3.3 AIR QUALITY

3.3.1 Background and Methodology

3.3.1.1 Regulatory Context

Federal Regulations

The Clean Air Act (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 U.S. Environmental Protection Agency (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 $PM_{2.5}$);[1]
- Sulfur dioxide (SO_2); and,
- Lead (Pb).

The standards for the criteria pollutants are known as the National Ambient Air Quality Standards (NAAQS). 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. Areas of the country where air pollution levels consistently exceed these standards may be designated nonattainment by the USEPA.

The Airport is located in Sonoma County, which is included in the Federal San Francisco Bay Intrastate Air Quality Region.[2] The region does not currently meet the Federal eight-hour standard for healthful levels of ozone and has been designated by the USEPA as a marginal nonattainment area for ozone.[3] Further, USEPA has determined the County exceeds the 24-hour standard for emissions of $PM_{2.5}$. In the past, Sonoma County has been designated as nonattainment for 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.

State Regulations

The Airport is also located within the jurisdiction of the Bay Area Air Quality Management District (BAAQMD). California maintains standards on the same six criteria pollutants as that comprise the NAAQS (the California Ambient Air Quality Standards, or CAAQS). California's standards are more stringent than those adopted by the USEPA, and the County must adhere to the CAAQS. Sonoma County has been designated by the BAAQMD as nonattainment for the

[1] 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.

[2] U.S. Environmental Protection Agency, 40 CFR Part 81, Section 81.21, *San Francisco Bay Intrastate Air Quality Control Region*, January 16, 1981.

[3] U.S. Environmental Protection Agency, *The Green Book Nonattainment Areas for Criteria Pollutants*, available at: http://www.epa.gov/oar/oaqps/greenbk. Accessed April, 10 2011.

eight-hour and one-hour standards for ozone, the annual arithmetic mean and the twenty four-hour standards for PM_{10}, and the annual arithmetic mean standard for $PM_{2.5}$.

Local Regulations

The 2009 Comprehensive Transportation Plan for Sonoma County[4] and the Sonoma County General Plan Air Transportation Element establish policies that guide the future growth and development of aviation activity and airport facilities in Sonoma County. The Sonoma County General Plan Open Space and Resource Conservation and Circulation and Transit Elements also contain policies to address air quality and GHG.

In addition to the above plans, the County of Sonoma General Services Department developed a Climate Protection Action Plan[5] and made a goal to voluntarily reduce greenhouse gas emissions 25% below 1990 levels by the year 2015. The Climate Action Plan does not specifically discuss operations at the Airport.

Greenhouse Gas Emissions

Greenhouse gases (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). 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. 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) can be calculated using global warming potential (GWP)[6] factors.

There are currently no state or local thresholds of significance for GHG emissions. However, federal, state, and local governments have studied and regulated the impacts of global climate change for several years. The following summarizes federal, state, and local actions dealing with global climate change and emissions of CO_2 equivalents (CO_2e).

Executive Order S-3-05

In 2005, Governor Schwarzenegger established Executive Order S-3-05, which sets forth a series of target dates by which statewide emissions of GHGs would be progressively reduced, as follows:

- By 2010, reduce GHG emissions to 2000 levels;
- By 2020, reduce GHG emissions to 1990 levels; and
- By 2050, reduce GHG emissions to 80 percent below 1990 levels.

[4] Sonoma County Transportation Authority, *2009 Comprehensive Transportation Plan for Sonoma County*.
[5] County of Sonoma, General Services Department, June 2006, *Climate Protection Action Plan for Sonoma County*.
[6] 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.

The executive order directed the secretary of the California Environmental Protection Agency (Cal/EPA) to coordinate a multi-agency effort to reduce GHG emissions to the target levels. The secretary was directed to submit biannual reports to the governor and California Legislature describing the progress made toward the emissions targets, the impacts of global climate change on California's resources, and mitigation and adaptation plans to combat these impacts. To comply with the executive order, the secretary of Cal/EPA created the California Climate Action Team, made up of members from various state agencies and commissions. The team released its first report in March 2006. The report proposed to achieve the targets by building on the voluntary actions of California businesses, local governments, and communities and through state incentive and regulatory programs.

Assembly Bill 32 (California Global Warming Solutions Act of 2006)
In 2006, California passed the California Global Warming Solutions Act (AB 32; California Health and Safety Code Division 25.5, Sections 38500 - 38599). AB 32 identifies global warming as a serious environmental threat with the potential to exacerbate air quality problems, reduce the quantity and supply of water from the Sierra snowpack, cause a rise in sea levels, damage marine ecosystems, and increase human health-related problems. AB 32 requires the California Air Resources Board (CARB) to adopt rules and regulations that, by 2020, would achieve GHG emissions equivalent to statewide levels in 1990 levels.

Massachusetts v. EPA
On April 2, 2007, the United States Supreme Court held GHGs are pollutants that can be regulated under the federal Clean Air Act. The Court held that EPA must determine whether GHGs from new motor vehicles cause or contribute to air pollution that may reasonably be anticipated to endanger public health or welfare, or whether the science is too uncertain to make a reasoned decision.

Senate Bill 97
In August 2007, Governor Schwarzenegger signed SB 97 (Chapter 185, Statutes of 2007; Public Resources Code Sections 21083.05 and 21097), which acknowledges that climate change is a prominent environmental issue that requires analysis under CEQA. This bill directed the Governor's Office of Planning and Research (OPR) to prepare, develop, and transmit to the Resources Agency guidelines for the feasible mitigation of GHG emissions (or the effects of GHG emissions), as required by CEQA, by July 1, 2009. The Resources Agency received the guidelines from OPR on April 13, 2009 and adopted them on December 30, 2009. The guidelines became effective on March 18, 2010.

The guidelines do not propose a specific threshold for determining whether a project's contribution to global climate change is significant. Rather, the draft guidelines provide guidance on determining the significance of impacts resulting from a project's greenhouse gas emissions as well as appropriate mitigation measures. The guidelines indicate that lead agencies have discretion to determine which type of methodology to use to evaluate greenhouse gas emissions, given that such methodologies are evolving.

CAPCOA January 2008 CEQA and Climate Change White Paper
In January 2008, the California Air Pollution Control Officers Association (CAPCOA) issued a "white paper" on evaluating GHG emissions under CEQA. The white paper does not provide CEQA guidelines and has not been adopted by any regulatory agency. The white paper was instead offered as a resource to assist lead agencies in considering climate change in environmental documents.

Among other items, the white paper addresses the identification of new emissions, the establishment of baseline emissions, the analysis of "cumulatively considerable" emissions under CEQA, the utility of a "business as usual" scenario.

OPR June 2008 Technical Advisory on CEQA and Climate Change
OPR published a June 2008 Technical Advisory as interim guidance during implementation of SB 97. The Advisory provides informal guidance for public agencies as they address the issue of climate change in their CEQA documents. The document offers recommendations for identifying GHG emissions, determining significance under CEQA, and mitigating impacts.

The Advisory states that lead agencies under CEQA should develop their own approach to performing a climate change analysis, for projects that generate GHG emissions. It states that lead agencies should attempt to assess whether project emissions are individually or cumulatively significant, and implement strategies to avoid, reduce, or otherwise mitigate the impacts of those emissions when impacts are potentially significant.

Senate Bill 375
Signed in September 2008, SB 375 (Chapter 728, Statutes of 2008) endeavors to align regional transportation planning, GHG reduction targets, and land use and housing allocation by requiring metropolitan planning organizations (MPOs) to adopt sustainable communities strategies (SCS) or alternative planning strategies (APS) that prescribe land use allocations in regional transportation plans and meet GHG reduction targets promulgated by CARB for the years 2020 and 2035.

Climate Change Scoping Plan
CARB released a Climate Change Proposed Scoping Plan pursuant to AB 32 in October 2008 and adopted the Plan on December 12, 2008. The Plan outlines proposed State strategies to achieve the 2020 GHG emissions limit. Key elements of the Plan include the following recommendations:

1. expanding and strengthening existing energy efficiency programs as well as building and appliance standards;
2. achieving a statewide renewables energy mix of 33 percent;
3. developing a California cap-and-trade program that links with other Western Climate Initiative partner programs to create a regional market system;
4. establishing targets for transportation-related greenhouse gas emissions for regions throughout California and pursuing policies and incentives to achieve those targets;
5. adopting and implementing measures pursuant to existing State laws and policies, including California's clean car standards, goods movement measures, and the Low Carbon Fuel standard;
6. creating targeted fees, including a public goods charge on water use, fees on high global warming potential gases, and a fee to fund the administrative costs of the state's long-term commitment to AB 32 implementation.

The Scoping Plan would subject approximately 85 percent of the state's emissions to a cap and-trade program in which covered sectors would be placed under a declining emissions cap. Emissions reductions will be achieved through regulatory requirements and the option to reduce emissions further or purchase allowances to cover compliance obligations. It is expected that emission reduction from this cap-and trade program will account for a large portion of the reductions required by AB 32.

CARB Preliminary Draft Staff Proposal, October 2008

In October 2008, CARB also separately issued a Staff Proposal as its first step toward developing recommended statewide interim thresholds of significance for GHGs that may be adopted by local agencies for their own use. The proposal focused on common project types that collectively generate substantial GHG emissions. CARB intended to develop statewide thresholds in these sectors to advance climate objectives, streamline project review, and encourage statewide consistency and uniformity in the CEQA analysis of GHG emissions. CARB also sought to spur mitigation of a substantial portion of GHG emissions from new projects, consistent with CEQA's mitigation requirement. CARB abandoned this effort, however, and has left this task to individual air quality districts to develop and implement within their own jurisdictions. CEQA's mitigation requirement is being implemented by the County of Sonoma and other agencies on a project-by-project basis.

EPA Clean Air Act (CAA) Findings

On December 7, 2009, the Administrator signed two distinct findings regarding GHGs under section 202(a) of the CAA. The Administrator first found that current and projected concentrations of the six key GHGs in the atmosphere threaten the public health and welfare of current and future generations. The Administrator further found that the combined emissions of these GHGs from new motor vehicles and new motor vehicle engines contribute to the GHG pollution. These findings were published in the Federal Register became effective on January 14, 2010.

CEQA Guidelines Amendments for Greenhouse Gas Emissions

On December 30, 2009, the California Natural Resources Agency approved amendments to the state CEQA Guidelines (including Appendix G), to address impacts of GHG emissions, as directed by Senate Bill 97. These amendments became effective March 18, 2010. The amendments revise Appendix G to state an impact related to global climate change is considered significant if the proposed project would:

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

BAAQMD Draft California Environmental Quality Act Air Quality Guidelines, December 2009

In December 2009, the Bay Area Air Quality Management District (BAAQMD) released a draft revision to its CEQA Air Quality Guidelines that include proposed thresholds of significant for GHG emissions. These Draft Guidelines provide that project-level GHG emissions would be less than significant if the project complies with the provisions of a locally-adopted Climate Action Plan. If no such qualifying Climate Action Plan has been adopted, then the Guidelines would apply a significance threshold of 1,100 metric tons per year of GHG's as CO2e to determine whether GHG emissions would be cumulatively considerable and cause a cumulatively significant impact to global climate change. These Guidelines and their associated thresholds of significance have not yet been formally adopted by BAAQMD, and are pending a board meeting approval in July 2010.

Toxic Air Contaminants

Air quality regulations also focus on toxic air contaminants (TACs). Toxic air contaminants (TACs) (or hazardous air pollutants (HAPs) in federal parlance) 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. Toxic air contaminants (TACs) can be emitted directly and can also be formed in the atmosphere through reactions among different pollutants.

In general, for those TACs that may cause cancer, there is no concentration that does not present some risk. This contrasts with the criteria air pollutants for which acceptable levels of exposure can be determined and for which the ambient standards have been established. Instead, EPA and CARB regulate hazardous air pollutants (HAPs) and TACs, respectively, through statutes and regulations that generally require the use of the maximum available control technology (MACT) or best available control technology for toxics (BACT) to limit emissions. These controls, in conjunction with additional rules set forth by BAAQMD, establish the regulatory framework for TACs.

Federal Hazardous Air Pollutant Programs

The USEPA has programs for identifying and regulating HAPs. Title III of the CAA directed USEPA to promulgate national emissions standards (NES) for HAPs (NESHAP). The NESHAP may differ for major sources than for area sources of HAPs. Major sources are defined as stationary sources with potential to emit more than 10 tons per year (tpy) of any HAP or more than 25 tpy of any combination of HAPs; all other sources are considered area sources. The CAA called on USEPA to promulgate emissions standards in two phases. In the first phase (1992–2000), USEPA developed technology-based emission standards designed to produce the maximum emission reduction achievable. These standards are generally referred to as requiring MACT. For area sources, the standards may be different, based on generally available control technology. In the second phase (2001–2008), USEPA is required to promulgate health risk–based emissions standards where deemed necessary to address risks remaining after implementation of the technology-based NESHAP standards.

The CAA also required USEPA to promulgate vehicle or fuel standards containing reasonable requirements that control toxic emissions, at a minimum to benzene and formaldehyde. Performance criteria were established to limit mobile-source emissions of toxics, including benzene, formaldehyde, and 1,3-butadiene. In addition, Section 219 of the CAA required the use of reformulated gasoline in selected areas with the most severe ozone nonattainment conditions to further reduce mobile-source emissions. The USEPA currently identifies 188 compounds as HAPs or TACs under the CAA.

State and Local Toxic Air Contaminant Programs

Toxic air contaminants in California are primarily regulated through the Tanner Air Toxics Act (AB 1807) and the Air Toxics Hot Spots Information and Assessment Act of 1987 (AB 2588) (Hot Spots Act). AB 1807 sets forth a formal procedure for CARB to designate substances as TACs. Research, public participation, and scientific peer review must occur before CARB can designate a substance as a TAC. To date, CARB has identified more than 21 TACs and adopted EPA's list of HAPs as TACs. Most recently, diesel PM was added to the CARB list of TACs.

Once a TAC is identified, CARB then adopts an Airborne Toxics Control Measure (ACTM) for sources that emit that particular TAC. If there is a safe threshold for a substance at which there is no toxic effect, the control measure must reduce exposure below that threshold. If there is no safe threshold, the measure must incorporate BACT to minimize emissions.

The Hot Spots Act requires that existing facilities that emit toxic substances above a specified level prepare a toxic-emission inventory, prepare a risk assessment if emissions are significant, notify the public of significant risk levels, and prepare and implement risk reduction measures.

CARB published the Air Quality and Land Use Handbook: A Community Health Perspective, which provides guidance concerning land use compatibility with TAC sources. While not a law or adopted policy, the handbook offers advisory recommendations for the siting of sensitive receptors near uses associated with TACs, such as freeways and high-traffic roads, commercial distribution centers, rail yards, ports, refineries dry cleaners, gasoline stations, and industrial facilities, to help keep children and other sensitive populations out of harm's way. A number of comments on the handbook were provided to CARB by air districts, other agencies, real estate representatives, and others. The comments included concern over whether CARB was playing a role in local land use planning, the validity of relying on static air quality conditions over the next several decades in light of technological improvements, and support for providing information that can be used in local decision making.

In July 2001, CARB adopted an airborne toxics control measure (ATCM) for construction, grading, quarrying, and surface mining operations that regulates grading and excavation activities in areas of serpentine or ultramafic rocks. In addition, the Governor's Office of Planning and Research issued a memorandum providing guidance to Lead Agencies in analyzing the impacts of naturally occurring asbestos (NOA) through the CEQA review process.

At the local level, air pollution control or management districts may adopt and enforce CARB control measures. Under BAAQMD Regulation I all stationary sources that possess the potential to emit TACs are required to obtain permits from the district. Permits may be granted to these operations if they are constructed and operated in accordance with applicable regulations, including new-source review standards and air toxics control measures. BAAQMD limits emissions and public exposure to TACs through a number of programs. BAAQMD prioritizes TAC-emitting stationary sources based on the quantity and toxicity of the TAC emissions and the proximity of the facilities to sensitive receptors. BAAQMD Regulation III also contains toxic control rules.

Sources that require a permit are analyzed by BAAQMD on the basis of their potential to emit toxics. If it is determined that the project would emit a significant amount of toxics, sources must implement the best available control technology for TACs (T-BACT) to reduce emissions. This helps to prevent new problems and reduces emissions from existing older sources by requiring them to apply new technology when retrofitting with respect to TACs. It is important to note that BAAQMD's air quality permitting process applies to stationary sources; properties that are exposed to elevated levels of nonstationary type sources of TACs, and the nonstationary type sources themselves (e.g., on-road vehicles), are not subject to air quality permits. Further, for reasons of feasibility and practicality, mobile sources (cars, trucks, etc.) are not required to implement T-BACT, even if they do have the potential to expose adjacent properties to elevated levels of TACs. Rather, emissions controls on such sources (e.g., vehicles) are subject to regulations implemented on the federal and state levels.

For a detailed discussion of the regulatory environment, see **Appendix G**.

3.3.1.2 Thresholds of Significance

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

1. a project that will "violate any ambient air quality standard or contribute substantially to an existing or projected air quality violation;"
2. a project that conflicts "with or obstruct[s] implementation of the applicable air quality plan";
3. 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)";
4. a project that exposes "sensitive receptors to substantial pollutant concentrations"; and
5. a project that creates "objectionable odors affecting a substantial number of people."

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

- generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment; and
- conflict with an applicable plan, policy or regulation adopted for the purpose of reducing the emissions of GHGs.

The thresholds for determining a significant impact have been developed by the BAAQMD and are contained in BAAQMD's Air Quality Guidelines.[7] Should the emissions caused by the Proposed Project exceed the annual or daily thresholds (see **Table 3.3-1**), it would be considered to have a significant air quality impact.

Table 3.3-1
BAAQMD THRESHOLDS

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

/a/ 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, 2010
PREPARED BY: L&B, 2011

In addition, the BAAQMD has thresholds of significance for construction emissions. If daily maximum construction emissions exceed the applicable thresholds provided in **Table 3.3-2**, the Proposed Project would likely result in a significant cumulative impact.

[7] Bay Area Air Quality Management District, *CEQA Air Quality Guidelines*. available at: http://www.baaqmd.gov/Divisions/Planning-and-Research/CEQA-GUIDELINES/Updated-CEQA-Guidelines.aspx. Accessed June 10, 2011.

The BAAQMD has developed thresholds of significance for 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 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 considered to result in a significant impact. The Risk and Hazard threshold for an individual project is an incremental increase (i.e., over conditions without the Proposed Project) 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. This threshold will be used as the significance threshold for residents, school children, and off-Airport workers.

Table 3.3-2
BAAQMD THRESHOLDS FOR CONSTRUCTION

POLLUTANTS /a/	**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

/a/ The daily maximum emission thresholds for PM_{10} and $PM_{2.5}$ applies to construction exhaust emissions only.

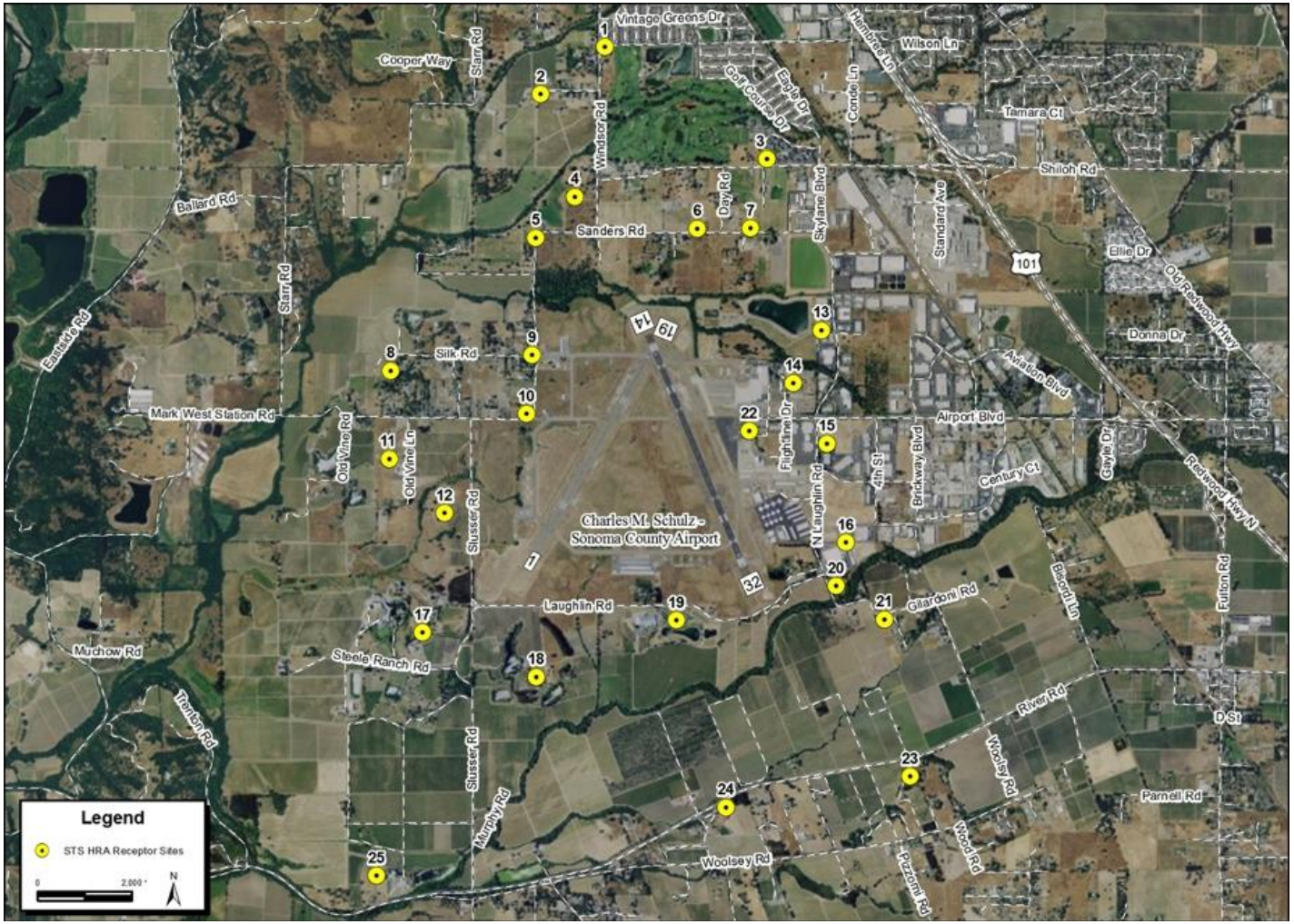
SOURCE: BAAQMD, CEQA Air Quality Guidelines, 2010
PREPARED BY: L&B, 2011

Because on-site Airport worker exposures are occupational and not incidental, workers are assessed appropriately through comparison of the maximum average air concentrations of TACs (conservative predictor of exposure) to thresholds determined for workers by relevant governing bodies. Receptor locations were used in the computer modeling to represent potential sensitive areas such as locations near schools, private residences, hospitals, and public parks. The highest overall pollutant concentrations at each receptor are reported below. The locations of these receptors are shown in **Figure 3.3-1**.

Receptors were selected to represent developed areas in the Airport vicinity. The majority of receptors are representative of residential uses near the airport. Receptors 1 through 7 represent residential areas to the north of the Airport. Receptors 8 through 12 represent residential areas to the west of the Airport. Receptors 17 through 21 represent residential areas immediately south of the Airport. Receptors 23 through 25 represent residential areas further south of the Airport.

Receptor 14 represents the Sonoma County Jail, which is east of the northern portion of the Airport. Receptors 13, 15, and 16, represent commercial areas east of the Airport and are representative of workers in these commercial areas. Receptor 22 is located at the terminal entrance and is representative of Airport workers.

Figure 3.3-1
HRA RECEPTOR SITES IN AIRPORT VICINITY



SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Permissible Exposure Limits (PEL) are air concentrations for chemicals adopted by Cal/OSHA to represent maximum concentrations (8-hour time-weighted average) to which workers may be repeatedly exposed during business hours without developing adverse health effects. Occupational exposures are thus assessed by comparing maximum 8-hour concentrations of TACs near gates and aprons, estimated through air dispersion modeling, with PEL. Under the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines, if TAC concentrations are below the PELs, health impacts are unlikely for the on-airport workers.

3.3.1.3 Methodologies

Emission inventories provide an estimate of increases and decreases in air pollutants and pollutant precursors by allowing a comparison of emissions with and without the Proposed Project. For the analysis of the Proposed Project, operational-related emission inventories were prepared for the air pollutants and pollutant precursors of CO, volatile organic compounds (VOC), NOx, SO_2, PM_{10}, and $PM_{2.5}$. The air pollutant and pollutant precursor inventories include emissions from sources that would be directly affected by the Proposed Project: aircraft, ground support equipment (GSE), and motor vehicles. In addition, an analysis of the changes in GHG emissions, and emissions related to construction activities was prepared. Supporting information for the operational and stationary emission calculations is contained in **Appendix H**. To determine the significance of an air quality impact, the difference in air emissions between the Proposed Project and the existing conditions are compared.

3.3.2 Existing Conditions

3.3.2.1 Air Pollutant Emissions

An emission inventory was prepared for the existing conditions (2009) using the Federal Aviation Administration (FAA) required and USEPA approved Emissions Dispersion Modeling System (EDMS) Version 5.1.3. The model estimates the rate of emissions of the criteria and precursor pollutants (described briefly below). Data was collected from the Airport to calculate air emissions from 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 3.3-3**. 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.

Criteria and Precursor Pollutants

A brief description of each criteria and precursor air pollutant is provided below.

Ozone

Ozone is a photochemical oxidant, a substance whose oxygen combines chemically with another substance in the presence of sunlight, and the primary component of smog. Ozone is not directly emitted into the air, but is formed through complex chemical reactions between precursor emissions of reactive organic gases (ROG) and oxides of nitrogen (NOx) in the presence of sunlight. ROG are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. NOx are a group of gaseous compounds of nitrogen and oxygen that results from the combustion of fuels. A highly reactive molecule, ozone readily combines with many different components of the atmosphere. Consequently, high levels of ozone tend to exist only while high ROG and NOx levels are present to sustain the ozone formation process. Once the

precursors have been depleted, ozone levels rapidly decline. Because these reactions occur on a regional scale, ozone is considered a regional pollutant.

Ozone located in the upper atmosphere (stratosphere) acts in a beneficial manner by shielding the earth from harmful ultraviolet radiation that is emitted by the sun. However, ozone located in the lower atmosphere (troposphere) is a major health and environmental concern. Meteorology and terrain play a major role in ozone formation. Generally, low wind speeds or stagnant air coupled with warm temperatures and clear skies provide the optimum conditions for formation. As a result, summer is generally the peak ozone season. Because of the reaction time involved, peak ozone concentrations often occur far downwind of the precursor emissions. In general, ozone concentrations over or near urban and rural areas reflect an interplay of emissions of ozone precursors, transport, meteorology, and atmospheric chemistry.

Carbon Monoxide

Carbon monoxide is a colorless, odorless, and poisonous gas produced by incomplete burning of carbon in fuels, primarily from mobile (transportation) sources. Seventy-seven percent (77%) of the nationwide CO emissions are from mobile sources. The other twenty-three percent (23%) consist of CO emissions from wood-burning stoves, incinerators, agricultural slash burning (in autumn), and industrial sources. The highest concentrations are generally associated with cold, stagnant weather conditions that occur during the winter. In contrast to problems caused by ozone, which tends to be a regional pollutant, CO problems tend to be localized.

Nitrogen Dioxide

Nitrogen oxides (NO_x) is a brownish, highly reactive gas that is present in all urban environments. The major human-made sources of NO_x are combustion devices, such as boilers, gas turbines, and mobile and stationary reciprocating internal combustion engines. Combustion devices emit primarily nitric oxide (NO), which reacts through oxidation in the atmosphere to form NO_2. The combined emissions of NO and NO_2 are referred to as NO_x and reported as equivalent NO_2. Because NO_2 is formed and depleted by reactions associated with photochemical smog (ozone), the NO_2 concentration in a particular geographical area may not be representative of the local NO_x emission sources.

Sulfur Dioxide

Sulfur dioxide (SO_2) is produced by such stationary sources as coal and oil combustion, steel mills, refineries, and pulp and paper mills. The major adverse health effects associated with SO_2 exposure pertain to the upper respiratory tract. SO_2 is a respiratory irritant with constriction of the bronchioles occurring with inhalation of SO_2 at five ppm or more. On contact with the moist mucous membranes, SO_2 produces sulfurous acid, which is a direct irritant. Concentration rather than duration of the exposure is an important determinant of respiratory effects. Exposure to high SO_2 concentrations may result in edema of the lungs or glottis and respiratory paralysis.

Respirable and Fine Particulate Matter

Respirable particulate matter with an aerodynamic diameter of 10 micrometers or less is referred to as PM_{10}. PM_{10} consists of particulate matter emitted directly into the air, such as fugitive dust, soot, and smoke from mobile and stationary sources, construction operations, fires and natural windblown dust, and particulate matter formed in the atmosphere by condensation and/or transformation of SO_2 and ROG (EPA 2007a). Fine particulate matter ($PM_{2.5}$) includes a subgroup of smaller particles that have an aerodynamic diameter of 2.5 micrometers or less.

Lead

Lead is a metal found naturally in the environment as well as in manufactured products. The major sources of lead emissions have historically been mobile and industrial sources. As a result of the phase-out of leaded gasoline, as discussed in detail below, metal processing is currently the primary source of lead emissions. The highest levels of lead in air are generally found near lead smelters. Other stationary sources are waste incinerators, utilities, and lead-acid battery manufacturers.

Reactive Organic Gasses (ROGs) and Total Organic Gasses (TOGs)

Reactive organic gasses (ROGs) are volatile organic compounds that are photochemically reactive. ROG emissions result primarily from incomplete combustion and the evaporation of chemical solvents and fuels. ROGs are defined by CARB and are a subset of total organic gasses (TOGs). ROGs are those TOGs that contribute to ozone formation.

Volatile Organic Compounds (VOCs)

The U.S. EPA defines and uses the term volatile organic compounds (VOC), which is essentially the same as ROG. However, due to technical legal issues, there are some minor differences between the specific TOGs that are included in CARB's ROGs and U.S. EPA's VOCs. The differences are minor enough that for planning purposes they are used interchangeably.

Table 3.3-3
EXISTING CONDITIONS (2009) EMISSIONS INVENTORY

EMISSION	**ANNUAL EMISSIONS**							
SOURCES	(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**

GSE = Ground Service Equipment
APU = Auxiliary Power Unit
GAV = Ground Access Vehicles
CO = Carbon Monoxide
VOC = Volatile Organic Compounds
TOG = Total Organic Gases
NOx = Nitrogen Oxides
SOx = Sulfur Oxides
PM_{10} = Coarse Particulate Matter
$PM_{2.5}$ = Fine Particulate Matter
Pb = Lead
NA = Not Applicable
Total emissions may not sum exactly due to rounding.

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

3.3.2.2 Greenhouse Gases

The earth's atmosphere naturally contains a number of gases, including (but not limited to) carbon dioxide, methane, and nitrous oxide, which are collectively referred to as greenhouse gases (GHGs). In this report, GHG emissions are numerically depicted as carbon dioxide (CO_2) since it is the predominant GHG associated with fuel combustion. Manmade emissions of GHG occur through the combustion of fuels, as well as a variety of other sources.[8]

These gases trap some amount of solar radiation and the earth's own radiation, preventing it from passing through earth's atmosphere and into space. GHGs are vital to life on earth; without them earth would be an icy planet. For example, CO_2 is also a trace element that is essential to the cycle of life. However, increasing GHG concentrations are believed to be warming the planet.

As the average temperature of the earth increases, weather may be affected, including changes in precipitation patterns, accumulation of snow pack, and intensity and duration of spring snowmelt. The sea level may rise, resulting in coastal erosion and inundation of coastal areas. Emissions of air pollutants and ambient levels of pollutants also may be affected in areas. Climate zones may change, affecting the ecology and biological resources of a region. There may be changes in fire hazards due to the changes in precipitation and climate zones.

While scientists have established a connection between increasing GHG concentrations and increasing average temperatures, important scientific questions remain about how much warming will occur, how fast it will occur, and how the warming will affect the rest of the climate system. At this point, scientific efforts are unable to quantify the degree to which human activity impacts climate change. The phenomenon is worldwide, yet it is expected that there will be substantial regional and local variability in climate changes. It is not possible with today's science to determine the effects of global climate change in a specific locale, or whether the effect of one aspect of climate change may be counteracted by another aspect of climate change, or exacerbated by it.

Human activities generate GHG emissions. Since pre-industrial times, there has been a build-up of levels of GHG in the atmosphere. Anthropogenic GHG emissions worldwide as of 2005 (the latest year for which data are available for Annex 1 countries[9]) totaled approximately 30,800 CO_2 equivalent million metric tons (MMTCO2e)[10]. Six countries and the European Community accounted for approximately 70 percent of the total global emissions.

The results of the GHG emission inventory are provided in **Table 3.3-4**.

[8] In October 2009, the Governor signed Senate Bill 104, which adds nitrogen triflouride to the list of GHGs that are to be regulated under AB 32. Nitrogen triflouride is primarily used in the manufacture of several consumer items, including photovoltaic solar panels, microprocessors, and LCD television screens. *Assembly Committee on Appropriations, SB 104 Bill Analysis* (July 15, 2009). Nitrogen triflouride is not generally used at Airports.

[9] Annex 1 countries are developed countries which have adopted greenhouse gas emission reduction obligations under the Kyoto Protocol.

[10] The CO_2 equivalent emissions are commonly expressed as "million metric tons of carbon dioxide equivalent (MMTCO2e)". The carbon dioxide equivalent for a gas is derived by multiplying the tons of the gas by the associated GWP, such that MMTCO2e = (million metric tons of a GHG) x (GWP of the GHG). For example, the GWP for methane is 21. This means that emissions of one million metric tons of methane are equivalent to emissions of 21 million metric tons of CO_2.

Table 3.3-4
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: EDMS Version 5.1.3, 2011 and ACRP Report 11
PREPARED BY: L&B, 2011

3.3.2.3 Toxic Air Contaminants

The health effects associated with TACs are quite diverse and generally are assessed locally, rather than regionally. Toxic air contaminants (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.

Toxic air contaminants (TACs) are evaluated as carcinogens and/or non-carcinogens based on the nature of the physiological effects associated with exposure to the pollutant. Many compounds have both carcinogenic and non-carcinogenic health effects. Carcinogens are those substances that have been shown to cause cancer. Carcinogenic impacts are measured based on the increased risk in contracting cancer due to exposure to the substances over a lifetime for residences and 40 years for workers.

Carcinogens are assumed to have no safe level 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-carcinogens are those substances that cause other non-cancer health related impacts. These substances can affect one or more body system such as eyes, respiratory system, skin, nose, bronchi, throat, nervous system, reproductive system or cardiovascular system. Different non-cancer health effects can occur due to short-term and long-term exposures to these substances. Non-cancer health effects are assessed for acute (1-hour), 8-hour, and chronic (annual) exposure times.

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, 8-hour and chronic exposure to non-

carcinogens is expressed as a hazard quotient (HQ), which is the ratio of expected exposure levels to an acceptable reference exposure levels. The hazard quotients from individual substances affecting the same body system (e.g., eyes, respiratory system) are summed to determine the hazard index (HI) for that system for each exposure time. A HQ or HI less than one demonstrates that no adverse health effects due to exposure to the TACs will occur.

Concentrations exceeding the REL (i.e. a HQ and/or HI of greater than one) do not necessarily indicate that an adverse health impact will occur. However, levels of exposure above the REL have an increasing but undefined probability of resulting in an adverse health impact, particularly in sensitive individuals (e.g., depending on the toxicant, the very young, the elderly, pregnant women, and those with acute or chronic illnesses). The significance of exceeding the REL is dependent on the seriousness of the health endpoint, the strength and interpretation of the health studies, the magnitude of combined safety factors, and other considerations. In addition, there is a possibility that an REL may not be protective of certain small, unusually sensitive human subpopulations. Such subpopulations can be difficult to identify and study because of their small numbers, lack of knowledge about toxic mechanisms, and other factors.

The FAA required and USEPA approved Emissions and Dispersion Modeling System (EDMS) was used to estimate TAC emissions from airport operations. The TAC emissions reported by EDMS include 396 airport related organic gas species that EPA identifies as Hazardous Air Pollutants (HAPS) and/or are included in the Integrated Risk Information System (IRIS) database. The OEHHA Risk Assessment Guidelines present a list of TACs with Unit Cancer Risks, and non-cancer Relative Exposure Levels (REL). The table of cancer risks was updated in 2009[11] and the table of non-cancer REL's was updated in 2008[12]. Those organic gas species reported by EDMS that are listed in the OEHHA Unit Cancer Risk and Non-Cancer REL tables were analyzed in this assessment. The most critical TACs assessed include 1,3-butadiene, acrolein, acetaldehyde, benzene, formaldehyde, and naphthalene.

Note that particulate matter from diesel powered engines (Diesel Particulate Matter or DPM) is also listed as a TAC from the OEHHA. Ground Service Equipment (GSE) is the primary source of DPM emissions at an airport. However, commercial airline operations use electric GSE at the Airport and the only sources of DPM at the Airport are one aircraft tractor, one ground power unit, two aircraft rescue and fire fighting vehicles, and eight diesel fuel trucks operated by the Fixed Based Operators (FBOs) at the Airport. In 2030, each unit of diesel powered equipment is projected to operate for less than three hours per day. This relatively low level of operation would not be expected to result in considerable health impacts from DPM. Typically DPM is only a considerable issue near a distribution center or truck stop where hundreds of truck trips occur each day.

Existing inhalation cancer risk and acute, 8-hour, and chronic non-cancer Hazard index were calculated for 25 receptors shown in **Figure 3.3-1. Table 3.3-5** presents the inhalation cancer risk under existing conditions and shows that the risk does not exceed ten in a million at any receptor.

[11] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxicology and Epidemiology Branch, *Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values, and adjustments to allow for early life stage exposures*, May 2009.

[12] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxicology and Epidemiology Branch, *Technical Support Document for the Derivation of Noncancer Reference Exposure Levels*, June 2008.

Table 3.3-6 presents the Acute Hazard Index (Acute HI) which measures the potential impact of short-term (1-hour) exposures to TAC. An Acute HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. Acute HI greater than one are shown in bold and italic text. **Table 3.3-6** shows that the existing Acute HI for Eyes exceeds 1 at Receptors 15 and 22 and the existing Acute HI for Respiratory System exceeds 1 at Receptor 22. These existing Acute HIs, which are not substantially greater than 1, indicate that sensitive persons in the area near Receptors 15 and 22 could experience eye irritation and tearing. Persons with asthma or allergies may experience irritation of the nose and throat, an increase in mucus secretion, and an exacerbation of pre-existing asthma and allergies.

Table 3.3-7 presents the 8-hour Hazard Index which measures the potential impact of longer term exposures to TAC. An HI of less than 1 indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. **Table 3.3-7** shows that no receptors are exposed to an existing 8-Hour HI of greater than 1.

Table 3.3-8 presents the Chronic HI for Respiratory System, which measures the potential impact of long term (annual) exposures to TAC. None of the other systems (development, hematologic, nervous, eyes, alimentary, kidney, endocrine, reproductive, or cardiovascular) have a value greater than 0 and are not presented in **Table 3.3-8**. An HI of less than 1 indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. **Table 3.3-8** shows that no receptors are exposed to an existing Chronic HI for the respiratory system of greater than 1.

3.3.3 Environmental Impacts and Mitigation Measures

Impact 3.3.1: Short-Term Increases in Air Pollution Emissions due to Project Construction Activity

Construction of the Proposed Project would result in 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 short-term project elements 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 **Appendix H**.

Based on the preliminary schedule, construction of the short-term project elements would occur over two years and would be completed in two phases (see **Tables 2-5** and **2-6**). Each of these short-term project elements 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 short-term 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.

The maximum daily construction emissions for the short-term project elements are presented in **Table 3.3-9.** For disclosure purposes, **Table 3.3-10** provides information regarding GHG emissions during the construction period. Based on the maximum daily emissions thresholds, the construction activity associated with the short-term project elements would not exceed BAAQMD thresholds for significance. Therefore, no significant construction-related emissions impacts would occur.

Table 3.3-5
EXISTING CONDITIONS (2009) INHALATION CANCER RISK

Receptor	Inhalation Cancer Risk (per million)
1	0.12
2	0.13
3	0.27
4	0.21
5	0.26
6	0.34
7	0.40
8	0.16
9	0.34
10	0.33
11	0.05
12	0.21
13 /a/	0.35
14	0.89
15 /a/	2.44
16 /a/	1.41
17	0.14
18	0.16
19	0.41
20	0.96
21	0.60
22 /a/	2.54
23	0.18
24	0.10
25	0.07

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-6
EXISTING CONDITIONS (2009) ACUTE NON-CANCER HAZARD INDEX

Receptor	Acute Hazard Index					
	Bronchi	Eyes	Nose	Throat	Nervous System	Respiratory System
1	0.00	0.21	0.00	0.00	0.00	0.16
2	0.00	0.23	0.00	0.00	0.00	0.18
3	0.00	0.38	0.00	0.00	0.00	0.30
4	0.00	0.30	0.00	0.00	0.00	0.23
5	0.00	0.32	0.00	0.00	0.00	0.25
6	0.00	0.51	0.00	0.00	0.00	0.40
7	0.00	0.55	0.00	0.00	0.00	0.43
8	0.00	0.23	0.00	0.00	0.00	0.18
9	0.00	0.37	0.00	0.00	0.00	0.29
10	0.00	0.22	0.00	0.00	0.00	0.17
11	0.00	0.22	0.00	0.00	0.00	0.17
12	0.00	0.17	0.00	0.00	0.00	0.13
13/a/	0.01	0.64	0.01	0.01	0.00	0.50
14	0.01	0.91	0.01	0.01	0.00	0.70
15/a/	0.01	1.00	0.01	0.01	0.00	0.77
16/a/	0.00	0.45	0.00	0.00	0.00	0.35
17	0.00	0.22	0.00	0.00	0.00	0.17
18	0.00	0.14	0.00	0.00	0.00	0.11
19	0.00	0.20	0.00	0.00	0.00	0.16
20	0.00	0.29	0.00	0.00	0.00	0.22
21	0.00	0.28	0.00	0.00	0.00	0.21
22/a/	0.01	1.41	0.01	0.01	0.00	1.09
23	0.00	0.20	0.00	0.00	0.00	0.16
24	0.00	0.20	0.00	0.00	0.00	0.16
25	0.00	0.21	0.00	0.00	0.00	0.16

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-7
EXISTING CONDITIONS (2009) 8-HOUR NON-CANCER HAZARD INDEX

Receptor	Respiratory System
1	0.17
2	0.19
3	0.27
4	0.33
5	0.41
6	0.44
7	0.36
8	0.18
9	0.24
10	0.20
11	0.19
12	0.19
13/a/	0.50
14	0.62
15/a/	0.67
16/a/	0.35
17	0.09
18	0.12
19	0.26
20	0.18
21	0.21
22/a/	0.99
23	0.20
24	0.22
25	0.08

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-8
EXISTING CONDITIONS (2009) CHRONIC NON-CANCER HAZARD INDEX

Receptor	Chronic Hazard Index for Respiratory System
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00
6	0.01
7	0.01
8	0.00
9	0.01
10	0.01
11	0.00
12	0.00
13*	0.02
14	0.05
15*	0.05
16*	0.03
17	0.00
18	0.00
19	0.01
20	0.02
21	0.01
22*	0.16
23	0.00
24	0.00
25	0.00

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-9
MAXIMUM DAILY CONSTRUCTION EMISSIONS FOR SHORT-TERM PROJECT ELEMENTS

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
PM_{10} = Coarse Particulate Matter
$PM_{2.5}$ = Fine Particulate Matter
CO_2 = Carbon Dioxide
The daily maximum emissions for PM_{10} and $PM_{2.5}$ are for construction exhaust emissions only.

SOURCE: URBEMIS Version 9.2.4, 2011
PREPARED BY: L&B, 2011

Table 3.3-10
GHG EMISSIONS DURING CONSTRUCTION

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

CO_2 = Carbon Dioxide

SOURCE: URBEMIS Version 9.2.4, 2011
PREPARED BY: L&B, 2011

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. To avoid any potential impacts from fugitive dust, the County would implement the following basic construction Best Management Practices (BMPs) measures recommended by BAAQMD and the FAA to further reduce and minimize any project-related impacts.

- all exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered (with recycled water, when available) two times per day and more often during windy period (i.e., 10 miles per hour);
- 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 County 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;
- require the construction contractor to submit and implement a construction management plan to control erosion and dust, and the disposal of waste materials pursuant to guidelines included in FAA, *Standards for Specifying Construction of Airports*[13] including

As a result of the implementation of these measures, the short-term construction-related emissions would not result in any violation of any ambient air quality standards. Therefore, this is considered to be a less-than-significant impact.

Mitigation Measure 3.3.1

No mitigation is warranted.

Impact 3.3.2: Operational Increases in Criteria Air Pollutant Emissions in 2015

The Proposed Project would result in an incremental long-term increase in total air pollutant emissions compared to the existing condition. The increase is due to additional taxi-time and the growth in activity that is expected to occur.

Additional Taxi-Time

Emissions due to aircraft taxiing would increase as compared to the conditions without the Proposed Project because the extension of the runways and taxiways would result in aircraft having to taxi farther from the apron areas to the ends of the runways. Longer taxi-times increase annual aircraft emissions because the engines are operating for a longer duration.

Increased Activity

Aviation activity at the Airport is expected to increase from existing conditions in the future. In 2015 there would be 143,209 annual operations, which is an approximate 58 percent increase. Aviation activity (take offs and landings) represents the largest contributor of emissions at the Airport; however this increase is anticipated to occur with or without the implementation of the Proposed Project.

The inventory of criteria pollutant emissions for 2015 are presented in **Table 3.3-11** for conditions without the Proposed Project and in **Table 3.3-12** for conditions with the Proposed Project. These tables show the greatest overall emission contribution comes from aircraft operations.

[13] Federal Aviation Administration, Advisory Circular 150/5370-10E, *Standards for Specifying Construction of Airports*, Item P-156, *Temporary Air and Water Pollution, Soil Erosion, and Siltation Control*, current edition.

Table 3.3-13 presents the change in criteria pollutant emissions in 2015 when comparing the emissions that would occur with the Proposed Project to the emissions that would occur without the Proposed Project. **Table 3.3-13** shows that the total change in criteria pollutant emissions would not exceed any of the BAAQMD significance thresholds.

Mitigation Measure 3.3.2

No mitigation is warranted.

Table 3.3-11
2015 EMISSIONS INVENTORY WITHOUT PROPOSED PROJECT

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**

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

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Table 3.3-12
2015 EMISSIONS INVENTORY WITH PROPOSED PROJECT

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**

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

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Table 3.3-13
ANNUAL NET IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS IN 2015

	ANNUAL CRITERIA AND PRECURSOR POLLUTANT EMISSIONS IN 2015 (in tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Without Proposed Project	1,082.38	40.62	43.88	35.01	4.75	19.13	19.12	0.77
With Proposed Project	1,150.63	47.58	51.22	34.26	5.13	18.41	18.41	0.81
Net Change	***68.25***	***6.96***	***7.35***	***-0.75***	***0.38***	***-0.72***	***-0.72***	***0.04***
BAAQMD Threshold /a/	NA	NA	10	10	NA	15	10	NA

/a/ BAAQMD Significance Thresholds are defined in both lbs/day and ton/year. These thresholds are functionally equivalent as the lbs/day threshold is just the tons/year threshold divided by 365 days.

CO: Carbon Monoxide
NOx: Nitrogen Oxides
PM2.5: Fine particulate matter
NA = Not applicable/Not available
VOC: Volatile Organic Compounds
SOx: Sulfur Oxides
Pb: Lead
TOG: Total Organic Gases
PM10: Course particulate matter
Total emissions may not sum exactly due to rounding.

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Impact 3.3.3: Operational Increases in Greenhouse Gas Emissions in 2015

As for the criteria pollutants discussed above, the Proposed Project would result in an incremental long-term increase in total GHG emissions. The increase is due to additional taxi-time and the increase in aircraft operations that would occur as a result of the Proposed Project.

The inventory of airport related GHG emissions for 2015 are presented in **Table 3.3-14** for 2015 conditions without the Proposed project and in **Table 3.3-15** for conditions in 2015 with the Proposed Project. These tables show the greatest overall emission contribution comes from aircraft operations.

Table 3.3-16 presents the change in GHG emissions in 2015 when comparing the GHG emissions that would occur with the Proposed Project to the GHG emissions that would occur without the Proposed Project. **Table 3.3-13** shows that the total change in GHG emissions would not exceed the BAAQMD significance threshold.

Mitigation Measure 3.3.3

No mitigation is warranted.

Table 3.3-14
2015 GHG EMISSIONS WITHOUT THE PROPOSED PROJECT

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: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Table 3.3-15
2015 GHG EMISSIONS WITH PROPOSED PROJECT

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
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	9,257.27	66.36	68.80
Total	**9,392.43**		

GAV: Ground Access Vehicles
CO_2: Carbon Dioxide
GWP: Global Warming Potential
CH4: Methane
CO_2e: Carbon Dioxide equivalent
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.

SOURCE: IPCC Fourth Assessment Report, 2011
PREPARED BY: L&B, 2011

Table 3.3-16
ANNUAL NET IMPACT OF GREENHOUSE GAS EMISSIONS IN 2015

	ANNUAL GHG EMISSIONS (in metric tons per year)
Without Proposed Project	8,519.41
With Proposed Project	9,392.43
Net Change	***873.02***
BAAQMD Threshold	1,100

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Impact 3.3.4: Changes in Cancer Risk due to TAC Emissions in 2015

The total Inhalation Cancer risk due to emissions of carcinogenic TACs are presented in **Table 3.3-17**, which shows that change as a result of the Proposed Project would be less than the significance threshold of ten in a million at any receptor. The primary reason for the change in Inhalation Cancer risk at any specific receptor is associated with the change in the location of the approach ends of Runways 14 and 19, which would result in a change in the location in which pollutants are emitted by aircraft. Because the change would be less than the significance threshold of ten in a million at any receptor, the Proposed Project would not result in a significant impact due to carcinogenic TAC emissions in 2015.

Table 3.3-17
INHALATION CANCER RISK IN 2015

Receptor	Inhalation Cancer Risk (Per Million)		Change in Cancer Risk
	Without Proposed Project	With Proposed Project	
1	0.2	0.1	*-0.1*
2	0.2	0.1	*-0.1*
3	0.4	0.2	*-0.2*
4	0.3	0.1	*-0.2*
5	0.4	0.2	*-0.2*
6	0.5	0.2	*-0.3*
7	0.6	0.3	*-0.3*
8	0.2	0.1	*-0.1*
9	0.5	0.2	*-0.3*
10	0.5	0.2	*-0.3*
11	0.1	0.1	*0.0*
12	0.3	0.1	*-0.2*
13 /a/	0.5	0.6	*0.1*
14	1.3	1.6	*0.3*
15 /a/	3.4	1.4	*-2.0*
16 /a/	2.2	0.9	*-1.3*
17	0.2	0.1	*-0.1*
18	0.2	0.1	*-0.1*
19	0.7	0.2	*-0.4*
20	1.4	0.6	*-0.9*
21	0.9	0.4	*-0.5*
22 /a/	3.5	4.3	*0.7*
23	0.3	0.1	*-0.2*
24	0.1	0.1	*-0.1*
25	0.1	0.0	*-0.1*

/a/ Receptors representing workers, all other receptors represent residences except Receptor 14 which represents Sonoma County Jail.

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Mitigation Measure 3.3.4

No mitigation is warranted.

Impact 3.3.5: Changes in Acute Non-Cancer Hazards TAC Emissions in 2015

Table 3.3-18 presents the Acute Hazard Index, which measures the potential affect of short-term (1-hour) exposures to TAC. An HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. HIs greater than one are shown in bold and italic text.

Table 3.3-18
ACUTE NON-CANCER HAZARD INDEX FOR 2015

Receptor	Without Proposed Project						With Proposed Project					
	Bronchi	Eyes	Nose	Throat	Nervous System	Respiratory System	Bronchi	Eyes	Nose	Throat	Nervous System	Respiratory System
1	0.00	0.38	0.00	0.00	0.00	0.29	0.00	0.44	0.00	0.00	0.00	0.34
2	0.00	0.28	0.00	0.00	0.00	0.22	0.00	0.42	0.00	0.00	0.00	0.33
3	0.00	0.33	0.00	0.00	0.00	0.25	0.00	0.56	0.00	0.00	0.00	0.44
4	0.00	0.50	0.00	0.00	0.00	0.39	0.01	0.66	0.01	0.01	0.00	0.51
5	0.00	0.46	0.00	0.00	0.00	0.36	0.01	0.69	0.01	0.01	0.00	0.54
6	0.01	0.63	0.01	0.01	0.00	0.49	0.01	0.80	0.01	0.01	0.00	0.62
7	0.00	0.46	0.00	0.00	0.00	0.36	0.01	0.88	0.01	0.01	0.00	0.68
8	0.00	0.28	0.00	0.00	0.00	0.22	0.00	0.34	0.00	0.00	0.00	0.27
9	0.00	0.33	0.00	0.00	0.00	0.25	0.00	0.46	0.00	0.00	0.00	0.36
10	0.00	0.33	0.00	0.00	0.00	0.26	0.00	0.59	0.00	0.00	0.00	0.46
11	0.00	0.33	0.00	0.00	0.00	0.25	0.00	0.32	0.00	0.00	0.00	0.25
12	0.00	0.39	0.00	0.00	0.00	0.30	0.00	0.34	0.00	0.00	0.00	0.27
13 /a/	0.00	0.52	0.00	0.00	0.00	0.40	0.01	0.68	0.01	0.01	0.00	0.53
14	0.01	0.67	0.01	0.01	0.00	0.52	0.01	***1.38***	0.01	0.01	0.00	***1.07***
15 /a/	0.01	0.74	0.01	0.01	0.00	0.58	0.01	0.68	0.01	0.01	0.00	0.53
16 /a/	0.00	0.51	0.00	0.00	0.00	0.40	0.00	0.59	0.00	0.00	0.00	0.46
17	0.00	0.25	0.00	0.00	0.00	0.20	0.00	0.32	0.00	0.00	0.00	0.25
18	0.00	0.22	0.00	0.00	0.00	0.17	0.00	0.24	0.00	0.00	0.00	0.19
19	0.00	0.36	0.00	0.00	0.00	0.28	0.00	0.32	0.00	0.00	0.00	0.25
20	0.00	0.34	0.00	0.00	0.00	0.27	0.01	0.66	0.01	0.01	0.00	0.51
21	0.00	0.41	0.00	0.00	0.00	0.32	0.01	0.64	0.01	0.01	0.00	0.50
22 /a/	0.01	***1.50***	0.01	0.01	0.00	***1.17***	0.01	***1.74***	0.01	0.01	0.00	***1.36***
23	0.00	0.39	0.00	0.00	0.00	0.30	0.01	0.68	0.01	0.01	0.00	0.53
24	0.00	0.45	0.00	0.00	0.00	0.35	0.00	0.28	0.00	0.00	0.00	0.22
25	0.00	0.18	0.00	0.00	0.00	0.14	0.00	0.18	0.00	0.00	0.00	0.14

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-18 shows that the overall HI for the bronchi, nose, and throat would be much less than 1; therefore, the increase in Acute HI for these systems would not result in a significant acute non-cancer health effect. **Table 3.3-18** also shows that the Acute HI for eyes and the respiratory system exceeds 1 at Receptors 14 and 22. In addition to noting that these Acute HIs indicate that sensitive persons in the area near Receptors 14 and 22 could experience eye irritation and tearing, having an Acute HI of greater than 1 also is used to focus the analysis to determine whether a significant acute non-cancer health effect would occur. Thus, additional analysis was conducted to determine whether the change in the Acute HI for eyes and the respiratory system would exceed the significance threshold of 1.

The total Acute HI for eyes in 2015 without and with the Proposed Project is presented in **Table 3.3-19**, which shows the Acute HI for eyes would increase by less than the significance threshold of 1. Therefore, the Proposed Project would not result in a significant impact due to acute (1-hour) exposures to non-cancer TACs that affect the eyes.

The total Acute HI for the respiratory system in 2015 without and with the Proposed Project is presented in **Table 3.3-20**, which shows the Acute HI for the respiratory system would increase by less than the significance threshold of 1. Therefore, the Proposed Project would not result in a significant impact due to acute (1-hour) exposures to non-cancer TACs that affect the respiratory system.

Mitigation Measure 3.3.5

No mitigation is warranted.

Impact 3.3.6: Changes in 8-Hour Non-Cancer Hazards TAC Emissions in 2015

Table 3.3-21 presents the 8-hour HI, which measures the potential affect of longer term exposures to TAC in 2015 without and with the Proposed Project. An HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. HIs greater than one are shown in bold and italic text.

The 8-hour HIs at Receptor 22 are greater than 1. In addition to noting that these Acute HIs indicate that sensitive persons with asthma or allergies spending moderate times (i.e., approximately 8 hours) in the area near Receptor 22 may experience increased symptoms and impaired lung function. Other sensitive persons may experience respiratory tract irritation and increased mucus production Having an 8-hour HI of greater than 1 also is used to focus the analysis to determine whether a significant 8-hour non-cancer health effect would occur. Thus, additional analysis was conducted to determine whether the change in the 8-hour HI for the respiratory system would exceed the significance threshold of 1.

Table 3.3-21 shows that the 8-hour HI for respiratory system is not projected to increase by more than the significance threshold of 1 as a result of the Proposed Project. Therefore, the Proposed Project would not result in a significant impact due to 8-hour exposures of TACs.

Mitigation Measure 3.3.6

No mitigation is warranted.

Table 3.3-19
ACUTE HAZARD INDEX FOR EYES IN 2015

Receptor	Acute Hazard Index for Eyes		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
14	0.67	1.38	*0.71*
15 /a/	0.74	0.68	*-0.07*
22 /a/	1.50	1.74	*0.24*

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-20
ACUTE HAZARD INDEX FOR RESPIRATORY SYSTEM IN 2015

Receptor	Acute Hazard Index for Respiratory System		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
14	0.52	1.07	*0.55*
22 /a/	1.17	1.36	*0.19*

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-21
8-HOUR NON-CANCER HAZARD INDEX IN 2015

Receptor	8-Hour Hazard Index for Respiratory System		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
1	0.29	0.23	*-0.06*
2	0.27	0.18	*-0.09*
3	0.33	0.40	*0.07*
4	0.38	0.25	*-0.13*
5	0.52	0.40	*-0.12*
6	0.55	0.41	*-0.13*
7	0.50	0.64	*0.14*
8	0.23	0.20	*-0.03*
9	0.41	0.30	*-0.11*
10	0.33	0.36	*0.03*
11	0.21	0.23	*0.02*
12	0.24	0.25	*0.01*
13 /a/	0.57	0.63	*0.06*
14	0.79	0.83	*0.04*
15 /a/	0.53	0.52	*-0.01*
16 /a/	0.46	0.35	*-0.10*
17	0.12	0.19	*0.07*
18	0.22	0.23	*0.02*
19	0.27	0.22	*-0.05*
20	0.39	0.34	*-0.05*
21	0.37	0.27	*-0.10*
22 /a/	***1.75***	***1.25***	*-0.50*
23	0.26	0.35	*0.10*
24	0.13	0.28	*0.15*
25	0.16	0.17	*0.00*

/a/ Receptors representing workers, all other receptors represent residences except Receptor 14 which represents Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Impact 3.3.7: Changes in Chronic Non-Cancer Hazards due to TAC Emissions in 2015

Tables 3.3-22 and **3.3-23** present the Chronic Hazard Index without the Proposed Project and with the Proposed Project, respectively. The Chronic Hazard Index measures the potential impact of long term (annual) exposures to TAC. An HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health effect.

Chronic Hazard Indices were calculated to examine the non-cancer effects from chronic (annual) exposures to TACs. HIs were calculated for the respiratory system, development, hematologic system, nervous system, eyes, alimentary system (liver), kidney, endocrine system, reproductive system, and cardiovascular system. The results of these calculations are presented in **Tables 3.3-22** and **3.3-23**. These calculations show that the Acute HI for all systems other than the respiratory system were less than 0.01 in 2015 for both conditions with and without the project.

The highest Chronic HI for the respiratory system of 0.27 is projected to occur at Receptor 22 with the Proposed Project. The HI at Receptor 22 is 0.22 without the Proposed Project. All other receptors are projected to experience Chronic HI for the respiratory system of less than 0.10.

Because no single Chronic HI exceeds one, then the increase in Chronic HI cannot exceed one. Therefore, the Proposed Project would not result in a significant impact due to the release of TACs that may cause chronic health impacts to these organ systems.

Mitigation Measure 3.3.7

No mitigation is warranted.

Table 3.3-22
CHRONIC NON-CANCER HAZARD INDEX FOR 2015 WITHOUT PROPOSED PROJECT

Receptor	Chronic Hazard Index for Respiratory System
1	0.00
2	0.00
3	0.00
4	0.00
5	0.00
6	0.01
7	0.01
8	0.00
9	0.01
10	0.01
11	0.00
12	0.00
13/a/	0.02
14	0.05
15/a/	0.05
16/a/	0.03
17	0.00
18	0.00
19	0.01
20	0.02
21	0.01
22/a/	0.16
23	0.00
24	0.00
25	0.00

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-23
CHRONIC NON-CANCER HAZARD INDEX FOR 2015 WITH PROPOSED PROJECT

Receptor	Chronic Hazard Index for Respiratory System
1	0.00
2	0.00
3	0.01
4	0.01
5	0.01
6	0.01
7	0.02
8	0.01
9	0.01
10	0.01
11	0.01
12	0.01
13/a/	0.04
14	0.09
15/a/	0.08
16/a/	0.05
17	0.00
18	0.01
19	0.01
20	0.03
21	0.02
22/a/	0.27
23	0.01
24	0.00
25	0.00

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Impact 3.3.8: Operational Increases in Criteria Air Pollutant Emissions in 2030

The Proposed Project would result in an incremental long-term increase in total air pollutant emissions compared to the existing condition. The increase is due to additional taxi-time and the growth in activity that is expected to occur.

Additional Taxi-Time

Emissions due to aircraft taxiing would increase as compared to the conditions without the Proposed Project because the extension of the runways and taxiways would result in aircraft having to taxi farther from the apron areas to the ends of the runways. Longer taxi-times increase annual aircraft emissions because the engines are operating for a longer duration.

Increased Activity

Aviation activity at the Airport is expected to increase. In 2030 there would be 173,785 annual operations, which is an approximate 91 percent increase. Aviation activity (take offs and landings) represents the largest contributor of emissions at the Airport; however, this increase is anticipated to occur with or without the implementation of the Proposed Project.

The inventory of criteria pollutant emissions for 2030 are presented in **Table 3.3-24** for conditions without the Proposed Project and in **Table 3.3-25** for conditions with the Proposed Project. These tables show the greatest overall emission contribution comes from aircraft operations.

Table 3.3-26 presents the change in criteria pollutant emissions in 2030 when comparing the emissions that would occur with the Proposed Project to the emissions that would occur without the Proposed Project. **Table 3.3-26** shows that the total change in criteria pollutant emissions would not exceed any of the BAAQMD significance thresholds.

Mitigation Measure 3.3.8

No mitigation is warranted.

Table 3.3-24
2030 EMISSIONS INVENTORY WITHOUT PROPOSED PROJECT

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**

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

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-25
2030 EMISSIONS INVENTORY WITH PROPOSED PROJECT

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**

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

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-26

ANNUAL NET IMPACT OF CRITERIA AND PRECURSOR POLLUTANT EMISSIONS IN 2030

	ANNUAL CRITERIA AND PRECURSOR POLLUTANT EMISSIONS IN 2030 (in tons per year)							
	CO	**VOC**	**TOG**	**NO_x**	**SO_x**	**PM_{10}**	**$PM_{2.5}$**	**Pb**
Without Proposed Project	1,357.41	56.96	61.23	51.79	7.85	21.64	21.64	0.95
With Proposed Project	1,277.24	49.20	53.04	50.77	7.12	22.37	22.37	0.91
Net Change	*80.17*	*7.76*	*8.19*	*1.01*	*0.73*	*-0.72*	*-0.72*	*0.04*
BAAQMD Threshold /a/	**NA**	**NA**	**10**	**10**	**NA**	**15**	**10**	**NA**

/a/ BAAQMD Significance Thresholds are defined in both lbs/day and ton/year. These thresholds are functionally equivalent as the lbs/day threshold is just the tons/year threshold divided by 365 days.

CO: Carbon Monoxide
NOx: Nitrogen Oxides
PM2.5: Fine particulate matter
VOC: Volatile Organic Compounds
SOx: Sulfur Oxides
Pb: Lead
TOG: Total Organic Gases
PM10: Course particulate matter
NA = Not applicable/Not available
Total emissions may not sum exactly due to rounding.

SOURCE: EDMS Version 5.1.3, 2011
PREPARED BY: L&B, 2011

Impact 3.3.9: Operational Increases in Greenhouse Gas Emissions in 2030

As for the criteria pollutants discussed above, the Proposed Project would result in an incremental long-term increase in total GHG emissions. The increase is due to additional taxi-time and the increase in aircraft operations that would occur as a result of the Proposed Project.

The inventory of airport related GHG emissions for 2015 are presented in **Table 3.3-27** for 2030 conditions without the Proposed project and in **Table 3.3-28** for conditions in 2030 with the Proposed Project. These tables show the greatest overall emission contribution comes from aircraft operations.

Table 3.3-29 presents the change in GHG emissions in 2030 when comparing the GHG emissions that would occur with the Proposed Project to the GHG emissions that would occur without the Proposed Project. **Table 3.3-29** shows that the total change in GHG emissions would exceed the BAAQMD significance threshold. This is considered to be a significant impact.

Mitigation Measure 3.3.9

Tables 3.3-27 and 3.3-28 show that the greatest increases in GHG emissions are from aircraft. Emissions from aircraft cannot be substantially reduced though direct mitigation as the County cannot reasonably impose mitigation on private aircraft. No viable mitigation measures are available and this would be considered a significant and unavoidable impact.

Table 3.3-27
2030 GHG EMISSIONS WITHOUT PROPOSED PROJECT

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
CO_2: Carbon Dioxide
GWP: Global Warming Potential
CH4: Methane
CO_2e: Carbon Dioxide equivalent
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.

SOURCE: IPCC Fourth Assessment Report, 2011
PREPARED BY: L&B, 2011

Table 3.3-28
2030 GHG EMISSIONS WITH PROPOSED PROJECT

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
GWP_{100}	*1.00*	*25.00*	*298.00*
CO_{2e}	11,246.82	78.12	83.64
Total	**11,408.57**		

GAV: Ground Access Vehicles
CO_2: Carbon Dioxide
GWP: Global Warming Potential
CH4: Methane
CO_2e: Carbon Dioxide equivalent
N20: Nitrogen Dioxide (nitrous oxide)
Total emissions may not sum exactly due to rounding.

SOURCE: IPCC Fourth Assessment Report, 2011
PREPARED BY: L&B, 2011

Table 3.3-29
ANNUAL NET IMPACT OF GREENHOUSE GAS EMISSIONS IN 2030

	ANNUAL GHG EMISSIONS (in metric tons per year)
Without Proposed Project	10,261.80
With Proposed Project	11,408.57
Net Change	***1,146.77***
BAAQMD Threshold	**1,100**

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Impact 3.3.10: Changes in Cancer Risk due to TAC Emissions in 2030

The total Inhalation Cancer risk due to emissions of carcinogenic TACs are presented in **Table 3.3-30**, which shows that change as a result of the Proposed Project would be less than the significance threshold of ten in a million at any receptor. Therefore, the Proposed Project would not result in a significant impact due to carcinogenic TAC emissions in 2030.

Table 3.3-30
INHALATION CANCER RISK IN 2030

Receptor	Inhalation Cancer Risk (Per Million)		Change in Cancer Risk
	Without Proposed Project	With Proposed Project	
1	0.1	0.1	*0.0*
2	0.1	0.1	*0.0*
3	0.2	0.2	*0.1*
4	0.1	0.2	*0.0*
5	0.2	0.2	*0.1*
6	0.2	0.3	*0.1*
7	0.3	0.3	*0.1*
8	0.1	0.1	*0.0*
9	0.2	0.3	*0.0*
10	0.2	0.3	*0.0*
11	0.1	0.1	*0.0*
12	0.1	0.2	*0.0*
13 /a/	0.7	0.8	*0.2*
14	1.6	2.0	*0.4*
15 /a/	1.4	1.7	*0.3*
16 /a/	0.9	1.0	*0.2*
17	0.1	0.1	*0.0*
18	0.1	0.1	*0.0*
19	0.3	0.3	*0.0*
20	0.6	0.7	*0.1*
21	0.3	0.4	*0.1*
22 /a/	5.0	6.1	*1.1*
23	0.1	0.1	*0.0*
24	0.1	0.1	*0.0*
25	0.0	0.0	*0.0*

/a/ Receptors representing workers, all other receptors represent residences except Receptor 14 which represents Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Mitigation Measure 3.3.10

No mitigation is warranted.

Impact 3.3.11: Changes in Acute Non-Cancer Hazards TAC Emissions in 2030

Table 3.3-31 presents the Acute Hazard Index, which measures the potential affect of short-term (1-hour) exposures to TAC. An HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. HIs greater than one are shown in bold and italic text.

Table 3.3-31 shows that the overall HI for the bronchi, nose, and throat would be much less than one; therefore, the increase in Acute HI for these systems would not result in a significant acute non-cancer health effect. **Table 3.3-31** also shows that the Acute HI for eyes exceeds 1 at Receptors 13, 14 and 22. In addition to noting that these Acute HIs indicate that sensitive persons in the area near Receptors 13, 14 and 22 could experience eye irritation and tearing, having an Acute HI of greater than 1 also is used to focus the analysis to determine whether a significant acute non-cancer health effect would occur. **Table 3.3-31** also shows that the Acute HI for respiratory systems exceeds 1 at Receptors 14 and 22. In addition to noting that these Acute His indicate that persons with asthma or allergies may experience irritation of the nose and throat, an increase in mucus secretion, and an exacerbation of pre-existing asthma and allergies in the area near Receptors 14 and 22, having an Acute HI of greater than 1 also is used to focus the analysis to determine whether a significant acute non-cancer health effect would occur. Thus, additional analysis was conducted to determine whether the change in the Acute HI for eyes and the respiratory system would exceed the significance threshold of 1.

The total Acute HI for eyes in 2030 without and with the Proposed Project is presented in **Table 3.3-32**, which shows the Acute HI for eyes would increase by less than the significance threshold of 1. Therefore, the Proposed Project would not result in a significant impact due to acute (1-hour) exposures to non-cancer TACs that affect the eyes.

The total Acute HI for the respiratory system in 2030 without and with the Proposed Project is presented in **Table 3.3-33**, which shows the Acute HI for the respiratory system would increase by less than the significance threshold of 1. Therefore, the Proposed Project would not result in a significant impact due to acute (1-hour) exposures to non-cancer TACs that affect the respiratory system.

Mitigation Measure 3.3.11

No mitigation is warranted.

Table 3.3-31
ACUTE NON-CANCER HAZARD INDEX FOR 2030

Receptor	Without Proposed Project						With Proposed Project					
	Bronchi	Eyes	Nose	Throat	Nervous System	Respiratory System	Bronchi	Eyes	Nose	Throat	Nervous System	Respiratory System
1	0.00	0.56	0.00	0.00	0.00	0.44	0.00	0.39	0.00	0.00	0.00	0.31
2	0.00	0.39	0.00	0.00	0.00	0.31	0.00	0.42	0.00	0.00	0.00	0.33
3	0.00	0.51	0.00	0.00	0.00	0.39	0.00	0.54	0.00	0.00	0.00	0.42
4	0.00	0.52	0.00	0.00	0.00	0.40	0.01	0.78	0.01	0.01	0.00	0.61
5	0.00	0.57	0.00	0.00	0.00	0.44	0.01	0.81	0.01	0.01	0.00	0.63
6	0.01	0.73	0.01	0.01	0.00	0.57	0.01	0.76	0.01	0.01	0.00	0.59
7	0.01	0.69	0.01	0.01	0.00	0.54	0.00	0.61	0.00	0.00	0.00	0.47
8	0.00	0.31	0.00	0.00	0.00	0.24	0.00	0.30	0.00	0.00	0.00	0.23
9	0.01	0.81	0.01	0.01	0.00	0.63	0.00	0.51	0.00	0.00	0.00	0.40
10	0.00	0.47	0.00	0.00	0.00	0.36	0.00	0.53	0.00	0.00	0.00	0.42
11	0.00	0.30	0.00	0.00	0.00	0.23	0.00	0.32	0.00	0.00	0.00	0.25
12	0.00	0.46	0.00	0.00	0.00	0.36	0.00	0.36	0.00	0.00	0.00	0.28
13 /a/	0.01	0.68	0.01	0.01	0.00	0.53	0.01	***1.01***	0.01	0.01	0.00	0.78
14	0.01	***1.16***	0.01	0.01	0.00	0.90	0.02	***1.92***	0.02	0.02	0.00	***1.50***
15 /a/	0.01	0.78	0.01	0.01	0.00	0.61	0.01	0.74	0.01	0.01	0.00	0.58
16 /a/	0.00	0.38	0.00	0.00	0.00	0.29	0.01	0.65	0.01	0.01	0.00	0.50
17	0.00	0.26	0.00	0.00	0.00	0.21	0.00	0.39	0.00	0.00	0.00	0.30
18	0.00	0.37	0.00	0.00	0.00	0.29	0.00	0.40	0.00	0.00	0.00	0.31
19	0.00	0.42	0.00	0.00	0.00	0.33	0.00	0.36	0.00	0.00	0.00	0.28
20	0.00	0.48	0.00	0.00	0.00	0.37	0.01	0.91	0.01	0.01	0.00	0.71
21	0.00	0.40	0.00	0.00	0.00	0.31	0.00	0.48	0.00	0.00	0.00	0.38
22 /a/	0.02	***2.54***	0.02	0.02	0.00	***1.98***	0.02	***2.77***	0.02	0.02	0.00	***2.16***
23	0.00	0.61	0.00	0.00	0.00	0.48	0.01	0.94	0.01	0.01	0.00	0.73
24	0.00	0.30	0.00	0.00	0.00	0.23	0.00	0.40	0.00	0.00	0.00	0.31
25	0.00	0.15	0.00	0.00	0.00	0.12	0.00	0.29	0.00	0.00	0.00	0.23

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-32
ACUTE HAZARD INDEX FOR EYES IN 2030

Receptor	Acute Hazard Index for Eyes		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
14	0.68	1.01	*0.32*
15 /a/	1.16	1.92	*0.76*
22 /a/	2.54	2.77	*0.23*

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-33
ACUTE HAZARD INDEX FOR RESPIRATORY SYSTEM IN 2030

Receptor	Acute Hazard Index for Respiratory System		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
14	0.90	1.50	*0.59*
22 /a/	1.98	2.16	*0.19*

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Impact 3.3.12: Changes in 8-Hour Non-Cancer Hazards TAC Emissions in 2030

Table 3.3-34 presents the 8-hour HI, which measures the potential affect of longer term exposures to TAC in 2030 without and with the Proposed Project. An HI of less than one indicates that there is little or no possibility for that substance to result in an adverse acute non-cancer health impact. HIs greater than one are shown in bold and italic text.

The Acute HIs at Receptors 14 and 22 are greater than 1 and indicate that sensitive persons with asthma or allergies spending moderate times (i.e., approximately 8 hours) in the area near the receptor may experience increased symptoms and impaired lung function. Other sensitive persons may experience respiratory tract irritation and increased mucus production.

Table 3.3-34 shows that the 8-hour HI for respiratory system is not projected to increase by more than the significance threshold of 1 as a result of the Proposed Project. Therefore, the Proposed Project would not result in a significant impact due to 8-hour exposures of TACs.

Table 3.3-34
8-HOUR NON-CANCER HAZARD INDEX IN 2030

Receptor	8-Hour Hazard Index for Respiratory System		Change in HI as a Result of the Proposed Project
	Without Proposed Project	With Proposed Project	
1	0.29	0.21	*-0.08*
2	0.27	0.31	*0.04*
3	0.41	0.51	*0.10*
4	0.38	0.47	*0.08*
5	0.52	0.63	*0.11*
6	0.55	0.50	*-0.05*
7	0.55	0.65	*0.10*
8	0.23	0.23	*0.00*
9	0.42	0.35	*-0.07*
10	0.33	0.31	*-0.02*
11	0.21	0.22	*0.01*
12	0.24	0.25	*0.01*
13 /a/	0.70	0.64	*-0.07*
14	0.88	***1.17***	*0.29*
15 /a/	0.63	0.58	*-0.04*
16 /a/	0.46	0.44	*-0.02*
17	0.16	0.26	*0.10*
18	0.22	0.23	*0.02*
19	0.27	0.29	*0.02*
20	0.40	0.50	*0.10*
21	0.37	0.34	*-0.03*
22 /a/	***1.78***	***2.00***	*0.22*
23	0.26	0.49	*0.23*
24	0.17	0.28	*0.11*
25	0.10	0.17	*0.07*

/a/ Receptors representing workers, all other receptors represent residences except Receptor 14 which represents Sonoma County Jail.

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Mitigation Measure 3.3.12

No mitigation is warranted.

Impact 3.3.13: Changes in Chronic Non-Cancer Hazards TAC Emissions in 2030

Chronic Hazard Indices were calculated to examine the non-cancer impacts from chronic (annual) exposures to TACs. HIs were calculated for the reparatory system, development,

hematologic system, nervous system, eyes, alimentary system (liver), kidney, endocrine system, reproductive system, and cardiovascular system. The results of these calculations are presented in **Tables 3.3-35** and **3.3-36**. These calculations show that the Acute HI for all systems other than the respiratory system were less than 0.01 in 2030 for both conditions with and without the Proposed Project.

With the Proposed Project, the highest Chronic HI for the respiratory system of 0.31 is projected to occur at Receptor 22. The HI at Receptor 22 is 0.29 without the Proposed Project in 2030. All other receptors are projected to experience Chronic HI for the respiratory system of less than 0.13.

Because no single Chronic HI exceeds 1, then the increase in Chronic HI cannot exceed 1. Therefore, the Proposed Project would not result in a significant impact due to the release of TACs that may cause chronic health impacts to these organ systems.

Mitigation Measure 3.3.13

No mitigation is warranted.

Impact 3.3.14: On-Airport Worker Exposures to TACs

The projected maximum 8-Hour concentration of TACs with Cal/OSHA Permissible Exposure Level (PEL) limits at Receptor 22, the on-airport receptors are presented in **Table 3.3-37**, which shows that projected concentrations are well below the PEL limits with most only a small fraction of the limit and only Glyoxal exceeding one percent of the limit. This table shows that on-site airport workers will not be significantly affected by TAC emissions.

Mitigation Measure 3.3.14

No mitigation is warranted.

Table 3.3-35
CHRONIC NON-CANCER HAZARD INDEX FOR 2030 WITHOUT PROPOSED PROJECT

Receptor	Chronic Hazard Index for Respiratory System
1	0.00
2	0.00
3	0.01
4	0.01
5	0.01
6	0.01
7	0.02
8	0.01
9	0.01
10	0.01
11	0.01
12	0.01
13*	0.04
14	0.09
15*	0.08
16*	0.05
17	0.01
18	0.01
19	0.01
20	0.03
21	0.02
22*	0.29
23	0.01
24	0.00
25	0.00

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-36
CHRONIC NON-CANCER HAZARD INDEX FOR 2030 WITH PROPOSED PROJECT

Receptor	Chronic Hazard Index for Respiratory System
1	0.01
2	0.01
3	0.02
4	0.01
5	0.02
6	0.02
7	0.02
8	0.01
9	0.02
10	0.02
11	0.01
12	0.01
13/a/	0.05
14	0.12
15/a/	0.10
16/a/	0.06
17	0.01
18	0.01
19	0.01
20	0.04
21	0.02
22/a/	0.31
23	0.01
24	0.00
25	0.00

/a/ Receptors representing workers, all others represent residences except Receptor 14, which represents the Sonoma County Jail

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011

Table 3.3-37
COMPARISON OF MAXIMUM ON-SITE 8-HOUR TAC CONCENTRATION TO CAL/OSHA PEL

TAC	Receptor 22 8-Hour Concentration (mg/m^3)	Cal/OSHA PEL (mg/m^3)	% of Limit
Formaldehyde	0.005712	0.94	0.61%
Methyl alcohol	0.000383	260	0.00015%
Acetone	0.000697	1200	0.00006%
Benzene	0.000896	3.25	0.028%
Propane	0.000111	1800	0.000006%
1-propyne	0.000002	1650	0.00000009%
Acetaldehyde	0.001828	45	0.0041%
Naphthalene	0.000242	50	0.00048%
Furfuryl alcohol	0.000382	40	0.0010%
Isopropylbenzene (cumene)	0.000009	245	0.0000037%
Ethylbenzene	0.000174	435	0.000040%
Styrene	0.000148	215	0.000069%
N-butane	0.000263	1900	0.000014%
1,3-butadiene	0.000692	2.2	0.031%
Acrolein (2-propenal)	0.000955	0.25	0.38%
Glyoxal	0.000211	0.01	2.1%
1,3,5-trimethylbenzene	0.000020	125	0.000016%
Methylcyclohexane	0.000007	1600	0.00000042%
Toluene	0.000663	188	0.00035%
Chlorobenzene	0.000001	46	0.0000016%
Phenol (carbolic acid)	0.000201	19	0.0011%
N-pentane	0.000188	1800	0.000010%
N-hexane	0.000109	180	0.000061%
Valeraldehyde	0.000052	175	0.000030%
Cyclohexane	0.000012	1050	0.0000011%
Cyclohexene	0.000011	1015	0.0000011%
N-octane	0.000023	1450	0.0000016%
N-nonane	0.000045	1050	0.0000043%
N-heptane	0.000078	1600	0.0000049%
Cyclopentane	0.000008	1720	0.00000044%
1-hexene	0.000318	180	0.00018%
Isomers of xylene	0.000746	435	0.00017%
Methyl styrene (mixed) (vinyl toluene)	0.000002	240	0.00000063%

SOURCE: L&B, 2011
PREPARED BY: L&B, 2011