.12**	**0.77**

APU: Auxiliary Power Units
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
GSE: Ground Service Equipment
GAV: Ground Access Vehicles
NA: Not available
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3 Landrum & Brown Analysis, 2011

In order to determine CO_2 equivalent all emissions sources were summed for each pollutant. Totals were converted from short to metric tons (1 short ton = 0.907184 metric tons) and then multiplied by the Global Warming Potential. The results are provided in **Table 6.1-2**.

Table 6.1-2
NO PROJECT ALTERNATIVE (2015) CO_2 EQUIVALENT

Metrics	Annual Metric Tons		
	CO_2	**CH_4**	**N_2O**
Aircraft	7,819.32	2.50	0.20
GAV	561.71	0.03	0.01
Stationary Sources	13.95	0.00	0.00
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	8,394.99	63.23	61.18
Total	**8,519.41**		

GAV: Ground Access Vehicles
GWP: Global Warming Potential
CO_2e: Carbon Dioxide equivalent
CO_2: Carbon Dioxide
CH4: Methane
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.
Source: IPCC Fourth Assessment Report and L&B Analysis, 2009

6.2 FUTURE CONDITIONS: 2015 PROPOSED PROJECT

With or without the implementation of the Proposed Project, the number of annual aircraft operations for the 2015 Proposed Project would be the same as for the 2015 No Project Alternative. The annual number of ground access vehicles in parking lots and on roadways would also be the same as for the 2015 No Project Alternative. However, emissions due to aircraft will change as compared to the 2015 No Project Alternative because the extension of the runway will cause a change in taxi time. The 2015 Proposed Project will result in an increase in average aircraft taxi time as compared to the 2015 No Project Alternative. Longer taxi times increase annual aircraft emissions.

The inventory for the 2015 Proposed Project provided in **Table 6.2-1,** shows the greatest overall emission contribution comes from aircraft operations. Emissions of Pb, PM_{10} and $PM_{2.5}$ are also produced primarily by aircraft engines.

Table 6.2-1
PROPOSED PROJECT (2015) EMISSIONS INVENTORY

EMISSION SOURCES	ANNUAL EMISSIONS (tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Aircraft	1,110.11	42.18	45.52	17.15	4.72	17.12	17.12	0.81
GSE	24.18	0.83	0.91	3.27	0.24	0.22	0.21	NA
APUs	1.22	0.06	0.06	0.47	0.09	0.08	0.08	NA
GAV in Parking Facilities	0.42	0.04	0.03	0.05	0.00	0.01	0.01	NA
GAV on Roadways	4.31	0.88	0.22	0.53	0.01	0.03	0.03	NA
Stationary Sources	10.39	3.59	4.48	12.79	0.08	0.96	0.96	NA
TOTAL	**1,150.63**	**47.58**	**51.22**	**34.26**	**5.13**	**18.41**	**18.41**	**0.81**

APU: Auxiliary Power Units
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
GSE: Ground Service Equipment
GAV: Ground Access Vehicles
Total emissions may not sum exactly due to rounding.
NA = Not applicable/Not available
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

In order to determine CO_2 equivalent all emissions sources were summed. Totals were converted from short to metric tons (1 short ton = 0.907184 metric tons) and then multiplied by the Global Warming Potential. The results are provided in **Table 6.2-2**.

Table 6.2-2
PROPOSED PROJECT (2015) CO_2 EQUIVALENT

Metrics	Annual Metric Tons		
	CO_2	**CH_4**	**N_2O**
Aircraft	8,681.61	2.63	0.23
GAV	561.71	0.03	0.01
Stationary Sources	13.95	0.00	0.00
Construction	38.91	0.00	0.00
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	9,296.19	66.36	68.80
Total	**9,431.35**		

GAV: Ground Access Vehicles
GWP: Global Warming Potential
CO_2e: Carbon Dioxide equivalent
CO_2: Carbon Dioxide
CH4: Methane
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.
Source: IPCC Fourth Assessment Report and L&B Analysis, 2009

6.3 FUTURE CONDITIONS: 2030 NO PROJECT ALTERNATIVE

Airport physical conditions such as the airfield configuration are assumed to be unchanged and therefore consistent with the 2009 Existing Conditions. However, with or without the Proposed Project, air traffic is projected to increase each year and the number of annual aircraft operations will be higher as compared to 2009 Existing Conditions. As such, the higher number of annual aircraft operations in the future would increase emissions due to aircraft as compared to 2009 Existing Conditions.

The inventory for the 2030 No Project Alternative provided in **Table 6.3-1,** shows the greatest overall emission contribution comes from aircraft operations. Emissions of Pb, PM_{10} and $PM_{2.5}$ are also produced primarily by aircraft engines.

Table 6.3-1
NO PROJECT ALTERNATIVE (2030) EMISSIONS INVENTORY

EMISSION SOURCES	**ANNUAL EMISSIONS** (tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Aircraft	1,231.97	43.24	46.71	32.68	6.52	20.86	20.86	0.91
GSE	29.35	1.00	1.10	3.89	0.29	0.25	0.25	NA
APUs	3.17	0.19	0.19	1.17	0.22	0.25	0.25	NA
GAV in Parking Facilities	0.19	0.03	0.02	0.02	0.00	0.01	0.01	NA
GAV on Roadways	2.15	0.71	0.11	0.23	0.01	0.04	0.04	NA
Stationary Sources	10.39	4.03	4.92	12.79	0.08	0.96	0.96	NA
TOTAL	**1,277.24**	**49.20**	**53.04**	**50.77**	**7.12**	**22.37**	**22.37**	**0.91**

APU: Auxiliary Power Units
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
GSE: Ground Service Equipment
GAV: Ground Access Vehicles
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3 Landrum & Brown Analysis, 2011

In order to determine CO_2 equivalent all emissions sources were summed. Totals were converted from short to metric tons (1 short ton = 0.907184 metric tons) and then multiplied by the Global Warming Potential. The results are provided in **Table 6.3-2**.

Table 6.3-2
NO PROJECT ALTERNATIVE (2030) CO_2 EQUIVALENT

Metrics	**Annual Metric Tons**		
	CO_2	**CH_4**	**N_2O**
Aircraft	9,417.65	2.94	0.24
GAV	681.64	0.03	0.01
Stationary Sources	13.95	0.00	0.00
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	10,113.25	74.34	74.21
Total	**10,261.80**		

GAV: Ground Access Vehicles
GWP: Global Warming Potential
CO_2e: Carbon Dioxide equivalent
CO_2: Carbon Dioxide
CH4: Methane
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.
Source: IPCC Fourth Assessment Report and L&B Analysis, 2011.

6.4 FUTURE CONDITIONS: 2030 PROPOSED PROJECT

With or without the implementation of this alternative the number of annual aircraft operations for the 2030 Proposed Project would be the same as for the 2030 No Project Alternative. The annual number of ground access vehicles in parking lots and on roadways would also be the same as for the 2030 No Project Alternative. However, emissions due to aircraft will change as compared to the 2030 No Project Alternative because the extension of the runways will cause a change in taxi time. The 2030 Proposed Project will result in an increase in average aircraft taxi time as compared to the 2030 No Project Alternative. Longer taxi times increase annual aircraft emissions.

The inventory for the 2030 Proposed Project provided in **Table 6.4-1,** shows the greatest overall emission contribution comes from aircraft operations. Emissions of Pb, PM_{10} and $PM_{2.5}$ are also produced primarily by aircraft engines.

Table 6.4-1
PROPOSED PROJECT (2030) EMISSIONS INVENTORY

EMISSION SOURCES	**ANNUAL EMISSIONS** (tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Aircraft	1,311.63	50.95	54.87	33.63	7.23	20.11	20.11	0.95
GSE	29.35	1.00	1.10	3.89	0.29	0.25	0.25	NA
APUs	3.69	0.21	0.22	1.23	0.24	0.28	0.28	NA
GAV in Parking Facilities	0.19	0.05	0.02	0.02	0.00	0.01	0.01	NA
GAV on Roadways	2.15	0.71	0.11	0.23	0.01	0.04	0.04	NA
Stationary Sources	10.39	4.03	4.92	12.79	0.08	0.96	0.96	NA
TOTAL	**1,357.41**	**56.96**	**61.23**	**51.79**	**7.85**	**21.64**	**21.64**	**0.95**

APU: Auxiliary Power Units
CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
GSE: Ground Service Equipment
GAV: Ground Access Vehicles
Total emissions may not sum exactly due to rounding.
NA = Not applicable/Not available
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

In order to determine CO_2 equivalent all emissions sources were summed. Totals were converted from short to metric tons (1 short ton = 0.907184 metric tons) and then multiplied by the Global Warming Potential. The results are provided in **Table 6.4-2**.

Table 6.4-2
PROPOSED PROJECT (2030) CO_2 EQUIVALENT

Metrics	**Annual Metric Tons**		
	CO_2	**CH_4**	**N_2O**
Aircraft	10,476.99	3.09	0.27
GAV	681.64	0.03	0.01
Stationary Sources	88.19	0.00	0.00
Construction	38.91	0.00	0.00
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	11,285.73	78.12	83.64
Total	**11,447.48**		

GAV: Ground Access Vehicles; GWP: Global Warming Potential
CO_2e: Carbon Dioxide equivalent; CO_2: Carbon Dioxide
CH4: Methane
N20: Nitrogen Dioxide (nitrous oxide)
NA=Not Applicable; Total emissions may not sum exactly due to rounding.
Source: IPCC Fourth Assessment Report and L&B Analysis, 2011

CHAPTER 7
DISCUSSION OF FINDINGS

7.1 TOTAL EMISSIONS

The results of the computer modeling to estimate air emissions are provided in **Table 7-1**.

Table 7-1
TOTAL ANNUAL EMISSIONS

ALTERNATIVES	TOTAL ANNUAL EMISSIONS FROM ALL AIRPORT-RELATED SOURCES (in tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
2009								
Existing Conditions	700.87	27.81	30.10	22.44	2.55	11.58	11.58	0.50
2015								
No Project Alternative	1,082.38	40.62	43.88	35.01	4.75	19.13	19.12	0.77
Proposed Project	1,150.63	47.58	51.22	34.26	5.13	18.41	18.40	0.81
2030								
No Project Alternative	1,277.24	49.20	53.04	50.77	7.12	22.37	22.36	0.91
Proposed Project	1,357.41	56.96	61.23	51.79	7.85	21.64	21.63	0.95

CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

The results of the emission inventory prepared for the Proposed Project were compared to the results of the No Project Alternative of the same future year to disclose the potential increase in emissions. Annual net emissions are provided in **Table 7-2*.***

Emissions from the Proposed Project primarily increase as compared to the No Project Alternative due to the runway extensions and the increased distances aircraft would travel on the ground at STS. PM_{10} and $PM_{2.5}$ emissions are lower with the Proposed Project as compared to the No Project Alternative because EDMS does not have emission factors for the Embraer190 aircraft. Emission factors from AP-42 were substituted.[36] The Proposed Project in 2015 includes operations of the Candair Regional Jet (CRJ) 200 as substitutes for half of the Embraer190 aircraft and the Proposed Project in 2030 includes operations of the CRJ 900 as substitutes for half of the Embraer190 aircraft. The use of the AP-42 emission factors resulted in higher emissions as compared to the EDMS emission factors.

[36] USEPA. *AP 42 Supplement A to Compilation of Air Pollutant Emission Factors Volume II: Mobile Sources*. Table II-1-9 Emission factors per aircraft per landing/takeoff cycle-civil aircraft. January 1991.

Table 7-2
ANNUAL NET IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS (PROPOSED PROJECT COMPARED TO NO PROJECT ALTERNATIVE OF THE SAME YEAR)

ALTERNATIVES	IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS (in tons per year)							
	CO	VOC	TOG	NO_x	SO_x	PM_{10}	$PM_{2.5}$	Pb
Federal Threshold	**100**	**100**	**NA**	**100**	**100**	**NA**	**100**	**NA**
BAAQMD Threshold	**NA**	**NA**	**10**	**10**	**NA**	**15**	**10**	**NA**
2015								
Proposed Project	68.25	6.96	7.35	-0.75	0.38	-0.72	-0.72	0.04
2030								
Proposed Project	80.17	7.76	8.19	1.01	0.73	-0.72	-0.72	0.04

CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
NA=Not Applicable
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

Table 7-3
ANNUAL NET IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS (PROPOSED PROJECT COMPARED TO THE 2009 EXISTING CONDITIONS)

ALTERNATIVES	IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS (in tons per year)							
	CO	VOC	TOG	NO_x	SO_x	PM_{10}	$PM_{2.5}$	Pb
BAAQMD Threshold	**NA**	**NA**	**10**	**10**	**NA**	**15**	**10**	**NA**
2015								
Proposed Project	449.76	19.77	21.13	11.81	2.58	6.83	6.82	0.31
2030								
Proposed Project	656.54	29.15	31.14	29.34	5.30	10.06	10.06	0.45

CO: Carbon Monoxide
VOC: Volatile Organic Compounds
TOG: Total Organic Gases
NOx: Nitrogen Oxides
SOx: Sulfur Oxides
PM10: Course particulate matter
PM2.5: Fine particulate matter
Pb: Lead
NA=Not Applicable
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

Annual net GHG emissions are provided in **Table 7-4*.***

Table 7-4
TOTAL GHG EMISSIONS

ANNUAL NET EMISSIONS	
CO_2e (metric tons per year)	
2009	
Existing Conditions	5,668.96
2015	
No Project Alternative	8,519.41
Proposed Project	9,431.35
2030	
No Project Alternative	10,261.80
Proposed Project	11,447.48

CO_2e is Carbon Dioxide equivalent
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

The results of the GHG emission inventory prepared for the Proposed Project were compared to the results of the No Project Alternative of the same future year and to the Existing Conditions to disclose the potential increase in GHG emissions. Annual net GHG emissions are provided in **Table 7-5 and Table 7-6*.***

Table 7-5
ANNUAL NET IMPACT OF GHG EMISSIONS
(PROPOSED PROJECT COMPARED TO NO PROJECT ALTERNATIVE OF THE SAME YEAR)

ANNUAL NET EMISSIONS	
CO_2e (metric tons per year)	
BAAQMD Threshold	1,100
2015	
Proposed Project	911.94
2030	
Proposed Project	1,185.68

CO_2e is Carbon Dioxide equivalent.
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

Table 7-6
ANNUAL NET IMPACT OF GHG EMISSIONS
(PROPOSED PROJECT COMPARED TO THE 2009 EXISTING CONDITIONS)

ANNUAL NET EMISSIONS	
CO_2e (metric tons per year)	
BAAQMD Threshold	1,100
2015	
Proposed Project	3,762.39
2030	
Proposed Project	5,778.52

CO_2e is Carbon Dioxide equivalent.
Total emissions may not sum exactly due to rounding.
Source: EDMS ver. 5.1.3, L&B Analysis, 2011.

7.1.1 No Project Alternative and Proposed Project Compared to the Existing Conditions

Emissions of the criteria and precursor pollutants as well as GHG from the Proposed Project increase as compared to the Existing Conditions due to the increase in aircraft operations. In 2015 there would be 143,209 annual operations, an approximate 58 percent increase compared to Existing Conditions. In 2030 there would be 173,785 annual operations, an approximate 91 percent increase compared to Existing Conditions. However, this also is true with the No Project Alternative in 2015 and 2030.

7.1.2 Existing Plus Project Conditions

The recent court case of Sunnyvale West Neighborhood Association v. City of Sunnyvale City Council confirmed the CEQA requirement to compare the existing condition to an existing plus project scenario. For this project, the existing plus project scenario would consist of the Airport operating at current aircraft operational levels with the proposed improvements to the Airport facilities. Most notably, the existing plus project case results in slightly longer taxi times and a corresponding increase in emissions over the existing case. In **Table 7-2**, the Proposed Project for 2015 best reflects the change in emissions that would occur between existing and existing plus project conditions. In this comparison all emissions are below the BAAQMD thresholds, and no impacts are projected.

7.2 FEDERAL THRESHOLDS OF SIGNIFICANCE

As shown in **Table 7-2**, the Proposed Project would not cause annual net emissions that would equal or exceed the relevant Federal *de minimis* thresholds for the pollutants of concern.

7.3 Greenhouse Gas Thresholds of Significance

The evaluation of GHG emissions showed that the operation of the Proposed Project when compared to the 2009 Existing Baseline would cause annual net GHG emissions that would exceed the BAAQMD threshold of 1,100 metric tons per year. A comparison of the Project and

No Project show that the difference is less than the 1,100 metric tons per year for 2015, but above the threshold for 2030.

7.4 Odors

While offensive odors rarely cause any physical harm, they still can be very unpleasant, leading to considerable distress among the public and often generating citizen complaints. The Proposed Project does not involve siting a new odor source near an existing sensitive receptor or siting a new sensitive receptor near an existing odor source. The Proposed Project does not include construction or operation of wastewater treatment plants, landfills, confined animal facilities, compositing stations, food manufacturing plants, refineries or chemical plants. Therefore, the Proposed Project does not have the potential to cause odor emissions or expose members of the public to objectionable odors.

THIS PAGE INTENTIONALLY LEFT BLANK

ATTACHMENT 1
GLOSSARY

This Air Quality analysis requires the use of many technical terms. Some of the most important terms are defined in this section. Terms in *italics* are defined separately in this glossary.

Air Quality Control Region (AQCR) An EPA designated interstate or intrastate geographic region that has significant air pollution or the potential for significant air pollution and, due to topography, meteorology, etc., needs a common air quality control strategy. The region includes all the counties that are affected by or have sources that contribute directly to the air quality of that region.

Attainment Area – Any area that meets the national primary or secondary ambient air quality standard for a particular *criteria pollutant*.

California Ambient Air Quality Standard (CAAQS – Air Quality standards established by the California Air Resources Board to protect human health.

California Air Resources Board (CARB) – California's Clean Air Agency.

California Environmental Quality Act of 1970 (CEQA) – State legislation establishing the environmental review process for proposed public agency actions in California.

Carbon Monoxide (CO) - A *criteria pollutant* that is colorless, odorless gas produced through the incomplete combustion of fossil fuels.

CFRs – Code of Federal Regulations

Clean Air Act (CAA) – The Federal law regulating air quality. The first Clean Air Act (CAA) passed in 1967, required that air quality criteria necessary to protect the public health and welfare be developed. Since 1967, there have been several revisions to the CAA. The Clean Air Act Amendments of 1990 represent the fifth major effort to address clean air legislation.

Conformity – The act of meeting Section 176(c)(1) of the *CAA* that requires Federal actions to conform to the *SIP* for air quality. The action may not increase the severity of an existing violation nor can it delay attainment of any standards.

Criteria Pollutants – The six air pollutants listed in the *CAA* for which the *USEPA* has established health-based limits. The six criteria pollutants are *carbon monoxide, nitrogen dioxide, lead, sulfur dioxide, particulate matter,* and *ozone*.

De Minimis Thresholds – The de minimis thresholds are considered the thresholds of significance relative to compliance of net emissions under Federal and local air quality regulations, and in determining the potential for significant air quality impacts caused by a Proposed Project. De minimis is defined by the *USEPA* as emissions that are insignificant and negligible, with no potential to cause significant adverse air quality impacts. The applicable rates depend on the severity of the nonattainment designation and whether the project is located within the ozone transport region. Also applicable are rates for precursor pollutants, which are NO_x and VOC for ozone, and SO_x for emissions of $PM_{2.5}$.

Dispersion – The process by which atmospheric pollutants disseminate due to wind and vertical stability.

Emission Factor – The rate at which pollutants are emitted into the atmosphere by one source or a combination of sources.

Federal Aviation Administration (FAA) - The Federal agency responsible for insuring the safe and efficient use of the nation's airspace, for fostering civil aeronautics and air commerce, and for supporting the requirements of national defense.

Fugitive Dust – Dust discharged to the atmosphere in an unconfined flow stream such as that from an unpaved road, storage piles, and heavy construction operations.

Global-warming potential (GWP) - A relative measure of how much heat a greenhouse gas traps in the atmosphere. It compares the amount of heat trapped by a certain mass of the gas in question to the amount of heat trapped by a similar mass of carbon dioxide.

Hazardous Air Pollutants (HAPs) – Gaseous organic and inorganic chemicals, compounds, and particulate matter that may be carcinogenic (known or suspected to cause cancer) or non-carcinogenic (known or suspected to cause other adverse health effects). USEPA currently identified 188 compounds as TACs under the Clean Air Act. The FAA has identified 19 TACs related to aircraft operations.

Hydrocarbons (HC) – Gases that represent unburned and wasted fuel. They come from incomplete combustion of gasoline and from evaporation of petroleum fuels.

Inversion – A thermal gradient created by warm air situated above cooler air. An inversion suppresses turbulent mixing and thus limits the upward dispersion of polluted air.

Lead (Pb) – A heavy metal that, when ingested or inhaled, affects the blood forming organs, kidneys, and the nervous system. The chief source of this pollutant at airports is the combustion of leaded aviation gasoline in piston-engine aircraft.

LTO – LTO refers to an aircraft's landing and takeoff cycle. One aircraft LTO is equivalent to two aircraft operations (one landing and one takeoff). The standard LTO cycle begins when the aircraft crosses the *mixing height* as it approaches the airport on its descent from cruising altitude, lands and taxis to the gate. The cycle continues as the aircraft taxis back out to the runway for takeoff and climbout as its heads past the mixing height and back up to cruising altitude. The five specific operating modes in a standard LTO are: approach, taxi/idle-in, taxi/idle-out, takeoff, and climbout. Most aircraft go through this sequence during a complete standard operating cycle.

Maintenance Area (MA) - Any geographic area of the United States previously designated *nonattainment* pursuant the CAA Amendments of 1990 and subsequently redesignated to attainment.

Mixing Height - The height of the completely mixed portion of atmosphere that begins at the earth's surface and extends to a few thousand feet overhead where the atmosphere becomes fairly stable.

Mobile Source - A moving vehicle that emits pollutants. Such sources include airplanes, automobiles, trucks and ground support equipment.

National Environmental Policy Act of 1969 (NEPA) - The original legislation establishing the environmental review process for proposed Federal actions.

Nitrogen Dioxide (NO_2) – A *criteria pollutant* gas that absorbs sunlight and gives air a reddish-brown color. NO_2 is a subset of the larger set of nitrogen oxides (*NO_X)*. The gas is reactive and forms when fuel is burned at high temperatures and high pressure. **Nitrogen Oxides (NO_X)** – See *NO_2*.

National Ambient Air Quality Standard (NAAQS) - Air Quality standards established by the *USEPA* to protect human health (primary standards) and to protect property and aesthetics (secondary standards).

Nonattainment Area– Any geographical area that does not meet (or that contributes to ambient air quality in a nearby area that does not meet) the national primary or secondary ambient air quality standard for any particular *criteria pollutant*.

Ozone (O_3) – A *criteria pollutant* which is not directly emitted, rather, ozone is formed in the atmosphere through photochemical reaction with *nitrogen oxides (NO_X)*, *volatile organic compounds (VOC)*, sunlight, and heat. It is the primary constituent of smog and problems occur many miles away from the pollutant sources. Due to the fact that ozone is not directly emitted and is a regional phenomenon, emissions of NO_x and VOC are evaluated to indicate the likely formation of ozone. Ozone is not evaluated for a project-level emission inventory.

Particulate Matter (PM_{10} & $PM_{2.5}$) – There are two sizes of particulate matter that account for one of the six *criteria pollutants*. PM_{10}, coarse particles with a diameter of 10 micrometers or less, and $PM_{2.5}$, fine particles with a diameter of 2.5 micrometers or less. Emissions of $PM_{2.5}$ is a subset of emissions of PM_{10}. Particulate matter can be any particle of these sizes, including dust, dirt, and soot. Particulate matter is directly emitted by engine combustion. $PM_{2.5}$ reacts with *precursor pollutants* VOC, NO*x*, and SO_x gases to form secondary particles.

PPB - Parts per billion

PPM - Parts per million

Precursor Pollutant – Pollutant which aid in the formation of *criteria pollutants*. *NO_x* and *VOC* are precursor pollutants to *ozone* development; *SO_x*, NO_x, and VOC are precursors to development of *$PM_{2.5}$*.

State Implementation Plan (SIP) – A plan stating the strategy the state will use to meet and maintain the Federal air quality standards as required under the *Clean Air Act* (CAA, including the 1990 Amendments). A SIP includes the projected emission budgets and controls for industrial, area, and *mobile sources* of pollution.

Sulfur Dioxide (SO_2) – A *criteria pollutant* formed when fuel containing sulfur, like coal, oil and jet fuel, is burned and is commonly expressed as SO_X since it is a large subset of sulfur dioxides (SO_2). SO_2 is a colorless gas that is typically identified as having a strong odor. SO_x is a *precursor pollutant* to the formation of *$PM_{2.5}$* emissions.

Sulfur Oxides (SO_X) – See *SO_2*.

Total Organic Gases (TOG) - This term includes all hydrocarbon compounds in an emission sample. See also HC and VOC.

Toxic Air Contaminant (TACs) – California state term for *hazardous air pollutants (HAPs*). *CARB* has identified 21 TACs in addition to the *USEPA*'s list of TACs. TACs are air contaminants not included in the *California Ambient Air Quality Standards* (CAAQS) but that are considered hazardous to human health. TACs are emitted by a wide range of sources from industrial plants to households. Since it is not practical to eliminate all TACs from our lives, these compounds are regulated through risk management programs. These programs are designed to ensure that the risk of adverse health effects from exposures to TACs is not significant.

U.S. Environmental Protection Agency (USEPA) – Federal agency charged to protect human health and the environment, by writing and enforcing regulations based on laws passed by Congress.

Vehicle Miles Traveled (VMT) – The sum of distances traveled by all motor vehicles in a specified region. VMT is equal to the total number of vehicle trips multiplied by the trip distance (measured in miles). This sum is used in computing an emission inventory for motor vehicles.

Volatile Organic Compound (VOC) – Gases that are emitted from solids or liquids, such as fuel storage, paint, and cleaning fluids. VOC include a variety of chemicals, some which can have short and long-term adverse health effects. VOCs are *precursor pollutants* that react with heat, sunlight and *nitrogen oxides* (NO_X) to form *ozone* (O_3). VOC also mix with other gases to form $PM_{2.5}$. VOCs are a subset of TOGs.

ATTACHMENT 2
LIST OF PREPARERS

Fred Greve
Managing Director
Mestre Greve Associates Division of Landrum & Brown
27812 El Lazo Road
Laguna Niguel, CA 92677

Christian Valdes
Project Manager
Mestre Greve Associates Division of Landrum & Brown
27812 El Lazo Road
Laguna Niguel, CA 92677

Matthew Jones
Project Manager
Mestre Greve Associates Division of Landrum & Brown
27812 El Lazo Road
Laguna Niguel, CA 92677

Chris Babb
Senior Consultant
Landrum & Brown
11279 Cornell Park Drive
Cincinnati, OH 45242

David Billiter
Analyst
Landrum & Brown
11279 Cornell Park Drive
Cincinnati, OH 45242

THIS PAGE INTENTIONALLY LEFT BLANK