Appendix C

Air Quality and Human Health Risk Assessment

City of Long Beach

Long Beach Airport Terminal Improvement Project
Environmental Impact Report No. 37-03

Appendix C
Air Quality Impact Analysis and Human Health Risk Assessment Technical Report

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List of Acronyms

AAC	Airport Advisory Commission
ACGIH	American Conference of Governmental Industrial Hygienists
AERMIC	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee
AERMOD	AERMIC Dispersion Model
ANOMS	Airport Noise and Operations Monitoring System
APU	Auxiliary Power Units
AQIA	Air Quality Impact Analysis
AQMP	Air Quality Management Plan
ATA	Air Transport Association
AVGAS	Aviation Gasoline
AVR	Average Vehicle Ridership
BACT	Best Available Control Technology
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CalTrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CATEF	California Air Toxics Emission Factor
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDI	Chronic Daily Intake
CEIDARS	California Emission Inventory and Reporting System
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CMP	Congestion Management Plan
CNEL	Community Noise Exposure Level
CNG	Compressed Natural Gas
CO	Carbon Monoxide
COPC	Chemical of Potential Concern
Cr(VI)	Chromium, Hexavalent
CSF	Cancer Slope Factor
DEIR	Draft Environmental Impact Report
DEM	Digital Elevation Model
DPM	Diesel (Exhaust) Particulate Matter
DTSC	Department of Toxic Substances Control
EDMS	Emissions and Dispersion Modeling System
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMFAC	Emission Factor Model for On-Road Mobile Sources

FAA	Federal Aviation Administration
FEIR	Final Environmental Impact Report
FOA	First Order Approximation (of aircraft PM emissions)
GA	General Aviation
GSE	Ground Support Equipment
H_2S	Hydrogen Sulfide
HARP	Hot Spots Analysis and Reporting Program
HC	Hydrocarbon (also Total Hydrocarbon)
HHRA	Human Health Risk Assessment
HI	Hazard Index
HIA	Hazard Index – Acute
HIC	Hazard Index – Chronic
HQ	Hazard Quotient
HVAC	Heating, Ventilating, and Air Conditioning
ICAO	International Civil Aviation Organization
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short-Term Model, Version 3.0
LGB	Long Beach Airport
LOS	Level of Service
LPG	Liquid Propane Gasoline
LST	Localized Significance Threshold
LTO	Landing/Takeoff Operation
MAP	Million Annual Passengers
MATES-II	Multiple Air Toxics Exposure Study
mg/m^3	milligrams per cubic meter
MOU	Memorandum of Understanding
MP	Multi-Pathway Adjustment Factor
MPO	Metropolitan Planning Organization
MRI	Midwest Research Institute
NAAQS	National Ambient Air Quality Standards
NCDC	National Climatic Data Center
NCP	National Contingency Plan
ng/m^3	nanograms per cubic meter
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NOP	Notice of Preparation
NOx	Oxides of Nitrogen, specifically NO and NO_2
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
PAH	Polycyclic Aromatic Hydrocarbons
Pb	Lead
PEL	Permissible Exposure Limit
PEL-TWA	Permissible Exposure Limit – Time-Weighted Average
PM	Particulate Matter

PM10	Particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (μm)
PM2.5	Particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers (μm)
ppb	parts per billion
ppm	parts per million
RAGS	Risk Assessment Guide for Superfund
REL	Reference Exposure Level
RfC	Reference Concentration
RfD	Reference Dose
ROC	Reactive Organic Compound
RTIP	Regional Transportation Improvement Plan
RTP	Regional Transportation Plan
SCAG	Southern California Association of Governments
SCAQMD	South Coast Air Quality Management District
SCEM	Site Conceptual Exposure Model
SIP	State Implementation Plan
SO_2	Sulfur Dioxide
$SO_4^=$	Sulfate
SoCAB	South Coast Air Basin
SRA	Source-Receptor Area
TAC	Toxic Air Contaminant
TIM	Time-in-Mode
TSA	Transportation Security Administration
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
US/OSHA	United States Occupational Safety and Health Administration
UTM	Universal Transverse Mercater
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
χ/Q	Chi-Over-Q, Concentration-to-Emissions Ratio
$\mu g/m^3$	micrograms per cubic meter

Section 1
Background

1.1 Introduction

The City of Long Beach (City) is the owner and operator of Long Beach Airport (LGB or Airport). This technical report presents the methodology and results of the air quality impact analysis (AQIA) and human health risk assessment (HHRA) conducted for the Draft Environmental Impact Report (DEIR) for the proposed Long Beach Airport Terminal Improvement Project (the Project or the proposed project). The proposed project is summarized in Section 1.3 below, and described more fully elsewhere in the DEIR.

This section of the AQIA and HHRA Technical Report provides general information on the project background, physical aspects, and alternatives. Section 2 presents the environmental setting; Section 3 discusses the methodology for estimating emissions and the emission inventories for alternatives considered; Section 4 describes the methodology for and results of estimating pollutant concentrations; Section 5 provides the health risk analysis methodology and results; Section 6 discusses uncertainties in the analysis; and Section 7 lists the references used in developing this technical report. The Protocol for Conducting an Air Quality Impact Analysis and Human Health Risk Assessment for the Long Beach Airport (protocol) is included as **Attachment A.** This protocol incorporates extensive input from the California Air Resources Board (CARB)[1,2] and South Coast Air Quality Management District (SCAQMD)[3,4].

1.2 Project Background

In June 2003, the City of Long Beach approved a scope of work for the preparation of an EIR to analyze the potential environmental impacts of possible improvements to the Airport's terminal area to accommodate passenger and cargo activity provided for under the existing Airport Noise Compatibility Ordinance. The project would also provide for required provisions for new security measures required by the Transportation Security Administration (TSA). The approved scope provided an opportunity for the City Council to reevaluate the scope of work after the project scoping process was complete to ensure the issues raised during the scoping process that were associated with the proposed improvements would be adequately addressed in the DEIR.

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[1] Conference call with CARB, June 7, 2005, regarding LGB Terminal Improvement Project – Draft Modeling Protocol dated May 20, 2005.
[2] Telephone conversation with CARB (G. Honcoop), June 23, 2005, regarding Aircraft Speciation Profiles.
[3] Meeting with SCAQMD, June 22, 2005, regarding LGB Terminal Improvement Project – Draft Modeling Protocol dated May 20, 2005.
[4] Meeting with SCAQMD, August 30, 2005, regarding LGB Terminal Improvement Project – Draft Modeling Protocol dated August 9, 2005.

The City held scoping meetings to solicit public input on October 11 and 16, 2003. Approximately 100 people attended the Saturday (October 11th) scoping meeting and approximately 200 people attended the Thursday (October 16th) scoping meeting. In addition, the City received 217 responses to the Notice of Preparation (a combination of letters, postcards and emails). The key issues raised through the scoping process were flight operations, air quality, health risk, noise, cumulative impacts, and land value. Recognizing the intense public interest, the City Council referred the scope of project and the scope of the EIR to the Airport Advisory Commission (AAC) for consideration.

The AAC held a series of meetings, open to the public, from November 2003 through July 2004 to consider recommendations on possible airport improvements and to advise on certain issues regarding scoping of the EIR. The AAC made recommendations regarding the project and technical studies to be prepared for the EIR. The City Council considered these recommendations on February 1 and 8, 2005. As a result of this process, changes were made to the improvements that would constitute the proposed project and be addressed in the EIR. The original 2003 scope of work focused just on impacts associated with construction of the facilities (i.e., a "bricks and mortar" project). Key changes to the EIR scope of work as a result of the AAC process and City Council action include providing a health risk assessment and providing a discussion of the environmental impacts associated with the operational environment at the Airport that could be accommodated within the existing Airport Noise Compatibility Ordinance. The revised Notice of Preparation (NOP) was issued April 14, 2005, and two additional scoping meetings were held, one in April and one in May 2005.

While the project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport, it was determined that the EIR should assess the impacts associated with the introduction of 25 commuter flights that could be accommodated at the Airport under the existing terms of the Airport Noise Compatibility Ordinance, even though these operations do not currently occur at the Airport.

The DEIR will also address the impacts associated with up to 52 commercial flights. This is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft, and still be within the noise limits ("noise bucket") permitted by the Airport Noise Compatibility Ordinance[5] . Both the addition of 25 commuter flights at the Airport and the potential increase of up to 11

[5] The permitted number of flights per day may be increased in each operator flight restriction category as long as the flights operate below the Community Noise Exposure Level (CNEL) budgets. In order for the number of flights to be increased and still comply with the Airport Noise Compatibility Ordinance the airlines would have to optimize their flight operations. This would include using quieter aircraft and reducing the number of late night operations. Under optimal conditions, which have never been achieved at LGB, the estimated number of increased flights would range between seven and eleven flights. The EIR will consider 11 flights as a worst-case scenario.

commercial flights over current operational levels (41 daily flights) at the Airport (which is the minimum number of commercial flights allowed by the Airport Noise Compatibility Ordinance) are not causally related to the project proposed facilities improvements, and any impacts would be applicable to all alternatives, including the No Project Alternative, because they could occur without any project-proposed improvements. If they occur, they will result from carrier decisions to optimize flight operations under the Airport Noise Compatibility Ordinance, rather than the availability of specific terminal facilities.

1.3 Project Location and Surrounding Uses

The project would be implemented at LGB in the City of Long Beach, Los Angeles County. The Airport is located on approximately 1,166 acres in central Long Beach. The street address for the Airport is 4100 East Donald Douglas Drive, Long Beach, California. Aviation activities are located just north of Interstate-405 (I-405) and generally bound by Cherry Avenue to the west, City of Lakewood and the future Douglas Park project to the north, and Lakewood Boulevard to the east. A site location map is provided in **Figure 1-1.**

Presently, LGB has five (5) runways, the longest being 10,000 feet. The Airport serves commercial carriers, general aviation, and air cargo. The area surrounding the Airport is generally developed and industrial (i.e., urban), rather than agricultural and rural in character. The layout of the existing facilities in the terminal area is provided in DEIR, Section 2.

Surrounding uses include existing Boeing property and industrial uses in City of Lakewood to the north. The City has approved a reuse plan titled "Douglas Park" for a portion of the Boeing property. That plan, which was approved in December 2004, provides for 261 acre of mixed-use development, including 3.3 million square feet of commercial and office space, 200,000 square feet of retail space, 1,400 residential units, 400 hotel rooms and 11 acres of park (City of Long Beach 2004a). The Skylinks Golf Course and the Airport Business Park are located to the east, and industrial and commercial uses to the south and west of the Airport. I-405 and several arterials surround the Airport; however, public access to the terminal area is gained only from Lakewood Boulevard on the east side of the Airport.

In 1941, the existing airport terminal was built to serve commercial carrier passengers. In 1984, a new concourse area and pre-boarding lounge were constructed immediately south of the existing terminal building. The 1984 improvements provided capacity for the City's court-mandated 15 daily flights, better accessibility for patrons with disabilities, improved mobility in the passenger screening process, and improved ticketing and check-in processing of airport users.

Between August 2001 and 2004, the number of passengers increased from 600,000 annual passengers to almost 3,000,000 annual passengers. The facilities at the Airport were not designed to adequately accommodate this level of increased number of

passengers. To help accommodate the growth, the Airport constructed two temporary holdrooms, temporary remote parking, and a new baggage claim area.

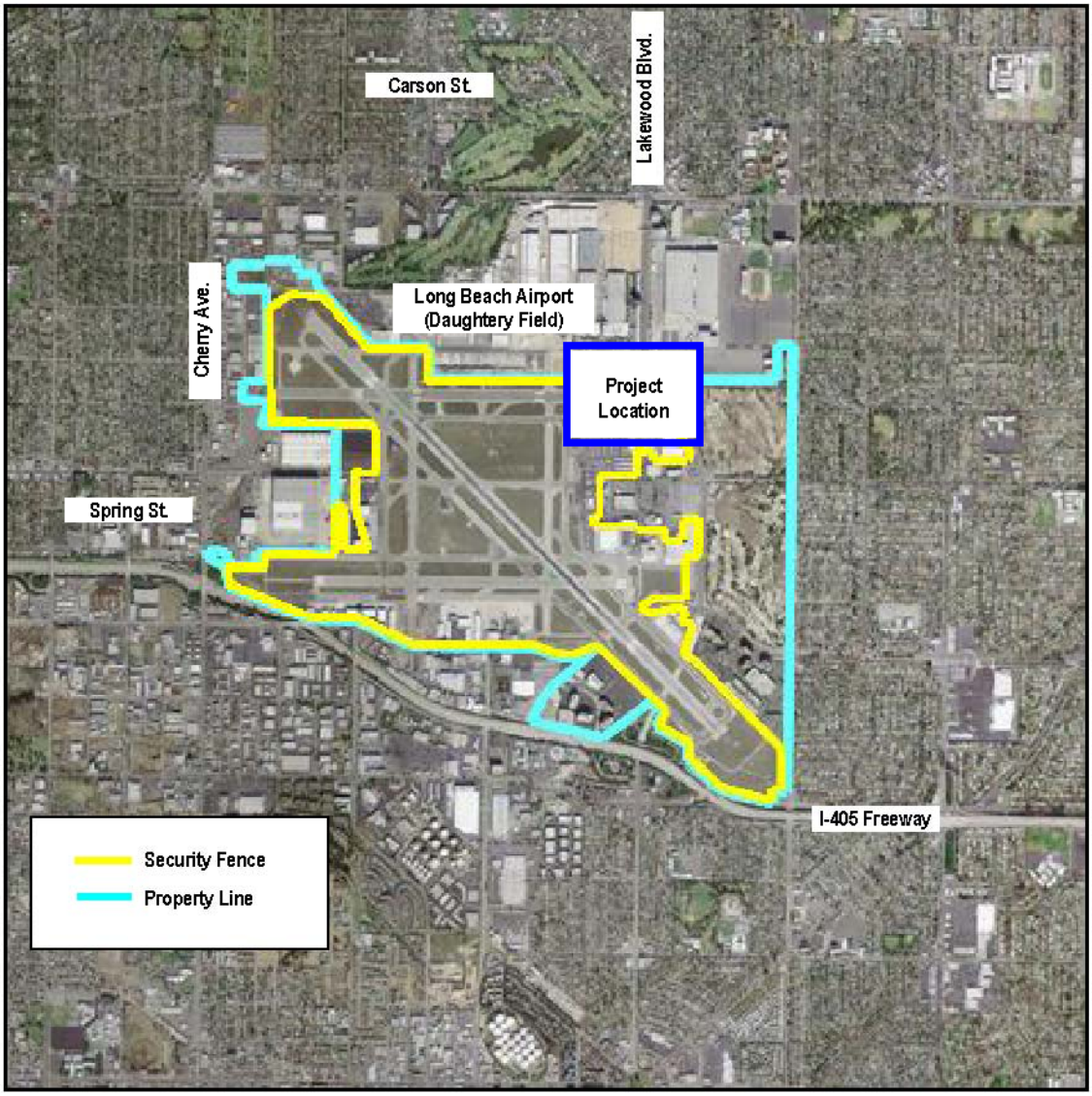

Figure 1-1
Site Location Map

The TSA started operations at LGB in October 2002 with the screening of passengers. On January 1, 2003, TSA initiated the screening of baggage at the Airport. They currently have 134 employees working at the Airport screening luggage and passengers. In addition, TSA currently has 17 ETD machines at the Airport for screening luggage and six stations for screening passengers.

1.4 Proposed Project

The proposed project description is provided in the Notice of Preparation (NOP) included as part of the protocol contained in Attachment A to this technical report. Additional project details are presented elsewhere in the DEIR.

1.4.1 Operations

As previously indicated, the DEIR will address impacts associated with the introduction of up to 25 commuter flights that could operate at the Airport consistent with the terms of the Airport Noise Compatibility Ordinance. The DEIR will also address impacts associated with up to 52 commercial flights (an increase of 11 flights), which is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft and still be within the "noise bucket" of the Airport Noise Compatibility Ordinance. The project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport. These flight levels were the basis for determining potential environmental impacts for all alternatives, including the No Project Alternative since the flight increase could occur with or without the proposed improvements.

1.4.2 Project Phasing

The project is designed to accommodate the current minimum permitted number of flights and passenger levels at the Airport. The actual phasing of the project will be determined based on availability of funding and service priorities. Design of the improvements would begin following the completion and certification of the Final EIR. Pending funding, it is anticipated that construction of the improvements would begin approximately one year following certification of the Final EIR. The construction would be phased to minimize impacts to operations at the Airport. Implementation of improvements to serve commuter service would be phased depending on the level of commuter services at the Airport.

For the AQIA and HHRA, it was assumed that the improvements would be phased as shown in **Table 1-1**. Since the emission rates for most mobile construction equipment decreases with time due to implementation of emission control regulations, the overall project completion was assumed to occur in 2011.

Table 1-1
Project Phasing

Project Element	Assumed Construction Start Date	Assumed Construction Duration or Completion Date
Parcel "O" Grading/Paving	March 2006	3 Months
Parking Structure	June or July 2006[1]	18 Months
Phase I – Terminal Improvements	March 2007	24 Months
Phase II – Commuter Aircraft Parking	2009	2011/2012[2]

Sources: BonTerra 2005a; City of Long Beach 2005a; and CDM 2005.
[1] July 2006 is the assumed start of construction for the parking structure in this air quality analysis.
[2] 2011 is the assumed year of completion for this air quality analysis.

1.5 Project Alternatives

The City of Long Beach will also evaluate project alternatives providing various levels of facilities improvements. The level of analysis for the air quality and health risk assessment will vary from a comprehensive evaluation of the proposed project to a qualitative evaluation, which discusses similarities and potential differences between the proposed project and the alternatives. The EIR will consider four project alternatives as well as the proposed project. The characteristics of the alternatives compared to the proposed project are presented in NOP (see Attachment A).

Alternative A assumes the size of the terminal facility would be slightly less than the size for the proposed project. The nature of the improvements would generally be the same as the proposed project, though compared to the proposed project, there are minor reductions in square footage in all except the following categories:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- The amount of airport office space is increased compared to the proposed project.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative A as for the proposed project.

Alternative B assumes the terminal facility is further reduced. Similar to Alternative A, the nature of the improvements would generally be the same, though reduced in size compared to the proposed project, with the following exceptions:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- No additional airport office space is assumed as part of this alternative.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative B as for the proposed project.

Alternative C is the No Project Alternative. This alternative assumes no change to existing conditions. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed and remote parking will continue to be leased through Boeing.

Qualitative analysis with regard to air quality and health risk will be conducted for a fourth alternative. Alternative D is a roll-back alternative in that it assumes no new facilities would be provided and that the temporary facilities currently in use would be removed. The terminal would be limited to the original terminal building. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed and the leased parking spaces are assumed not to be available because of the nature (month-to-month) of the lease.

Section 2
Environmental Setting

2.1 Regulatory Setting

In response to concerns about air pollution, Federal, State, and local authorities have adopted various rules and regulations requiring evaluation of air quality impacts of planned projects and appropriate mitigation for air pollutant emissions. The following discussion focuses on current air quality planning efforts and the responsibilities of agencies involved in these efforts. A discussion of ambient air quality standards is also provided.

2.1.1 Federal

The U.S. Environmental Protection Agency (USEPA) is responsible for implementation of the Federal Clean Air Act (CAA). The CAA was first enacted in 1955 and has been amended numerous times in subsequent years (1963, 1965, 1967, 1970, 1977, 1990, and 1997). Under the authority granted by the CAA, USEPA has established National Ambient Air Quality Standards (NAAQS) for the following criteria pollutants: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM10 and PM2.5), and sulfur dioxide (SO_2). **Table 2-1** presents the NAAQS that are currently in effect for criteria air pollutants. O_3 is a secondary pollutant, meaning that it is formed from reactions of "precursor" compounds under certain conditions. The primary precursor compounds that can lead to the formation of O_3 include volatile organic compounds (VOC) and oxides of nitrogen (NOx).

The CAA also specifies future dates for achieving compliance with the NAAQS and mandates that states submit and implement a State Implementation Plan (SIP) for local areas not meeting these standards. These plans must include pollution control measures that demonstrate how the standards will be met. The 1990 amendments to the CAA identify specific emission reduction goals for areas not meeting the NAAQS. These amendments require both a demonstration of reasonable further progress toward attainment and incorporation of additional sanctions for failure to attain or meet interim milestones.

The cities of Long Beach, Lakewood, and Signal Hill are included in the South Coast Air Basin (SoCAB or Basin), which is a subregion of the SCAQMD's jurisdiction including all of Orange County and the non-desert portions of Los Angeles, Riverside, and San Bernardino counties. The SoCAB is designated as a federal non-attainment area for O_3, PM10, PM2.5, and CO[6]. Non-attainment designations are categorized into levels of severity based on the level of concentration above the standard, which is also used to set the required attainment date. The SoCAB was reclassified in 1998 from non-attainment to attainment/maintenance for NO_2 since concentrations of that

[6] At its March 4, 2005 meeting, the SCAQMD governing board announced that the SoCAB has met the federal CO NAAQS and will formally seek attainment designation from the USEPA. The USEPA will have 18 months upon receipt to process the SCAQMD's redesignation request.

pollutant dropped below (became better than) the NO_2 NAAQS in the early 1990s. Attainment/maintenance means that the pollutant is currently in attainment and that measures are included in the SIP to ensure that the NAAQS for that pollutant are not exceeded again. **Table 2-2** presents the attainment designation for each of the federal criteria air pollutants.

Table 2-1
National and California Ambient Air Quality Standards

Pollutant	Averaging Time	NAAQS Primary	NAAQS Secondary	CAAQS
Carbon monoxide (CO)	1 hour	35 ppm (40 mg/m^3)	N/A	20 ppm (23 mg/m^3)
	8-hour	9 ppm (10 mg/m^3)	N/A	9.0 ppm (10 mg/m^3)
Ozone (O_3)	1 hour	N/A[(1)]	N/A	0.09 ppm (180 µg/m^3)
	8-hour	0.08 ppm (157 µg/m^3)	Same as primary	0.07 ppm[(2)] (137 µg/m^3)
Nitrogen dioxide (NO_2)	1 hour	N/A	N/A	0.25 ppm (470 µg/m^3)
	Annual	0.053 ppm 100 µg/m^3)	Same as primary	N/A
Sulfur dioxide (SO_2)	1 hour	N/A	N/A	0.25 ppm (655 µg/m^3)
	3 hour	N/A	0.5 ppm (1300 µg/m^3)	N/A
	24 hour	0.14 ppm (365 µg/m^3)	N/A	0.04 ppm (105 µg/m^3)
	Annual	0.03 ppm (80 µg/m^3)	N/A	N/A
Respirable Particulate Matter (PM10)	24 hour	150 µg/m^3	Same as primary	50 µg/m^3
	Annual	50 µg/m^3	Same as primary	20 µg/m^3
Fine Particulate Matter (PM2.5)	24 hour	65 µg/m^3	Same as primary	N/A
	Annual	15 µg/m^3	Same as primary	12 µg/m^3
Lead (Pb)	Monthly	N/A	N/A	1.5 µg/m^3
	Quarterly	1.5 µg/m^3	Same as primary	N/A
Sulfates (SO_4^{2-})	24 hour	N/A	N/A	25 µg/m^3
Hydrogen sulfide (H_2S)	1 hour	N/A	N/A	0.03 ppm (42 µg/m^3)
Vinyl chloride	24 hour	N/A	N/A	0.01 ppm (26 µg/m^3)

Sources: 40 CFR 50; 17 CCR 70200; and CARB 2005a.
(1) The ozone 1-hour NAAQS was revoked by USEPA on June 15, 2005.
(2) The ozone 8-hour CAAQS was approved by CARB on April 28, 2005, and is expected to become effective in early 2006.
mg/m^3 = milligrams per cubic meter
N/A = Not applicable or not available
ppm = parts per million by volume
µg/m^3 = micrograms per cubic meter

Table 2-2
South Coast Air Basin Attainment Status[1]

Pollutant	National Standards	California Standards
Ozone (O_3)	Nonattainment – Severe 17	Nonattainment
Carbon monoxide (CO)	Nonattainment - Serious[2]	Nonattainment - Transitional[3]
Nitrogen dioxide (NO_2)	Attainment - Maintenance	Attainment
Sulfur dioxide (SO_2)	Attainment	Attainment
Respirable Particulate Matter (PM10)	Nonattainment - Serious	Nonattainment
Fine Particulate Matter (PM2.5)	Nonattainment	Nonattainment
Lead (Pb)	Attainment	Attainment

Source: CDM 2005
[1] Status as of September 19, 2005.
[2] The SCAQMD will formally seek redesignation to attainment/maintenance status based on its recent attainment of the CO standard.
[3] The Los Angeles County portion of the SoCAB was redesignated by CARB as attainment for the CO CAAQS, awaiting final State administrative process to officially change designation.

2.1.2 State

The California Clean Air Act (CCAA), signed into law in 1988, requires all areas of the state to achieve and maintain the California Ambient Air Quality Standards (CAAQS) by the earliest practical date. The CAAQS are at least as stringent, and often more stringent than the NAAQS. The currently applicable CAAQS are presented with the NAAQS in Table 2-1. The attainment status with regard to the CAAQS is presented in Table 2-2 for each pollutant.

The California Air Resources Board (CARB) has been granted jurisdiction over a number of air pollutant emission sources that operate in the state. Specifically, CARB has the authority to develop emission standards for on-road motor vehicles, as well as for stationary sources and some off-road mobile sources. In turn, CARB has granted authority to the regional air pollution control and air quality management districts to develop stationary source emission standards, issue air quality permits, and enforce permit conditions.

2.1.3 Regional

2.1.3.1 South Coast Air Quality Management District (SCAQMD)

The SCAQMD has jurisdiction over an area of 10,743 square miles consisting of Orange County and the non-desert portions of Los Angeles, Riverside and San Bernardino counties, and the Riverside County portions of the Salton Sea Air Basin and Mojave Desert Air Basin. The SoCAB is a subregion of the SCAQMD's jurisdiction and covers an area of 6,745 square miles. While air quality in this area has improved, the basin requires continued diligence to meet air quality standards.

The SCAQMD has adopted a series of Air Quality Management Plans (AQMPs) to meet the CAAQS and NAAQS. These plans require, among other emissions-reducing activities, control technology for existing sources; control programs for area sources and indirect sources; a permitting system designed to ensure no net increase in emissions from any new or modified permitted sources of emissions; transportation control measures; sufficient control strategies to achieve a five percent or more annual reduction in emissions (or 15 percent or more in a three-year period) for Reactive Organic Compounds (ROC)[7], NOx, CO, and PM10; and demonstration of compliance with CARB's established reporting periods for compliance with air quality goals.

The current, USEPA-approved SIPs for each federal nonattainment or maintenance pollutant in the SoCAB are summarized below:

- O_3 – SIP approved by USEPA on April 10, 2000 (65 FR 18903), based on the 1997 AQMP and a 1999 amendment to the 1997 AQMP.
- CO – SIP approved by USEPA on April 21, 1998 (63 FR 19661), based on the 1997 AQMP. The attainment demonstration lapsed in 2000. The 2003 AQMP provides the basis for a future maintenance plan, and such a CO maintenance plan was prepared in March 2005 and submitted to USEPA along with a request for redesignation to attainment status.
- PM10 – SIP approved by USEPA on April 18, 2003 (68 FR 19315), based on the 1997 AQMP, amendments to the 1997 AQMP submitted in 1998 and 1999, and further modifications to the 1997 AQMP submitted in a status report to USEPA in 2002.
- NO_2 – SIP approved by USEPA on July 24, 1998 (63 FR 39747), based on the 1997 AQMP. In this SIP approval, USEPA also redesignated the SoCAB from nonattainment to attainment/maintenance for NO_2.

On August 1, 2003, SCAQMD adopted a comprehensive update, the 2003 AQMP for the basin. The 2003 AQMP outlines the air pollution control measures needed to meet now superceded federal 1-hour standard for O_3 by 2010[8], and to meet the federal PM10 standard by 2006. It also demonstrates how the federal standard for CO, achieved for the first time at the end of 2002, will be maintained. Lastly, the plan takes a preliminary look at what will be needed to achieve new and more stringent health standards for O_3 and PM2.5. The 2003 AQMP was approved by CARB and submitted to USEPA for its final approval on January 9, 2004.

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[7] Reactive organic compounds (ROC) and volatile organic compounds (VOC) are designations made by CARB and USEPA, respectively, for organic compounds that can react with NOx in the presence of sunlight to form O_3. Slight variations exist between the two designations; for example, the CARB definition of ROC includes ethane while the USEPA definition of VOC does not.

[8] In 1997, the USEPA adopted a new 8-hour O_3 NAAQS, and on June 15, 2005, the previous 1-hour O_3 NAAQS was revoked.

In adopting the 2003 AQMP, the SCAQMD: (1) committed to analyzing 12 additional long-term control measures, such as requiring the electrification of all cranes at ports; (2) set a target for distributing needed long-term emission reductions between SCAQMD, CARB and USEPA; (3) assigned emission reductions to USEPA (in the event that USEPA rejects the plan due to the assignment, the plan will drop the provision); and (4) forwarded to CARB and USEPA a list of more than 30 specific measures for consideration to further reduce emissions from on- and off-road mobile sources and consumer products. The 2003 AQMP also identifies 26 air pollution control measures to be adopted by SCAQMD to further reduce emissions from businesses, industry and paints. It also identifies 22 measures to be adopted by CARB and USEPA to further reduce pollution from cars, trucks, construction equipment, aircraft, ships and consumer products.

The SCAQMD also adopts rules to implement portions of the AQMP. Several of these rules may apply to construction or operation of the project. For example, Rule 403 requires the implementation of best available fugitive dust control measures during active operations capable of generating fugitive dust emissions from onsite earth-moving activities, construction/ demolition activities, and construction equipment travel on paved and unpaved roads.

Certain stationary sources of air pollution that may be part of the project (e.g., heaters and generators) may require permits from the SCAQMD pursuant to Rules 201, 202 and 203. Emission increases related to those sources may also be subject to SCAQMD Regulation XIII or Regulation XXX which, among other things, requires that Best Available Control Technology (BACT) be utilized to reduce pollutants and that any increases of criteria air pollutants be offset by achieving equivalent emission reductions at a facility within the SoCAB. Emergency equipment, however, is exempt from modeling and offset requirements (Rule 1304) and does not require a health risk assessment (Rule 1401).

In addition to the AQMP and its rules and regulations, the SCAQMD published a handbook (CEQA Air Quality Handbook; most recent version: November 1993, with some section updates and guidance available from http://www.aqmd.gov) that is intended to provide local governments with guidance for analyzing and mitigating project-specific air quality impacts for both land use and permitting projects. The Handbook provides standards, methodologies and procedures for conducting air quality analyses in EIRs and was used extensively in the preparation of this analysis. The Handbook was used to develop the project air quality and human health risk assessment protocol contained in Attachment A of this appendix.

2.1.3.2 Southern California Association of Governments (SCAG)

Under the conformity regulations (40 CFR 93) of the CAA, SCAG is the metropolitan planning organization (MPO) responsible for coordinating the development of transportation infrastructure in the Southern California region such that air quality objectives as well as transportation goals are included in regional transportation

plans. SCAG estimates population and business growth in the region, and uses these estimates to predict future vehicle miles traveled (VMT) which represents demand on the regional roadway system. Demand for ports, airports, and train stations are also determined. From the demand estimates, SCAG develops the Regional Transportation Plan (RTP) and Regional Transportation Improvement Program (RTIP) to guide transportation growth and infrastructure development to meet the demand and air quality requirements in the region. The forecasts are updated approximately every three years. The VMT as well as activities predicted for ports, airports, and train stations are used by the SCAQMD in developing updates to the AQMPs discussed above.

The 2004 RTP assumes that LGB will accommodate 3.8 million annual passengers (MAP) and 137,000 tons of air cargo by 2030 (SCAG 2003a).

2.1.3.3 Los Angeles County Congestion Management Plan

The Congestion Management Plan (CMP) for the County of Los Angeles has been developed to meet the requirements of Section 65089 of the California Government Code. In enacting the CMP statute, the State legislature noted the increasing concern that urban congestion was impacting the economic vitality of the State and diminishing the quality of life in many communities. The CMP was created to further the following objectives:

- To link land use, transportation and air quality decisions.
- To develop a partnership among transportation decision makers to encourage appropriate transportation solutions that include all modes of travel.
- To propose transportation projects which are eligible for State gas tax funds.

2.1.4 Local

The Cities of Long Beach and Lakewood have adopted General Plan Air Quality Elements to aid the greater Los Angeles region in attaining state and federal ambient air quality standards at the earliest feasible date, while still maintaining economic growth and improving the quality of life. These Air Quality Elements acknowledge the inter-relationships between transportation and land use planning in meeting mobility and clean air goals. By adopting Air Quality Elements, both Cities are seeking to achieve consistency with the AQMP, RTP and CMP.

2.1.4.1 City of Long Beach General Plan Air Quality Element

Contained in the City of Long Beach General Plan Air Quality Element are numerous Goals, Policies, and Actions that are intended to improve air quality throughout the City, which are based on the following guiding principles:

1. To achieve air quality improvements in such a manner that sustains current economic development while encouraging future growth.

2. To improve the quality of life for citizens by providing greater opportunities, conveniences, and choices.
3. To reinforce local mobility goals by reducing peak-hour traffic congestion.
4. To foster behavior change through public information and education, incentives, and pricing that reflects total societal costs for administration and enforcement.

The Air Quality Element is divided into seven topical areas: Government Organization, Roles and Responsibilities; Ground Transportation; Air Transportation; Land Use; Particulate Emissions; Energy Conservation; and Education. A general goal statement for each topic expresses the general, long-range condition toward which effort is being directed. Each goal is reinforced by a series of policies that provide guidance for decision making that will advance that particular goal. Policies are then implemented through a number of actions. For the project, the following actions are applicable:

- Action 2.1.2.3—Promote the creation of, and develop incentives for, sector committees consisting of local establishments providing consumer services and goods to offer and distribute those services and goods in a manner that will reduce overall automobile travel.
- Action 2.1.3.1—Apply system management techniques specified in the City's Transportation Element, such as traffic signal synchronization or computerization, parking prohibitions, left-hand turn pockets, and recessed bus ways where appropriate to optimize existing capacity on regional corridors, and major and minor arterials.
- Action 2.1.3.6—Invest in capital improvements intended to eliminate traffic bottlenecks, such as grade separations, street widening, intersection improvements, and new or realigned roadways.
- Action 2.4.1.3—Ensure that all new development is designed and constructed to facilitate and encourage travel by carpool, vanpool, transit, bicycle, and foot.
- Action 2.4.1.10—Ensure that pedestrian walkways are safe, convenient, and aesthetically appealing, especially at major activity centers.
- Action 5.2.2—Improve the jobs/housing balance at the Southeast Los Angeles County Sub-regional level in relation to major activity centers as new development occurs.
- Action 6.1.8—Once sources of particulate pollution have been identified, the City shall pursue potential mitigation measures through private/public collaborations, or through other available means.
- Action 7.1.4—Encourage the incorporation of energy conservation features in the design of all new construction.

- Action 7.1.5—Encourage the installation of conservation devices and low energy using/water consuming appliances in new and existing development.

2.1.4.2 City of Lakewood General Plan Air Quality Element

The City of Lakewood has adopted a General Plan Air Quality Element that was derived (in large part) from the Model Air Quality Element that was prepared jointly by 21 jurisdictions during the early 1990s. Many of the element's goals and policies are directed at economic efficiency and jurisdictional coordination. Others promote reduction in vehicle miles traveled (VMT) by encouraging compact development patterns and an increase in commuter average vehicle ridership (AVR). Policies applicable to the project include the following:

- Policy 3.1—Achieve a pattern of land uses that facilitates a reduction in mobile emissions through the availability of alternative transportation modes.
- Policy 4.1-Reduce particulate emissions through regulations and enforceable measures to the extent possible. Sources of particulate emissions include unpaved roads, accumulated debris on paved roads, and dirt lots.

2.1.4.3 City of Signal Hill General Plan Air Quality Element

The City of Signal Hill has adopted a General Plan Environmental Element that includes Air Quality subtopics. Although Signal Hill does not have an explicit Air Quality element as with Long Beach and Lakewood, the Environmental Element contains a Los Angeles County Subregional Element that may have applicability to future projects in Signal Hill. Policy 5.1 of the Environmental Element also specifically addresses air quality in the City of Signal Hill. Air Quality topics in the General Plan include the following:

- Encourage new development to incorporate commercial and industrial uses near residential communities to reduce trips and trip lengths.
- Encourage several parking strategies, carpool and bus alternatives, the promotion of bicycle rack installation, and tree and shrub planting.
- Policy 5.1-Cooperate and participate in regional air quality management plans, programs and enforcement measures.

2.2 Existing Air Quality Conditions and Trends

2.2.1 Regional Air Quality

The distinctive climate of the SoCAB is determined primarily by its terrain and geographical location. Regional meteorology is dominated by a persistent high pressure area which commonly resides over the eastern Pacific Ocean. Seasonal variations in the strength and position of this pressure cell cause changes in the weather patterns of the area. Warm summers, mild winters, infrequent rainfall, moderate daytime on-shore breezes, and moderate humidity characterize local

climatic conditions. This normally mild climatic condition is occasionally interrupted by periods of hot weather, winter storms, and hot easterly Santa Ana winds.

The SoCAB is an area of high air pollution potential, particularly from June through September. This condition is generally attributed to the large amount of pollutant emissions, light winds and shallow vertical atmospheric mixing. This frequently reduces pollutant dispersion, thus causing elevated air pollution levels. Pollutant concentrations in the SoCAB vary with location, season and time of day. Concentrations of O_3, for example, tend to be lower along the coast, higher in the near inland valleys and lower in the far inland areas of the Basin and adjacent desert.

Over the past 30 years, substantial progress has been made in reducing air pollution levels in southern California. The SoCAB previously was in non-attainment for all NAAQS, except SO_2. The basin is now in attainment for NO_2, lead, SO_2, and CO. PM10, PM2.5, and ozone levels, while reduced substantially from their peak levels, are still above the respective NAAQS and CAAQS. Although 2003 resulted in the worst smog season in seven years, 2004 concentrations dropped closer to the 2002 levels.

The SCAQMD published (SCAQMD 2000) a Basin-wide air toxics study, the Multiple Air Toxics Exposure Study (MATES-II). The MATES II study represents one of the most comprehensive air toxics studies ever conducted in an urban environment. The study determined the cancer risk from toxic air emissions throughout the Basin by conducting a comprehensive monitoring program, an updated emissions inventory of toxic air contaminants, and a modeling effort to fully characterize health risks for those living in the Basin. The study concluded that the average carcinogenic risk in the Basin is approximately 1,400 in one million. Mobile sources (e.g., cars, trucks, trains, ships, aircraft, etc.) represent the greatest contributors. About 70 percent of all risk is attributed to diesel particulate emissions, about 20 percent to other toxics associated with mobile sources (including benzene, butadiene, and formaldehyde), and about 10 percent of all carcinogenic risk is attributed to stationary sources (which include industries and other certain businesses such as dry cleaners and chrome plating operations).

2.2.2 Local Air Quality in the Airport Vicinity

The SCAQMD maintains a network of air quality monitoring stations located throughout the Basin. As defined by the SCAQMD, the monitoring station most representative of existing air quality conditions in the project area is the South Los Angeles County Coastal Monitoring Station No. 072 (also referred to herein as the North Long Beach Monitoring Station), located in the 3600 block of North Long Beach Boulevard, in the City of Long Beach, approximately one mile west of the airport's western boundary. Criteria pollutants, including O_3, CO, NO_2, PM10, PM2.5, and SO_2 are monitored at this station.

2.2.2.1 Air Quality Trends in Long Beach

The 10-year trend in pollutant concentrations can be seen in the 1995 through 2004 data presented in **Table 2-3. Table 2-4** presents the 10-year trend in the number of days that the NAAQS or CAAQS were exceeded for each criteria pollutant. The trends indicate that between 1995 and 2004:

- CO concentrations have dropped 56 percent for the 1-hour average and 49 percent for the 8-hour average
- NO_2 concentrations have dropped 43 percent for the 1-hour average and 24 percent for the annual average
- PM10 concentrations have dropped 51 percent for the 24-hour average and 14 percent for the annual average
- O_3 concentrations have dropped 18 percent for the 1-hour average and 4 percent for the 8-hour average (since 1996)

Since 1995, no exceedances of the NAAQS for CO, NO_2, SO_2, PM10, and Pb and of the CAAQS for CO, NO_2, SO_2, and Pb have not been measured at the North Long Beach Monitoring Station. In 2004, only the NAAQS for PM2.5, and CAAQS for PM10 and PM2.5 were exceeded in Long Beach. All other pollutant concentrations, including those for O_3, were at or better than the standards that existed at the time the measurements were collected[9].

[9] An ozone 8-hour CAAQS was approved by CARB on April 28, 2005, and is expected to become effective in early 2006. The Long Beach 8-hour ozone measurement in 2004 (0.071 ppm) was slightly above the new standard (0.07 ppm).

Table 2-3
10-Year Ambient Air Quality Trends in the Vicinity of Long Beach Airport

Pollutant	Averaging Period	Conc. Units	Year											
			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	NAAQS	CAAQS
Carbon monoxide (CO)	1-hour	ppm	9	10	9	8	7	10	6	6	6	4	*35*	*20*
	8-hour	ppm	6.6	6.9	6.7	6.6	5.4	5.8	4.7	4.6	4.7	3.4	*9*	*9.0*
Ozone (O_3)	1-hour	ppm	0.110	0.110	0.100	0.120	0.130	0.120	0.091	0.084	0.099	0.090	*(0.12)*[2]	*0.09*
	8-hour[1]	ppm	NA	0.074	0.066	0.065	0.068	0.069	0.060	0.060	0.063	0.071	*0.08*	*0.070*
Nitrogen dioxide (NO_2)	1-hour	ppm	0.21	0.17	0.20	0.16	0.15	0.14	0.13	0.13	0.14	0.12	*NA*	*0.25*
	Annual	ppm	0.0367	0.0342	0.0333	0.0339	0.0342	0.0313	0.0308	0.0298	0.0288	0.0280	*0.053*	*NA*
Sulfur dioxide (SO_2)	1-hour	ppm	0.14	0.04	0.04	0.08	0.05	0.05	0.05	0.03	0.03	0.04	*NA*	*0.25*
	3-hour[3]	ppm	0.14	0.04	0.04	0.08	0.05	0.05	0.05	0.03	0.03	0.04	*0.5*	*NA*
	24-hour	ppm	0.018	0.013	0.011	0.013	0.011	0.014	0.012	0.008	0.008	0.012	*0.04*	*0.14*
	Annual[4]	ppm	0.002	0.004	0.004	0.003	0.003	0.002	0.002	0.002	0.002	0.005	*0.03*	*NA*
Respirable Particulate Matter (PM10)	24-hour	$\mu g/m^3$	146	113	87	69	79	105	91	74	63	72	*150*	*50*
	Annual	$\mu g/m^3$	38.7	35.3	40.5	32.3	38.9	37.6	37.4	35.9	32.8	33.1	*50*	*20*
Fine Particulate Matter (PM2.5)	24-hour[4,5]	$\mu g/m^3$	NA	NA	NA	NA	NA	NA	49.2	47.1	46.5	NA	*65*	*NA*
	Annual	$\mu g/m^3$	NA	NA	NA	NA	21.5	19.2	21.4	19.5	18.0	17.6	*15*	*12*
Lead (Pb)	Monthly	$\mu g/m^3$	0.05	0.08	0.05	0.07	0.06	0.05	0.05	0.03	0.10	0.02	*NA*	*1.5*
	Quarterly	$\mu g/m^3$	0.04	0.08	0.03	0.04	0.05	0.04	0.04	0.02	0.05	0.01	*1.5*	*NA*

Source: SCAQMD Air Quality Data Tables for 2002, 2003, and 2004 (unless otherwise noted); available at: http://www.aqmd.gov/smog/historicaldata.htm
[1] Reported ozone 8-hour average is the fourth highest value measured in each year.
[2] The ozone 1-hour NAAQS was revoked on June 15, 2005.
[3] SO2 3-hour concentration assumed to be equal to the measured SO2 1-hour concentration.
[4] Measurments obtained from the California Air Resources Board, available at: http://www.arb.ca.gov/adam/welcome.html.
[5] 24-Hour average PM2.5 standard is based on the 98th percentile, per National Ambient Air Quality Standard (40 CFR 50.7).
CAAQS = California Ambient Air Quality Standards
NAAQS = National Ambient Air Quality Standards
NA = Not applicable or not available
ppm = parts per million by volume
µg/m3 = micrograms per cubic meter

Table 2-4
10-Year Ambient Air Quality Trends in the Vicinity of Long Beach Airport - Days Above the Standards

Pollutant	Averaging Period		No. of Days Above the Federal or State Standards									
			1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Carbon monoxide (CO)	1-hour	Federal	0	0	0	0	0	0	0	0	0	0
		State	0	0	0	0	0	0	0	0	0	0
	8-hour	Federal	0	0	0	0	0	0	0	0	0	0
		State	0	0	0	0	0	0	0	0	0	0
Ozone (O_3)	1-hour	Federal	0	0	0	0	1	0	0	0	0	0
		State	3	5	1	2	3	3	0	0	1	0
	8-hour	Federal	NA	NA	0	0	0	0	0	0	0	0
		State	NA	NA	NA	NA	NA	NA	NA	NA	NA	0
Nitrogen dioxide (NO_2)	1-hour	State	0	0	0	0	0	0	0	0	0	0
Sulfur dioxide (SO_2)	1-hour	State	0	0	0	0	0	0	0	0	0	0
	3-hour	Federal	0	0	0	0	0	0	0	0	0	0
	24-hour	Federal	0	0	0	0	0	0	0	0	0	0
		State	0	0	0	0	0	0	0	0	0	0
Respirable Particulate Matter (PM10)	24-hour[(1)]	Federal	0	0	0	0	0	0	0	0	0	0
		State	11 (18.6)	7 (14.6)	10 (17.5)	6 (10.2)	13 (22)	12 (21)	10 (17)	5 (8.6)	4 (6.6)	4 (6.7)
Fine Particulate Matter (PM2.5)	24-hour[(1)]	Federal	NA	NA	NA	NA	1 (1)	4 (1.3)	1 (0.3)	0	3 (0.9)	1 (0.3)
Lead (Pb)	Monthly	State	0	0	0	0	0	0	0	0	0	0
	Quarterly	Federal	0	0	0	0	0	0	0	0	0	0

Source: SCAQMD Air Quality Data Tables for 2002, 2003, and 2004 (unless otherwise noted).
Available at: http://www.aqmd.gov/smog/historicaldata.htm
[(1)] Number of samples exceeding the standard, percent of samples presented in parantheses (%).
NA = Not applicable or not available.

2.2.2.2 Existing Air Quality in Long Beach

Table 2-5 presents the existing air quality used to represent CEQA baseline (2005) conditions, which was determined from the highest measurements for each pollutant from the most recent three-year period (2002-2004). As noted above, recent measurements in Long Beach only exceed the PM10 CAAQS, and PM2.5 NAAQS and CAAQS. Also, one 8-hour period over the last three years has an O_3 concentration that exceeded the new 8-hour O_3 CAAQS.

2.2.2.3 Existing Health Risk in the Surrounding Area

Based on the MATES II Study, the SCAQMD concluded that the project area was characterized by a risk of approximately 1,000 to 1,200 in one million due to toxic air contaminants, based on concentration data and emission inventories developed in 1998 to 1999. Approximately 90 percent of the measured risk from TACs at the North Long Beach Monitoring Station is due to mobile sources (e.g., cars, trucks, trains, ships, aircraft, etc.) associated with the Port of Long Beach, 1-405,1-710,1-605, SR-91, Alameda Corridor, and the Long Beach Airport. In addition, the project vicinity cancer risk of 1,000 to 1,200 in one million was approximately 14 to 29 percent lower than the average cancer risk within the Basin as a whole, which was 1,400 per million.

As with the criteria pollutant trends noted in Section 2.2.2, TAC concentrations have declined since 1998, indicating that existing risks have also dropped, as shown in **Table 2-6.** Based on the decline in several key TAC concentrations over the last seven to eight years, existing cancer risk in the project vicinity may be 600 to 800 in one million near the airport.

Table 2-5
Existing Ambient Air Quality in the Vicinity of Long Beach Airport and Ambient Air Quality Standards

Pollutant	Averaging Period	Conc. Units	Measurement Year 2002	2003	2004	Maximum 2005[1]	NAAQS	CAAQS
Carbon monoxide (CO)	1-hour	ppm	6	6	4	**6**	35	20
		µg/m^3	6870	6870	4580	**6,870**	40,000	23,000
	8-hour	ppm	4.6	4.7	3.4	**4.7**	9	9.0
		µg/m^3	5270	5380	3890	**5,380**	10,000	10,000
Ozone (O_3)	8-hour	ppm	0.06	0.063	0.071	**0.071**	0.09	0.070
		µg/m^3	118	124	139	**139**	180	137
Nitrogen dioxide (NO_2)	1-hour	ppm	0.13	0.14	0.12	**0.14**	NA	0.25
		µg/m^3	245	263	226	**263**	NA	470
	Annual	ppm	0.0298	0.0288	0.0280	**0.0298**	0.053	NA
		µg/m^3	56	54	53	**56**	100	NA
Sulfur dioxide (SO_2)	1-hour	ppm	0.03	0.03	0.04	**0.04**	NA	0.25
		µg/m^3	79	79	105	**105**	NA	655
	3-hour[2]	ppm	0.03	0.03	0.04	**0.04**	0.5	NA
		µg/m^3	79	79	105	**105**	1,300	NA
	24-hour	ppm	0.008	0.008	0.012	**0.012**	0.04	0.14
		µg/m^3	21	21	31	**31**	105	365
	Annual[3]	ppm	0.002	0.002	0.005	**0.005**	0.03	NA
		µg/m^3	5.2	5.2	13.1	**13.1**	80	NA
Respirable Particulate Matter (PM10)	24-hour	µg/m^3	74	63	72	**74**	150	50
	Annual	µg/m^3	35.9	32.8	33.1	**35.9**	50	20
Fine Particulate Matter (PM2.5)	24-hour[3,4]	µg/m^3	47.1	46.5	NA	**47.1**	65	NA
	Annual	µg/m^3	19.5	18	17.6	**19.5**	15	12
Lead (Pb)	Monthly	µg/m^3	0.03	0.10	0.02	**0.10**	NA	1.5
	Quarterly	µg/m^3	0.02	0.05	0.01	**0.05**	1.5	NA

Source: SCAQMD Air Quality Data Tables for 2002, 2003, and 2004 (unless otherwise noted).
Available at: http://www.aqmd.gov/smog/historicaldata.htm
[1] Maximum concentration from 2002-2004 measurements are assumed to be representative of existing conditions in 2005.
[2] SO_2 3-hour concentration assumed to be equal to the measured SO_2 1-hour concentration.
[3] Measurments obtained from the California Air Resources Board, available at: http://www.arb.ca.gov/adam/welcome.html.
[4] 24-Hour average PM2.5 standard is based on the 98th percentile, per National Ambient Air Quality Standard (40 CFR 50.7).
CAAQS = California Ambient Air Quality Standards
NAAQS = National Ambient Air Quality Standards
NA = Not applicable or not available.
ppm = parts per million by volume
µg/m3 = micrograms per cubic meter

Table 2-6
Trend in TAC Cancer Risk From 1998 to 2004 in the Vicinity of Long Beach Airport

Toxic Air Contaminant	Conc. Units	Concentration[1] 1998	Concentration[1] 2004	Estimated Risk[2] 1998	Estimated Risk[2] 2004	Change in Risk
Acetaldehyde	ppb	1.43	1.19	7	6	-14%
Benzene	ppb	1.16	0.554	108	51	-53%
1,3-Butadiene	ppb	0.339	0.144	127	54	-57%
Carbon tetrachloride	ppb	0.118	0.092	31	24	-23%
Chloroform	ppb	0.040	0.039	1	1	0%
p-Dichlorobenzene	ppb	0.16	0.15	10	10	0%
cis-1,3-Dichloropropene	ppb	NA	0.05	NA	4	NA
trans-1,3-Dichloropropene	ppb	NA	0.05	NA	4	NA
Formaldehyde	ppb	3.68	2.78	27	20	-26%
Methylene chloride	ppb	0.60	0.24	2	0.8	-60%
Perchloroethylene	ppb	0.193	0.057	8	2	-75%
Trichloroethylene	ppb	0.025	0.022	0.3	0.2	-33%
Benzo(a)pyrene	ng/m^3	0.168	0.107	0.2	0.1	-50%
Benzo(b)fluoranthene	ng/m^3	0.190	0.116	0.02	0.01	-50%
Benzo(k)fluoranthene	ng/m^3	0.077	0.055	0.008	0.006	-25%
Dibenz(a,h)anthracene	ng/m^3	0.033	0.032	0.01	0.01	0%
Indeno(1,2,3-cd)pyrene	ng/m^3	0.286	0.136	0.03	0.01	-67%
Chromium – hexavalent	ng/m^3	0.11	0.09	16	14	-13%
Lead	ng/m^3	12.3	NA[3]	0.1	NA	NA
Nickel	ng/m^3	5.7	NA[3]	1	NA	NA
Estimated Risk Without Considering Diesel PM:				339	191	-43%
Estimated Risk Considering Diesel PM[4]:				~1130	~640	-43%

Source: CARB 2005b.
[1] Mean 1998 conc. presented if available - highest value between 1997 and 1999 used if not; mean 2004 conc. presented if available - highest value between 2002 and 2003 used if not.
[2] Risk values are incremental cancer risks per million population.
[3] Lead and nickel concentrations were last measured in Long Beach in 2001.
[4] Based on general MATES-II finding, diesel PM is assumed to contribute 70% to the total cancer risk.
NA = Not available or not applicable.
ppb = parts per billion by volume
ng/m3 = nanograms per cubic meter

Section 3
Emission Estimates

This section briefly discusses the methodology used for estimating criteria air pollutant and toxic air contaminant (TAC) emissions from air emission sources located at LGB. This section also presents the criteria and TAC emission inventories developed for each alternative.

3.1 Methodology

Detailed emission estimation methodology is included in the Protocol for Conducting the Air Quality Impact Analysis and Human Health Risk Assessment for Long Beach Airport, provided in Attachment A of this appendix. A summary of the methodology is presented below, and deviations from the protocol are noted.

Criteria air pollutants associated with airport operation include: CO, Pb, NO_2, O_3, PM10, PM2.5, and SO_2. The analysis of O_3, a photochemical oxidant, was accomplished by estimating emissions of its precursors: VOC and NOx.

TAC emission inventories were developed for those pollutants known or expected to be emitted by sources at the airport. Emissions from both aircraft and non-aircraft activities were estimated for the following alternatives:

- 2005 Existing Conditions
- 2011 and 2020 Project with Optimized Flight Operations
- 2011 and 2020 No Project with Optimized Flight Operations

Hydrocarbon (HC) and particulate matter (PM) emissions were developed for airport sources, with the latter including both metals and diesel exhaust PM (DPM). Specific TAC emission rates were then estimated through use of speciation profiles suitable for each source/pollutant. Pollutant-specific emission rates were estimated for the following types of sources operated at LGB:

- aircraft and auxiliary power units (APU),
- ground support equipment (GSE),
- ground access vehicles (passenger, employee, cargo),
- fuel storage and handling,
- maintenance facilities,
- utility plants, and
- construction equipment and other construction activities that generate air emissions.

The primary emission models used to develop criteria air pollutant inventories for LGB included the FAA's Emissions and Dispersion Modeling System (EDMS), Version 4.3 (FAA 2005) for aircraft and APU sources; CARB's OFFROAD model (CARB 2001) for GSE and construction equipment; and CARB's EMFAC2002 model (CARB 2002a) for ground access vehicles. The PM10 and PM2.5 size fractions from

airport sources were determined using the CARB-approved California Emission Inventory and Reporting System (CEIDARS)(CARB 2002b). These models were supplemented with AP-42 emission factors (USEPA 1995a) for fuel storage and handling, MRI emission factors for fugitive dust (MRI 1996), and SCAQMD CEQA guidance for project-related terminal HVAC systems.

3.1.1 Aircraft Emissions Estimation

Aircraft emissions are primarily dependent on the following:

- category of operation and number of operations for each category,
- operational mode and time spent in each mode,
- criteria pollutant emission factors for the type and size of engines used, and
- speciation profiles or other methods to determine TAC emissions.

These emissions are estimated from the mode-specific emission factors, the number of engines, the time-in-mode (TIM), the number of landing/takeoff operations (LTOs) for a given hour or year, and the temporal variations associated with each category of aircraft.

3.1.1.1 Fleet Mix and Operational Activity

Aircraft operations were determined for the following flight categories: 1) air carrier 2) air cargo, 3) industrial (aircraft manufacturing/maintenance), 4) commuter, 5) charter, 6) general aviation (GA), and 7) military/government. The temporal variations (activity variations by hour-of-day, day-of-week, and month-of-year) for these categories are presented in **Attachment B.**

Fleet mix and activity information for air carrier and commuter flight categories were obtained from 2004 Airport Noise and Operations Monitoring System (ANOMS) data (used to represent the 2005 Existing Conditions) and forecasts for the 2020 alternatives (HNTB 2004). The aircraft types for these categories are included in the ANOMS and forecast reports. The 2004 ANOMS data is summarized in **Attachment C**, and the 2020 forecast report is presented in **Attachment D** to this appendix.

For air cargo, industrial, charter, general aviation, and military/government flight categories, the activity levels were assumed the same as the 2005 Existing Conditions. The project does not expand facilities or components for these categories. The fleet mix for air cargo and industrial categories were based on the ANOMS data for 2004. The fleet mix for the other three categories were based on basic aircraft size (one or two engine) and type (jet/turbofan or propeller) provided by the City (City of Long Beach 2005b). Additionally, the 2003 General Aviation Study for the SCAG Region was used to supplement assumptions regarding the types of GA aircraft at LGB (SCAG 2003b).

3.1.1.2 Time in Mode

Emissions occur during four basic modes of aircraft operation: 1) taxi/idle, 2) takeoff, 3) climb-out, and 4) approach. The time spent in each mode, TIM, affects the magnitude of pollutant emissions from that mode of operation.

A fifth mode, reverse thrust, has been included in some analyses. Reverse thrust will have similar emissions as climbout or takeoff modes. Reverse thrust emissions for this analysis will be indirectly estimated by assuming that all aircraft departing from LGB are fully loaded (depart at maximum takeoff weight) and thus spend more time in the takeoff and climbout modes than aircraft departing at the airport-average takeoff weight. The calculation of the differences in takeoff and climbout time between aircraft at maximum takeoff weight and those at 90 percent of maximum takeoff weight are included in the protocol presented in Attachment A.

Data used to determine TIM were obtained from two sources. Taxi/idle times for LGB were estimated at 10 minutes per LTO (EEA 1999). TIMs for the other three modes were the same as those calculated in EDMS - Version 4.3 (FAA 2005), for each airframe/engine combination analyzed.

3.1.1.3 Emission Factors

Mode-specific CO, VOC, NOx, and SO2 emission factors from EDMS 4.3 for both turbine and piston aircraft engines were used. Mode-specific PM10 emissions for most aircraft turbofan engines are included in EDMS 4.3. However, a number of aircraft, including all piston aircraft, do not have PM10 or PM2.5 emission factors in EDMS 4.3. Therefore, PM10 and PM2.5 emissions from aircraft were estimated using the emission indices presented in the protocol included as Attachment A to this appendix. The aerodynamic diameter of PM from turbine engines are typically much less than 2.5 micrometers (μm) (Anderson, et al. 2003; Petzold et al. 2003), thus PM10 and PM2.5 emissions from turbine engines are assumed to be equal. CARB's PM speciation profile for gasoline engines (no catalyst) was assumed to approximate PM size fractions from piston engines; thus, the ratio of PM2.5 to PM10 was used to develop the emissions inventory for piston engines.

3.1.1.4 Chemical Speciation

To estimate chemical-specific emissions for aircraft in each of the flight categories, the following information was used: 1) HC and PM emission factors for each engine, 2) fleet mix and operational activity for each flight category, 3) TIM, and 4) chemical speciation for aircraft VOC and PM emissions.

The mode-specific speciation profiles for organic TACs used in this analysis are included in the protocol (Attachment A). Piston aircraft VOC speciation was based on CARB's profile number 413 (CARB 2003d).

Metal speciation profiles are distinct for turbine and piston aircraft. For piston aircraft, lead is the only major metal pollutant, due to the use of leaded aviation gasoline. The

lead specification for 100LL (0.56 g/gal) was used to estimate lead emissions from piston aircraft. For turbines, a profile was developed from elemental analysis of Jet A fuel conducted by the U.S. Navy (Shumway 2000). The elemental analysis is included in the protocol (Attachment A).

3.1.2 Auxiliary Power Unit Emissions Estimation

Criteria pollutant emissions from auxiliary power units (APUs) were estimated using EDMS APU assignments to aircraft types. Since LGB does not use jet ramps (only external stairs), APUs were assumed to operate for 26 minutes per LTO (the EDMS default operating time for APUs) during the 2005 Baseline. The forecast tables (HNTB 2004) for the optimized flights scenario included arrival and departure times for the airlines at LGB. In a deviation from the protocol (Attachment A), APUs were assumed to operate the entire time between arrival and departure for each aircraft at the Airport; therefore, the average time on the ground per airframe and airline was used to calculate the APU operating time. APU speciated TAC emissions were based on profiles used for aircraft engines, since APUs are small turbines fired on jet fuel.

3.1.3 Ground Support Equipment Emissions Estimation

GSE emissions of criteria pollutants were calculated using the LGB-specific GSE population and fuel type, and CARB's OFFROAD model emissions, activity, load factor, and horsepower data (CARB 2001). It was originally intended to account for the effect of the South Coast GSE Memorandum of Understanding (MOU) in the GSE emissions inventory, per the protocol. However, the GSE emission inventories were ultimately developed without considering the GSE MOU due to concerns that the airlines may not implement the MOU in the originally agreed time period; which in turn was due to the airlines' concerns about pending emission regulations under consideration in California that would apply to GSE after the MOU sunset date.

The TAC inventories from GSE VOC emissions were developed from CARB Profile No. 413 for gasoline-fueled equipment and from Profile No. 719 for propane or natural gas-fueled equipment. The TAC inventories from GSE PM emissions were developed from CARB Profile No. 399 for gasoline-fueled equipment. DPM was assessed as a single TAC for the diesel-fueled equipment.

3.1.4 Ground Access Vehicle Emissions Estimation

Ground access vehicles include on-road vehicle activity associated with air passenger activity, air cargo activity, and general aviation activity. Gasoline and diesel passenger automobiles, various types of vans, buses, and trucks of different weight classes were included.

VOC from engine exhaust and fuel system evaporation, and PM from engine exhaust, tire wear, brake wear, and re-entrained road dust contribute to TAC emissions. DPM was treated as a single TAC in accordance with current state guidance (Cal/EPA 2002a,b).

The daily mass emissions for each criteria pollutant were estimated as the product of an emission factor and the amount of travel occurring on the airport, expressed in vehicle miles traveled (VMT). The VMT itself is a product of the number of vehicles traveling on each airport roadway and the length of these routes.

CARB's EMFAC2002 model, Version 2.2 (CARB 2002a), was originally intended to be used for developing emission factors for the typical driving conditions around the Airport. However, simplified emissions factors available from the SCAQMD, which are based on EMFAC2002 model results, were ultimately used for gasoline- and diesel-fueled vehicles. The EMFAC2002 model was still used to develop emission factors for buses and parking lots. Speeds and VMT were estimated from data contained in the recently completed Douglas Park Final EIR (City of Long Beach 2004), supplemented with intersection traffic movements contained in the Terminal Improvement Project Traffic Impact Assessment (Appendix G of this DEIR). The fleet mix assumptions used in this analysis are presented in **Attachment E**. Temperature and humidity parameters were selected to represent annual averages. Re-entrained road dust emission factors were estimated from a Midwest Research Institute report (MRI 1996) using county average precipitation and silt loading values.

Gasoline exhaust start, running, and evaporative hydrocarbons were estimated on a VOC basis and were further subdivided into specific TACs using CARB Profile No. 888 for engine exhaust in 2005, No. 894 for engine exhaust in 2020, and No. 906 for evaporative emissions in both years. Gasoline PM emissions were fractionated according to CARB Profile No. 400. Evaporative emissions are assumed to be negligible for diesel vehicles. As previously mentioned DPM was treated as a single TAC.

Finally, elemental TAC emissions from paved road dust were developed using CARB Profile No. 471, from tire wear using Profile No. 472, and from brake wear using Profile No. 473.

3.1.5 Fuel Storage and Handling Emissions Estimation

Evaporative emissions from the storage and transfer of Jet A fuel, aviation and motor vehicle gasoline, and diesel fuel were estimated based upon fuel use logs provided by the City for existing conditions. Future Jet A use was based on the aircraft activity and fleet mix in 2020 relative to the 2005 existing conditions. Aviation gasoline use was assumed constant from 2005 to 2020 since general aviation activity is not expected to change during that period.

Fugitive VOC emissions from the fuel facility storage tanks are not expected to occur due to the "bullet" configuration of the tanks. Fuel truck loading and aircraft fueling fugitive emissions were based on emission factors found in AP-42, Section 5.2 "Transportation and Marketing of Petroleum Liquids" (USEPA 1995a). The VOC emissions were speciated according to CARB Profile No. 100 for Jet A and Profile No. 906 for gasoline.

3.1.6 Utility Plant Emissions Estimates

Utility plant emissions were determined for those facilities that were impacted by the proposed LGB Terminal Improvement Project. Differences in emissions between 2005 and 2020 at these facilities were developed from changes in onsite structures (square feet of building floor space). Changes in the floor space resulted in changes in demand for electricity and building heating/air conditioning. Estimates of natural gas combustion emissions for heating and power were to be estimated from URBEMIS 2002 (CARB 2003a) emissions data and supplemented if necessary by USEPA AP-42 factors (USEPA 1995) and/or SCAQMD annual emission inventory reports. However, the natural gas demand was eventually estimated using the SCAQMD CEQA Handbook and supplemental information contained on the website. Emissions of TAC were estimated using AB 2588 Combustion Emission Factors published by the Ventura County Air Pollution Control District.

Due to the limited space for aircraft maintenance at LGB, commercial aircraft maintenance operations are not extensive, and changes in maintenance activity was assumed to be negligible.

3.1.7 Construction Equipment Emissions Estimate

Criteria pollutant emissions from construction activities were estimated using CARB OFFROAD model emission factors (CARB 2001) for equipment engines, and URBEMIS2002 (SCAQMD 2005a) for architectural coatings and Parcel O grading/paving. Construction activities will include demolition of several existing structures, construction of new permanent terminal facilities and a parking structure, and addition of aircraft parking locations. Construction-related fugitive dust is assumed to be controlled by periodic watering (two to three times per day) as required by SCAQMD Rule 403; therefore, "unmitigated" fugitive dust emissions include a 50 percent control factor for this watering.

The project will be constructed in phases as funding becomes available. The period of construction for a given phase is anticipated to be limited, typically between one and three years as shown in Section 1, Table 1-1. Therefore, only TACs with acute Reference Exposure Levels (RELs), as defined by the California Office of Environmental Health Hazard Assessment (OEHHA), were analyzed for health risk.

The TAC inventories from construction equipment VOC emissions were developed from Profile No. 818 for diesel-fueled equipment. The TAC inventories from construction equipment PM emissions were developed from Profile No. 425 for diesel-fueled equipment. TACs from architectural coatings were estimated from CARB Profile No. 1902. TACs from construction dust were estimated from CARB Profile No. 420.

3.2 Emission Inventories

3.2.1 Construction Emissions

The Project construction emissions are summarized in **Table 3-1**, and the calculation spreadsheets are included in **Attachment F** to this appendix. The significance thresholds for construction emissions from SCAQMD's CEQA Handbook (SCAQMD 1993) are also included in Table 3-1. Based on a comparison to these thresholds, the estimated Project construction emissions will be significant for NOx and VOC. Construction emissions for the other criteria pollutants (CO, SO_2, PM10, and PM2.5) are less than significant.

In addition to the traditional significance thresholds presented in the CEQA Handbook, the SCAQMD has also developed emission lookup tables for CO, NOx and PM10 based on localized significance threshold (LST) methodology (SCAQMD 2003). These emission thresholds are applicable to small (five acres or less) construction or facility sites. The use of these thresholds are voluntary, and will be used in this analysis to determine if a more detailed dispersion analysis of construction source emissions is warranted.

Although the airport is much larger than five acres, the construction areas for the terminal building improvements and new parking structure can be compared to the LST lookup tables for five acre sites. The table values are dependent on the site location in the region as well as on the distance between the construction site and the receptor. The airport is located in South Coastal Los Angeles County source receptor area (SRA) for purposes of comparison to the LST tables.

Figures 3-1, 3-2, and 3-3 provide comparisons of average day (in the peak month) and peak day construction emissions to emission thresholds for CO, NOx, and PM10, respectively, for given distances from the edge of the construction site. Based on this comparison, CO emissions from construction would not be significant at any location. Average day emissions of NOx would not be significant at locations beyond 25 meters from the construction site; however, peak day NOx emissions may be significant at distances greater than 500 meters. Average day PM10 emissions would not be significant at locations beyond 50 meters from the construction site; and peak day PM10 emissions would not be significant beyond about 75 meters. Therefore, only peak day NOx emissions could impact receptors beyond the airport property line.

Some commercial facilities are located on airport property and could be affected by construction NOx and PM10 emissions. Therefore, a detailed dispersion analysis of NOx and PM10 from construction sources was included in Section 4 of this report.

Cumulative Construction Emissions

Although construction emissions of all criteria pollutants, except NOx and VOC, are considered to be less than significant for the Terminal Improvement Project, the cumulative impact of construction-related emissions from both this project and the adjacent Douglas Park -project may be significant. According to the Douglas Park EIR

(City of Long Beach 2004), construction emissions of CO, VOC, NOx, and PM10 were significant. Since the phasing of construction for these two projects may overlap and the Douglas Park project is adjacent to the airport's northern boundary, it is assumed that cumulative construction emissions are significant for CO, VOC, NOx, and PM10.

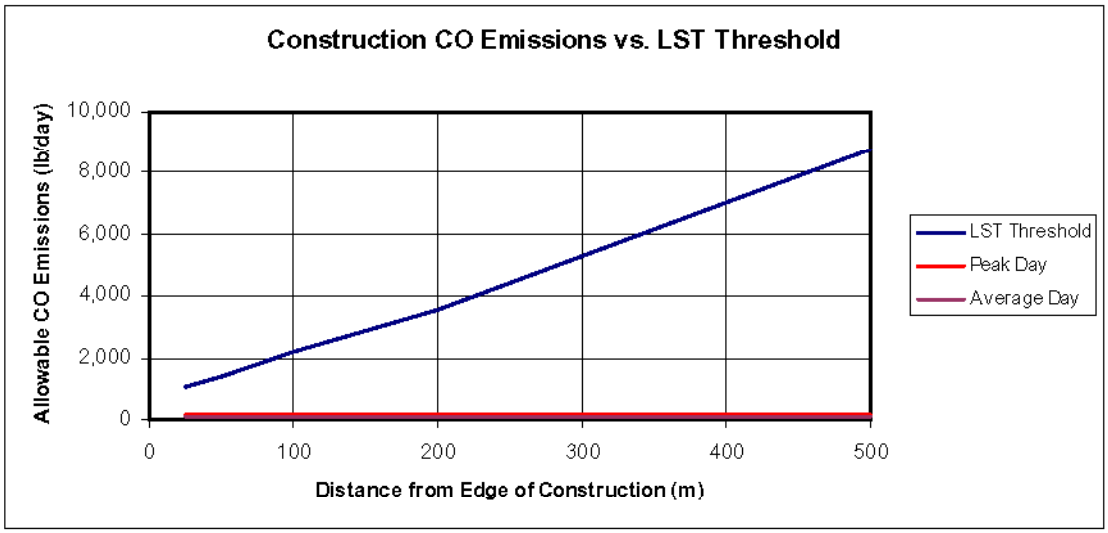
Table 3-1
Project Construction Emission Inventories

Pollutant	Construction Emissions by Year					
	2006	2007	2008	2009	2010	2011
	Annual Emissions (tons/year)					
CO	3.8	10.9	8.0	6.3	5.7	5.6
VOC	0.9	6.4	1.7	2.9	1.1	1.0
NOx	11.8	30.9	20.1	17.9	17.5	16.6
SOx	0.0	0.0	0.0	0.0	0.0	0.0
PM2.5	0.6	1.9	1.4	1.1	1.0	1.0
PM10	1.1	3.8	3.1	2.6	2.7	2.7

	Peak Quarterly Emissions (tons/quarter)						Significance Threshold (tons/qrtr)	Significant?
CO	1.3	3.1	2.0	1.9	1.4	1.4	24.75	No
VOC	0.3	**4.5**	0.4	2.0	0.3	0.2	2.5	**Yes**
NOx	**3.7**	**8.6**	**5.1**	**4.8**	**4.4**	**4.2**	2.5	**Yes**
SOx	0.0	0.0	0.0	0.0	0.0	0.0	6.75	No
PM2.5	0.2	0.5	0.3	0.3	0.3	0.2	NA	NA
PM10	0.4	1.1	0.8	0.7	0.7	0.7	6.75	No

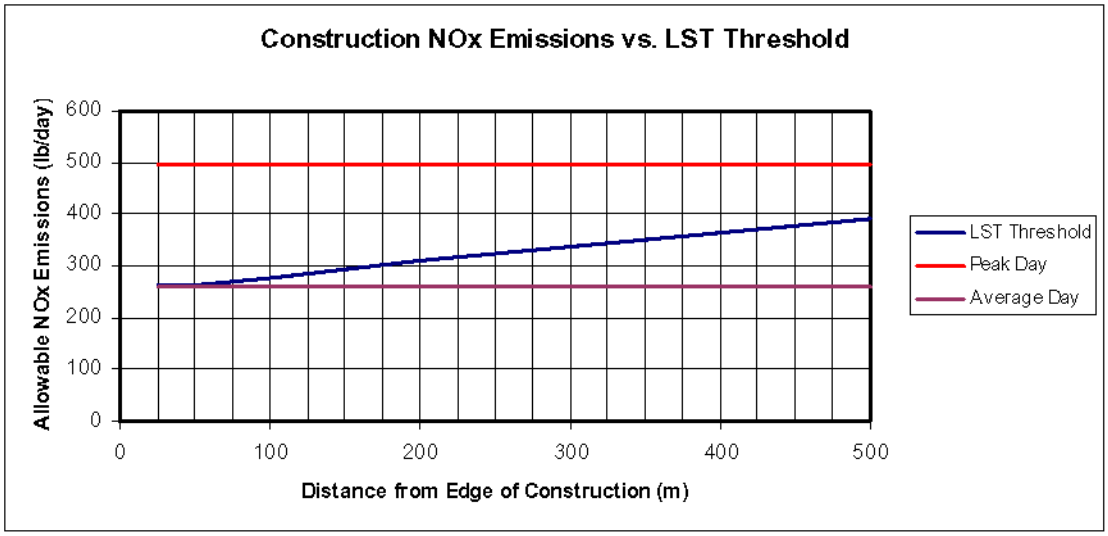
	Daily Emissions (lbs/day) for Average Day in Peak Month						Peak Day (lbs/day)[1]	Significance Threshold (lbs/day)	Significant?
CO	68	93	61	60	43	43	177	550	No
VOC	17	**270**	13	**161**	8	7	**513**	75	**Yes**
NOx	**217**	**260**	**154**	**150**	**134**	**128**	**494**	100	**Yes**
SOx	0	0	0	0	0	0	1	150	No
PM2.5	12	17	10	10	8	8	31	NA	NA
PM10	28	34	24	23	21	21	64	150	No

Source: CDM 2005.
NA = Not available or not applicable.
(1) Peak day construction emissions = 1.9 x average day emissions in peak month (BonTerra 2005b).



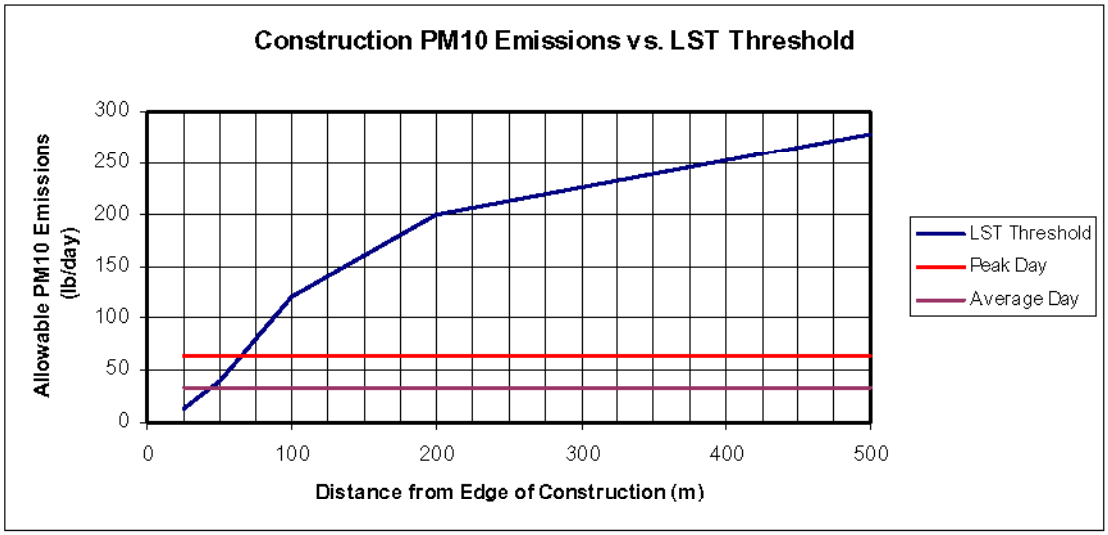
Sources: SCAQMD 2003b; and CDM 2005

Figure 3-1
Construction CO Emissions Compared to LST Threshold



Sources: SCAQMD 2003b; and CDM 2005.

Figure 3-2
Construction NOx Emissions Compared to LST Threshold



Sources: SCAQMD 2003b; and CDM 2005.

Figure 3-3
Construction PM10 Emissions Compared to LST Threshold

3.2.2 Operational Emissions with Optimized Flights

The total criteria air pollutant emission inventories for operations are presented in **Table 3-2** for the 2005 Existing Conditions, in **Table 3-3** for the 2011 No Project alternative, in **Table 3-4** for the 2020 No Project alternative, in **Table 3-5** for the 2011 Project alternative, and in **Table 3-6** for the 2020 Project alternative. Except for the existing conditions in 2005, these emission inventories include the optimized flights scenario.

Table 3-7 presents the incremental Project and No Project related emissions compared to the operational emission significance thresholds. This comparison indicates that operational emissions with optimized flights are significant for CO and NOx in 2011 and 2020 for both the Project and No Project alternatives.

Finally, **Table 3-8** presents the TAC emissions for 2005 Existing Conditions, 2011 and 2020 No Project, and 2011 and 2020 Project alternatives. The TACs are classified as either VOC, PAH, DPM, or metals. As with the criteria pollutants, the TAC inventories for the future Project and No Project alternatives include the optimized flights scenario.

Table 3-2
2005 Existing Conditions Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[(1)]**	**PM2.5[(1)]**
Turbine Aircraft						
Idle	67.93	5.01	14.82	3.28	1.74	1.74
Approach	9.46	0.52	24.06	2.57	1.05	1.05
Climb Out	1.32	0.16	31.04	1.43	0.43	0.43
Takeoff	2.01	0.21	69.73	2.70	0.90	0.90
Turbine Aircraft Subtotal	80.72	5.90	139.65	9.98	4.12	4.12
Piston Aircraft Subtotal	1,314.56	18.80	3.30	0.14	2.30	1.74
All Aircraft Subtotal	1,395.28	24.70	142.95	10.11	6.42	5.86
APU Subtotal	4.45	0.34	9.39	1.02	0.85	0.85
Ground Service Equipment (GSE)						
CNG	10.68	0.00	3.79	0.00	0.02	0.02
Gasoline	96.18	6.64	19.76	0.29	0.09	0.09
Diesel	6.54	2.18	21.34	2.10	1.47	1.42
GSE Subtotal	113.40	8.83	44.89	2.39	1.58	1.53
Roadways						
Gasoline	36.26	3.89	3.91	0.03	0.19	0.17
Diesel	0.50	0.07	0.96	0.01	0.02	0.01
Fugitive	-	-	-	-	4.33	0.75
Roadway Subtotal	36.76	3.96	4.87	0.03	4.54	0.94
Parking						
Evaporative Losses	-	1.42	-	-	-	-
Exhaust	28.14	0.87	5.17	-	0.19	0.19
Parking Subtotal	28.14	2.30	5.17	-	0.19	0.19
Stationary Sources Subtotal	0.04	3.92	0.13	0.00	0.01	0.01
GRAND TOTAL[(2)]	**1,578.07**	**44.05**	**207.40**	**13.56**	**13.58**	**9.37**

Source: CDM 2005.

(1) PM emissions for aircraft calculated external to EDMS 4.3.

(2) Totals may not add exactly due to rounding.

Table 3-3
2011 No Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal	18.89	1.36	23.82	2.83	2.32	2.32
Ground Service Equipment (GSE)						
CNG	21.37	0.01	4.39	0.01	0.04	0.04
Gasoline	205.57	5.54	19.52	0.58	0.19	0.18
Diesel	10.71	1.68	25.12	4.19	1.31	1.27
GSE Subtotal	237.64	7.22	49.03	4.78	1.54	1.49
Roadways						
Gasoline	52.93	5.79	5.44	0.05	0.48	0.44
Diesel	0.54	0.09	1.13	-	0.02	0.02
Fugitive	-	-	-	-	10.33	1.78
Roadway Subtotal	53.47	5.89	6.57	0.05	10.83	2.25
Parking						
Evaporative Losses	-	0.74	-	-	-	-
Exhaust	17.42	0.41	3.25	-	0.19	0.19
Parking Subtotal	17.42	1.15	3.25	-	0.19	0.19
Stationary Sources Subtotal	0.04	4.61	0.13	0.00	0.01	0.01
GRAND TOTAL[2]	**1,766.56**	**47.02**	**302.36**	**23.39**	**21.63**	**12.45**

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] Totals may not add exactly due to rounding.

Table 3-4
2020 No Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal	18.89	1.36	23.82	2.83	2.32	2.32
Ground Service Equipment (GSE)						
CNG	21.37	0.00	3.11	0.01	0.04	0.04
Gasoline	160.91	2.55	10.74	0.58	0.19	0.18
Diesel	9.97	1.38	23.51	4.19	0.99	0.95
GSE Subtotal	192.25	3.94	37.36	4.78	1.22	1.17
Roadways						
Gasoline	25.34	3.16	2.46	0.05	0.48	0.44
Diesel	0.29	0.06	0.44	-	0.02	0.01
Fugitive	-	-	-	-	10.33	1.78
Roadway Subtotal	25.64	3.22	2.90	0.05	10.82	2.24
Parking						
Evaporative Losses	-	0.40	-	-	-	-
Exhaust	8.04	0.18	1.34	-	0.19	0.19
Parking Subtotal	8.04	0.58	1.34	-	0.19	0.19
Stationary Sources Subtotal	0.04	4.61	0.13	0.00	0.01	0.01
GRAND TOTAL[2]	**1,683.95**	**40.56**	**285.10**	**23.39**	**21.29**	**12.13**

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] Totals may not add exactly due to rounding.

Table 3-5
2011 Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal	18.89	1.36	23.82	2.83	2.32	2.32
Ground Service Equipment (GSE)						
CNG	21.37	0.01	4.39	0.01	0.04	0.04
Gasoline	205.57	5.54	19.52	0.58	0.19	0.18
Diesel	10.70	1.68	25.12	4.19	1.31	1.27
GSE Subtotal	237.64	7.22	49.03	4.78	1.54	1.49
Roadways						
Gasoline	42.68	4.67	4.39	0.04	0.39	0.35
Diesel	0.67	0.11	1.21	-	0.03	0.02
Fugitive	-	-	-	-	8.33	1.44
Roadway Subtotal	43.34	4.78	5.60	0.04	8.74	1.81
Parking						
Evaporative Losses	-	0.74	-	-	-	-
Exhaust	17.42	0.41	3.25	-	0.19	0.19
Parking Subtotal	17.42	1.15	3.25	-	0.19	0.19
Stationary Sources Subtotal	0.06	4.61	0.23	0.00	0.01	0.01
GRAND TOTAL[2]	**1,756.46**	**45.97**	**301.49**	**23.38**	**19.54**	**12.02**

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] Totals may not add exactly due to rounding.

Table 3-6
2020 Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal	18.89	1.36	23.82	2.83	2.32	2.32
Ground Service Equipment (GSE)						
CNG	21.37	0.00	3.11	0.01	0.04	0.04
Gasoline	160.91	2.55	10.74	0.58	0.19	0.18
Diesel	9.97	1.38	23.51	4.19	0.99	0.95
GSE Subtotal	192.25	3.94	37.36	4.78	1.22	1.17
Roadways						
Gasoline	20.44	2.55	1.98	0.04	0.39	0.35
Diesel	0.37	0.07	0.58	-	0.02	0.01
Fugitive	-	-	-	-	8.33	1.44
Roadway Subtotal	20.81	2.62	2.55	0.04	8.73	1.81
Parking						
Evaporative Losses	-	0.40	-	-	-	-
Exhaust	8.04	0.18	1.34	-	0.19	0.19
Parking Subtotal	8.04	0.58	1.34	-	0.19	0.19
Stationary Sources Subtotal	0.06	4.61	0.23	0.00	0.01	0.01
GRAND TOTAL[2]	**1,679.15**	**39.97**	**284.86**	**23.38**	**19.21**	**11.70**

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] Totals may not add exactly due to rounding.

Table 3-7
Incremental[1] Operational Emissions Compared to Significance Thresholds

Year and Alternative	Incremental Emissions					
	CO	**VOC**	**NOx**	**SO_2**	**PM10**	**PM2.5**
Operational Significance Thresholds, lb/day[2]	550	55	55	150	150	NA
2011 Project Incremental Emissions, tpy	178.39	1.92	94.09	9.82	5.96	2.65
2011 Project Incremental Emissions, lb/day	977	11	516	54	33	15
Above Thresholds? (yes/no)	**Yes**	No	**Yes**	No	No	NA
2011 No Project Incremental Emissions, tpy	188.49	2.97	94.96	9.83	8.05	3.08
2011 No Project Incremental Emissions, lb/day	1,033	16	520	54	44	17
Above Thresholds? (yes/no)	**Yes**	No	**Yes**	No	No	NA
2020 Project Incremental Emissions, tpy	101.08	(4.08)	77.46	9.82	5.63	2.33
2020 Project Incremental Emissions, lb/day	554	(22)	424	54	31	13
Above Thresholds? (yes/no)	**Yes**	No	**Yes**	No	No	NA
2020 No Project Incremental Emissions, tpy	105.88	(3.49)	77.70	9.83	7.71	2.76
2020 No Project Incremental Emissions, lb/day	580	(19)	426	54	42	15
Above Thresholds? (yes/no)	**Yes**	No	**Yes**	No	No	NA

Source: CDM 2005.

Notes:

[1] Incremental emissions are those above the 2005 Existing Conditions emissions.

[2] Operational Significance Thresholds from SCAQMD CEQA Handbook (SCAQMD 1993).

NA = Not available or not applicable.

Table 3-8
Toxic Air Contaminant Emission Inventories

		Emissions in tons/year[1]				
Toxic Air Contaminant	**TAC Type**	**Basline 2005**	**No Project 2011**	**No Project 2020**	**Project 2011**	**Project 2020**
Acetaldehyde	VOC	2.76E-01	3.15E-01	2.88E-01	3.13E-01	2.86E-01
Acrolein	VOC	7.59E-02	8.97E-02	8.08E-02	8.82E-02	7.99E-02
Benzene	VOC	1.37E+00	1.38E+00	1.16E+00	1.35E+00	1.15E+00
Butadiene, 1,3-	VOC	2.85E-01	2.99E-01	2.56E-01	2.93E-01	2.53E-01
Ethylbenzene	VOC	5.13E-01	5.04E-01	4.17E-01	4.92E-01	4.11E-01
Formaldehyde	VOC	1.04E+00	1.37E+00	1.28E+00	1.35E+00	1.27E+00
Naphthalene	VOC	5.13E-02	5.61E-02	5.02E-02	5.55E-02	4.99E-02
Phenol	VOC	1.47E-02	2.18E-02	2.18E-02	2.18E-02	2.18E-02
Styrene	VOC	1.04E-01	1.08E-01	9.47E-02	1.07E-01	9.40E-02
Toluene	VOC	2.66E+00	2.60E+00	2.14E+00	2.54E+00	2.11E+00
Xylene, o-	VOC	6.84E-01	6.68E-01	5.56E-01	6.53E-01	5.48E-01
Xylenes, m- and p-	VOC	1.92E+00	1.88E+00	1.56E+00	1.84E+00	1.54E+00
Benzo(a)anthracene	PAH	4.52E-06	6.71E-06	6.71E-06	6.71E-06	6.71E-06
Benzo(a)pyrene	PAH	4.43E-06	6.57E-06	6.57E-06	6.57E-06	6.57E-06
Benzo(b)fluoranthene	PAH	2.92E-06	4.33E-06	4.33E-06	4.33E-06	4.33E-06
Benzo(k)fluoranthene	PAH	2.92E-06	4.33E-06	4.33E-06	4.33E-06	4.33E-06
Chrysene	PAH	2.92E-06	4.28E-06	4.28E-06	4.35E-06	4.35E-06
Dibenzo(a,h)anthracene	PAH	3.68E-06	5.46E-06	5.46E-06	5.46E-06	5.46E-06
Indeno(1,2,3-cd)pyrene	PAH	2.92E-06	4.34E-06	4.34E-06	4.34E-06	4.34E-06
Diesel PM	DPM	1.60E+00	1.57E+00	1.24E+00	1.56E+00	1.23E+00
Barium	Metals	3.31E-05	1.76E-02	7.20E-04	1.42E-02	5.53E-05
Calcium	Metals	8.21E-03	3.51E-01	1.37E-01	2.85E-01	1.34E-02
Chromium – Total	Metals	4.77E-04	1.03E-03	6.58E-03	9.45E-04	7.67E-04
Cobalt	Metals	1.90E-04	4.65E-04	3.35E-04	3.94E-04	2.88E-04
Copper	Metals	2.45E-04	3.32E-03	1.53E-03	2.71E-03	3.80E-04
Iron	Metals	2.51E-03	6.02E-01	5.07E-02	4.86E-01	4.16E-03
Lead	Metals	9.76E-01	9.62E-01	2.34E+01	9.61E-01	9.60E-01
Manganese	Metals	2.56E-04	8.82E-03	1.78E-03	7.15E-03	3.99E-04
Nickel	Metals	1.90E-04	4.38E-04	3.35E-04	3.72E-04	2.88E-04
Scandium	Metals	1.21E-04	2.03E-04	2.64E-03	2.03E-04	2.03E-04
Strontium	Metals	1.32E-04	3.83E-03	2.88E-03	3.13E-03	2.21E-04
Sulfur	Metals	1.35E-02	5.82E-02	2.93E-01	5.13E-02	2.25E-02
Tin	Metals	1.10E-04	1.55E-03	2.40E-03	1.29E-03	1.84E-04
Titanium	Metals	1.10E-03	5.26E-02	2.40E-02	4.28E-02	1.84E-03
Zinc	Metals	1.90E-04	1.10E-02	3.35E-04	8.87E-03	2.88E-04
Zirconium	Metals	1.77E-04	1.62E-03	3.84E-03	1.36E-03	2.95E-04

Source: CDM 2005.

[1] Results presented in exponential format; for example: 2.76E-01 = 2.76×10^{-1}.

3.3 Mitigation

3.3.1 Construction Emissions Mitigation

The construction mitigation measures provided below implement recommended mitigation measures included in SCAQMD's CEQA Air Quality Handbook (SCAQMD 1993), Chapter 11, and are in addition to the requirements of SCAQMD Rule 403 (Fugitive Dust). All construction mitigation measures adopted in the Douglas Park Final EIR (City of Long Beach 2004) are assumed to be in place during the construction of the Douglas Park facilities, and will be applied to the LGB Terminal Improvement Project construction activities where such mitigation measures are appropriate and feasible. In addition, the following mitigation measures are recommended to reduce construction-related air quality impacts associated with the Proposed Project and project alternatives:

AQ-Const-1: The contract specifications shall require general contractors to ensure that all equipment is properly tuned and maintained in accordance with manufacturer's specifications. The City shall enforce this mitigation requirement.

AQ-Const-2: The contract specifications shall require general contractors to maintain and operate construction equipment so as to minimize exhaust emissions. During construction, engines on trucks and vehicles in loading and unloading queues will be turned off when not in use, to reduce vehicle emissions. Construction activities should be phased and scheduled to avoid emissions peaks and discontinued during second-stage smog alerts. The City shall enforce these requirements.

AQ-Const-3: The contract specifications shall require general contractors to sweep streets as needed during construction, but not more frequently than hourly, if visible soil material has been carried onto adjacent public roads. The City shall enforce this requirement.

AQ-Const-4: The contract specifications shall require general contractors to visually inspect construction equipment prior to leaving the site; loose dirt shall be washed off with wheel washers as necessary. The City shall enforce this requirement.

AQ-Const-5: During construction, the City shall coordinate with the contractors to maximize to the extent possible, the use of electricity from power poles rather than temporary diesel or gasoline power generators to operate electric-powered construction equipment.

AQ-Const-6: The contract specifications shall require that on-site mobile equipment used during construction shall be powered by alternative fuel sources (i.e., methanol, natural gas, propane, or butane) where feasible.

AQ-Const-7: During construction, the City shall provide a location and require the contractors to store all construction equipment used in the project construction within the project site (away from adjacent residential areas) to reduce the impact on the roadway system and resultant air emissions.

AQ-Const-8: On-site construction equipment staging areas and construction worker parking lots shall be located on either paved surfaces or unpaved surfaces that are periodically treated with non-toxic soil stabilizers.

AQ-Const-9: The contract specifications shall require the contractors to schedule all deliveries related to construction activities that affect traffic flow during off-peak hours (e.g., 10:00 am and 3:00 pm) and deliveries shall be coordinated to achieve consolidated truck trips. When traffic flow is impacted by the movement of construction materials and/or equipment, temporary traffic controls shall be provided to improve traffic flow (e.g., flag person). The City shall enforce these requirements.

AQ-Const-10: The contract specifications shall require that emulsified diesel fuel will be used in diesel-fueled construction equipment to reduce NOx emissions. The contractors shall be responsible for obtaining emulsified diesel fuel, and the City shall enforce this requirement.

AQ-Const-11: The contract specifications shall require all on-site heavy-duty construction equipment be equipped with diesel particulate traps to the extent that such equipment is available for use with emulsified diesel fuel when the contracts are awarded.

The use of emulsified diesel fuel in construction equipment is assumed to reduce construction equipment NOx emissions by 15 to 20 percent (CARB 2004). Applying the lower end of that range to the peak daily NOx emissions from construction equipment would reduce NOx emissions by approximately 70 lbs/day to a peak day NOx emission inventory for construction of 424 lbs/day. This level is still above the significance threshold. Also, VOC emissions would remain significant and unavoidable. Finally, the mitigated construction emissions from the Douglas Park project remained above the significance thresholds after mitigation for CO, VOC, NOx, and PM10 (City of Long Beach 2004).

3.3.2 Operational Emissions Mitigation

The Proposed Project will provide improved terminal and parking facilities at LGB which do not have any direct impact on the aviation activity at the Airport. Therefore, the proposed project would not result in significant operational air quality impacts. However, since the Draft EIR addresses impacts associated with the Optimized Flight scenario, various potential mitigation measures that could be applied to airport operations were considered. Those measures that appear feasible are recommended for implementation. The following mitigation options are proposed to reduce operational emission impacts associated with optimized flights.

AQ-Ops-1: During project design, the architect shall include provisions for all fixtures used for lighting exterior common areas to be regulated by automatic devices to turn off lights when they are not needed.

AQ-Ops-2: As part of the air carrier ramp design, the City shall incorporate provisions for alternative fueling infrastructure (i.e., electric charging infrastructure) to support the operation of electric and/or alternative fueled GSE and other on-airport vehicles.

AQ-Ops-3: As part of the air carrier ramp design, the City shall incorporate provisions for preconditioned air and 400 Hz power (from electric units or electric utility power grid) to be located at the commercial passenger aircraft parking positions to allow aircraft pilots the ability to plug in at the gates and turn off the APUs.

AQ-Ops-4: If determined to be reasonably available by the City, the City shall require on all future lease and operational agreements with commercial airlines (including commuter airlines) that ultra-low sulfur diesel fuel be used in diesel-fueled GSE that are not readily convertible to electric power.

AQ-Ops-5: Through its lease language with the airlines, the City shall require airlines to comply with the intent of the South Coast GSE MOU, or any similar agreements or regulations. Through implementation of AQ-Ops-2 and AQ-Ops-3, the Airport will design the infrastructure necessary to assist airlines in complying the objectives of the GSE MOU.

The mitigated criteria pollutant emission inventories associated with installing preconditioned air, 400 Hz power, and electric battery chargers are presented in **Table 3-9** (Project 2011) and **Table 3-10** (Project 2020). These mitigation measures will reduce APU CO emissions by 61 percent, NOx emissions by 57 percent, and PM emissions by 58 percent in 2011 and 2020. GSE CO emissions will be reduced by 96 percent in 2011 and 95 percent in 2020; NOx emissions will be reduced by 55 percent

Table 3-9
Mitigated 2011 Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal[2]	7.35	0.53	10.26	1.19	0.97	0.97
APU Emis. Reduct. (%)	***61%***	***61%***	***57%***	***58%***	***58%***	***58%***
GSE Subtotal[3]	9.43	1.25	22.36	1.91	0.30	0.29
GSE Emis. Reduct. (%)	***96%***	***96%***	***55%***	***60%***	***81%***	***81%***
Roadways						
Gasoline	42.68	4.67	4.39	0.04	0.39	0.35
Diesel	0.67	0.11	1.21	-	0.03	0.02
Fugitive	-	-	-	-	8.33	1.44
Roadway Subtotal	43.34	4.78	5.60	0.04	8.74	1.81
Parking						
Evaporative Losses	-	0.74	-	-	-	-
Exhaust	17.42	0.41	3.25	-	0.19	0.19
Parking Subtotal	17.42	1.15	3.25	-	0.19	0.19
Stationary Sources Subtotal	0.06	4.61	0.23	0.00	0.01	0.01
GRAND TOTAL[4]	**1,516.71**	**39.18**	**261.25**	**18.87**	**16.94**	**9.47**
Emis. Reduct. (%)	***14%***	***47%***	***13%***	***19%***	***13%***	***21%***

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] APU Time in mode assumed to be 15 minutes per LTO for all commercial passenger aircraft, based on installation of preconditioned air and 400 Hz power source at each aircraft parking position (Honeywell 2000).

[3] Assumes that aircraft and baggage tractors, bobtails, belt loaders, passenger stands, GPU, and "other" GSE units are electrified. Also assumes that NOx and VOC limits in GSE MOU are met: 2.65 g/bhp-hr NOx + HC (CARB and ATA 2002). Specific factors assumed for this estimate: 2.50 g NOx/bhp-hr and 0.15 g VOC/bhp-hr.

[4] Totals may not add exactly due to rounding.

Table 3-10
Mitigated 2020 Project (With Optimized Flights) Criteria Pollutant Emission Inventory

	Total Emissions, tons/yr					
Source Type	**CO**	**VOC**	**NOx**	**SO_2**	**PM10[1]**	**PM2.5[1]**
Turbine Aircraft						
Idle	107.36	6.92	22.95	5.10	1.84	1.84
Approach	12.87	0.66	39.59	4.03	1.12	1.12
Climb Out	1.69	0.20	47.23	2.20	0.51	0.51
Takeoff	2.62	0.29	106.48	4.26	1.07	1.07
Turbine Aircraft Subtotal	124.55	8.06	216.25	15.59	4.55	4.55
Piston Aircraft Subtotal	1,314.55	18.80	3.31	0.14	2.18	1.65
All Aircraft Subtotal	1,439.10	26.86	219.56	15.73	6.73	6.20
APU Subtotal[2]	7.35	0.53	10.26	1.19	0.97	0.97
APU Emis. Reduct. (%)	***61%***	***61%***	***57%***	***33%***	***58%***	***58%***
GSE Subtotal[3]	9.43	1.25	22.36	1.91	0.30	0.29
GSE Emis. Reduct. (%)	***95%***	***68%***	***40%***	***60%***	***75%***	***75%***
Roadways						
Gasoline	20.44	2.55	1.98	0.04	0.39	0.35
Diesel	0.37	0.07	0.58	-	0.02	0.01
Fugitive	-	-	-	-	8.33	1.44
Roadway Subtotal	20.81	2.62	2.55	0.04	8.73	1.81
Parking						
Evaporative Losses	-	0.40	-	-	-	-
Exhaust	8.04	0.18	1.34	-	0.19	0.19
Parking Subtotal	8.04	0.58	1.34	-	0.19	0.19
Stationary Sources Subtotal	0.06	4.61	0.23	0.00	0.01	0.01
GRAND TOTAL[4]	**1,484.79**	**36.45**	**256.29**	**18.87**	**16.94**	**9.47**
Emis. Reduct. (%)	***12%***	***9%***	***10%***	***19%***	***12%***	***19%***

Source: CDM 2005.

[1] PM emissions for aircraft calculated external to EDMS 4.3.

[2] APU Time in mode assumed to be 15 minutes per LTO for all commercial passenger aircraft, based on installation of preconditioned air and 400 Hz power source at each aircraft parking position (Honeywell 2000).

[3] Assumes that aircraft and baggage tractors, bobtails, belt loaders, passenger stands, GPU, and "other" GSE units are electrified. Also assumes that NOx and VOC limits in GSE MOU are met: 2.65 g/bhp-hr NOx + HC (CARB and ATA 2002). Specific factors assumed for this estimate: 2.50 g NOx/bhp-hr and 0.15 g VOC/bhp-hr.

[4] Totals may not add exactly due to rounding.

in 2011 and 40 percent in 2020; and PM emissions will be reduced by 81 percent in 2011 and 75 percent in 2020.

Comparing the mitigated Project with optimized flights incremental inventories to the operational emission thresholds indicates that the mitigated inventories of all pollutants except NOx will be below the significance thresholds in 2011 and 2020, as shown in **Table 3-11.**

Table 3-11
Mitigated Incremental[1] Operational Emissions Compared to Significance Thresholds

	Incremental Emissions					
Year and Alternative	**CO**	**VOC**	**NOx**	**SO_2**	**PM10**	**PM2.5**
Operational Significance Thresholds, lb/day[2]	550	55	55	150	150	NA
2011 Project Incremental Emissions, tpy	(70.36)	(4.87)	53.85	5.31	3.36	0.10
2011 Project Incremental Emissions, lb/day	(386)	(27)	295	29	18	1
Above Thresholds? (yes/no)	No	No	**Yes**	No	No	NA
2020 Project Incremental Emissions, tpy	(93.28)	(7.60)	48.89	5.31	3.36	0.09
2020 Project Incremental Emissions, lb/day	(511)	(42)	268	29	18	1
Above Thresholds? (yes/no)	No	No	**Yes**	No	No	NA

Source: CDM 2005.

[1] Incremental emissions are those above the 2005 Existing Conditions emissions.

[2] Operational Significance Thresholds from SCAQMD CEQA Handbook (SCAQMD 1993).

NA = Not available or not applicable..

Section 4
Air Dispersion Modeling

This section briefly discusses the methodology used for estimating criteria air pollutant and TAC concentrations at receptor locations around LGB from airport sources. This section also presents the modeled criteria air pollutant and TAC concentrations for each alternative.

4.1 Methodology

Air dispersion modeling was used to estimate ambient criteria air pollutant and TAC concentrations for 2005 and the 2020 alternatives listed in Section 1.0. The project-related ambient concentrations were added to measured (2005) or estimated (2020) background concentrations for comparison to the NAAQS and CAAQS.

The predicted incremental difference in TAC concentrations between the 2020 alternatives and the 2005 Existing Conditions was used to assess the project specific incremental health risks to the potentially exposed populations described in Section 5.

The air dispersion analysis was performed in accordance with USEPA, CARB, and SCAQMD modeling guidelines and the modeling protocol developed for this project (see Attachment A). The results of the air dispersion analysis was used in conjunction with the chemical specific emissions rates discussed in Section 3.0 to estimate ambient criteria air pollutant and TAC concentrations. The air dispersion analysis requires the following: 1) selection of the dispersion model, 2) evaluation of potential terrain considerations, 3) selection of appropriate dispersion coefficients based on land use, 4) selection and/or preparation of meteorological data, 5) identification of source locations and modeling parameters, 6) selection of receptor locations, and 7) selection of appropriate averaging time periods. Each of these steps is summarized in the sections that follow.

4.1.1 Model Selection

The first step in an air dispersion analysis is the selection of an applicable model. The most commonly used air models for dispersion of pollutant emissions from airports are FAA's EDMS program, which uses USEPA's AERMOD model, and USEPA's Industrial Source Complex Short-Term 3 (ISCST3) dispersion model. In addition, CAL3QHC or CALINE4 are often used to assess CO concentrations at roadway intersections.

The FAA has developed EDMS for analyzing airport criteria pollutant concentrations. In the current release, EDMS Versions 4.0 and later implement AERMOD (USEPA 1998a), an air dispersion model developed by the American Meteorological Society/ Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC). AERMIC's objective is to develop a replacement for USEPA's ISCST3 air dispersion model (USEPA 1995b and c) that meets the following criteria: 1) adopts ISCST3's input/output computer architecture; 2) updates, where practical, ISCST3 model algorithms with newly developed or current state-of-the-art modeling

techniques; and 3) insures that the source and atmospheric processes presently modeled by ISCST3 will continue to be handled by AERMOD (USEPA 1998a and 2002a).

For this project, the EDMS/AERMOD system and CALINE4 were selected for the following reasons:

- The FAA requires EDMS be used to assess air quality impacts at airports (63FR18068).
- EDMS was used to calculate emissions from aircraft and APU, and by simply selecting the appropriate dispersion button on the EDMS pull down menu the program generated the input file for AERMOD.
- CALINE4 (Benson 1989) is the preferred regulatory model for conducting roadway intersection CO concentration analyses in California (CalTrans 1997).

Project-related concentrations of criteria pollutants were calculated directly from EDMS/AERMOD (for all on-airport sources) and from CALINE4 (from off-airport roadway intersections), with the following exception: the annual NO_2 NAAQS and 1-hour NO_2 CAAQS determination required supplemental analyses since the EDMS/AERMOD model calculates total NOx emissions and concentrations, not NO_2 impacts. The supplemental NO_2 approaches include the USEPA's Multi-tiered Screening Approach for the annual NO_2 analysis described in 40 CFR 51 Appendix W Section 6.2.4, and the SCAQMD localized significance threshold (LST) method for the 1-hour NO_2 analysis (SCAQMD 2003).

For the Multi-tiered Screening Approach to determine annual NO_2 concentrations from estimated annual NOx values, hourly monitoring data collected at the SCAQMD North Long Beach monitoring station (SCAQMD Station No. 072) was used. The data for 2002 through 2004 was obtained, and this data indicated that the annual average ratio of NO_2-to-NOx is 0.48. This value compares well with the value of 0.47 reported by Chico, et al (1998) for the 1994 to 1996 time period. The annual NOx concentration determined from EDMS/AERMOD was multiplied by 0.48 to determine the annual NO_2 concentration at each receptor location.

The 1-hour NO_2 concentration was determined from the peak 1-hour NOx concentration and the NO_2-to-NOx ratios presented in the SCAQMD LST methodology (SCAQMD 2003). The value of the NO_2-to-NOx ratio is dependent on the source-to-receptor distance. For this analysis the distance was determined from each receptor to the source with the maximum contribution to the highest 1-hour NOx concentration.

To develop annual concentrations for the 15 to 20 TACs typically considered at airports, dispersion factors, sometimes called chi-over-Q (χ/Q) values, were used. The χ/Q value for each group of similar sources was calculated from AERMOD results. These χ/Q values represent the ratio between concentration and emission rate as expressed in units of concentration per emissions rate. The χ/Q values were

developed for each group of sources that have similar dispersion characteristics and speciation profiles. The χ/Q values were then multiplied by the chemical-specific emission rates to determine TAC concentrations at each receptor.

Building downwash is the effect of structures on the dispersion of emissions from nearby point (stack) sources. No point sources within the terminal improvement area have been identified as significant emission sources of TACs. Therefore, an analysis of building downwash was not conducted.

4.1.2 Terrain

An important consideration in an air dispersion modeling analysis is whether the terrain in the modeling area is simple or complex (i.e., terrain above the effective height of the emission point). Complex terrain can affect the results of a dispersion analysis involving point and volume sources, but does not affect the predicted results for area sources (USEPA 1995c). Terrain elevations were obtained from digital elevation model (DEM) files[10] of the United States Geological Survey (USGS) maps for the Long Beach and Los Alamitos 7.5 Minute Quadrangles. The proposed modeling area contains both simple and complex terrain. USGS elevation information was used in the air dispersion modeling analysis to identify the terrain height of modeled sources and receptor points.

4.1.3 Land Use

Auer's (Auer 1978) method of classifying land-use as either rural or urban was used to analyze the surrounding region. This method calls for analysis of a three-kilometer radius around a facility to determine if the majority of the land can be classified as either rural (i.e., undeveloped) or urban. A review of Long Beach, Lakewood, and Signal Hill zoning maps as well as aerial photos indicates that over 50 percent of the land within 3 kilometers of the LGB is urban and, therefore, urban dispersion coefficients were used in the modeling.

4.1.4 Meteorological Data

An extensive review of meteorological data was conducted before the final selection of appropriate data was made. The steps followed in selecting the data are described in **Attachment G** to this appendix. Selection of the data was also coordinated with the SCAQMD[11,12] prior to use in the analysis. All dispersion analyses were conducted using 1985 hourly meteorological data obtained from Long Beach Airport. Use of this data satisfies USEPA modeling requirements. Processing of the meteorological data followed USEPA guidance as noted in the protocol (Attachment A). The 1985 windrose for Long Beach Airport is presented in Figure 4-1.

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[10] Obtained from: http://data.geocomm.com/catalog/US/61069/2389/group4-3.html , March 2005.
[11] Meeting with SCAQMD, August 30, 2005, regarding LGB Terminal Improvement Project – Draft Modeling Protocol dated August 9, 2005.
[12] Email from SCAQMD (T. Chico) on September 2, 2005.

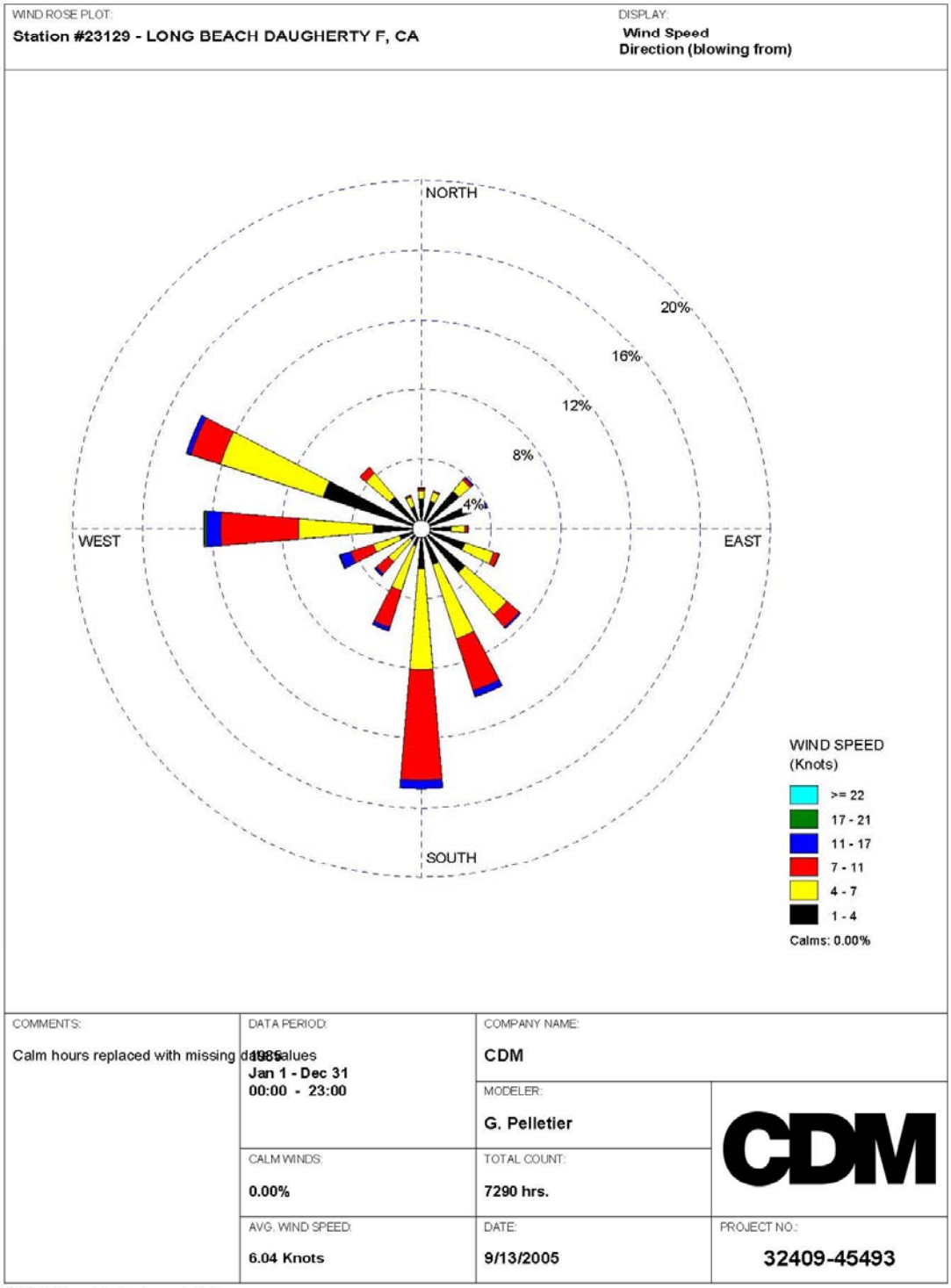


Figure 4-1
1985 Long Beach Airport Windrose

4.1.5 Source Parameters

The following emission sources identified in the emission inventories described in Section 3.0 were modeled: 1) aircraft, 2) APU, 3) GSE, 4) ground access vehicles, 5) fuel storage, 6) building heaters/boilers for the new terminals. The locations of the sources were determined from the airport layout plan, maps, aerial photos and other information provided by the City. The general methodology used to model each source type is described below, detailed methodology is included in the protocol (Attachment A).

4.1.5.1 Aircraft

The dispersion of emissions from aircraft operations at the Airport were modeled as area sources in AERMOD, as generated in EDMS. Actively used taxiways and runways entered into EDMS generated groups of area sources representing aircraft on the runways, taxiways, as well as in approach and departure airspace. EDMS 4.3 does calculate PM emissions from many, but not all, aircraft. Therefore, the emissions file created by EDMS and used as input to the AERMOD dispersion analysis was used to determine aircraft PM χ/Q values. These values were then used to estimate total aircraft PM concentrations by multiplying the χ/Q values by the total PM emissions presented in Section 3.2.

As discussed previously, aircraft emissions occur in four operating modes (taxi/idle, approach, takeoff, and climbout). For operations at each field, taxiway source groups were used to model the emissions from taxi/idle mode, runway source groups to model emissions during takeoff mode, arrival space source groups to model emissions during approach, and departure space source groups to model the emissions during climbout modes.

4.1.5.2 Ground Access

CO Hot Spot Analysis

Dispersion analysis of CO concentrations at roadway intersections was conducted for all 19 intersections[13] identified by the traffic consultant as the most likely to be impacted by the project. An additional intersection for the proposed project was also modeled for a new entrance to the Airport. The analysis was conducted following the recommended California Department of Transportation methodology (CalTrans 1997), using CALINE4 (Benson 1989).

On-Airport Roadway/Parking Dispersion

The locations of ground access sources (traffic and parking) were determined from the airport layout plan as well as recent aerial photos and maps. Roadways and parking facilities located within airport property were modeled as area sources, as generated by EDMS.

[13] For the Project alternatives, 20 intersections were analyzed which included a new proposed airport entrance/exit onto Lakewood Blvd.

4.1.5.3 Ground Support Equipment (GSE)/Auxiliary Power Unit (APU)

Pollutant emissions from GSE/APU operations were modeled by EDMS/AERMOD as volume sources. The locations of GSE/APU sources were at the commercial aircraft parking and cargo areas.

4.1.5.4 Stationary Sources

Stationary sources affected by the project were modeled. These sources included fuel farms and new terminal building heaters/boilers. Fugitive emissions from tanks in the fuel farms were modeled as elevated area sources (at the tank height elevation), and the building heaters/boilers were modeled as point (stack) sources.

4.1.5.5 Construction Sources

Construction source dispersion will be modeled following the general methodologies presented in the SCAQMD's Localized Significance Threshold Methodology document (SCAQMD 2003). CARB's OFFROAD model was used to estimate emissions, as noted in Section 3.1.7.

4.1.6 Receptor Locations

Ambient concentrations of criteria air pollutants and TACs were estimated at 390 receptor locations around the airport. Receptors were located at the following general locations in and around LGB:

- Along the airport security fence,
- Along the airport property line,
- At on-site worker locations (including ground handlers, rental car facility operators, valet parking attendant locations, and other commercial sites within the airport property line),
- At nearby residential sites,
- At nearby schools,
- At nearby hospitals,
- At nearby commercial/industrial worker locations, and
- At nearby recreational sites (golf courses).

The detailed receptor coordinates and receptor type are presented in **Attachment H.**

4.1.7 Dispersion Factor Averaging Time

The calculation of criteria air pollutant concentrations will be based on the averaging period(s) included in the NAAQS and/or CAAQS for each of the pollutants analyzed.

Two averaging periods were used in the TAC HRA dispersion analysis. The annual average concentration for the meteorological data period was calculated for each TAC used in estimating cancer and chronic non-cancer risk. Maximum one-hour concentrations were calculated for use in estimating acute non-cancer risk.

4.1.8 Concentrations of Toxic Air Contaminants

As discussed above, airborne off-site transport of vapor phase and particulate bound TACs from the facility to the receptors identified in Section 4.1.6 were analyzed. In summary, the process used to estimate the off-site ambient air concentrations of TACs included:

1. Estimation of total VOC or PM emission rates from aircraft, ground access vehicles, GSE/ APU, construction, and on-airport stationary sources

2. A TAC-specific emission rate for each source was determined by multiplying the VOC or PM emissions by the TAC-specific weight fraction from the appropriate source speciation profile

3. The annual average dispersion factors, χ/Qs, at the receptors of concern were obtained from the air dispersion analysis

4. The χ/Q factors were multiplied by the TAC-specific emission rates determined in the Step 2 to obtain TAC-specific annual air concentrations at the receptors of concern for each scenario

5. Acute (1-hour) TAC concentrations from all sources were calculated directly from AERMOD for each TAC with an acute reference exposure level

6. Incremental TAC concentrations for each scenario were determined by subtracting the 2005 Existing Conditions concentrations from TAC concentrations for each future 2020 scenario

4.2 Modeled Results

4.2.1 Criteria Air Pollutants

4.2.1.1 Construction

The airport's contribution to ambient concentrations of NO_2, PM2.5, and PM10 from construction sources are presented in **Table 4-1**. Annual average concentrations are based on annual emissions in 2007, the year of peak construction emissions. The 1-hour and 24-hour average concentrations are based on peak day emissions. Construction emissions of CO and SOx were shown to be insignificant in Section 3, therefore, modeling analysis of these pollutants was not necessary.

The construction dispersion modeling analysis included, among others, a receptor located just outside the terminal in the rental car lot. This location is between the terminal improvement construction area and the new parking structure area, and was

the most impacted receptor for the construction analysis. The results of the dispersion analysis indicate that concentrations of NO_2, PM2.5, and PM10 from construction sources are less than significant.

Table 4-1
Future Ambient Air Quality in the Vicinity of Long Beach Airport
Project Construction Contribution Only

Pollutant	Averaging Period	Conc. Units	Existing AQ 2005[1]	Constr. 2007	Background +Constr 2007	Significance Threshold[2]	Significant?
Nitrogen dioxide (NO_2)	1-hour[3]	ppm	0.14	0.038	0.18	0.25	No
		µg/m^3	263	71	334	470	No
	Annual	ppm	0.030	0.0034	0.033	0.053	No
		µg/m^3	56	6	62	100	No
Respirable Particulate Matter (PM10)	24-hour	µg/m^3	---	6.9	---	10.4	No
Fine Particulate Matter (PM2.5)	24-hour[4,5]	µg/m^3	47.1	3.2	50.3	65	No

Sources: CDM 2005, SCAQMD Air Quality Data Tables for 2002, 2003, and 2004 (unless otherwise noted).

Available at: http://www.aqmd.gov/smog/historicaldata.htm

[1] Maximum concentration from 2002-2004 measurements are assumed to be representative of existing conditions in 2005.

[2] Significance thresholds: 1-Hr NO_2 CAAQS; Annual NO_2 NAAQS; 24-Hr PM10 SCAQMD CEQA Threshold (applies to project increment only); and 24-Hr PM2.5 NAAQS.

[3] 1-Hour NO_2 concentration estimated from NOx concentration and NO_2-to-NOx ratio presented in SCAQMD's Localized Significance Threshold Methodology (SCAQMD 2003), based in distance from terminal and new parking structure to each receptor location.

[4] Measurments obtained from the California Air Resources Board, available at: http://www.arb.ca.gov/adam/welcome.html.

[5] 24-Hour average PM2.5 standard is based on the 98th percentile, per National Ambient Air Quality Standard (40 CFR 50.7).

CAAQS = California Ambient Air Quality Standards

NAAQS = National Ambient Air Quality Standards

ppm = parts per million by volume

µg/m^3 = micrograms per cubic meter

4.2.1.2 Operations

CO Concentrations at Intersections

The results of CALINE4 CO concentrations at roadway intersections are provided in **Table 4-2** under the 2005 Baseline condition, and in **Tables 4-3 through 4-6** under the optimized flight scenario for Project and No Project alternatives in 2011 and 2020. These results indicate that even at the most heavily impacted intersection, CO concentrations will not exceed the applicable CAAQS or NAAQS.

Table 4-2
Maximum Carbon Monoxide Concentrations at Roadway Intersections
Baseline (2005) [1]

ID	Intersection	Traffic CO Conc. (ppm)		Max. Conc. (ppm)		Exceeds Threshold?	
		1-Hour	8-Hour	1-Hour [2]	8-Hour [3],[4]	1-Hour [5]	8-Hour [6]
1	Carson St / Cherry Ave	3.7	2.6	9.7	7.3	no	no
2	Carson St / Paramount Blvd	3.5	2.5	9.5	7.2	no	no
3	Carson St / Lakewood Blvd	4.5	3.2	10.5	7.9	no	no
4	Carson St / Clark Ave	3.5	2.5	9.5	7.2	no	no
5	Bixby Rd / Cherry Ave	3.8	2.7	9.8	7.4	no	no
6	Conant St / Lakewood Blvd	2.8	2.0	8.8	6.7	no	no
7	Conant St / Clark Ave	1.9	1.3	7.9	6.0	no	no
8	E 36th St / Cherry Ave	4.5	3.2	10.5	7.9	no	no
9	E Wardlow Rd / Cherry Ave	5.1	3.6	11.1	8.3	no	no
10	E Wardlow Rd / Dr. Douglas Rd / Lakewood Blvd	3.6	2.5	9.6	7.2	no	no
11	E Wardlow Rd / Clark Ave	2.4	1.7	8.4	6.4	no	no
12	E Spring St / Cherry Ave	3.5	2.5	9.5	7.2	no	no
13	E Spring St / Temple Ave	4.7	3.3	10.7	8.0	no	no
14	E Spring St / Redondo Ave	4.5	3.2	10.5	7.9	no	no
15	E Spring St / Lakewood Blvd	4.4	3.1	10.4	7.8	no	no
16	E Spring St / Clark Ave	3.5	2.5	9.5	7.2	no	no
17	E Willow St / Redondo Ave	3.4	2.4	9.4	7.1	no	no
18	E Willow St / Lakewood Blvd	5.2	3.6	11.2	8.3	no	no
19	E Willow St / Clark Ave	3.6	2.5	9.6	7.2	no	no

Source: CDM, 2005.

(1) Receptors 3 meters from roadway

(2) Background (1-Hour) 6 ppm

(3) Background (8-Hour) 4.7 ppm

(4) Generalized Persistence Factor 0.7 (Urban Locations)

Source: California Department of Transportation. 1997. "Transportation Project-Level Carbon Monoxide Protocol." Table B.15. December.

(5) Significance Threshold (1-Hour) 20.0 ppm

(6) Significance Threshold (8-Hour) 9.0 ppm

Source: SCAQMD Air Quality Significance Thresholds. [Accessed August 31, 2005]. http://www.aqmd.gov/ceqa/handbook/signthres.doc

Table 4-3
Maximum Carbon Monoxide Concentrations at Roadway Intersections
No Project (2011) with Optimized Flights [1]

ID	Intersection	Traffic CO Conc. (ppm)		Max. Conc. (ppm)		Exceeds Threshold?	
		1-Hour	8-Hour	1-Hour [2]	8-Hour [3],[4]	1-Hour [5]	8-Hour [6]
1	Carson St / Cherry Ave	3.4	2.4	8.5	6.3	no	no
2	Carson St / Paramount Blvd	3.1	2.2	8.2	6.1	no	no
3	Carson St / Lakewood Blvd	3.5	2.5	8.6	6.4	no	no
4	Carson St / Clark Ave	2.5	1.8	7.6	5.7	no	no
5	Bixby Rd / Cherry Ave	3.5	2.5	8.6	6.4	no	no
6	Conant St / Lakewood Blvd	4.4	3.1	9.5	7.0	no	no
7	Conant St / Clark Ave	1.3	0.9	6.4	4.8	no	no
8	E 36th St / Cherry Ave	4.0	2.8	9.1	6.7	no	no
9	E Wardlow Rd / Cherry Ave	3.7	2.6	8.8	6.5	no	no
10	E Wardlow Rd / Dr. Douglas Rd / Lakewood Blvd	4.5	3.2	9.6	7.1	no	no
11	E Wardlow Rd / Clark Ave	1.9	1.3	7.0	5.2	no	no
12	E Spring St / Cherry Ave	3.0	2.1	8.1	6.0	no	no
13	E Spring St / Temple Ave	3.9	2.7	9.0	6.6	no	no
14	E Spring St / Redondo Ave	3.4	2.4	8.5	6.3	no	no
15	E Spring St / Lakewood Blvd	4.4	3.1	9.5	7.0	no	no
16	E Spring St / Clark Ave	2.9	2.0	8.0	5.9	no	no
17	E Willow St / Redondo Ave	2.4	1.7	7.5	5.6	no	no
18	E Willow St / Lakewood Blvd	4.1	2.9	9.2	6.8	no	no
19	E Willow St / Clark Ave	2.4	1.7	7.5	5.6	no	no

Source: CDM, 2005.

(1) Receptors 3 meters from roadway

(2) Background (1-Hour) 5.1 ppm

(3) Background (8-Hour) 3.9 ppm

(4) Generalized Persistence Factor 0.7 (Urban Locations)

Source: California Department of Transportation. 1997. "Transportation Project-Level Carbon Monoxide Protocol." Table B.15. December.

(5) Significance Threshold (1-Hour) 20.0 ppm

(6) Significance Threshold (8-Hour) 9.0 ppm

Source: SCAQMD Air Quality Significance Thresholds. [Accessed August 31, 2005].
http://www.aqmd.gov/ceqa/handbook/signthres.doc

Table 4-4
Maximum Carbon Monoxide Concentrations at Roadway Intersections
Project (2011) with Optimized Flights [1]

ID	Intersection	Traffic CO Conc. (ppm)		Max. Conc. (ppm)		Exceeds Threshold?	
		1-Hour	8-Hour	1-Hour [2]	8-Hour [3],[4]	1-Hour [5]	8-Hour [6]
1	Carson St / Cherry Ave	3.3	2.3	8.4	6.2	no	no
2	Carson St / Paramount Blvd	3.0	2.1	8.1	6.0	no	no
3	Carson St / Lakewood Blvd	3.5	2.5	8.6	6.4	no	no
4	Carson St / Clark Ave	2.5	1.8	7.6	5.7	no	no
5	Bixby Rd / Cherry Ave	3.3	2.3	8.4	6.2	no	no
6	Conant St / Lakewood Blvd	4.3	3.0	9.4	6.9	no	no
7	Conant St / Clark Ave	1.3	0.9	6.4	4.8	no	no
8	E 36th St / Cherry Ave	4.0	2.8	9.1	6.7	no	no
9	E Wardlow Rd / Cherry Ave	3.7	2.6	8.8	6.5	no	no
10	E Wardlow Rd / Dr. Douglas Rd / Lakewood Blvd	3.6	2.5	8.7	6.4	no	no
11	E Wardlow Rd / Clark Ave	1.9	1.3	7.0	5.2	no	no
12	E Spring St / Cherry Ave	3.0	2.1	8.1	6.0	no	no
13	E Spring St / Temple Ave	3.9	2.7	9.0	6.6	no	no
14	E Spring St / Redondo Ave	3.3	2.3	8.4	6.2	no	no
15	E Spring St / Lakewood Blvd	4.3	3.0	9.4	6.9	no	no
16	E Spring St / Clark Ave	2.9	2.0	8.0	5.9	no	no
17	E Willow St / Redondo Ave	2.3	1.6	7.4	5.5	no	no
18	E Willow St / Lakewood Blvd	4.0	2.8	9.1	6.7	no	no
19	E Willow St / Clark Ave	2.4	1.7	7.5	5.6	no	no
20	New Driveway/Lakewood	3.9	2.7	9.0	6.6	no	no

Source: CDM, 2005.

(1) Receptors 3 meters from roadway

(2) Background (1-Hour) 5.1 ppm

(3) Background (8-Hour) 3.9 ppm

(4) Generalized Persistence Factor 0.7 (Urban Locations)

Source: California Department of Transportation. 1997. "Transportation Project-Level Carbon Monoxide Protocol." Table B.15. December.

(5) Significance Threshold (1-Hour) 20.0 ppm

(6) Significance Threshold (8-Hour) 9.0 ppm

Source: SCAQMD Air Quality Significance Thresholds. [Accessed August 31, 2005].
http://www.aqmd.gov/ceqa/handbook/signthres.doc

Table 4-5
Maximum Carbon Monoxide Concentrations at Roadway Intersections
No Project (2020) with Optimized Flights [1]

ID	Intersection	Traffic CO Conc. (ppm)		Max. Conc. (ppm)		Exceeds Threshold?	
		1-Hour	8-Hour	1-Hour [2]	8-Hour [3],[4]	1-Hour [5]	8-Hour [6]
1	Carson St / Cherry Ave	1.6	1.1	6.7	5.0	no	no
2	Carson St / Paramount Blvd	1.4	1.0	6.5	4.9	no	no
3	Carson St / Lakewood Blvd	1.7	1.2	6.8	5.1	no	no
4	Carson St / Clark Ave	1.2	0.8	6.3	4.7	no	no
5	Bixby Rd / Cherry Ave	1.6	1.1	6.7	5.0	no	no
6	Conant St / Lakewood Blvd	2.0	1.4	7.1	5.3	no	no
7	Conant St / Clark Ave	0.6	0.4	5.7	4.3	no	no
8	E 36th St / Cherry Ave	1.8	1.3	6.9	5.2	no	no
9	E Wardlow Rd / Cherry Ave	1.7	1.2	6.8	5.1	no	no
10	E Wardlow Rd / Dr. Douglas Rd / Lakewood Blvd	2.1	1.5	7.2	5.4	no	no
11	E Wardlow Rd / Clark Ave	0.9	0.6	6.0	4.5	no	no
12	E Spring St / Cherry Ave	1.4	1.0	6.5	4.9	no	no
13	E Spring St / Temple Ave	1.8	1.3	6.9	5.2	no	no
14	E Spring St / Redondo Ave	1.5	1.1	6.6	5.0	no	no
15	E Spring St / Lakewood Blvd	1.9	1.3	7.0	5.2	no	no
16	E Spring St / Clark Ave	1.4	1.0	6.5	4.9	no	no
17	E Willow St / Redondo Ave	1.1	0.8	6.2	4.7	no	no
18	E Willow St / Lakewood Blvd	1.9	1.3	7.0	5.2	no	no
19	E Willow St / Clark Ave	1.1	0.8	6.2	4.7	no	no

Source: CDM, 2005.

(1) Receptors 3 meters from roadway

(2) Background (1-Hour) 5.1 ppm

(3) Background (8-Hour) 3.9 ppm

(4) Generalized Persistence Factor 0.7 (Urban Locations)

Source: California Department of Transportation. 1997. "Transportation Project-Level Carbon Monoxide Protocol." Table B.15. December.

(5) Significance Threshold (1-Hour) 20.0 ppm

(6) Significance Threshold (8-Hour) 9.0 ppm

Source: SCAQMD Air Quality Significance Thresholds. [Accessed August 31, 2005].
http://www.aqmd.gov/ceqa/handbook/signthres.doc

Table 4-6
Maximum Carbon Monoxide Concentrations at Roadway Intersections
Project (2020) with Optimized Flights [1]

ID	Intersection	Traffic CO Conc. (ppm)		Max. Conc. (ppm)		Exceeds Threshold?	
		1-Hour	8-Hour	1-Hour [2]	8-Hour [3],[4]	1-Hour [5]	8-Hour [6]
1	Carson St / Cherry Ave	1.6	1.1	6.7	5.0	no	no
2	Carson St / Paramount Blvd	1.4	1.0	6.5	4.9	no	no
3	Carson St / Lakewood Blvd	1.6	1.1	6.7	5.0	no	no
4	Carson St / Clark Ave	1.2	0.8	6.3	4.7	no	no
5	Bixby Rd / Cherry Ave	1.5	1.1	6.6	5.0	no	no
6	Conant St / Lakewood Blvd	2.0	1.4	7.1	5.3	no	no
7	Conant St / Clark Ave	0.6	0.4	5.7	4.3	no	no
8	E 36th St / Cherry Ave	1.8	1.3	6.9	5.2	no	no
9	E Wardlow Rd / Cherry Ave	1.7	1.2	6.8	5.1	no	no
10	E Wardlow Rd / Dr. Douglas Rd / Lakewood Blvd	1.7	1.2	6.8	5.1	no	no
11	E Wardlow Rd / Clark Ave	0.9	0.6	6.0	4.5	no	no
12	E Spring St / Cherry Ave	1.4	1.0	6.5	4.9	no	no
13	E Spring St / Temple Ave	1.8	1.3	6.9	5.2	no	no
14	E Spring St / Redondo Ave	1.5	1.1	6.6	5.0	no	no
15	E Spring St / Lakewood Blvd	2.0	1.4	7.1	5.3	no	no
16	E Spring St / Clark Ave	1.4	1.0	6.5	4.9	no	no
17	E Willow St / Redondo Ave	1.1	0.8	6.2	4.7	no	no
18	E Willow St / Lakewood Blvd	1.9	1.3	7.0	5.2	no	no
19	E Willow St / Clark Ave	1.1	0.8	6.2	4.7	no	no
20	New Driveway/Lakewood	1.8	1.3	6.9	5.2	no	no

Source: CDM, 2005.

(1) Receptors 3 meters from roadway

(2) Background (1-Hour) 5.1 ppm

(3) Background (8-Hour) 3.9 ppm

(4) Generalized Persistence Factor 0.7 (Urban Locations)

Source: California Department of Transportation. 1997. "Transportation Project-Level Carbon Monoxide Protocol." Table B.15. December.

(5) Significance Threshold (1-Hour) 20.0 ppm

(6) Significance Threshold (8-Hour) 9.0 ppm

Source: SCAQMD Air Quality Significance Thresholds. [Accessed August 31, 2005].
http://www.aqmd.gov/ceqa/handbook/signthres.doc

Total Airport Operational Contributions With Optimized Flights

The airport's incremental contribution to ambient concentrations of criteria air pollutants under the optimized flight scenario for Project and No Project are presented in **Table 4-7** for operations in 2011 and 2020. The incremental airport concentrations are also added to the existing background concentrations in Table 4-2 for comparison to the CAAQS and NAAQS.

The concentrations of CO include the highest increment from on-airport operations plus the roadway intersection increment. The results are conservative since the calculation does not account for the fact that the peak increments from on-airport operations and roadway intersections occur at different locations and different times.

The annual NO_2 concentrations are calculated by multiplying the annual NOx concentrations by a factor of 0.48, as noted in Section 4.1, to account for the annual average NO_2-to-NOx ratio. The 1-hour NO_2 concentrations are determined using the NO_2-to-NOx ratios presented in the SCAQMD LST guidance (SCAQMD 2003).

The 24-hour PM10 increment is compared to the SCAQMD CEQA threshold for operations (2.5 $\mu g/m^3$). The 24-hour PM2.5 increment plus background is compared to the NAAQS for PM2.5.

The concentrations from future airport operations would not be significant for CO, NO_2, or the 24-hour PM2.5 impacts. The incremental concentrations from future operations with optimized flights would be significant for PM10 for both Project and No Project alternatives. However, the Project annual incremental PM10 impacts are less than those for No Project. The SCAQMD has not yet established an incremental PM2.5 significance threshold(s). The existing PM2.5 concentrations in Long Beach exceed both the annual NAAQS and annual CAAQS, and will continue to exceed these standards in the future with or without the Project.

Table 4-7
Future Ambient Air Quality in the Vicinity of Long Beach Airport with Optimized Flights
Operational Contributions

Pollutant	Averaging Period	Conc. Units	Existing AQ 2005[1]	Incremental Optimized Flights Contribution (Future - Existing)[2]				Future Air Quality with Optimized Flights				NAAQS	CAAQS
				NP 2011	P 2011	NP 2020	P 2020	NP 2011	P 2011	NP 2020	P 2020		
Carbon monoxide (CO)[3]	1-hour	ppm	**6.0**	0.45	0.25	-1.90	-2.72	6.45	6.25	4.10	3.28	35	20
		µg/m^3	**6870**	514	285	-2,179	-3,117	7,384	7,155	4.691	3.753	40,000	23,000
	8-hour	ppm	**4.7**	-0.21	-0.41	-1.88	-2.18	4.49	4.29	2.82	2.52	9	9.0
		µg/m^3	**5380**	-243	-472	-2,156	-2,491	5,137	4.908	3,224	2.889	10,000	10,000
Nitrogen dioxide (NO_2)	1-hour	ppm	**0.14**	0.0214	0.0177	0.0220	0.0232	0.16	0.16	0.16	0.16	NA	0.25
		µg/m^3	**263**	40	33	41	44	304	297	305	307	NA	470
	Annual	ppm	**0.030**	0.0067	0.0048	0.0029	0.0023	0.037	0.035	0.033	0.032	0.053	NA
		µg/m^3	**56**	13	9	6	4	69	65	62	60	100	NA
Respirable Particulate Matter (PM10)	24-hr[4]	µg/m^3	**74.0**	**10.1**	**10.4**	**14.3**	**10.4**	**84.1**	**84.4**	**88.3**	**84.4**	150	50
	Annual	µg/m^3	**35.9**	9.3	7	9.4	6.8	**45.1**	**42.9**	**45.3**	**42.7**	50	20
Fine Particulate Matter (PM2.5)	24-hr[5,6]	µg/m^3	**47.1**	1.6	1.9	2.6	1.7	48.7	49.0	49.7	48.8	65	NA
	Annual	µg/m^3	**19.5**	1.9	1.2	1.7	1.1	**21.4**	**20.7**	**21.2**	**20.6**	15	12

Sources: SCAQMD Air Quality Data Tables for 2002, 2003, and 2004 (unless otherwise noted). Available at: http://www.aqmd.gov/smog/historicaldata.htm

[1] Maximum concentration from 2002-2004 measurements are assumed to be representative of existing conditions in 2005.

[2] Airport contributions to criteria pollutant concentrations are presented in Attachment I.

[3] CO concentrations include sum of airport operations and roadway intersections.

[4] 24-Hour PM10 incremental significance threshold is 2.5 µg/m^3 (SCAQMD 1993).

[5] Measurments obtained from the California Air Resources Board, available at: http://www.arb.ca.gov/adam/welcome.html.

[6] 24-Hour average PM2.5 standard is based on the 98th percentile, per National Ambient Air Quality Standard (40 CFR 50.7).

CAAQS = California Ambient Air Quality Standards

NAAQS = National Ambient Air Quality Standards

NA = Not applicable or not available.

NP = No Project with Optimized Flights.

P = Project (i.e., terminal improvements) with Optimized Flights.

ppm = parts per million by volume

µg/m^3 = micrograms per cubic meter

4.2.2 Toxic Air Pollutants

The peak incremental annual concentrations of 1,3-butadiene, benzene, formaldehyde, and diesel particulate matter for each receptor type in each alternative are presented in **Table 4-8.** The peak incremental acute concentrations of these TACs for each receptor type in each alternative are presented in **Table 4-9.** These four TACs typically produce 95 percent or greater of the calculated total risks presented in Section 5.

Table 4-8
Incremental Annual Concentrations of Selected TAC (in µg/m^3)

Receptor Type	1,3-Butadiene	Benzene	Formaldehyde	Acrolein	Diesel PM
2020 Project with Optimized Flights					
Resident	-7.50E-05	-4.45E-04	2.05E-03	2.39E-05	-8.15E-04
School	-5.74E-05	-3.35E-04	4.99E-04	-4.06E-06	-7.17E-04
Worker (Restricted)	1.36E-06	-1.18E-03	3.17E-02	9.43E-04	1.26E-01
Worker (Non-restricted)	-1.90E-04	-1.11E-03	1.20E-02	3.23E-04	1.25E-02
Hospital	-4.77E-05	-2.79E-04	5.35E-04	-3.83E-06	-5.92E-04
Recreational	-2.63E-04	-1.58E-03	1.99E-03	-1.49E-05	-2.58E-03
2020 No Project with Optimized Flights					
Resident	-8.14E-05	-4.43E-04	1.98E-04	-1.26E-05	-7.81E-04
School	-6.23E-05	-3.38E-04	3.98E-05	-9.90E-06	-6.94E-04
Worker (Restricted)	-2.20E-04	-1.19E-03	4.79E-02	-3.56E-05	-2.52E-03
Worker (Non-restricted)	-2.08E-04	-1.12E-03	2.09E-03	-3.34E-05	-2.37E-03
Hospital	-5.09E-05	-2.78E-04	1.39E-07	-7.67E-06	-5.72E-04
Recreational	-2.85E-04	-1.58E-03	-1.68E-05	-3.91E-05	-2.67E-03
2011 Project with Optimized Flights					
Resident	1.93E-04	8.07E-05	4.33E-03	1.82E-04	4.78E-03
School	2.12E-05	-5.64E-05	2.11E-03	7.50E-05	1.78E-04
Worker (Restricted)	9.14E-03	3.99E-02	8.29E-02	2.97E-03	2.12E-01
Worker (Non-restricted)	1.80E-03	6.14E-03	4.29E-02	9.32E-04	3.72E-02
Hospital	-8.88E-07	-7.17E-05	1.61E-03	4.31E-05	-1.13E-04
Recreational	2.27E-04	1.00E-04	5.29E-03	2.10E-04	6.15E-03
2011 No Project with Optimized Flights					
Resident	3.62E-04	1.25E-03	2.95E-03	1.56E-04	1.04E-03
School	8.92E-05	8.77E-05	1.75E-03	7.55E-05	-1.58E-04
Worker (Restricted)	1.61E-02	7.04E-02	1.00E-01	5.14E-03	1.39E-01
Worker (Non-restricted)	7.43E-03	2.33E-02	7.63E-02	3.78E-03	1.59E-02
Hospital	-5.71E-06	-6.34E-05	4.36E-04	5.89E-06	-1.39E-04
Recreational	8.22E-05	-1.88E-04	3.43E-03	1.36E-04	7.27E-04

Source: CDM 2005.

Table 4-9
Incremental 1-Hour Concentrations of Selected TAC (in µg/m^3)

Receptor Type	Acrolein	Formaldehyde
2020 Project with Optimized Flights		
Resident	0.0675	1.5020
School	0.0299	0.7276
Worker (Restricted)	0.0925	2.1515
Worker (Non-restricted)	0.0827	1.8250
2020 No Project with Optimized Flights		
Resident	0.0674	3.9568
School	0.0309	2.4110
Worker (Restricted)	0.0965	11.2037
Worker (Non-restricted)	0.0826	8.4367
2011 Project with Optimized Flights		
Resident	0.0437	0.5100
School	0.0385	0.2941
Worker (Restricted)	0.0697	0.7006
Worker (Non-restricted)	0.0828	0.9804
2011 No Project with Optimized Flights		
Resident	0.0262	2.5645
School	0.1118	1.8815
Worker (Restricted)	0.0534	9.1220
Worker (Non-restricted)	0.1603	7.4808

Source: CDM 2005.

4.3 Mitigation

4.3.1 Construction Concentrations

Concentrations from Project construction activities are below the SCAQMD CEQA significance thresholds. However, mitigation will be included for construction sources, as described in Section 3.3.1, due to significant construction source emissions discussed in Section 3.

4.3.2 Operational Concentrations with Optimized Flights

Concentrations from future airport operations with optimized flights would be significant for particulate matter (PM10 and PM2.5) only. As noted in Section 3.3.2, the airport will include in the terminal design the infrastructure necessary to assist airlines in complying with the GSE MOU. The GSE MOU included provisions for electrifying diesel GSE and retrofitting the remaining diesel GSE with particulate traps where feasible. Therefore, compliance with the GSE MOU will reduce PM10 and PM2.5 impacts as well as NOx and CO emissions.

Fugitive road dust from paved roads also contributes to the PM10 impacts. Therefore improved street sweeping/washing of the on-airport roadways could potentially reduce the PM10 impacts.

These measures will reduce PM10 and PM2.5 operational emissions by 12 to 20 percent, as shown in Section 3.3.2. However, the PM10 incremental concentrations for the Project are 10.7 $\mu g/m^3$ and 10.4 $\mu g/m^3$ for 2011 and 2020, respectively (from Table 4-7); well above the 2.5 $\mu g/m^3$ significance threshold for PM10 (SCAQMD 1993). Therefore, it is assumed that operational PM10 and PM2.5 concentrations will remain significant after mitigation.

Section 5
Health Risk Analysis

This section describes methodology for and results of evaluation of possible cancer risks and non-cancer health hazards that may result from inhalation of TACs emitted during normal operations of the Airport. Specifically, the purpose of the risk assessment is to estimate potential incremental cancer risks and non-cancer hazards to human health associated with several projected alternative scenarios for Airport improvements.

The HHRA was conducted in the following steps:

1. estimation of chemical emissions from operational sources under conditions existing in 2005 ("2005 Baseline Conditions" scenario), and under future conditions predicted for the proposed Project and No Project alternatives assuming the maximum level of facilities improvements;

2. calculation of possible impacts to air quality using emissions estimates and refined air dispersion modeling;

3. selection of TACs of concern for airport operations;

4. evaluation of possible exposures to TACs;

5. evaluation of toxicity of TACs;

6. characterization of possible cancer risks and chronic and acute non-cancer hazards; and

7. evaluation of uncertainties in the risk assessment process.

The results of the risk assessment are used to characterize possible human health impacts on communities nearest to the Airport that might result from implementation of the project. The first two steps in this process are described in detail in Sections 3 and 4. The remainder of this section presents steps 3 through 6. The analysis of uncertainties is presented in Section 6.

Risk assessment methods described below are consistent with guidelines provided by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) in Supplemental Guidance for Human Health Multimedia Risk Assessment Hazardous Waste Sites and Permitted Facilities (Cal/EPA 1992); California Air Pollution Control Officers Association (CAPCOA) Air Toxics "Hot Spots" Revised Risk Assessment Guidelines (CAPCOA 1993), Office of Environmental Health Hazard Assessment in Air Toxic Hot Spots Program Risk Assessment Guidelines Guidance Manual for Preparation of Health Risk Assessments and its four technical support documents, Cal/EPA (1999, 2000a, 2000b, 2002b, and 2003); and

USEPA in Risk Assessment Guidance for Superfund (RAGS) (USEPA 1989) and supplements. The SCAQMD Rules (particularly Rules 1401 and 1402) were also consulted during preparation of this document.

Risk assessments are conducted in four phases as defined in Cal/EPA and USEPA guidance, including:

- Identification of substances (in this case TACs) that may be released in sufficient quantities to present a public health risk (Hazard Identification)
- Analysis of ways in which people might be exposed to substances (TACs) (Exposure Assessment)
- Evaluation of the toxicity of substances (TACs) that may present public health risks (Toxicity Assessment)
- Characterization of the magnitude and location of potential health risks for the exposed community (Risk Characterization)

Methods used in this HHRA are conservative; that is they are more likely to overestimate than underestimate possible health risks. For example, risks and hazards are calculated for individuals that are likely to be exposed at locations where TAC concentrations are predicted to be highest. Further, individuals are assumed to be exposed for almost all days of the year and for many years to maximize estimates of possible exposure. Resulting incremental cancer risk estimates represent upper-range predictions of exposure and health risk associated with living or working near and breathing emissions from the Airport. By protecting hypothetical individuals that receive the highest exposures (i.e., people living at or working at locations for which the highest emissions are predicted), the risk assessment will also be protective for actual members of the population near the Airport that are not as highly exposed.

Consistent with the purposes of CEQA, the analysis is intended to provide a reasonable estimate of the change in the environment that could occur due to implementation of the project. For the purposes of assessing human health risk in this report, a reasonable estimate has been defined as an estimate far above an average risk or hazard, and falling within or even above the upper range of possible cancer risks or chronic non-cancer health hazards. As used in this HHRA, reasonable is not, however, defined as an absolute worst-case estimate of health risks or hazards. Assumptions that go into developing reasonable risk estimates are conservative, as indicated above, but are not always the most extreme assumptions possible. For example, inhalation rates for off-Airport residents used to estimate the amount of TAC inhaled are taken from the upper range of rates for moderately active individuals. Since these rates are applied over long periods of time (70 years) and over hours of inactivity (sleep), these rates are unlikely to underestimate long-term exposure to TAC.

This approach to human health risk assessment is consistent with Cal/EPA and USEPA risk assessment guidance. Throughout the HHRA, estimates of incremental cancer risk or incremental chronic non-cancer hazards that meet the above definition are referred to as "Highest Incremental Risk" or "Highest Incremental Hazard".

More conservative, worst-case assumptions are sometimes used by regulatory agencies to estimate risks and hazards for purposes of permitting emissions sources and other purposes. Where those assumptions differ substantially from those used in the analysis performed for determination of significance in this HHRA, the effects that such more conservative assumptions would have on the analysis of risks are provided in an uncertainties analysis (Section 6).

5.1 Summary of Selection of TACs of Concern

The selection process for TACS of concern identifies substances that, because of the combination of their toxicity and amounts released, should be the main focus of the risk analysis. The selection process involves gathering and analyzing data on both toxicity and emissions, as described below.

Consistent with USEPA (1989) guidance, a concentration-toxicity screen is one of the procedures for selection of TACs of concern that may be employed to reduce the number of TACs carried through a risk assessment to a manageable number while still maintaining a health protective approach. "The objective of this screening procedure is to identify chemicals in a particular medium that – based on concentration and toxicity – are most likely to contribute significantly to risks calculated for exposure scenarios involving that medium, so that the risk assessment is focused on the most significant chemicals" (USEPA 1989). By focusing efforts on the "most significant" chemicals, one improves the level of confidence and ease of interpretation of emission estimation, air dispersion modeling, and risk assessment results.

A potency-weighted emissions screening method, analogous to the concentration-toxicity screen procedures recommended by USEPA (1989), was used for all TACs identified in Airport-related emissions (see Table 5-1). First, Airport-related TACs were identified. Second, total estimated emission rate in tons per year for each TAC was estimated. Third, toxicological information was reviewed and appropriate toxicity criteria selected for each TAC. Fourth, each individual chemical was scored according to its emission rate and toxicity. Chemicals determined to contribute significantly to the overall risk (i.e., chemicals that account for 99 percent of the potency weighted emissions of carcinogens or potency-weighted non-cancer emissions) were identified as TACs of concern and became the focus of the remainder of the risk analysis.

Table 5-1
Selection of TACs of Concern for Inhalation Exposure

TAC Category	TAC Name	2011 No Project (tons per year)	Cal/EPA[1] CSF_{in} (mg/kg-d)	Cal/EPA[1] RfD_{in} (mg/kg-d)	Possible %[2] Cancer Contribution	Possible %[2] Non-Cancer Contribution
Major Contributors						
Diesel PM	Diesel Particulate Matter	1.57	1.1	0.0014	78.3%	12.2%
VOC	Acrolein	0.09	NA	0.000017	NA	58.3%
VOC	Formaldehyde	1.37	0.021	0.00086	1.3%	17.8%
VOC	1,3-Butadiene	0.30	0.6	0.00057	8.1%	5.8%
VOC	Benzene	1.38	0.1	0.017	6.3%	0.9%
Trace Element	Chromium VI	0.00015	510	0.000029[3]	3.4%	0.06%
VOC	Acetaldehyde	0.32	0.01	0.0026	0.1%	1.4%
Trace Element	Lead	0.96	0.042	NA	1.8%	NA
Trace Element	Manganese	0.009	NA	0.000057	NA	1.7%
Trace Element	Cobalt	0.0005	9.8 [3]	0.0000057[3]	0.2%	0.9%
VOC	Naphthalene	0.06	0.12	0.0026	0.3%	0.2%
Minor Contributors						
VOC	Toluene	2.60	NA	0.086	NA	0.3%
VOC	Xylene, total	2.54	NA	0.2	NA	0.1%
Trace Element	Titanium	0.05	NA	0.0086[3]	NA	0.07%
Trace Element	Iron	0.60	NA	0.3[3]	NA	0.02%
VOC	Ethylbenzene	0.50	NA	0.57	NA	0.01%
Trace Element	Nickel	0.0004	0.91	0.02[3]	0.02%	0.0002%
VOC	Styrene	0.11	NA	0.26	NA	0.005%
VOC	Phenol	0.02	NA	0.057	NA	0.004%
PAH	Benzo(a)pyrene	0.000007	3.9	NA	0.0012%	NA
PAH	Dibenzo(a,h)anthracene	0.000005	4.1	NA	0.0010%	NA
Trace Element	Barium	0.02	NA	0.2[3]	NA	0.00098%
Trace Element	Copper	0.003	NA	0.04[3]	NA	0.00093%
Trace Element	Zinc	0.011	NA	0.3[3]	NA	0.00041%
PAH	Benzo(a)anthracene	0.000007	0.39	NA	0.00012%	NA
PAH	Indeno(1,2,3-cd)pyrene	0.000004	0.39	NA	0.00008%	NA
PAH	Benzo(k)fluoranthene	0.000004	0.39	NA	0.00008%	NA
PAH	Benzo(b)fluoranthene	0.000004	0.39	NA	0.00008%	NA
Trace Element	Strontium	0.004	NA	0.6[3]	NA	0.00007%
Trace Element	Tin	0.002	NA	0.6[3]	NA	0.00003%
PAH	Chrysene	0.000004	0.039	NA	0.000008%	NA
Trace Element	Zirconium	0.002	NA	NA	NA	NA
Trace Element	Sulfur	0.06	NA	NA	NA	NA
Trace Element	Scandium	0.0002	NA	NA	NA	NA
Trace Element	Calcium	0.35	NA	NA	NA	NA

Source: CDM 2005.

(1) CSF_{in} and RfD_{in} values were obtained from Cal/EPA OEHHA Online Toxicity Criteria Database, 2005 unless noted otherwise. RfD_{in} values were converted from RELs.

(2) Estimates of percent contribution are based only on total estimated emissions. Actual percent contributions are presented later in this report, and are based on air concentrations estimated using air dispersion modeling.

(3) Toxicity values were obtained from USEPA IRIS online database (2005) or USEPA Region 9 PRG Table (2004) since values from Cal/EPA OEHHA Online Toxicity Criteria Database were unavailable. Oral values were substituted if inhalation values were unavailable.

NA = Not applicable or not available.

CSF_{in} = Cancer slope factor for inhalation pathway.

RfD_{in} = Reference dose for inhalation pathway.

The analysis identified eleven TACs of concern for Airport-related sources, including diesel particulate matter (PM), acrolein, formaldehyde, 1-3-butadiene, benzene, chromium VI, acetaldehyde, lead, manganese, cobalt, and naphthalene. In combination, these TACs are expected to account for about 99 percent of all potency-weighted emissions that could be associated with Airport operations (see Table 5-1). These TACs are the focus of this risk analysis.

However, some TACs that are likely to contribute negligibly to potential risks and hazards were also carried through the risk assessment. Polycyclic aromatic hydrocarbons (PAHs) have been of concern to the public on other recent health risk assessments (for example, HHRA for the LAX Master Plan) and were included to ensure that chemicals that might be recognized by the public were included. In addition, nickel was included because nickel is considered a known human carcinogen following inhalation.

The above screening provides a means to identify those chemicals that should be evaluated for health risks following inhalation exposure. A second screening mechanism was used to establish chemicals of potential concern, if any, for health risks via indirect pathways. Some TACs released to air may deposit onto soils and other surfaces around the Airport. People living, working, or going to school could be exposed to these chemicals through direct contact with soil or dust, through ingestion of mother's breast milk, and/or through exposure to chemicals taken up into homegrown produce. These multi-additional exposure pathways are discussed in the following section.

5.1.1 TACs of Concern for Multi-pathway Analysis

Toxic air contaminants enter the body through inhalation; absorption through skin; and ingestion from contaminated food, water, milk and soil. To account for uptake of contaminants through routes other than inhalation, a multi-pathway screening evaluation was conducted. A multi-pathway analysis includes evaluation of potential exposures to chemicals emitted from a facility and deposited onto surface soil. From soils, TACs could theoretically be incidentally ingested, absorbed through the skin, or taken up into garden vegetables. Methods for conducting a multi-pathway analysis are presented in the Air Toxics Hot Spots Risk Assessment Guidelines Part IV (Cal/EPA 2000a) and in the final guidance (Cal/EPA 2003).

To simplify the screening risk assessment process, SCAQMD developed multi-pathway adjustment (MP) factors (SCAQMD 2005b) to be consistent with current CARB guidance. MP factors were developed using the software package, Hotspots Analysis and Reporting Program (HARP), version 1.0 (build 21.09.03), which combines tools of emission inventory database, facility prioritization, air dispersion modeling, and risk assessment analysis. MP factors are estimates of an appropriate multiplier that can be applied to estimates of risk or hazard due to inhalation exposure to account for exposure through non-inhalation pathways. For example, an MP factor of 1 suggests that multi-pathway exposures are insignificant, while an MP

factor of 10 suggests that multi-pathway risks or hazards could be 10 times greater than those associated with inhalation. MP factors were used in this assessment as an initial screening step to determine if a TAC of concern should be further assessed for exposure pathways other than inhalation. Separate MP factors are provided and were used in the screening analysis for urban residential and worker exposure situations since the potential routes of exposure for these receptors vary.

Several assumptions and parameters were used in the HARP model to develop MP factors provided below in **Table 5-2.** Dispersion model options included urban environment, gradual plume rise, stack top downwash, buoyancy induced dispersion, and an emission rate of 1 pound per year. Risk assessment options included a deposition velocity of 0.02 m/sec, a fraction of homegrown fruits and vegetables consumed of 5.2%, and a 70-year exposure. Pathways considered for residential exposure included inhalation, soil ingestion, dermal absorption, homegrown produce, and mother's milk. Pathways considered for worker exposure included inhalation, soil ingestion, and dermal absorption.

Note that Table 5-2 includes TACs other than the TACs of concern identified in Section 5.1. Selection of TACs of concern based on inhalation could, in theory, miss chemicals that are not anticipated to cause adverse health effects via inhalation, but could be of concern following deposition onto soil. Therefore, the analysis examined MP factors for the larger list of TACs. Based on the MP factors in Table 5-2, TACs that are likely of most concern for multi-pathway analysis are dibenzo(a,h)anthracene, PAHs, and lead. All of these TACs have MP factors greater than one, suggesting that non-inhalation exposure pathways could be important. These TACs are included in Table 5-1.

5.1.2 TACs of Concern for Acute Exposure

Cal EPA's OEHHA has developed an acute reference exposure level (REL) for acrolein, and several other TACs of concern in emissions from the Airport. To identify TACs of concern for acute exposure, potential acute effects were screened initially by multiplying maximum incremental annual average concentrations estimated from air dispersion modeling by 12.5 to produce a crude estimate of a maximum 1-hour concentration. These 1-hour maximum concentrations were then compared to acute RELs developed by Cal/EPA, as shown in **Table 5-3.**

This screening showed that ratios for all chemicals except acrolein were so small that they would have no impact on assessment of acute risks. Estimated 1-hour maximum incremental concentrations for all TACs except acrolein are less than 5 percent of their respective acute RELs. For this reason, the analysis calculated incremental acute hazards with a strong focus on acrolein.

Table 5-2
Multi-Pathway Adjustment Factors (MP)

Toxic Air Contaminant	Cancer		Chronic	
	MP_R (Resident)	MP_W (Worker)	MP_R (Resident)	MP_W (Worker)
VOCs				
Acetaldehyde	1.00	1.00	--	--
Acrolein	--	--	1.00	1.00
Benzene	1.00	1.00	1.00	1.00
1,3-Butadiene	1.00	1.00	1.00	1.00
Formaldehyde	1.00	1.00	1.00	1.00
Toluene	--	--	1.00	1.00
Xylene (total)	--	--	1.00	1.00
SVOCs				
PAHs	29.76	14.62	--	--
Naphthalene	1.00	1.00	1.00	1.00
Dibenzo(a,h)anthracene	10.26	5.45	--	--
Ethylbenzene	--	--	1.00	1.00
Styrene	--	--	1.00	1.00
Phenol	--	--	1.00	1.00
Hydrocarbons				
Diesel PM	--	--	--	--
Metals				
Barium	--	--	--	--
Calcium	--	--	--	--
Cobalt	--	--	--	--
Copper	--	--	--	--
Chromium (VI)	1.00	1.00	1.00	1.00
Iron	--	--	--	--
Lead	4.19	2.94	--	--
Manganese	--	--	1.00	1.00
Nickel	1.00	1.00	1.00	1.00
Scandium	--	--	--	--
Strontium	--	--	--	--
Sulfur	--	--	--	--
Tin	--	--	--	--
Titanium	--	--	--	--
Zirconium	--	--	--	--
Zinc	--	--	--	--

Source: SCAQMD 2005b.
-- indicates that MP value is not available

Table 5-3
Screening Analysis for TACs of Concern for Acute Exposure

TAC	Estimated 1-Hour Maximum Incremental Concentrations for 2011 No Project (ug/m^3)	Acute REL (ug/m^3)	Percent of REL
Acrolein	0.062	0.19	32%
Formaldehyde	1.2	94	1.3%
Benzene	0.84	1,300	0.7%
Nickel	0.0053	6	0.09%
Copper	0.050	100	0.05%
Xylenes, total	1.5	22,000	0.007%
Toluene	1.9	37,000	0.005%
Phenol	0.026	5,800	0.0004%
Styrene	0.034	21,000	0.0002%

Source: CDM 2005.

Acrolein is a TAC of concern and has been shown in analyses of noncancer hazards at other airports to be associated with essentially all such hazards due to airport operations. However, because of public concern regarding formaldehyde, potential incremental acute non-cancer hazards associated with formaldehyde were also evaluated. Thus, the full analysis includes evaluation of potential acute non-cancer hazards for acrolein and formaldehyde, along with the above screening analysis, which shows the negligible impact of possible exposure to other TAC on the incremental acute non-cancer hazard analysis. Although this screening process was not specifically mentioned in the protocol (Attachment A) for this assessment, this refinement to the protocol has no effect on conclusions concerning acute non-cancer health hazards. The analysis of incremental acute non-cancer hazards was performed using a simple ratio between predicted 1-hour concentrations and acute RELs, as described in the approved protocol (Attachment A).

Use of a factor of 12.5 to estimate 1-hour maximum concentrations may underestimate actual 1-hour maximums because this value is intended for screening in the opposite direction. That is, dividing 1-hour maximum concentrations by 12.5 is used in screening-level air dispersion models to provide a conservative estimate (overestimate) of annual average concentrations. Thus, the factor of 12.5 probably underestimates the true difference between annual average and 1-hour concentrations. However, based on the results presented below, this underestimation will probably be by no more than a factor of about 3 to 4. Maximum 1-hour concentrations of acrolein estimated above are about twice the acute REL, and more refined 1-hour estimates exceed the acute REL of acrolein by factors of about 10. If a factor of 5 (the difference between screening and refined 1-hour estimates) is applied

to estimates of maximum 1-hour concentrations in Table 5-3, resulting concentrations of all TACs other than acrolein and formaldehyde would still be negligible compared to their acute RELs. Additional discussion of uncertainties in the above analysis is provided in Section 6.4.5.

5.2 Exposure Assessment

In the exposure assessment, populations potentially exposed to TACs associated with the Airport operations were identified and chemical intakes estimated for individuals within these populations. A combination of a receptor population and potential exposure pathways comprises an exposure scenario. Exposure scenarios for the HHRA were selected to provide an upper range, and therefore, protective, health impact assessment. By protecting the most highly exposed and sensitive populations, the general population is also protected. Additional discussion of land use and exposure scenarios is included in Section 5.6.2.

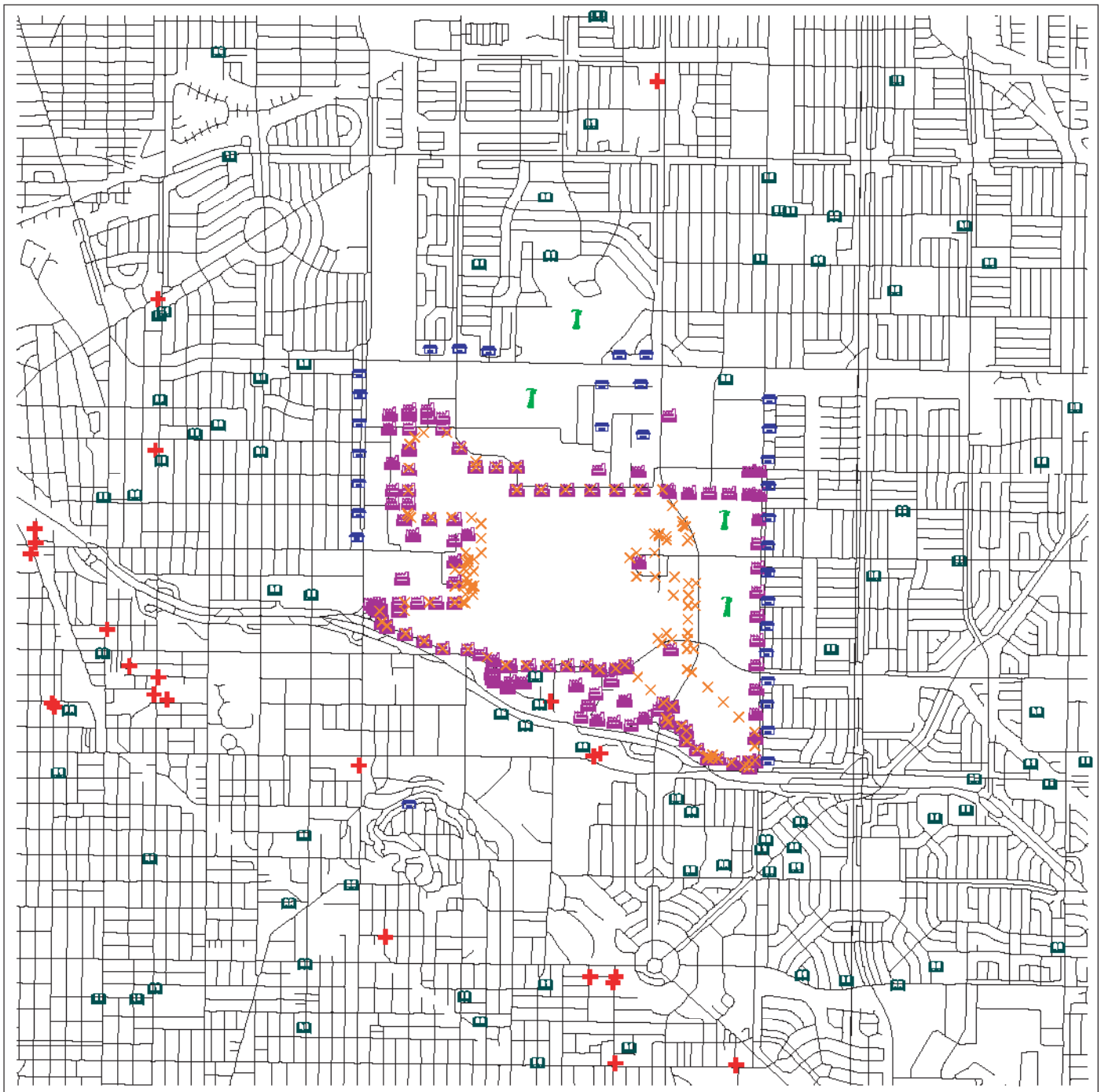
5.2.1 Land Use Analysis

As discussed in previous sections, air dispersion modeling was conducted for a series of locations, called grid points, spread through the communities surrounding the airport. Modeling grid points were selected to represent specific receptor areas and land uses, including: schools, hospitals, residential, Signal Hill, property line, security fence line, commercial, and other (e.g. golf course). A description of the typical receptors found in each of these area categories is described under receptor populations. UTM coordinates of all grid points are provided in Attachment H.

5.2.2 Summary of Receptor Populations

Identification of potentially exposed populations is based on current land uses near the Airport (Section 5.2.1), and on exposure to TACs via inhalation. Inhalation is the only exposure pathway identified as potentially important in Section 5.1. The area surrounding the Airport includes residential and commercial land uses. The nearest residential and mixed use communities are located across the street from the Airport fence line on the southeast corner. Predominant wind directions at the Airport are from the south, the west and west northwest. Thus, individuals living or working to the north and east of the airport would be expected to incur the greatest exposures to TACs released from the airport and carried by winds into the community.

Certain subpopulations may be more sensitive or susceptible to negative health impacts caused by environmental contaminants than the population at large. Approximate locations of sensitive receptors are shown in **Figure 5-1**. These subpopulations were also considered in the exposure assessment. During this evaluation, the following sensitive receptor locations were identified:



W:\PROJECTS\324091\Receptors_Fig5-1.ai 10/10/05 JJT

CDM

Figure 5-1
Location of Receptors

- **Schools:** School children include all students enrolled in kindergarten through high school. Over 80 schools were identified within the study area. The nearest school is George Washington Carver School (Elementary) located at 5335 East Pavo Street about one third mile east of the airport.

- **Hospitals:** Patients and residents in hospitals are subpopulations with possibly increased sensitivity to environmental contaminants. Twenty-three hospitals were identified within one and a half miles of the Airport fence line. The nearest hospital, Pediatric Medical Center at 2921 Redondo Avenue, lies approximately one-third mile south of the airport runway.

- **Residential areas with children:** Children are probably more sensitive or susceptible to effects of many TACs than adults. Areas immediately surrounding include commercial properties, open space, and residential. The nearest residential and mixed use communities are located across the street from the Airport fence line to the southeast of the airport.

Of these several sensitive receptors, school children and children in residential areas are assessed quantitatively in this HHRA. Methods to estimate exposures and risks for these populations are well defined in guidance. BonTerra Consulting provided a list of school locations within approximately one and a half miles of the Airport fence line (BonTerra 2005c). Locations of schools were obtained by searching the yellow pages (on http://yellowpages.superpages.com) and by contacting the Long Beach School District (http://www.lbusd.k12.ca.us/schools/school_finder/MapPage.asp). Hospitals were located by searching the yellow pages (on http://yp.yahoo.com).

Since schools and hospitals change over time, the facilities listed may not be exhaustive. However, as indicated in Section 5.6, the identification of sensitive receptor locations is sufficient for the purposes of this assessment.

Other sensitive population groups are protected by the analysis of child and adult residential populations in this HHRA. Toxicity criteria (cancer slope factors and reference doses) are defined by Cal EPA or U.S. EPA to be protective for sensitive subpopulations of people. Thus, if protection based on these toxicity criteria is provided for residents living close to the Airport, sensitive subpopulations (such as people in hospitals, nursing homes, and retirement communities) located farther from the Airport should also be protected. Children in daycare centers and preschools are not separately evaluated because children in this age range are evaluated as residents living near the Airport. Resident children are assumed to be present in the residential areas 24 hours per day. When resident children are protected, children in daycares and preschools close to the Airport, who spend only part of their day at the school in these locations, will also be protected.

5.3 Site Conceptual Exposure Model

Potential exposures associated with emissions from Airport-related sources are illustrated in the site conceptual exposure model (SCEM) in **Figure 5-2.** The SCEM provided a basis for identifying and evaluating pathways by which human receptors may be exposed to TAC emissions from Airport-related sources. Some of the exposure pathways depicted in the model either do not exist or are unlikely to contribute substantially to overall exposures, as indicated in the figure. Such pathways are not included in the quantitative risk assessment. They are, however, included implicitly in the analysis of potential multi-pathway exposures using the MP factors described above (Section 5.1.1).

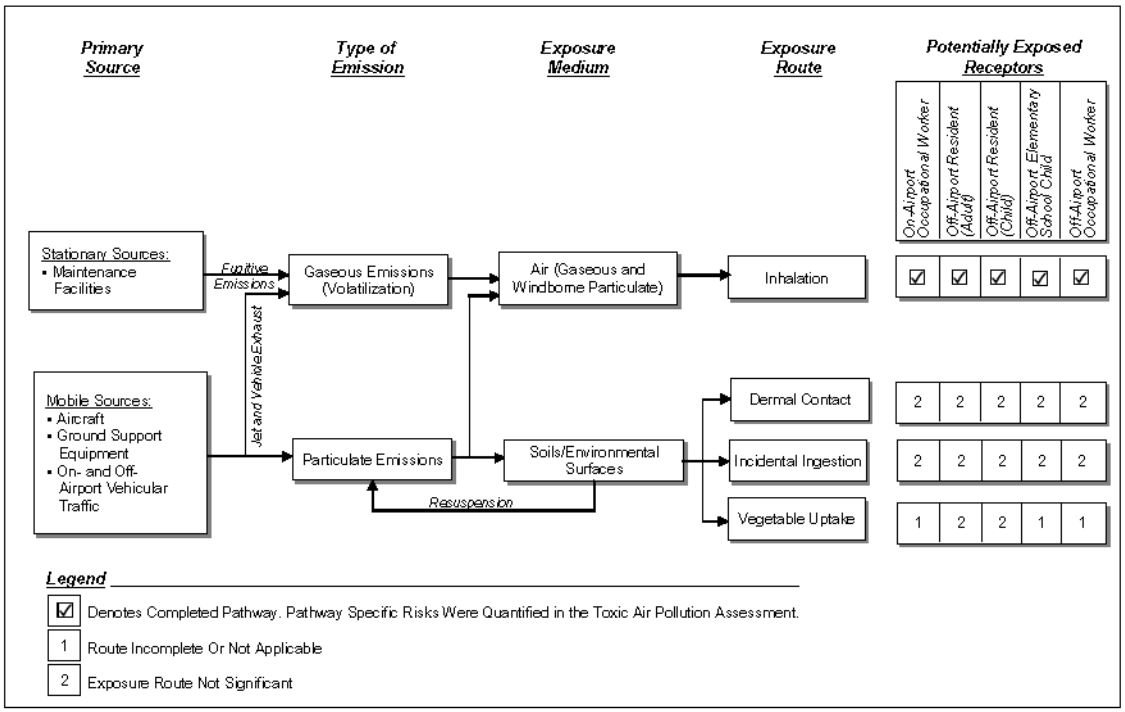


Figure 5-2
Site Conceptual Exposure Model

Based on discussions in Section 5.2.2 above, and on human activity and land use patterns in the vicinity of the Airport, the following off-Airport populations are evaluated:

- residential adults and children,
- off-Airport workers, and
- elementary school children.

In this assessment, incremental cancer risks were estimated for people who grow up and spend most of their adult life near the Airport. Longer exposure durations result in higher incremental cancer risk estimates because cancer risks are proportional to the total amount of exposure to carcinogenic TACs. Young children are separately evaluated for non-cancer health hazards because hazards are proportional to daily exposure rate. A child's daily exposure to a non-carcinogenic TAC is likely to be higher than an adult's exposure because child body weights are lower and chemical intake rates relatively high.

Elementary school children are included for quantitative assessment because these children could live at locations where exposures are relatively low, but could attend school close to the Airport where exposure may be higher.

People that use open space for recreation are not evaluated quantitatively in the risk assessment for either incremental cancer risk or chronic non-cancer hazards. Open space and recreational area users would receive less exposure than either residents or off-Airport workers and estimation of risks and hazards for these latter groups will be protective of people using open space. However, estimates of incremental acute non-cancer hazards are equally applicable for residents, workers and open space and recreational area users. Incremental acute non-cancer hazards for areas of different land use, including open space, are discussed in Section 5.6.2.3.

On-Airport outdoor workers are located close to the major sources of emissions. These workers are expected to receive the highest exposures to TACs because a large percentage of aircraft idle and taxi times are spent at or near terminal gates, and because ground support equipment is concentrated near the gates. Aircraft and GSE account for the majority of TAC releases at the Airport. On-Airport workers working outdoors near the terminal gates were, therefore, targeted for the assessment of possible on-Airport impacts.

Other on-Airport workers would have much lower exposure potential. Workers at concessions in terminals, airline counter staff, airport administration, and other office workers spend most of their time indoors where air quality is much better than on the airfield. These workers could spend short times outdoors on breaks, but probably not in areas where TACs are expected to be in highest concentrations. Short amounts of time are also spent outdoors coming to and from work, but, again, locations are away from those areas where highest impacts from emissions are expected. The combination of brief outdoor exposure and expected lower TAC concentrations indoors and in break and "commuting" areas suggests that these workers will experience lower exposures than workers on the tarmac.

Passengers at the Airport would also experience lower exposures to Airport-related air toxics than would outdoor workers at the gates. These people visit the Airport only intermittently and for relatively short periods of time. Most of their time is spent indoors, and outdoor time is limited in duration as they travel from parking or shuttles to cars and terminals, as well as to and from aircraft while enplaning or

deplaning. Exposures to passengers are expected to be among the lowest for on-Airport receptors. Workers that visit the Airport for deliveries might also experience intermittent, short-term exposures such as those envisioned for passengers. Some of these workers might visit the Airport more often than passengers, but overall their exposure should still be much less than outdoor on-Airport workers.

Again, incremental acute non-cancer hazards associated with Airport operations are equally applicable to all people that live or work near or on the airport, or who visit the airport for short periods. Acute hazards are discussed separately for different areas around and on the airport.

Potential exposures are summarized in **Table 5-4.**

Table 5-4
Scenarios Evaluated in the HHRA

Receptor	Pathways
On-Airport Worker	Inhalation of TACs
Off-Airport Worker	Inhalation of TACs
Off-Airport Adult Resident	Inhalation of TACs
Off-Airport Child Resident	Inhalation of TACs
Off-Airport School Child	Inhalation of TACs

Source: CDM 2005.

Note: As discussed in the text, acute hazards are equally applicable to all receptor groups and are evaluated for both on- and off-Airport populations.

5.4 Exposure Assumptions and Methods Used to Quantify Exposures

Each exposure scenario has a unique set of exposure parameters (inhalation rates, exposure frequencies, body weights, etc.) that describe how much exposure people may receive. These parameters are discussed below for each scenario.

5.4.1 Exposure Assumptions

Exposure parameters used in the intake equations are based on reports and assumptions regarding land use in the vicinity of the Airport, and human activity and physiology. Exposure parameters common to all intake equations including exposure frequency, exposure time, exposure duration, body weight, and averaging time are discussed below, as well as exposure parameters specific to the inhalation pathway.

5.4.1.1 On-Airport Worker

The on-Airport worker was assumed to be in contact with TACs related to the Airport operations throughout a normal workday. Because 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. Permissible Exposure Limits – Time-Weighted Average (PEL-TWA) 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-TWAs. Under the American Conference of Governmental Industrial Hygienists (ACGIH) guidelines, if TAC concentrations are below PEL TWAs, health impacts are unlikely for the on-Airport workers.

5.4.1.2 Adult and Child Residents and Elementary School Students

To estimate potential cancer risks and the potential for adverse chronic non-cancer health hazards for residential receptors and elementary school children, chronic daily intakes (CDIs) for the inhalation pathway were estimated as follows:

$$CDI = (C \times DBR \times A \times EF \times ED \times 10^{-6})/(AT)$$

Where:

CDI = chronic daily intake (mg/kg of body weight/day)

C = chemical concentration in air in milligrams per cubic meter (mg/m^3)

A = Inhalation absorption factor (unitless)

DBR = daily breathing rate in liters per kilogram body weight per day (L/kg-day)

EF = exposure frequency and duration in days/year

ED = exposure duration in years

10^{-6} = Conversion factor of micrograms to milligrams and liters to cubic meters

AT = average time; e.g., the period over which exposure is averaged in days

Two types of CDI are calculated. Lifetime Average Daily Dose (LADD) is calculated for exposure to carcinogens. Cancer risk is thought to be cumulative over a lifetime, and chemical exposures are averaged for an average lifetime instead of over the duration of exposure. Average Daily Dose (ADD) is calculated for exposure to non-carcinogens and for carcinogens with significant chronic non-cancer health effects. Chronic non-cancer health impacts are more closely related to average daily intake than cumulative exposure, and chronic intakes are evaluated only over the duration of the exposure.

Exposure parameters used to calculate LADD and ADD for each of these pathways are summarized in **Table 5-5.** All parameters are taken from standard and widely used and accepted risk assessment guidance.

Table 5-5
Parameters Used To Estimate Exposures to TACs of Concern

Exposure Pathway	Off-Airport Receptors			
Inhalation of Particulates and Gases	Off-site Resident		Off-site School Child	Off-site Worker
	Adult	Child		
Daily Breathing Rate (L/kg-day) [1]	302 [f]	581 [e]	112 [e]	149 [f]
Exposure Frequency (days/yr)	350 [b,f]	350 [b,f]	200 [c]	245 [f]
Exposure Duration (years)	70[2] [f]	9 [f]	7 [c]	40 [f]
Body Weight (kg)	63 [a,f]	18 [e]	31	70 [a,f]
Averaging Time - Non-cancer (days) [1]	25,550 [a,f]	3,285 [a]	2,555 [a]	14,600 [a]
Averaging Time - Cancer (days)	25,550 [a,f]	25,550 [a,f]	25,550 [a,f]	25,550 [a,f]

Source: CDM 2005.

[1] Other daily breathing rates and non-cancer averaging times described in the protocol will be used in the sensitivity analysis described in Section 6.

[2] 70 year exposure duration will be used as basis for determining significance.

Sources:

a – USEPA, 1989. Risk Assessment Guidance for Superfund. Volume I - Human Health Evaluation Manual, Part A. USEPA/540/1-89/002. Office of Emergency and Remedial Response. Washington D.C.

b – USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. Washington D.C. August.

c – Site-specific. Professional judgment. See text.

d – Cal/EPA 1992. Supplemental Guidance for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities. Sacramento. California. July.

e – USEPA, 1997. Exposure Factors Handbook. USEPA/600/P-95/002Fa

f – Cal/EPA 2003. Air Toxic Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August.

The four parameters – exposure time, exposure frequency, exposure duration, and daily breathing rate (inhalation rate) – together define the extent of contact with pollutants in air. Contact rate, in this case the amount of air a person breathes per unit time, is further discussed below. Exposure time is the number of hours per day that a receptor is present at an exposure point. Exposure frequency is the number of days per year that exposure occurs. Exposure duration is the total number of years over which exposure occurs.

In this HHRA, off-Airport workers are assumed to be exposed to airport chemicals 8 hours per day for 245 days per year (Cal/EPA 2003). This exposure frequency corresponds to working 5 days/week for 49 weeks/year. Further, workers are assumed to be exposed for 40 years on the same job, which is the same assumption used for regulations under Proposition 65 (Cal/EPA 2003).

For residents, exposure is assumed to occur 24 hours per day (USEPA 1991). Consistent with USEPA (1991) and Cal/EPA (1992) guidance, an exposure frequency of 350 days per year is assumed for both the adult and child residents. This corresponds to residents being present in their home 7 days a week for 50 weeks a year (or about 96 percent of the time) with approximately 2 weeks (or 15 days) spent away from home.

Exposure duration for adult residents is assumed to be 70 years (SCAQMD 2005b) when estimating exposure to carcinogens. It should be noted that according to USEPA (1997), an exposure duration of 30 years is about the 90th percentile for time spent at one residence. Use of the upper range estimate of 70-years of possible exposure duration, along with other conservative exposure assumptions, provides estimates of risks and hazards that are unlikely to be exceeded for people living at any location near the Airport. Uncertainty with the use of the 70-year exposure duration is further discussed in Section 6.

Other agencies, in implementing other programs, recommend that additional exposure durations also should be analyzed in assessing health risks. In addition to the 70-year scenario, draft guidance for OEHHA's Air Toxics "Hot Spots" program recommends using exposure durations of 9 years and 30 years for carcinogenic effects. This HHRA includes an analysis of the 9-year and 30-year exposure durations, and associated cancer risks for residents, in its analysis of uncertainties. These results are presented in Section 6.

Exposure duration for estimating chronic non-cancer hazards is assumed to be 9 years and applies only to children. Exposures to non-carcinogens are averaged only over the duration of exposure and are proportional to daily exposure. The lower body weights of young children more than offset their somewhat lower inhalation rates, resulting in higher daily exposure estimates for these children than for adults in the same environment.

To evaluate potential carcinogenic effects, an age-adjusted method is used to take into account differences in intake rates, body weights, and exposure duration for children and adults. The 70-year residential exposure duration for carcinogenic effects is assumed to be a composite of exposure assumptions for 9 years as a child and 61 years as an adult. These assumptions allow for the possibility that the 70 years an individual is assumed to live in the area may include the time from birth to adulthood. Regulatory guidance recommends this age-adjusted approach (USEPA 1991, Cal/EPA 1992, 1994). The lower body weights for children in this age-adjusted approach will generally lead to higher exposure estimates.

School children are assumed to spend 7 years (i.e., ages 6 to 12 years old) in elementary school. These children are assumed to attend school from 8:00 a.m. to 2:00 p.m. (6 hours) each day, for 200 days per year. These assumptions are based on professional judgment, but reflect general knowledge of school hours and numbers of school days per year.

5.4.1.3 Body Weight

In accordance with USEPA guidance (1989), the value for body weight is the average weight of the receptor over the exposure period. For estimating potential exposures, a body weight of 63 kg is used for the adult resident and a body weight of 70 kg is used for the off-site worker as recommended by Cal/EPA (2003).

The child resident (0 to 9 years of age) is assumed to have a body weight of 18 kg (Cal/EPA 2003). An average value of 31 kg was calculated for the elementary school child (6 to 12 years of age), based on the mean male and female body weights presented in 1-year incremental age groups in USEPA guidance (1997b, 2000c).

5.4.1.4 Averaging Time

Consistent with USEPA guidance (USEPA 1989), averaging time for the assessment of chronic non-carcinogenic effects is equal to the exposure duration times 365 days per year. Carcinogenic exposures are averaged (amortized) over a lifetime. Thus, averaging time is the number of days in a 70-year lifetime, or 25,550 days.

5.4.1.5 Inhalation Pathway-Specific Assumptions

Inhalation rates used to estimate an inhaled dose or intake for a given chemical is dependent on the activity level of the potential receptor. A daily breathing rate of 302 L/kg-day as recommended by SCAQMD (2005) was used for evaluating adult resident. For child residents, a high-end breathing rate of 518 L/kg-day was used (Cal/EPA 2003). Cal/EPA (2003) and SCAQMD (2005) both recommended a daily breathing rate of 149 L/kg-day for an off-site (off-Airport) workers. An analysis of other breathing rates is included in HHRA's discussion of uncertainties, which is presented in Section 6.

An inhalation rate for an elementary school child (0.58 m3/hr, 3.48 m3/day for a 6-hour day) was taken from recommendations by USEPA for male children ages 9 to 11 years old. This age group provides a conservative estimate of inhalation rate for all children in the 6 to 13 year old age group. This inhalation rate is higher than that for children engaged in sedentary activities (0.4 m3/hr) (USEPA 1997) as is appropriate for children engaged mainly in indoor classroom activities, but with some relatively short periods of greater activity during lunch, recess, or other non-classroom pursuits. This inhalation rate of 3.48 m3/day for a 6-hour day is equivalent to a daily breathing rate of 112 L/kg-day for a 31 kg school child.

5.4.2 Exposure Concentrations

Exposure concentrations in air for assessment of incremental cancer risks and incremental chronic non-cancer hazards were estimated from annual average concentrations calculated by AERMOD, version 02222 with EDMS Version 4.3 used to derive the source parameters. Modeling details are provided in Sections 3 and 4. Exposure concentrations were calculated as the difference between calculated concentrations for 2005 baseline and either No Project or Project alternatives for each point in a modeling grid. These concentrations were used to estimate the highest incremental TAC concentrations for use in assessing maximum impacts (see Section 5.6, Risk Characterization).

The same air dispersion model was also used to provide 1-hour maximum concentrations of acrolein for each of the same grid points used to estimate annual average concentrations. Incremental 1-hour maximum concentrations were calculated in the same way as incremental annual average concentrations. The range of estimates of incremental 1-hour concentrations was used to characterize acute non-cancer hazards.

5.5 Dose-Response (Toxicity) Assessment

Dose-response assessment (also referred to as the toxicity assessment) examines the potential for a chemical to cause adverse health effects in exposed individuals. It also presents the relationship between magnitude of exposure and potential adverse effects. Toxicity values that can be used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the dose-response task within the risk assessment process.

The toxicity assessment evaluates potential human health effects from exposure to TACs related to aircraft and airport operations at the Airport. Potential adverse effects from exposure to such pollutants include both carcinogenic and non-carcinogenic health effects. This section presents toxicity criteria for all TACs of concern.

The primary sources of toxicity information used in this assessment were Cal/EPA OEHHA Cancer Potency Factors, USEPA's Integrated Risk Information System (IRIS), Health Effects Assessment Summary Tables (HEAST), Agency for Toxic Substances and Disease Registry (ATSDR) Toxicological Profiles, USEPA criteria documents, and occupational standards from ACGIH.

The hierarchy of sources of the toxicity values used in this assessment was:

1. Cal/EPA cancer unit risks and cancer potency factors, chronic RELs, and acute RELs (Cal/EPA 2000b, 2001, 2003, and 2005),

2. USEPA IRIS (USEPA 2005),

3. USEPA HEAST (USEPA 1997),

4. USEPA Region 9 PRG Table (USEPA 2004),

5. National Center for Environmental Assessment (NCEA 2000)

No toxicity factors outside of those obtained from the above sources were sought or derived for this assessment. In past assessments performed for airports, the most important TACs were all common, relatively well-studied chemicals for which at least one, and often more than one, of the above sources provide toxicity criteria.

For evaluation of possible exposures to outdoor on-Airport workers, California Occupational Safety and Health Administration (Cal/OSHA) established permissible exposure limits (PELs) (Cal/OSHA 2004) and United States OSHA (US/OSHA) established PELs (US/OSHA 2004) were compared to concentrations of TACs estimated within the site boundary as described in Section 5.4.1.1. These comparisons provide the means of assessing possible impacts of occupational exposures to on-Airport workers.

5.5.1 Cancer Slope Factors

Toxicity criteria for carcinogens are slope factors expressed as per milligram per kilogram-day (mg/kg-day)-1. The cancer slope factor (CSF) describes the increase in an individual's risk of developing cancer over a 70-year lifetime per unit of exposure where exposure is expressed as mg/kg-day. CSFs for carcinogenic TACs of concern for the Airport are listed in **Table 5-6.** TACs from Table 5-1 are listed in Table 5-6 only if they have been classified as Group A, B, or C carcinogens. The exception is Diesel PM, which has been classified as Group D, but for which OEHHA has derived a cancer slope factor used in this HHRA.

Further, CSFs are developed for both inhalation and oral exposure for many chemicals. Oral CSFs were used only if no inhalation CSF was available from either Cal/EPA or USEPA (i.e., inhalation slope factors took precedence over oral factors regardless of source).

5.5.2 Non-Cancer Reference Doses

Reference doses (RfDs) are toxicity values developed by USEPA for chemicals exhibiting non-carcinogenic effects, or for carcinogens that also have important non-cancer effects. The RfD is intended as an estimate of the daily exposure to a chemical that would not cause adverse effects even if the exposure occurs continuously over a lifetime. RfDs are presented in units of mg/kg-day for comparison with estimated chronic daily intake into the body. Intakes that are less than the RfD are not likely to cause adverse health effects. Chronic daily intakes that are greater than the RfD indicate a possibility for adverse effects. RfDs are developed for both inhalation and oral exposure for many chemicals. For this HHRA, oral RfDs were used only if no inhalation RfD was available. As with cancer slope factors, criteria developed by Cal/EPA were used preferentially over those developed by OEHHA. RfDs for TACs of concern for the Airport are presented in **Table 5-7.**

Table 5-6
Cancer Slope Factors

TAC of Concern	Cal/EPA Inhalation Cancer Slope Factor [(mg/kg/day)$^{-1}$][(1)]	Tumor Site	Cancer Classification[(2)]
		Inhalation	
Major Contributors			
Diesel Particulates	1.1	Lung	D
Acrolein	NA	NA	C
Formaldehyde	0.021	Respiratory System	B1
1,3-Butadiene	0.6	Reproductive System, Blood, Lung, GI	A
Benzene	0.1	Blood	A
Chromium VI	510	Lung	A
Acetaldehyde	0.01	Nasal, Larynx	B2
Lead	0.042	NA	B2
Naphthalene	0.12	Respiratory System	C
Minor Emissions Constituents			
Nickel	0.91	NA	A
Benzo(a)pyrene	3.9	GI, Respiratory System	B2
Dibenzo(a,h)anthracene	4.1	NA	B2
Benzo(a)anthracene	0.39	NA	B2
Indeno(1,2,3-cd)pyrene	0.39	NA	B2
Benzo(b)fluoranthene	0.39	NA	B2
Benzo(k)fluoranthene	0.39	NA	B2
Chrysene	0.039	NA	B2

Source: CDM 2005.
mg/kg/day – milligram per kilogram per day
(1) Cal/EPA 2005
(2) A = human carcinogen
B1 = probable human carcinogen – human epidemiological evidence
B2 = probable human carcinogen – sufficient animal evidence
C = possible human carcinogen
D = not classified

Table 5-7
Toxicity Criteria for Systemic Toxicants

TAC of Concern	USEPA Chronic Oral RfD (mg/kg-day)[(1)]	Cal/EPA Chronic Inhalation RfD[(2)] (mg/kg-day)	Cal/EPA Acute REL[(3)] (µg/m^3)	Target Organ		Uncertainty Factor	
				Oral	Inhalation	Oral	Inhalation (Cal/EPA RfD)
Major Contributors							
Diesel Particulates	NA	$1.43x10^{-3}$	NA	NA	Respiratory System	NA	NA
Acrolein	$5x10^{-4}$	$1.71x10^{-5}$	$1.9x10^{-1}$	Decreased Survival	Respiratory System, Eye	100	300/60[(4)]
Formaldehyde	$2x10^{-1}$	$8.57x10^{-4}$	$9.4x10^{1}$	Body Weight	Respiratory System	100	10
1,3-Butadiene	NA	$5.71x10^{-4}$ [(1)]	NA	NA	Reproductive System	NA	30
Benzene	$4x10^{-3}$	$1.71x10^{-2}$	$1.3x10^{3}$	Decreased Lymphocyte count	Hematopoietic System, Development, Nervous System	300	10
Chromium (VI)	$3x10^{-3}$	$2.86x10^{-5}$ [(1)]	NA	None reported	Respiratory System	300	100
Acetaldehyde	NA	$2.57x10^{-3}$	NA	NA	Respiratory System	NA	NA

Table 5-7
Toxicity Criteria for Systemic Toxicants

TAC of Concern	USEPA Chronic Oral RfD (mg/kg-day)[1]	Cal/EPA Chronic Inhalation RfD[2] (mg/kg-day)	Cal/EPA Acute REL[3] ($\mu g/m^3$)	Target Organ		Uncertainty Factor	
				Oral	Inhalation	Oral	Inhalation (Cal/EPA RfD)
Lead	NA	NA	NA	NA	NA	NA	NA
Manganese	$1.4x10^{-1}$(Food)	$5.71x10^{-5}$	NA	CNS	CNS	1	300
Cobalt	$2x10^{-2}$ [5]	$5.70x10^{-6}$ [5]	NA	NA	NA	NA	NA
Naphthalene	$2x10^{-2}$	$2.57x10^{-3}$	NA	Body Weight	Respiratory System	3,000	1,000
Minor Emissions Constituents							
Toluene	$2x10^{-1}$	$8.57x10^{-2}$	$3.7x10^{4}$	Liver, Kidney weight	CNS, Respiratory System, Development	1,000	300
Xylene	$2x10^{-1}$	$2x10^{-1}$	$2.2x10^{4}$	Body Weight	CNS, Respiratory.System	1,000	30
Titanium	$4x10^{0}$ [5]	$8.60x10^{-3}$ [5]	NA	NA	NA	NA	NA
Iron	$3x10^{-1}$ [5]	NA	NA	NA	NA	NA	NA
Ethylbenzene	$1x10^{-1}$	$5.71x10^{-1}$	NA	Liver, Kidney	Developmental, Liver, Kidney, Endocrine System	1,000	30
Nickel	$2x10^{-2}$	NA	$6.0x10^{0}$	Body, Organ Weight	Respiratory System, Hematopoietic System	300	30
Styrene	$2x10^{-1}$	$2.57x10^{-1}$	$2.1x10^{4}$	Red blood cells, Liver	CNS	1,000	3
Phenol	$3x10^{-1}$	$5.71x10^{-2}$	$5.8x10^{3}$	Maternal	CNS, Kidney, Liver, Cardiovascular System	300	100
PAHs (as Benzo(a)pyrene equivalents)	NA	NA	NA	NA	NA	NA	NA
Dibenzo(a,h)anthracene	NA	NA	NA	NA	NA	NA	NA
Barium	$2x10^{-1}$	NA	NA	Increase Kidney Wt.	NA	3	NA
Copper	$4x10^{-2}$ [5]	NA	100	NA	NA	NA	NA
Zinc	$3x10^{-1}$	NA	NA	Blood	NA	3	NA
Strontium	$6x10^{-1}$	NA	NA	Rachitic Bone	NA	300	NA
Tin	$6x10^{-1}$ [5]	NA	NA	NA	NA	NA	NA
Zirconium	NA	NA	NA	NA	NA	NA	NA
Sulfur	NA	NA	NA	NA	NA	NA	NA
Scandium	NA	NA	NA	NA	NA	NA	NA
Calcium	NA	NA	NA	NA	NA	NA	NA

Source: CDM 2005.
mg/kg/day – milligram per kilogram per day
$\mu g/m^3$ – microgram per cubic meter
NA – Not available or not applicable.
CNS – Central Nervous System
RfD – Reference Dose
REL – Reference Exposure Level

(1) Values obtained from the USEPA Integrated Risk Information System (IRIS), 2005.
(2) Calculated from RELs obtained from OEHHA Online Toxicity Criteria database, 2005. RELs are concentrations in air that would not result in toxic effects even if exposure continued for a lifetime. RELs can be converted to inhalation RfDs by multiplying by inhalation rate (20 m^3/d) and dividing by body weight (70 kg).
(3) Values obtained from the OEHHA Online Toxicity Criteria database, 2005
(4) First value is for chronic REL, second is for acute REL
(5) Values obtained from the USEPA Region 9 PRG Table, 2004.

Finally, acute toxicity criteria have been developed by OEHHA for several TACs identified in airport emissions. These criteria, termed acute RELs, generally take the form of concentrations in air that would not be of concern for short-term (1-hour) exposures. These "safe" concentrations can be compared directly to estimates of 1 hour maximum concentrations to assess the potential for acute health risks. Acute RELs for TACs in Airport-related emissions are also summarized in Table 5-7.

5.6 Risk Characterization Results

Possible adverse impacts to human health are characterized in terms of potential cancer risks and potential non-cancer hazards. Both USEPA and Cal/EPA have developed guidelines for use in interpreting such risks and hazards.

The National Contingency Plan (NCP) (40 CFR § 300) is commonly cited as the basis for target risk and hazard levels. According to the NCP, lifetime incremental cancer risks posed by a site should not exceed one in a million (1×10^{-6}) to one hundred in a million (1×10^{-4}), and non-carcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., hazard index [HI] greater than one). As a risk management policy, the Cal/EPA generally considers 1×10^{-6} to be a point of departure for purposes of making risk management decisions, with most approved remediation activities achieving incremental risk levels of 10 in one million (1×10^{-5}). A public notification threshold of 10 in one million (1×10^{-5}) is suggested in the CAPCOA Air Toxics "Hot Spots" Program Public Notification Guidelines (CAPCOA 1992). The California Safe Drinking Water and Toxic Enforcement Act considers 1×10^{-5} as a no significant risk level.

A significance threshold of an incremental (future alternative compared to 2005 Baseline) cancer risk of 10 in one million (1×10^{-5}) was used in this HHRA for purposes of measuring risks to residents, school children, and off-Airport workers. A significance threshold for incremental non-cancer effects (future alternative compared to 2005 Baseline) was a HI of 1 for this HHRA for purposes of measuring incremental non-cancer hazards to residents, school children, and off-Airport workers. This threshold is widely used for evaluating potential for health hazards other than cancer by both federal and State of California agencies. The threshold was applied to both chronic and acute non-cancer hazards.

On-Airport workers are evaluated in this assessment against occupational standards developed or adopted by Cal/OSHA. In some cases, PELs developed by US/OSHA were used if Cal/OSHA values were not available. These standards, PEL-TWAs, are used as thresholds of significance for on-Airport workers.

5.6.1 Calculation of Risk Estimates

Potential cancer risks and potential non-cancer hazards are separately calculated using standard methods from USEPA and Cal/EPA as described in the following sections.

5.6.1.1 Cancer Risks

Cancer risks are estimated by multiplying exposure estimates for carcinogenic chemicals by corresponding cancer slope factors. The result is a risk estimate expressed as the odds of developing cancer. Commonly, risks (or odds) of developing cancer of 10 in one million (10×10^{-6}) or less are considered de minimis. Higher risks may be deemed unacceptable in some instances (USEPA 1992). In such instances, mitigation of risks may be considered necessary. Development of cancer slope factors is discussed in Section 5.5.1, Cancer Slope Factors.

Carcinogenic risks were estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens (USEPA 1989). The estimated risk is expressed as a unitless probability. The equation used to calculate the potential excess cancer risk for each carcinogenic chemical is:

$$\text{Risk}_i = CDI_i \times \text{CSF}_i$$

Where:

Risk_i = Lifetime Excess Cancer Risk from exposure to chemical_i

CDI_i = Chronic Daily Intake (or LADD) for chemical_i in milligrams per kilograms per day (mg/kg-day)

CSF_i = Inhalation Cancer Slope Factor $(\text{mg/kg-day})^{-1}$

An estimate of an individual's incremental excess cancer risk from potential exposure to multiple chemicals emitted from the Airport is then calculated by summing the chemical-specific excess cancer risks (i.e., Total risk = $\Sigma\ \text{Risk}_i$).

5.6.1.2 Chronic Non-Cancer Hazards

Chronic non-cancer HIs are calculated by dividing exposure estimates by RfDs. As discussed in Section 5.5.2, RfDs are estimates of highest exposure levels that would not cause adverse health effects even if exposures continue over a lifetime. The ratio of exposure to RfD is termed the hazard quotient (HQ). A HQ greater than one indicates an exposure greater than that considered safe. Risks or odds of adverse effects cannot be estimated using references doses. However, because reference doses are developed in a conservative fashion, HQs only slightly higher than one are generally accepted as being associated with low risks (or even no risk) of adverse effects, and that potential for adverse effects increases as the HQ gets larger.

Impacts of exposure to multiple chemicals are accounted for by adding estimated HQs for non-carcinogenic chemicals that affect the same target organ or tissue in the body. Addition of HQs for TACs that produce effects in similar organs and tissues results in a HI that reflects possible cumulative hazards. Several TACs have effects on the respiratory system including acetaldehyde, acrolein, formaldehyde, xylenes, and

diesel particulates. Cumulative exposure to these chemicals accounts for essentially all potential chronic non-cancer hazards. Therefore, the only HI calculated is that for the respiratory system.

For TACs that are not classified as carcinogens and for those carcinogens known to cause adverse health effects in addition to cancer, the potential for exposure to result in non-carcinogenic effects is evaluated by comparing estimated daily dose to the chemical-specific non-cancer RfD. The non-cancer RfD represents the average daily exposure concentrations at (or below) which no adverse health effects are anticipated.

When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient. To evaluate the potential for non-carcinogenic adverse health effects from simultaneous exposure to multiple chemicals, hazard quotients for all chemicals that affect the same target organs were summed yielding HIs.

Equations used to calculate the chemical-specific hazard quotients and the overall hazard index were:

$$HQ_i = \frac{CDI_i}{RfD_i}$$

$$HI = \Sigma HQ_i$$

Where:

HI	=	Hazard Index
HQ_i	=	Hazard Quotient for individual chemical$_i$
CDI_i	=	Chronic daily intake (or ADD) for chemical$_i$ (mg/kg-day)
RfD_i	=	Chronic Non-cancer Inhalation Reference Dose for chemical$_i$ (mg/kg-day)

5.6.1.3 Acute Effects

The potential for acute effects was evaluated by a simple comparison of estimates of 1-hour maximum concentrations with acute RELs developed by Cal/EPA (2000b). Acute hazard quotients were estimated for acrolein and formaldehyde. No other TACs for which an acute REL is available might be released in sufficient quantities to produce a short-term hazard (Section 5.1.2). The equation used to calculate acute hazard quotients is as follows:

$$HQ_i = \frac{C_i}{REL_i}$$

Where:

HQ_i	=	Acute Hazard Quotient for individual chemical$_i$

C_i = One-Hour Maximum Air Concentration for chemical$_i$ in micrograms per cubic meter ($\mu g/m^3$)

REL_i = Acute Non-cancer Reference Exposure Level for chemical$_i$ ($\mu g/m^3$)

5.6.1.4 On-Airport Worker Risk

Potential impacts to on-Airport workers were evaluated by comparing estimated exposure concentrations to benchmarks established by Cal/OSHA and US/OSHA. Both Cal/OSHA and US/OSHA have established chemical-specific PELs at which no adverse effects are expected. The more stringent of these PELs was used for the purposes of comparison to modeled on-Airport concentrations.

5.6.1.5 Multi-pathway Analysis Methodology and Results

Incremental multi-pathway cancer risks and chronic non-cancer health hazards were calculated for adult residents, and resident children ages 0 to 9 years, at off-Airport locations where the highest air concentrations for TACs were predicted for project scenarios in years 2011 and 2020. Inhalation risks for residents were multiplied by MP factors to estimate risk associated with multi-pathway exposures. The potential for chemicals to accumulate in soil was therefore evaluated.

TACs which have a cancer MP factor greater than one are PAHs, dibenzo(a,h)anthracene, and lead. For these TACs exposure pathways other than inhalation could potentially contribute significantly to multi-pathway cancer risks. Exposure pathways considered in the development of MPs included inhalation, incidental soil ingestion, dermal absorption, ingestion of homegrown produce, and ingestion of mother's milk.

Incremental cancer risks associated with inhalation cancer risk for the resident in project year 2011 are 1.8 in one million. TACs which contribute the majority of cancer risk include diesel PM, primarily from GSE, and, to a lesser extent, 1,3-butadiene and benzene from aircraft exhaust, GSE, and/or commercial vehicles; chromium VI and formaldehyde, make minor contributions to cancer risk. Other TACs contribute less than 5 percent of the total cancer risk estimate.

Deposition of non-volatile TACs onto soil is unlikely to represent a significant human health threat. Based on the multi-pathway analysis, only very small amounts of TACs are predicted to accumulate, even at locations of the highest off-airport air concentrations, as shown in **Table 5-8**. Multi-pathway cancer risks associated with exposure to PAHs and dibenzo(a,h)anthracene are 0.001 in one million and 0.0003 in one million, respectively. These incremental cancer risks are negligible compared to the overall estimate of 1.8 in one million. Thus, multi-pathway exposure is not anticipated to add measurably to estimated impacts.

Table 5-8
Summary of Project With Optimized Flights
Multi-pathway Incremental Cancer Risks for Adult Resident[1]

	Cancer Risk (per million individuals)				
	Cancer Multi-Pathway Adjustment Factor (MPr)	Peak Inhalation 2011 Project[2]	Multi-Pathway 2011 Project[2]	Peak Inhalation 2020 Project[2]	Multi-Pathway 2020 Project[2]
SVOCs					
PAHs	29.76	0.000044	0.0013	0.000002	0.000060
Dibenzo(a,h)anthracene	10.26	0.000029	0.00030	0.000001	0.000014
Inorganics					
Lead	4.19	-0.00039	-0.0017	-0.000005	-0.000022

Source: CDM 2005.
[1] Adult, 70 year exposure duration
[2] Location of maximum inhalation risk

Incremental cancer risks associated with lead for the 2011 Project with optimized flights are less than baseline for all exposure pathways. That is, potential lead exposures for 2011 with optimized flights are predicted to be less than the current (2005) baseline and exposure to lead will not contribute to potential overall cancer risks.

No TACs evaluated in this risk assessment have a chronic MP factor greater than one; therefore, no additional hazard above that for inhalation exposures is expected from multi-pathway exposure.

A comparison of inhalation and multi-pathway total cancer risk and non-cancer health hazard is presented in **Table 5-9.** The multi-pathway screening analysis indicates that exposures to TACs associated with airport operations by pathways other than inhalation for people living in the study area are negligible.

Table 5-9
Summary of Multi-pathway Cancer Risks and
Noncancer Health Hazards for the Resident, Project with Optmized Flights

Cancer Risks (per million individuals)			
Peak Inhalation Risk 2011 Project[1]	Multi-Pathway Risk 2011 Project[1]	Peak Inhalation Risk 2020 Project[1]	Multi-Pathway Risk 2020 Project[1]
1.8	**1.8**	**-0.2**	**-0.2**
Non-Cancer Health Hazard Index (HI)			
Inhalation Pathway HI 2011 Project[2]	Multi-Pathway HI 2011 Project[2]	Inhalation Pathway HI 2020 Project[2]	Multi-Pathway HI 2020 Project[2]
0.01	**0.01**	**0.0003**	**0.0003**

Source: CDM 2005.
[1] Adult, 70 year exposure duration
[2] Resident child 0 to 6 years of age

5.6.2 Presentation of Risk Estimates

Potential health impacts associated with the Proposed Project and the No Project Alternative are evaluated in several ways, as listed below:

- Comparison of on-Airport air concentrations with OSHA standards for on-Airport workers
- Highest incremental cancer risks and chronic non-cancer hazards – adult and child residents, school children, and off-Airport workers
- Highest incremental acute non-cancer hazards - adult and child residents, school children, off-Airport workers, open space/recreational area users

In addition, information is provided to show how impacts vary depending on location around the airport. Summaries of peak cancer risks and chronic non-cancer hazards are presented in **Attachment J.**

5.6.2.1 Optimized Flights Comparison of On-Airport Air Concentrations with OSHA Standards for On-Airport Workers

Possible health hazards for on-Airport workers were assessed by comparison of maximum 8-hour concentrations of TACs with Cal/OSHA Permissible Exposure Limit – Time-Weighted Averages (PEL-TWAs). For these comparisons, all TACs evaluated were included in the analysis because the methods for screening for TACs of concern described in Section 5.1 do not specifically address occupational exposures.

Estimates of maximum 8-hour concentrations for on-airport locations were calculated by multiplying maximum annual average concentration estimates by 8.8. This value is used in screening level air dispersion modeling to convert 8-hour concentrations to annual averages. Reversing the process could underestimate 8-hour maximum concentrations, and this uncertainty is discussed in more detail below.

Estimated 8-hour maximum concentrations for the 2011 Proposed Project scenario are all less than associated PEL-TWAs by two orders of magnitude or more. This finding suggests that even at locations where workers might be exposed to the highest concentrations, no exceedances of workplace standards are expected.

The three major TACs of concern that could achieve the highest 8-hour maximum concentrations are formaldehyde, manganese, and lead. In each case, estimated air concentrations could reach less than one (1) percent of their PEL-TWAs. For example, the estimated 8-hour concentration of formaldehyde is expected to reach about 0.08 percent of the PEL-TWA of 0.94 mg/m^3.

As mentioned above, the estimation method used for calculation of 8-hour maxima could underestimate possible concentrations. The factor of 8.8 is intended to convert an 8-hour estimate to a conservative annual average estimate. Reversing the process,

starting with a refined estimate of annual average may not completely capture the range of shorter-term concentrations possible.

When 1-hour maximum concentrations were compared to annual averages from acrolein (see Section 5.2.6.4), the difference was estimated to be up to a factor of 40. That is, 1-hour maxima were estimated to be as high as 40 times annual average concentrations for the same location. A screening conversion from 1-hour to conservative annual average concentrations is 12.5. Thus, the screening calculation could have underestimated 1-hour maxima by up to 4 times.

If an even higher factor of 10 were applied to the 8-hour estimates, the resulting air concentrations of acrolein, benzene, and formaldehyde would still represent only a small fraction of their respective PEL-TWAs. Thus, the method used for the analysis does indicate that PEL-TWAs are unlikely to be exceeded for the 2011 Proposed Project even if 8-hour estimates are underestimated.

Finally, the PEL-TWA comparisons in **Table 5-10** are made for the maximum on-Airport concentrations regardless of location. Thus, exposure to all of these TACs at their maximum concentration is theoretical. In addition, most, or all, on-Airport workers will either move around the Airport or be located in an area removed from the point of highest exposure. Thus, all or virtually all on-Airport workers would experience lower air-borne concentrations of TACs than those used for the above comparisons. The analysis thus suggests little potential for unacceptable exposure for on-Airport workers.

5.6.2.2 Optimized Flights Highest Incremental Cancer Risks and Chronic Non-Cancer Hazards—Resident, School Child, and Off-Airport Worker

Differences between the 2005 Baseline and the Proposed Project and No Project scenarios were estimated by subtracting the 2005 Baseline TAC concentrations modeled from a project scenario's TAC concentrations modeled for each grid point and identifying the locations where incremental changes in TAC concentrations resulted in the highest estimates for cancer risks and non-cancer hazard. These incremental risks and hazards represent those for the maximum exposed individual (MEI) and are used to determine the significance of impacts under CEQA.

Incremental cancer risks and chronic non-cancer health hazards were calculated for adult residents, resident children ages 0 to 9 years, elementary-aged school children, and workers at off-Airport locations where the highest air concentrations for TACs were predicted. Differences in the locations of highest increments were observed. Estimated highest incremental cancer inhalation risks and chronic non-cancer health hazards are summarized in **Tables 5-11 and 5-12** and **Figures 5-3 and 5-4**.

Table 5-10
Comparison of Cal/OSHA Permissible Exposure Limits (PEL-TWA) to Maximum Estimated 8-Hour On-Airport Air Concentrations for 2011 Project Conditions with Optimized Flights

TAC	2011 Proposed Project Maximum 8-hour Concentration (mg/m^3)[1]	Cal/OSHA PEL-TWA (mg/m^3)[2]	Ratio[3]
Major Contributors			
Diesel Particulate Matter	0.002	5	0.0004
Acrolein	0.00003	0.25	0.0001
Formaldehyde	0.0007	0.94	0.0008
1,3-Butadiene	0.00008	2.20	0.00004
Benzene	0.0004	3.25	0.0001
Chromium VI	0.0000008	0.01	0.00008
Acetaldehyde	0.00009	45	0.000002
Lead	0.00002	0.05	0.0004
Manganese	0.0001	0.20	0.0007
Minor Contributors			
Cobalt	0.000004	0.02	0.0002
Naphthalene	0.00002	50	0.0000003
Toluene	0.0006	188	0.000003
Xylene, total	0.0006	435	0.000001
Titanium	0.0009	NA	NA
Iron	0.01	1	0.01
Ethylbenzene	0.001	435	0.0000003
Nickel	0.000004	1	0.000004
Styrene	0.00003	215	0.0000001
Phenol	0.00002	19	0.000001
PAHs[4]	0.000000007	0.20	0.00000004
Dibenzo(a,h)anthracene	0.000000005	NA	NA
Barium	0.0003	0.50	0.0006
Copper	0.00005	1	0.00005
Zinc	0.0002	5	0.00004
Strontium	0.00006	NA	NA
Tin	0.00002	0.10	0.0002
Zirconium	0.00002	5	0.000004
Sulfur	0.0006	NA	NA
Scandium	0.0000002	NA	NA
Calcium	0.006	NA	NA

Source: CDM 2005.

[1] The concentrations for Project in this table are presented in mg/m^3 to correspond with the common units for PEL-TWAs although in the rest of this analysis project concentrations are shown in $\mu g/m^3$.

[2] PEL-TWAs are presented as mg/m^3 because these are the common units for these standards. PEL-TWA for benzene and formaldehyde have been converted from PEL concentrations in ppmv. The PEL listed for zinc is for zinc oxide fume. The PEL listed for PAHs is for coal tar pitch volatiles. The PEL listed for diesel particulate matter is the PEL for particulates not otherwise regulated - respirable fraction.

[3] Ratio of 2011 Project maximum 8-hour concentration to Cal/OSHA PEL-TWA.

[4] PAHs include benzo(a)pyrene, indeno(1,2,3-cd)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)anthracene, and chrysene.

NA= Not applicable or not available.

Table 5-11
Estimated Highest Incremental Cancer Inhalation Risks

	Cancer Inhalation Risks(per million individuals)				
	Resident			School	Off-Airport
Alternative	Adult	Child	Adult + Child[1]	Child	Worker
2011 No Project	0.5	0.1	0.5	-0.0007	1.1
2011 Proposed Project	1.8	0.4	1.8	0.0003	2.6
2020 No Project	2.0	0.5	2.1	0.003	1.7
2020 Proposed Project	-0.2	-0.07	-0.3	-0.004	0.8

Source: CDM 2005.
(1) This residential receptor represents the combination of an adult resident with a 61-year exposure duration and a child resident with a 9-year exposure duration.

Table 5-12
Estimated Highest Incremental Chronic Non-Cancer Inhalation Health Hazards

	Chronic Non-cancer Inhalation Health Hazard Indices			
	Resident			
Alternative	Adult	Child [1]	School Child	Off-Airport Worker Worker
2011 No Project	0.01	0.01	0.0005	0.05
2011 Proposed Project	0.007	0.01	0.0007	0.02
2020 No Project	-0.0003	-0.0007	-0.00006	-0.00008
2020 Proposed Project	0.0002	0.0003	-0.00002	0.004

Source: CDM 2005.
(1) The child resident has a 9-year exposure duration.

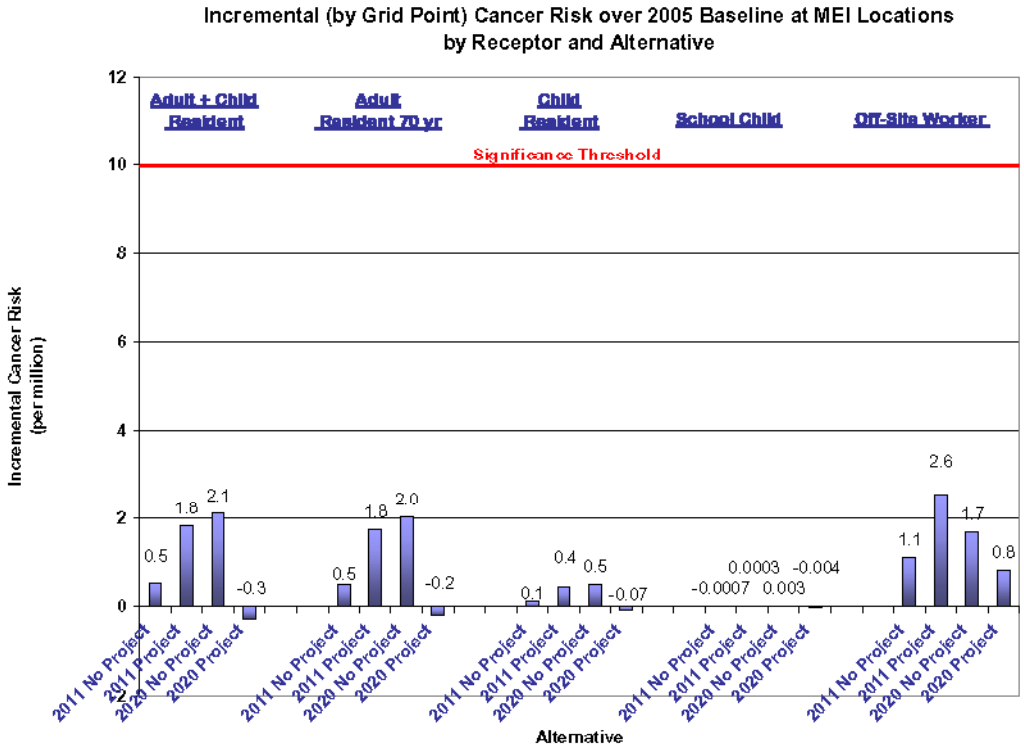


Figure 5-3
Incremental Cancer Risk for Optimized Flights Scenario

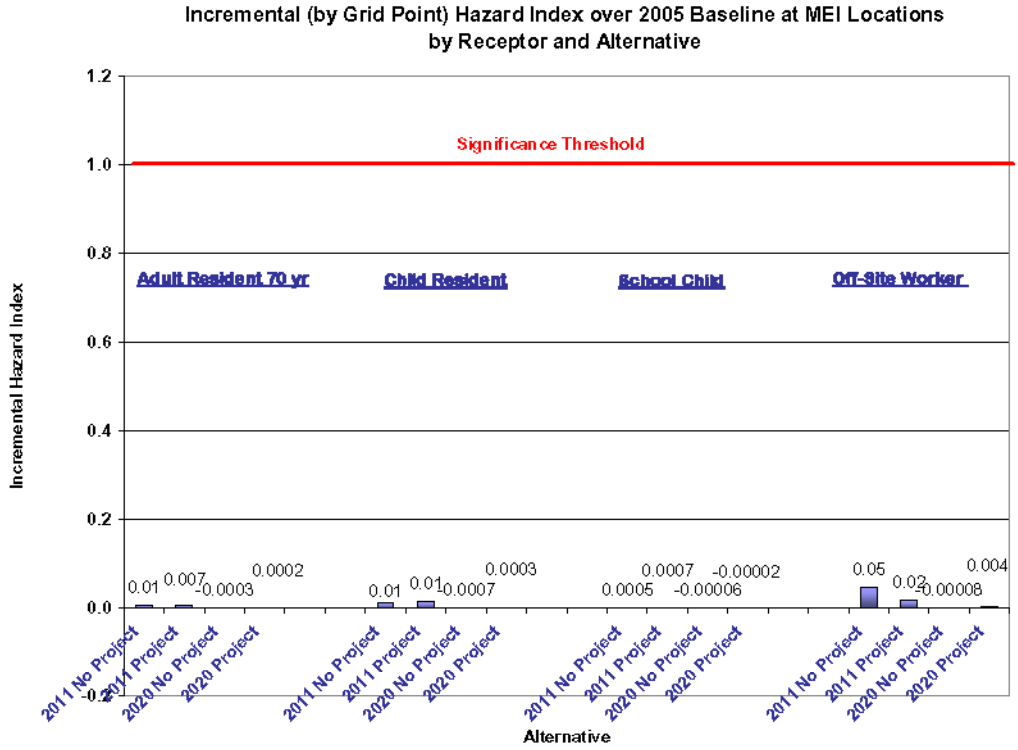


Figure 5-4
Incremental Chronic Hazard Index for Optimized Flights Scenario

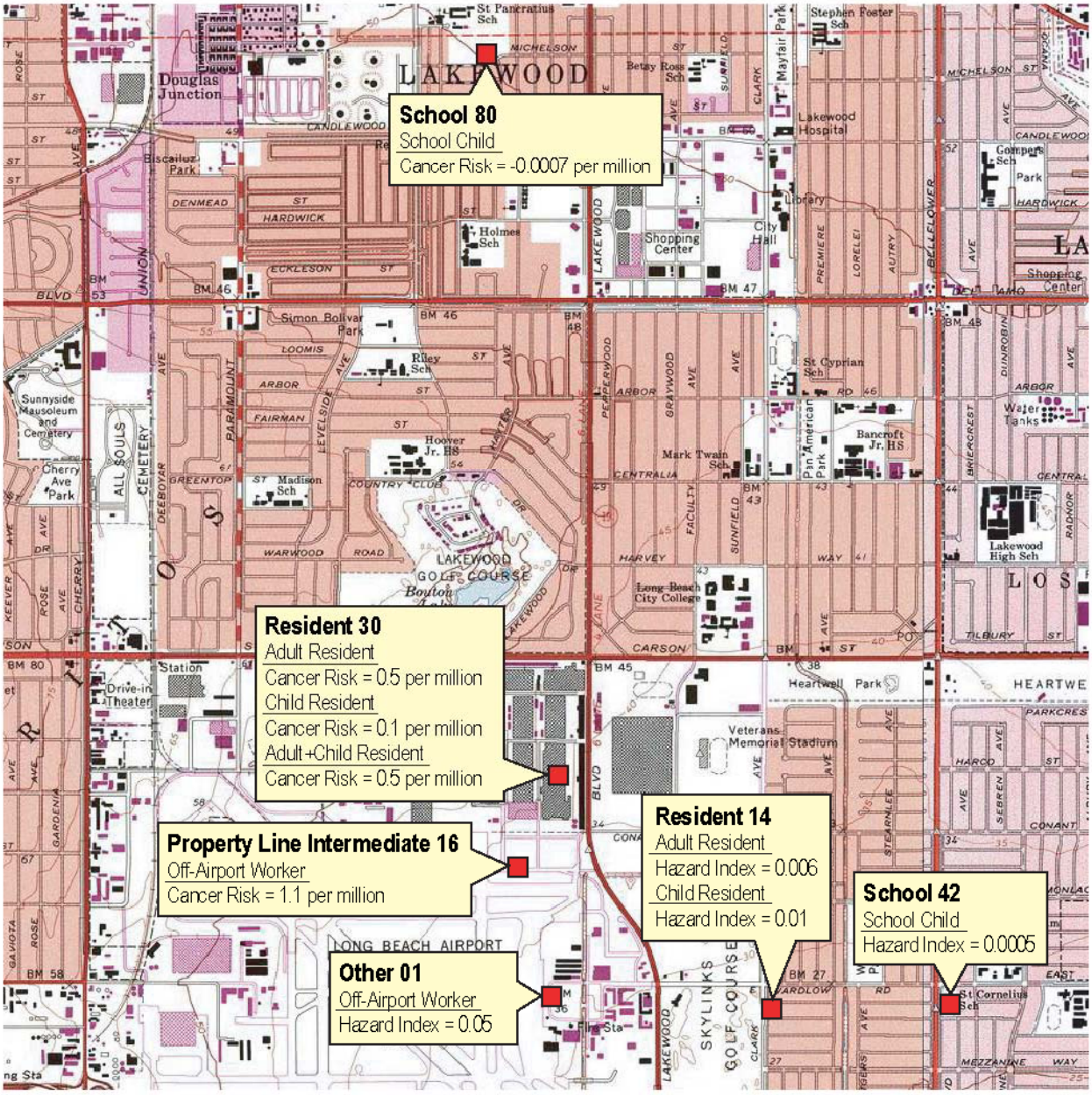
5.6.2.2.1 Residents

The Airport is surrounded by commercial areas on the west, north, and south with a golf course located to the east. Residential areas are located somewhat farther away in these directions although residential areas are directly across the street from the southeast corner of the Airport and a mixed use development is planned in Douglas Park to the north. Because residents are not located as close to on-Airport sources as commercial areas, estimated risks from these receptors are not sensitive to small changes in Airport operations in specific locations. Instead, possible incremental cancer risks and non-cancer hazards reflect overall Airport operations and, thus, overall differences in emissions.

Cancer Risks

All estimated incremental cancer risks for residents are less than the cancer risk significance threshold of 10 in one million (Table 5-11 and **Figures 5-5 though 5-8**).The incremental cancer risks for 2011 Proposed Project are slightly higher than for 2011 No Project indicating slightly greater impacts for this scenario than for 2011 No Project. The 2011 Project spreads out the aircraft parking positions in a north-south line west of the terminal, thereby moving some GSE activities further north. Since one of the prevailing wind directions is from south to north, the residential area of Douglas Park, which is almost due north of the terminal area, is sensitive to the movement of these sources further north. As a result, the residents in Douglas Park (Resident 30) receive a larger impact from these sources and have higher risks under the Project than No Project scenario.

The 2020 Project alternative with optimized flights has lower incremental cancer risks than the 2011 scenarios. In fact, the residential incremental risks indicate a minor beneficial impact for the 2020 Project (with optimized flights). These risks may reflect the improved traffic flow and lower emissions for the project in 2020. Regulations of emissions that apply to both on-road (passenger cars and cargo trucks) and off-road mobile sources (GSE) phase in over time resulting in the decrease of emissions. In addition, the fleet mix (cars, trucks and GSE) analyzed for each year assumes some fleet turnover that incorporates newer technologies that are implemented to comply with the regulations. The fleet mix turnover for on-road vehicles is accounted for in the EMFAC2002 emission factors. For GSE, each piece of equipment was assumed to be aged to half of its useful life, based on the EDMS default useful life designation for each type of GSE. For example, a GSE type with a useful life of 16 years (aircraft tug) was assumed to be 8 years old, thus was manufactured in 2003 for the 2011 scenarios, and in 2012 for the 2020 scenarios. The CARB OFFROAD model provides emission factors by year of manufacture and size of engine (hp); it also includes a deterioration factor to account for engine aging. Therefore, for the 2011 scenario example, the GSE would have been manufactured in 2003 and would include 8 years of deterioration. The emission factors for both GSE and motor vehicles are substantially lower in 2020 than in 2011.



Legend

Model Grid Location

NORTH

0 1 KM

W:\PROJECTS\32409\Fig 5-5 2011 N - peak conc - v2.ai 10/31/05 JJT

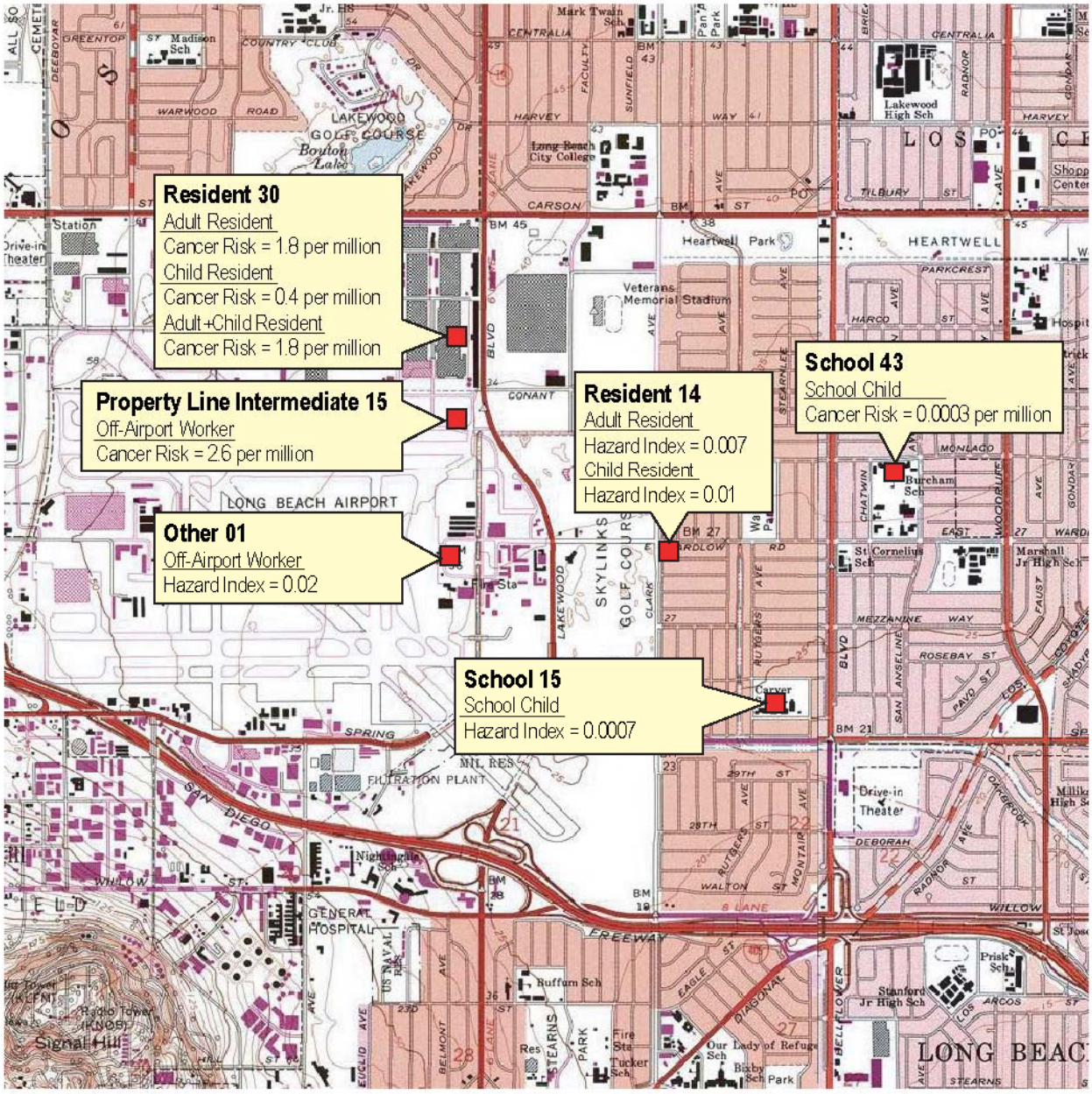
CDM

Figure 5-5

Location of Peak Chronic Cancer and Non-Cancer Receptors

Long Beach Airport

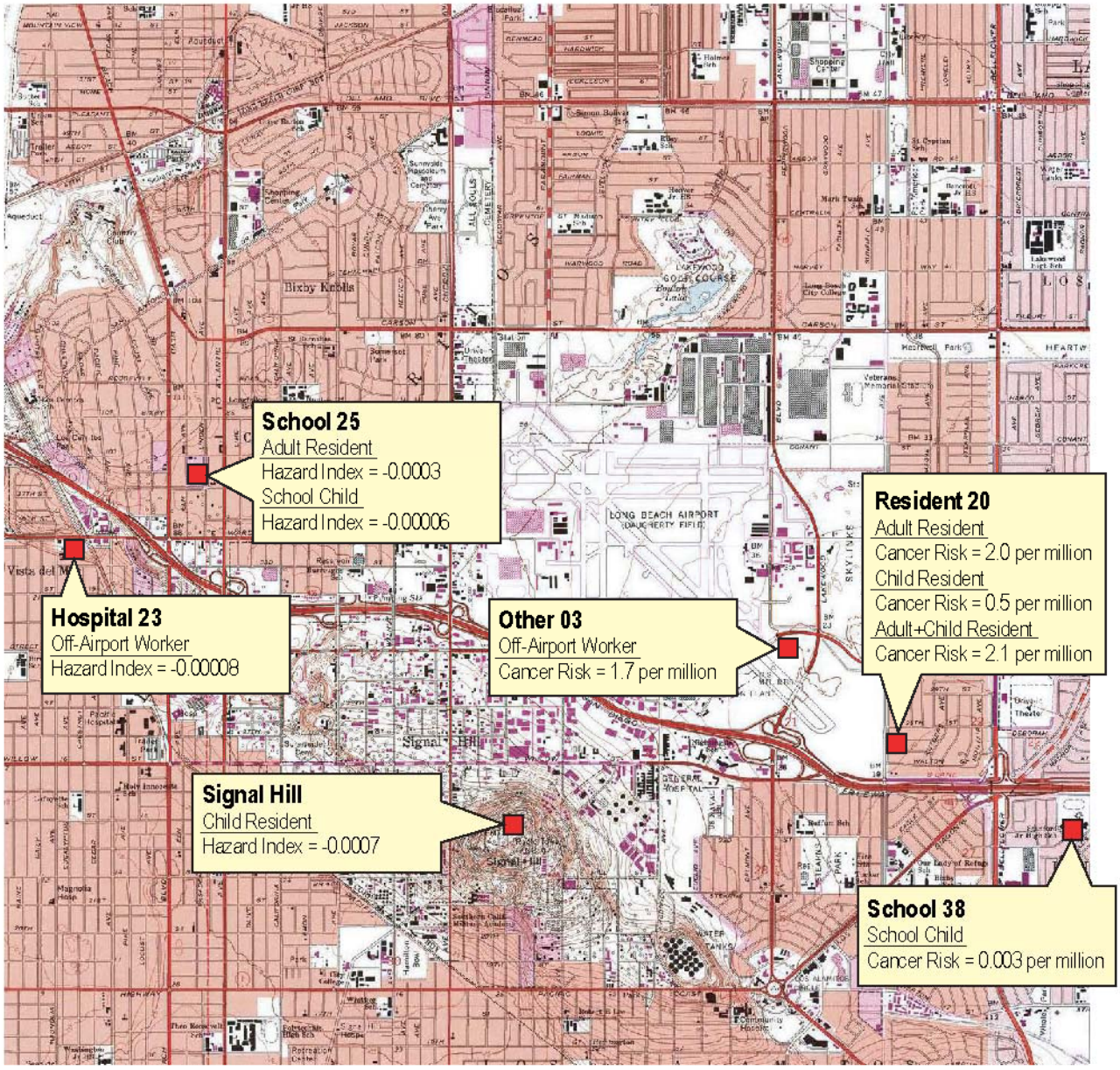
Future, No Project (2011)



W:\PROJECTS\32409\Fig 5-6 2011P - peak conc - V2.ai 10/31/05 JJT

CDM

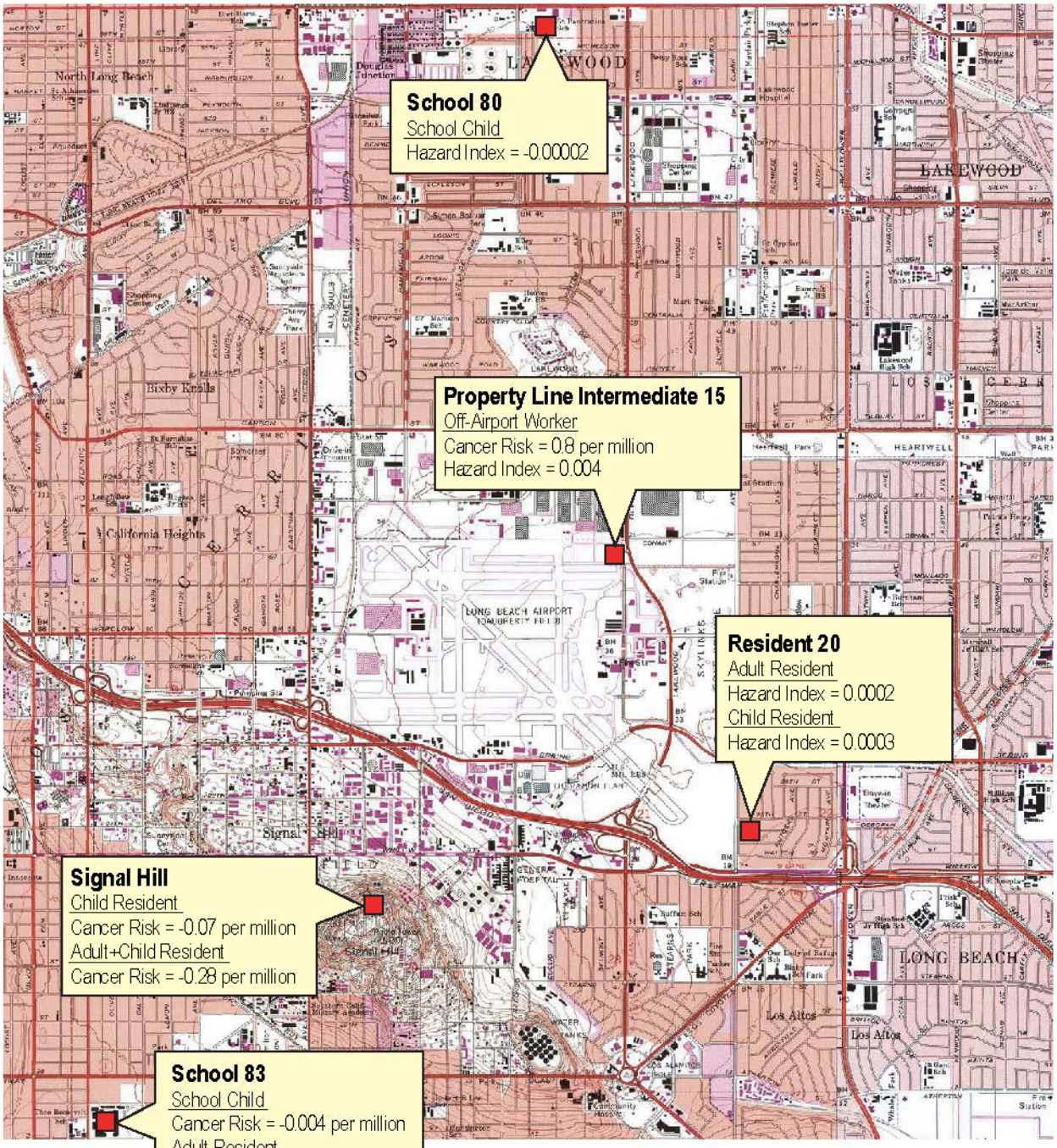
Figure 5-6
Location of Peak Chronic Cancer and Non-Cancer Receptors
Long Beach Airport
Future, Project (2011)



W:\PROJECTS\32409\Fig 5-7 2020N - peak conc - v.ai 10/14/05 JJT

CDM

Figure 5-7
Location of Peak Chronic Cancer and Non-Cancer Receptors
Long Beach Airport
Future, No Project (2020)



W:\PROJECTS\32409\Fig 5-8 2020P - peak conc - V2.ai 10/19/05 JJT

CDM

Figure 5-8
Location of Peak Chronic Cancer and Non-Cancer Receptors
Long Beach Airport
Future, Project (2020)

From 2011 to 2020, the impact of GSE and on-road emissions on the results decreases causing the relative impact of aircraft emissions at the locations of the peaks to increase. As aircraft emissions become the driving factor, the peak impact locations generally move south due to Runway 30 (in the southeast part of the airfield) becoming the primary takeoff runway. By assuming that almost all jet aircraft taxi to and takeoff from this location, the peak impact locations move southward. (Although aircraft occasionally takeoff from Runway 12 on the opposite end, this occurs less than 10 percent of the time.)

TACs associated with Airport-related cancer risks include diesel PM, primarily from GSE, and, to a lesser extent, 1,3-butadiene from aircraft exhaust, GSE, and/or commercial vehicles. Other TACs such as benzene, chromium VI, and formaldehyde, make minor contributions. Exposure to diesel PM contributed roughly 65 and 87 percent to estimated incremental cancer risks for the 2011 No Project and the 2011 Project alternatives, respectively. The contribution from chromium VI was 30 and 9 percent for these alternatives, respectively. Estimated cancer risks are higher for the adult plus child scenario than for children alone because exposure to carcinogens is cumulative throughout both childhood and adult years (see Section 5.4.1).

Chronic Non-Cancer Hazards

HI estimates include cumulative exposures to all TACs that are toxic to the respiratory system at low chronic daily exposure. All incremental chronic non-cancer HIs are less that the significance threshold of 1, with the highest incremental non-cancer hazards for residents associated with the 2011 scenarios, and the lowest with the 2020 No Project scenario (Table 5-12 and Figures 5-5 through 5-8).

Chronic non-cancer hazards for residents are mainly due to possible exposure to acrolein, (36 - 42 percent) and to a lesser extent, manganese (28 – 33 percent) and formaldehyde (16 – 18 percent) in 2011. Acrolein and formaldehyde are associated primarily with combustion engine exhaust. Manganese concentrations are primarily attributable to fugitive dust from roadways. Lower emissions from cleaner automobile and GSE engines anticipated for 2020 result in slightly improved conditions with respect to chronic non-cancer hazards for 2011 conditions. In 2020, chronic non-cancer hazards for residents are still primarily due to possible exposure to acrolein; however, diesel PM is also a contributor.

Chronic non-cancer HIs are higher for children than adults because HIs are normalized to body weight, which is lower for children than for adults.

Peak Percentile Cancer Risks and Chronic Non-cancer Hazards for Project 2011

Locations for maximally exposed individuals (MEIs) for Project 2011 are mapped in Figures 5-5 and 5-6. In addition, locations where different percentiles in the range of

risk estimates occur for Project 2011 are presented in **Figure 5-9**. For interpreting the latter figure, 95th percentiles represent locations where potential risks or hazards exceed 95% of all the estimates developed for the modeling grid points described earlier. Risks or hazards for a resident at this location would therefore be among the highest of any calculated during the development of the risk assessment. Conversely, 50th percentiles represent locations where potential risks and hazards are in the middle of all the estimates developed during the risk evaluation. Risks and hazards in these locations are anticipated to be typical for people living near the airport.

MEI locations, and those locations that represent percentiles of 75 and higher, are found close to the airport boundary in an arc that runs from the southeast to the north. This pattern is expected, because the prevailing winds would blow contaminants emitted from airport operations towards these locations most of the time. In contrast, locations of 50th percentiles occur west and south of the airport boundary. Although winds blow contaminants from the airport in these directions, it occurs much less frequently than winds blowing to the east and north. Thus, potential exposures, and, hence, risks and hazards are less in this location. Based on the wind rose for the airport (Figure 4-1), areas to the west and south of the airport will receive TACs from the airport infrequently, and potential risks and hazards for people living, working or attending schools in these areas would be substantially less than the maximum incremental impacts reported and used in the determination of significance.

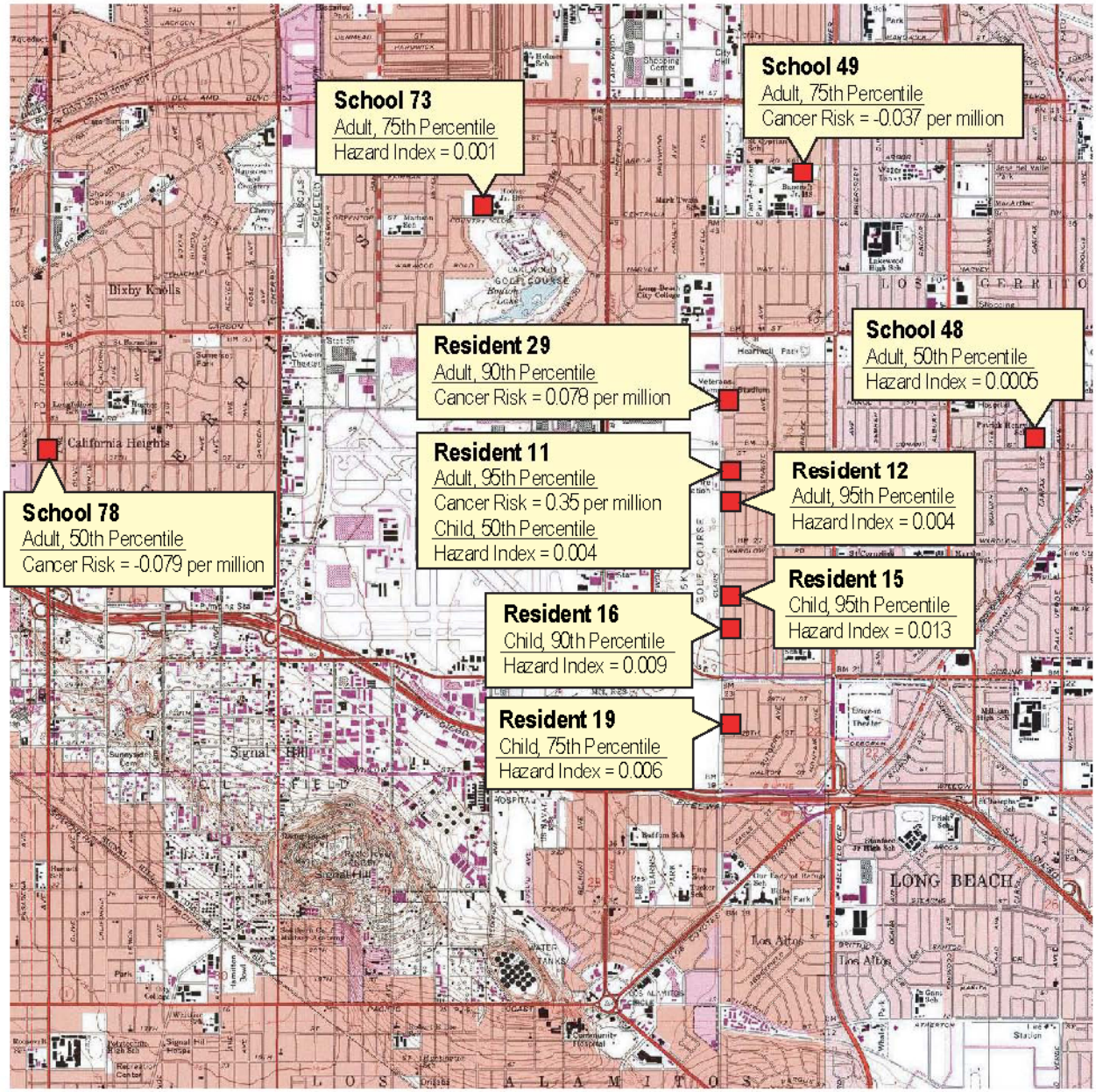
5.6.2.2.2 School Children

Cancer Risks

Incremental cancer risks for a school child ranged from -0.004 in 1 million (a slight reduction of 4 in 1 billion) for 2020 Proposed Project to 0.003 in 1 million (a slight increase of 3 in 1 billion) for the 2020 No Project (Table 5-11). These incremental risks are far below the significance threshold of 10 in one million. A school child attending Burcham Elementary School (School_43) located at 5610 Monlaco Road (Figure 5-8) is anticipated to receive the highest, but still very small, incremental cancer risk impact from implementation of the 2011 Project alternative with optimized flights.

Chronic Non-Cancer Hazards

Incremental chronic non-cancer HIs for a school child ranged from -0.00006 for the 2020 No Project to 0.0007 for the 2011 Proposed Project. These HIs are below the significance criterion of one. A school child attending George Washington Carver Elementary School (School_15) located at 5355 East Pavo Street (Figure 5-8) is anticipated to receive the highest incremental hazard index impact from implementation of the 2011 Project alternative with optimized flights.



Legend

Model Grid Location

NORTH

0 1 KM

W:\PROJECTS\32409\Fig 5-9 2011 N - peak conc - v2.ai 10/31/05 JJT

CDM

Figure 5-9

Locations of Specified Percentiles for 2011 Project, Residents

Long Beach Airport

Future, Project (2011)

5.6.2.2.3 Off-Airport Workers

Cancer Risk

Incremental cancer risks for off-Airport workers were highest in commercial areas immediately east of the Airport. Incremental cancer risks for both the 2011 and 2020 Project and No Project alternatives for off-Airport workers are below the significance threshold of ten in one million.

Cancer risks for off-Airport workers are mostly due to predicted exposure to diesel PM and, to a lesser extent, 1,3-butadiene. For the 2011 Proposed Project, diesel PM contributed about 91 percent to estimated cancer risks. Small contributions are made by 1,3-butadiene, benzene, chromium VI, and formaldehyde.

Chronic Non-Cancer Hazards

All incremental chronic non-cancer HIs are less than the threshold of significance of 1, with the highest incremental hazard (0.05) associated with the 2011 No Project scenario, and the lowest (-0.00008) with the 2020 No Project scenario (Table 5-12 and Figures 5-5 through 5-8). Acrolein, formaldehyde, and 1,3-butadiene each contribute roughly 30 percent to the chronic non-cancer HIs for the 2011 Project alternative with optimized flights.

5.6.2.3 Evaluation of Acute Hazards from Operations with Optimized Flights

5.6.2.3.1 RELs for Acrolein and Formaldehyde

Acute HQs for acrolein and formaldehyde were estimated using results of air dispersion modeling. HQs were calculated for all grid points in the modeling domain and then separated by land use and receptor. Acute hazards are simply the ratio of a predicted concentration and a "safe" level of determined by OEHHA (the acute REL). Acute hazards are thus equally applicable to all receptors (workers, residents, adults, children, etc.) The division of acute hazard estimates by land use provides additional information about the extent of possible incremental acute impacts for the various receptor types in the vicinity of the Airport.

OEHHA has developed acute RELs for a small number of chemicals, including acrolein and formaldehyde. These criteria are intended to protect people from short-term impacts (usually from exposures on the order of 1-hour). Acute RELs are concentrations above which some health impacts might occur if inhalation exposure continues for an hour or more. The acute REL for acrolein is 0.19 µg/m3 and is based on mild irritation of mucous membranes (primarily eyes, though the upper respiratory tract is likely to also be sensitive). Included in the estimation of the acrolein REL is an uncertainty factor of 60, which was applied to an estimated lowest-observable-adverse-effect-level (LOAEL) to account for potentially more sensitive

individuals. Thus, the REL is 60 times lower than the lowest concentration where mild irritation was reported by people exposed to acrolein. The acute REL for formaldehyde is 94 µg/m3 and is also based on mild irritation of the eyes. The uncertainty factor for the acute REL for formaldehyde is 10.

Acute RELs for acrolein and formaldehyde were used along with refined predictions of 1-hour maximum concentrations of these TACs to assess possible incremental acute non-cancer health hazard impacts associated with 2011 No Project and Proposed Project and the 2020 No Project and Proposed Project scenarios. To calculate acute hazards associated with each scenario, maximum incremental 1-hour concentrations estimated for each grid point and scenario were divided by the appropriate acute REL to produce an acute HQ for each grid point. When the HQ for acrolein is above 1, acrolein concentrations exceed the acute REL and some potential for mild irritation of mucous membranes in sensitive individuals is suggested. When the quotient for formaldehyde is above 1, formaldehyde concentrations exceed the acute REL, resulting in potential mild eye or upper respiratory irritation. When the quotient is below one for acrolein or formaldehyde, concentrations do not exceed the acute REL and no irritant effects are expected

Ordinarily, HQs from acrolein and formaldehyde would be added together to produce an HI for acute irritation effects. In this case, however, the HQs for formaldehyde are so much lower than those for acrolein, the two HQs were kept separate. Keeping the HQ estimates separate allows readers to judge the relative impacts of acrolein and formaldehyde directly.

Note that all estimates of possible acrolein acute hazards suggest minimal potential impact. Estimated emissions of acrolein are likely overestimated, as are concentrations in air. As an example, in a recent study of air quality in residential areas near O'Hare International Airport in Chicago (Illinois Environmental Protection Agency 2002), acrolein was not present in detectable quantities in essentially all air samples collected.

Further, the acute REL for acrolein is designed to protect even individuals who are extremely sensitive to such effects. The likelihood that acrolein concentrations are significantly overestimated in the analysis and the conservative derivation of the acute REL suggest that notable acute impacts are very unlikely. Uncertainties in acrolein assessment are further discussed in Section 6.

5.6.2.3.2 Acute Hazards

Incremental acute non-cancer hazard ranges, based on estimated maximum 1-hour acrolein and formaldehyde concentrations, for all scenarios for grid points representative of each receptor and land use area are presented on **Tables 5-13 though 5-17.** All incremental acute non-cancer hazards for 2011 and 2020 scenarios are below the significance threshold of one.

All estimates of possible incremental acute HQs associated with formaldehyde resulting from Airport operations suggest minimal potential impact. The highest incremental HQs for all receptors are well below the acute threshold of 1. When the index is below 1, formaldehyde concentrations do not exceed the acute REL and no irritant effects are expected. Note that both formaldehyde and acrolein cause the same effect, mild eye irritation. HQs for these two chemicals could reasonably be added to give a total hazard index or HI. However, the very small quotients estimated for formaldehyde would not noticeably affect acrolein hazard quotients when the two are added. Thus, formaldehyde hazards are presented separately to show the lack of contribution. Overall acute hazards for the project alternatives are those associated with exposure to acrolein. Therefore, this discussion of acute hazards will focus on the acute non-cancer hazards for acrolein.

Table 5-13
Adult Resident Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Minimum	-0.18	-0.27	-0.08	-0.11	0.005	-0.008	0.0016	-0.001
Average	0.14	0.07	0.07	0.06	0.01	0.0005	0.01	0.004
Maximum	0.59	0.23	0.35	0.36	0.03	0.005	0.04	0.02
	Acrolein				Formaldehyde			
Grid Location	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Signal_Hill	-0.09	0.23	-0.08	-0.11	0.01	0.005	0.01	-0.001
Resident_1	0.05	0.06	0.09	0.10	0.02	0.0007	0.02	0.006
Resident_2	0.09	0.11	0.09	0.07	0.02	0.002	0.02	0.005
Resident_3	0.06	0.10	0.11	0.09	0.02	0.002	0.02	0.005
Resident_4	0.02	0.03	0.16	0.16	0.01	0.0002	0.02	0.007
Resident_5	0.09	0.04	0.16	0.16	0.02	0.0003	0.02	0.008
Resident_6	0.09	0.00	0.15	0.14	0.02	-0.0010	0.02	0.007
Resident_7	0.10	0.10	0.08	0.06	0.02	0.002	0.02	0.005
Resident_8	0.05	0.22	0.02	0.02	0.01	0.005	0.01	0.003
Resident_9	0.06	0.17	0.04	0.04	0.01	0.004	0.02	0.003
Resident_10	0.04	0.11	0.02	0.01	0.02	0.002	0.02	0.003
Resident_11	-0.01	0.07	-0.02	-0.04	0.02	0.0010	0.02	0.002
Resident_12	0.02	0.01	-0.04	-0.05	0.02	-0.0007	0.02	0.001
Resident_13	0.03	-0.03	-0.04	-0.09	0.02	-0.002	0.02	0.001
Resident_14	0.02	-0.02	-0.03	-0.06	0.02	-0.002	0.02	0.001
Resident_15	0.04	0.02	-0.04	-0.04	0.02	-0.0003	0.02	0.002
Resident_16	0.04	0.02	-0.02	-0.02	0.02	-0.0005	0.02	0.002
Resident_17	0.03	0.00	0.01	-0.02	0.02	-0.0008	0.02	0.002
Resident_18	0.03	0.06	0.07	0.06	0.02	0.0008	0.02	0.005
Resident_19	-0.18	-0.11	0.27	0.28	0.02	-0.004	0.03	0.012
Resident_20	-0.09	-0.27	0.35	0.35	0.02	-0.008	0.04	0.016
Resident_21	-0.03	-0.21	0.35	0.36	0.03	-0.007	0.04	0.016
Resident_22	0.07	0.16	0.08	0.07	0.01	0.004	0.02	0.004
Resident_23	0.09	0.19	0.11	0.09	0.02	0.004	0.02	0.005
Resident_24	0.02	0.04	0.17	0.17	0.02	0.0003	0.02	0.008
Resident_25	0.09	0.13	0.09	0.10	0.02	0.003	0.02	0.005
Resident_26	0.09	0.09	0.08	0.06	0.02	0.002	0.02	0.005
Resident_27	0.10	0.06	0.14	0.12	0.02	0.0006	0.03	0.007
Resident_28	0.14	0.20	0.16	0.13	0.03	0.004	0.03	0.008
Resident_29	0.08	0.12	0.10	0.09	0.02	0.002	0.02	0.005
Resident_30	0.08	0.14	0.16	0.15	0.03	0.003	0.03	0.009

Source: CDM 2005.

Table 5-13 (continued)
Adult Resident Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_1	0.04	0.13	0.05	0.05	0.01	0.0002	0.01	0.003
School_2	0.08	0.10	0.07	0.07	0.01	0.002	0.01	0.004
School_3	0.04	0.05	0.05	0.04	0.008	0.001	0.009	0.002
School_6	0.04	0.04	0.10	0.09	0.01	0.0005	0.02	0.005
School_7	0.15	0.00	0.15	0.14	0.02	-0.0008	0.02	0.007
School_8	0.11	-0.02	0.14	0.14	0.02	-0.001	0.02	0.007
School_9	0.01	0.18	0.02	0.02	0.01	0.0005	0.01	0.003
School_10	0.05	0.05	0.11	0.10	0.02	-0.002	0.02	0.006
School_11	0.13	0.05	0.12	0.11	0.02	0.0007	0.02	0.006
School_12	0.06	-0.02	0.13	0.13	0.02	-0.002	0.03	0.007
School_13	0.06	0.07	0.09	0.09	0.01	0.001	0.02	0.005
School_14	0.06	0.09	0.07	0.05	0.01	0.002	0.02	0.004
School_15	0.05	0.10	0.01	0.01	0.01	-0.0009	0.02	0.002
School_16	0.05	0.04	0.05	0.04	0.008	-0.0004	0.009	0.002
School_17	0.08	0.04	0.08	0.07	0.01	-0.0009	0.01	0.004
School_18	0.09	0.04	0.08	0.07	0.01	-0.001	0.01	0.004
School_19	0.03	0.03	0.06	0.06	0.008	-0.001	0.01	0.003
School_20	0.06	0.12	0.04	0.03	0.01	0.003	0.02	0.003
School_21	0.06	0.13	0.05	0.04	0.01	0.0000	0.02	0.003
School_22	0.06	0.09	0.07	0.05	0.02	0.002	0.02	0.004
School_23	0.04	0.12	0.05	0.04	0.01	0.003	0.01	0.003
School_24	0.04	0.14	0.04	0.02	0.01	0.003	0.01	0.002
School_25	0.01	0.08	0.03	0.02	0.01	-0.0006	0.01	0.002
School_27	0.07	0.04	0.07	0.05	0.02	0.0001	0.02	0.005
School_28	0.04	0.11	0.02	0.01	0.02	0.002	0.02	0.003
School_29	0.07	0.10	0.07	0.06	0.02	0.002	0.02	0.005
School_30	0.05	0.04	0.07	0.07	0.009	0.0006	0.01	0.004
School_31	0.07	0.05	0.07	0.07	0.01	-0.0004	0.01	0.004
School_32	0.14	0.01	0.16	0.16	0.02	-0.0006	0.02	0.008
School_33	0.12	0.03	0.14	0.13	0.02	0.0001	0.02	0.007
School_34	0.13	0.06	0.11	0.11	0.02	0.0008	0.02	0.006
School_35	0.12	0.06	0.11	0.10	0.02	0.0009	0.02	0.006
School_36	0.04	0.05	0.07	0.06	0.009	0.0008	0.01	0.004
School_37	0.05	0.02	0.07	0.06	0.011	-0.002	0.01	0.004
School_38	0.01	-0.02	0.11	0.11	0.011	-0.003	0.02	0.005
School_39	0.05	0.06	0.04	0.03	0.009	0.0000	0.01	0.002
School_40	0.04	0.06	0.05	0.05	0.008	-0.0001	0.01	0.003
School_41	0.04	0.05	0.05	0.05	0.008	-0.0003	0.01	0.003
School_42	0.50	0.11	0.03	0.02	0.02	-0.0002	0.003	0.002
School_43	0.43	0.09	0.02	0.01	0.01	0.002	0.002	0.002

Source: CDM 2005.

Table 5-13 (continued)
Adult Resident Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_44	0.37	0.10	0.04	0.04	0.01	0.0003	0.003	0.002
School_45	0.46	0.03	0.14	0.13	0.02	0.0001	0.007	0.006
School_46	0.31	0.10	0.04	0.04	0.01	0.002	0.002	0.002
School_47	0.30	0.10	0.03	0.03	0.01	0.0006	0.002	0.002
School_48	0.24	0.06	0.02	0.02	0.008	0.001	0.002	0.001
School_49	0.29	0.10	0.03	0.03	0.01	0.002	0.002	0.002
School_50	0.35	0.08	0.05	0.05	0.01	0.002	0.003	0.003
School_51	0.22	0.07	0.03	0.02	0.008	0.0004	0.002	0.001
School_52	0.22	0.07	0.02	0.02	0.008	0.0003	0.002	0.001
School_53	0.21	0.07	0.04	0.04	0.007	0.0007	0.002	0.002
School_54	0.28	0.07	0.06	0.06	0.010	0.0000	0.003	0.003
School_55	0.59	0.20	0.02	0.01	0.019	0.002	0.002	0.002
School_56	0.36	0.08	0.03	0.02	0.012	0.002	0.002	0.002
School_57	0.24	0.07	0.04	0.04	0.008	0.0002	0.002	0.002
School_58	0.25	0.08	0.06	0.06	0.009	0.0004	0.003	0.003
School_59	0.23	0.07	0.03	0.03	0.008	0.0015	0.002	0.002
School_60	0.19	0.07	0.03	0.03	0.007	0.0015	0.002	0.001
School_61	0.23	0.06	0.03	0.03	0.008	0.00010	0.002	0.002
School_62	0.21	0.06	0.04	0.04	0.008	0.00011	0.002	0.002
School_63	0.20	0.06	0.03	0.02	0.007	0.0012	0.002	0.002
School_64	0.43	0.09	0.03	0.02	0.013	0.0019	0.003	0.002
School_65	0.21	0.05	0.04	0.03	0.007	-0.00007	0.002	0.002
School_66	0.17	0.02	0.08	0.07	0.007	0.00005	0.004	0.003
School_67	0.19	0.05	0.04	0.04	0.007	0.0002	0.002	0.002
School_68	0.19	0.05	0.04	0.04	0.007	0.0000	0.002	0.002
School_69	0.18	0.04	0.03	0.03	0.006	-0.0002	0.002	0.002
School_70	0.17	0.05	0.03	0.03	0.006	0.0002	0.002	0.002
School_71	0.15	0.04	0.03	0.02	0.006	0.00009	0.002	0.001
School_72	0.33	0.02	0.03	0.02	0.011	-0.002	0.003	0.002
School_73	0.44	0.14	0.07	0.06	0.016	0.0008	0.004	0.003
School_74	0.33	0.09	0.03	0.03	0.012	0.0002	0.002	0.002
School_75	0.17	0.05	0.04	0.04	0.006	0.00013	0.002	0.002
School_76	0.26	0.09	0.03	0.03	0.009	0.002	0.002	0.002
School_77	0.28	0.10	0.04	0.04	0.010	0.002	0.002	0.002
School_78	0.46	0.10	0.04	0.03	0.014	0.002	0.003	0.002
School_79	0.22	0.07	0.04	0.03	0.008	0.0003	0.002	0.002
School_80	0.20	0.06	0.04	0.04	0.008	0.0012	0.002	0.002
School_81	0.43	0.11	0.05	0.04	0.014	0.00006	0.003	0.003
School_82	0.16	0.04	0.03	0.02	0.006	0.00009	0.002	0.001
School_83	0.14	0.03	0.03	0.03	0.005	-0.0002	0.002	0.001

Source: CDM 2005.

Table 5-14
Child Resident Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Minimum	-0.18	-0.27	-0.08	-0.11	0.010	-0.008	0.012	-0.0013
Average	0.04	0.06	0.09	0.08	0.02	0.0007	0.02	0.005
Maximum	0.14	0.23	0.35	0.36	0.03	0.005	0.04	0.02
	Acrolein				Formaldehyde			
Grid Location	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Signal_Hill	-0.09	0.23	-0.08	-0.11	0.01	0.005	0.01	-0.001
Resident_1	0.05	0.06	0.09	0.10	0.02	0.0007	0.02	0.006
Resident_2	0.09	0.11	0.09	0.07	0.02	0.002	0.02	0.005
Resident_3	0.06	0.10	0.11	0.09	0.02	0.002	0.02	0.005
Resident_4	0.02	0.03	0.16	0.16	0.01	0.0002	0.02	0.007
Resident_5	0.09	0.04	0.16	0.16	0.02	0.0003	0.02	0.008
Resident_6	0.09	0.00	0.15	0.14	0.02	-0.0010	0.02	0.007
Resident_7	0.10	0.10	0.08	0.06	0.02	0.002	0.02	0.005
Resident_8	0.05	0.22	0.02	0.02	0.01	0.005	0.01	0.003
Resident_9	0.06	0.17	0.04	0.04	0.01	0.004	0.02	0.003
Resident_10	0.04	0.11	0.02	0.01	0.02	0.002	0.02	0.003
Resident_11	-0.01	0.07	-0.02	-0.04	0.02	0.0010	0.02	0.002
Resident_12	0.02	0.01	-0.04	-0.05	0.02	-0.0007	0.02	0.001
Resident_13	0.03	-0.03	-0.04	-0.09	0.02	-0.002	0.02	0.001
Resident_14	0.02	-0.02	-0.03	-0.06	0.02	-0.002	0.02	0.001
Resident_15	0.04	0.02	-0.04	-0.04	0.02	-0.0003	0.02	0.002
Resident_16	0.04	0.02	-0.02	-0.02	0.02	-0.0005	0.02	0.002
Resident_17	0.03	0.00	0.01	-0.02	0.02	-0.0008	0.02	0.002
Resident_18	0.03	0.06	0.07	0.06	0.02	0.0008	0.02	0.005
Resident_19	-0.18	-0.11	0.27	0.28	0.02	-0.004	0.03	0.012
Resident_20	-0.09	-0.27	0.35	0.35	0.02	-0.008	0.04	0.016
Resident_21	-0.03	-0.21	0.35	0.36	0.03	-0.007	0.04	0.016
Resident_22	0.07	0.16	0.08	0.07	0.01	0.004	0.02	0.004
Resident_23	0.09	0.19	0.11	0.09	0.02	0.004	0.02	0.005
Resident_24	0.02	0.04	0.17	0.17	0.02	0.000	0.02	0.008
Resident_25	0.09	0.13	0.09	0.10	0.02	0.003	0.02	0.005
Resident_26	0.09	0.09	0.08	0.06	0.02	0.002	0.02	0.005
Resident_27	0.10	0.06	0.14	0.12	0.02	0.0006	0.03	0.007
Resident_28	0.14	0.20	0.16	0.13	0.03	0.004	0.03	0.008
Resident_29	0.08	0.12	0.10	0.09	0.02	0.002	0.02	0.005
Resident_30	0.08	0.14	0.16	0.15	0.03	0.003	0.03	0.009

Source: CDM 2005.

Table 5-15
School Child Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Minimum	0.01	-0.02	0.01	0.01	0.00	-0.003	0.00	0.00
Average	0.18	0.07	0.06	0.05	0.01	0.0005	0.01	0.00
Maximum	0.59	0.20	0.16	0.16	0.02	0.003	0.03	0.01
	Acrolein				Formaldehyde			
Grid Location	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_1	0.04	0.13	0.05	0.05	0.013	0.0002	0.01	0.003
School_2	0.08	0.10	0.07	0.07	0.012	0.002	0.01	0.004
School_3	0.04	0.05	0.05	0.04	0.008	0.0010	0.01	0.002
School_6	0.04	0.04	0.10	0.09	0.012	0.0005	0.02	0.005
School_7	0.15	0.00	0.15	0.14	0.020	-0.0008	0.02	0.007
School_8	0.11	-0.02	0.14	0.14	0.020	-0.0014	0.02	0.007
School_9	0.01	0.18	0.02	0.02	0.012	0.0005	0.01	0.003
School_10	0.05	0.05	0.11	0.10	0.015	-0.002	0.02	0.006
School_11	0.13	0.05	0.12	0.11	0.017	0.0007	0.02	0.006
School_12	0.06	-0.02	0.13	0.13	0.020	-0.002	0.03	0.007
School_13	0.06	0.07	0.09	0.09	0.015	0.0012	0.02	0.005
School_14	0.06	0.09	0.07	0.05	0.015	0.002	0.02	0.004
School_15	0.05	0.10	0.01	0.01	0.014	-0.0009	0.02	0.002
School_16	0.05	0.04	0.05	0.04	0.008	-0.0004	0.009	0.002
School_17	0.08	0.04	0.08	0.07	0.011	-0.0009	0.01	0.004
School_18	0.09	0.04	0.08	0.07	0.011	-0.0012	0.01	0.004
School_19	0.03	0.03	0.06	0.06	0.008	-0.0010	0.01	0.003
School_20	0.06	0.12	0.04	0.03	0.014	0.003	0.02	0.003
School_21	0.06	0.13	0.05	0.04	0.013	0.0000	0.02	0.003
School_22	0.06	0.09	0.07	0.05	0.015	0.002	0.02	0.004
School_23	0.04	0.12	0.05	0.04	0.011	0.003	0.01	0.003
School_24	0.04	0.14	0.04	0.02	0.012	0.003	0.01	0.002
School_25	0.01	0.08	0.03	0.02	0.011	-0.0006	0.01	0.002
School_27	0.07	0.04	0.07	0.05	0.018	0.0001	0.02	0.005
School_28	0.04	0.11	0.02	0.01	0.016	0.002	0.02	0.003
School_29	0.07	0.10	0.07	0.06	0.019	0.002	0.02	0.005
School_30	0.05	0.04	0.07	0.07	0.009	0.0006	0.01	0.004
School_31	0.07	0.05	0.07	0.07	0.010	-0.0004	0.01	0.004
School_32	0.14	0.01	0.16	0.16	0.019	-0.0006	0.02	0.008
School_33	0.12	0.03	0.14	0.13	0.018	0.0001	0.02	0.007
School_34	0.13	0.06	0.11	0.11	0.017	0.0008	0.02	0.006
School_35	0.12	0.06	0.11	0.10	0.017	0.0009	0.02	0.006
School_36	0.04	0.05	0.07	0.06	0.009	0.0008	0.01	0.004
School_37	0.05	0.02	0.07	0.06	0.011	-0.002	0.01	0.004
School_38	0.01	-0.02	0.11	0.11	0.011	-0.003	0.02	0.005
School_39	0.05	0.06	0.04	0.03	0.009	0.0000	0.01	0.002
School_40	0.04	0.06	0.05	0.05	0.008	-0.0001	0.01	0.003
School_41	0.04	0.05	0.05	0.05	0.008	-0.0003	0.01	0.003
School_42	0.50	0.11	0.03	0.02	0.015	-0.0002	0.003	0.002
School_43	0.43	0.09	0.02	0.01	0.014	0.002	0.002	0.002

Source: CDM 2005.

Table 5-15 (continued)
School Child Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_44	0.37	0.10	0.04	0.04	0.013	0.0003	0.003	0.002
School_45	0.46	0.03	0.14	0.13	0.017	0.0001	0.007	0.006
School_46	0.31	0.10	0.04	0.04	0.011	0.002	0.002	0.002
School_47	0.30	0.10	0.03	0.03	0.011	0.0006	0.002	0.002
School_48	0.24	0.06	0.02	0.02	0.008	0.0012	0.002	0.001
School_49	0.29	0.10	0.03	0.03	0.010	0.002	0.002	0.002
School_50	0.35	0.08	0.05	0.05	0.012	0.002	0.003	0.003
School_51	0.22	0.07	0.03	0.02	0.008	0.0004	0.002	0.001
School_52	0.22	0.07	0.02	0.02	0.008	0.0003	0.002	0.001
School_53	0.21	0.07	0.04	0.04	0.007	0.0007	0.002	0.002
School_54	0.28	0.07	0.06	0.06	0.010	0.0000	0.003	0.003
School_55	0.59	0.20	0.02	0.01	0.019	0.002	0.002	0.002
School_56	0.36	0.08	0.03	0.02	0.012	0.0017	0.002	0.002
School_57	0.24	0.07	0.04	0.04	0.008	0.0002	0.002	0.002
School_58	0.25	0.08	0.06	0.06	0.009	0.0004	0.003	0.003
School_59	0.23	0.07	0.03	0.03	0.008	0.0015	0.002	0.002
School_60	0.19	0.07	0.03	0.03	0.007	0.0015	0.002	0.001
School_61	0.23	0.06	0.03	0.03	0.008	0.00010	0.002	0.002
School_62	0.21	0.06	0.04	0.04	0.008	0.00011	0.002	0.002
School_63	0.20	0.06	0.03	0.02	0.007	0.001	0.002	0.002
School_64	0.43	0.09	0.03	0.02	0.013	0.002	0.003	0.002
School_65	0.21	0.05	0.04	0.03	0.007	-0.00007	0.002	0.002
School_66	0.17	0.02	0.08	0.07	0.007	0.00005	0.004	0.003
School_67	0.19	0.05	0.04	0.04	0.007	0.0002	0.002	0.002
School_68	0.19	0.05	0.04	0.04	0.007	0.00003	0.002	0.002
School_69	0.18	0.04	0.03	0.03	0.006	-0.0002	0.002	0.002
School_70	0.17	0.05	0.03	0.03	0.006	0.0002	0.002	0.002
School_71	0.15	0.04	0.03	0.02	0.006	0.00009	0.002	0.001
School_72	0.33	0.02	0.03	0.02	0.011	-0.002	0.003	0.002
School_73	0.44	0.14	0.07	0.06	0.016	0.0008	0.004	0.003
School_74	0.33	0.09	0.03	0.03	0.012	0.0002	0.002	0.002
School_75	0.17	0.05	0.04	0.04	0.006	0.0001	0.002	0.002
School_76	0.26	0.09	0.03	0.03	0.009	0.002	0.002	0.002
School_77	0.28	0.10	0.04	0.04	0.010	0.002	0.002	0.002
School_78	0.46	0.10	0.04	0.03	0.014	0.002	0.003	0.002
School_79	0.22	0.07	0.04	0.03	0.008	0.0003	0.002	0.002
School_80	0.20	0.06	0.04	0.04	0.008	0.0012	0.002	0.002
School_81	0.43	0.11	0.05	0.04	0.014	0.00006	0.003	0.003
School_82	0.16	0.04	0.03	0.02	0.006	0.00009	0.002	0.001
School_83	0.14	0.03	0.03	0.03	0.005	-0.0002	0.002	0.001

Source: CDM 2005.

Table 5-16
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Minimum	-0.67	-1.29	-0.71	-1.33	0.00	-0.04	0.00	-0.03
Average	0.10	0.07	0.09	0.09	0.02	0.0008	0.02	0.01
Maximum	0.84	0.44	0.43	0.44	0.08	0.01	0.09	0.02
	Acrolein				Formaldehyde			
Grid Location	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_1	0.04	0.13	0.05	0.05	0.013	0.0002	0.01	0.003
School_2	0.08	0.10	0.07	0.07	0.012	0.002	0.01	0.004
School_3	0.04	0.05	0.05	0.04	0.008	0.001	0.01	0.002
School_4	0.06	0.15	0.05	0.05	0.015	0.003	0.02	0.004
School_5	0.00	0.04	0.02	0.00	0.020	-0.0001	0.02	0.003
School_6	0.04	0.04	0.10	0.09	0.012	0.0005	0.02	0.005
School_7	0.15	0.00	0.15	0.14	0.020	-0.0008	0.02	0.007
School_8	0.11	-0.02	0.14	0.14	0.020	-0.0014	0.02	0.007
School_9	0.01	0.18	0.02	0.02	0.012	0.0005	0.01	0.003
School_10	0.05	0.05	0.11	0.10	0.015	-0.002	0.02	0.006
School_11	0.13	0.05	0.12	0.11	0.017	0.0007	0.02	0.006
School_12	0.06	-0.02	0.13	0.13	0.020	-0.002	0.03	0.007
School_13	0.06	0.07	0.09	0.09	0.015	0.0012	0.02	0.005
School_14	0.06	0.09	0.07	0.05	0.015	0.002	0.02	0.004
School_15	0.05	0.10	0.01	0.01	0.014	-0.0009	0.02	0.002
School_16	0.05	0.04	0.05	0.04	0.008	-0.0004	0.009	0.002
School_17	0.08	0.04	0.08	0.07	0.011	-0.0009	0.01	0.004
School_18	0.09	0.04	0.08	0.07	0.011	-0.0012	0.01	0.004
School_19	0.03	0.03	0.06	0.06	0.008	-0.0010	0.01	0.003
School_20	0.06	0.12	0.04	0.03	0.014	0.003	0.02	0.003
School_21	0.06	0.13	0.05	0.04	0.013	0.00004	0.02	0.003
School_22	0.06	0.09	0.07	0.05	0.015	0.002	0.02	0.004
School_23	0.04	0.12	0.05	0.04	0.011	0.003	0.01	0.003
School_24	0.04	0.14	0.04	0.02	0.012	0.003	0.01	0.002
School_25	0.01	0.08	0.03	0.02	0.011	-0.0006	0.01	0.002
School_26	0.84	0.10	0.06	0.05	0.021	0.002	0.02	0.005
School_27	0.07	0.04	0.07	0.05	0.018	0.0001	0.02	0.005
School_28	0.04	0.11	0.02	0.01	0.016	0.002	0.02	0.003
School_29	0.07	0.10	0.07	0.06	0.019	0.002	0.02	0.005
School_30	0.05	0.04	0.07	0.07	0.009	0.0006	0.01	0.004
School_31	0.07	0.05	0.07	0.07	0.010	-0.0004	0.01	0.004
School_32	0.14	0.01	0.16	0.16	0.019	-0.0006	0.02	0.008
School_33	0.12	0.03	0.14	0.13	0.018	0.00010	0.02	0.007
School_34	0.13	0.06	0.11	0.11	0.017	0.0008	0.02	0.006
School_35	0.12	0.06	0.11	0.10	0.017	0.0009	0.02	0.006
School_36	0.04	0.05	0.07	0.06	0.009	0.0008	0.01	0.004
School_37	0.05	0.02	0.07	0.06	0.011	-0.002	0.01	0.004
School_38	0.01	-0.02	0.11	0.11	0.011	-0.003	0.02	0.005
School_39	0.05	0.06	0.04	0.03	0.009	-0.00004	0.01	0.002
School_40	0.04	0.06	0.05	0.05	0.008	-0.00010	0.01	0.003
School_41	0.04	0.05	0.05	0.05	0.008	-0.0003	0.01	0.003

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-16 (continued)
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
School_42	0.50	0.11	0.03	0.02	0.015	-0.0002	0.003	0.002
School_43	0.43	0.09	0.02	0.01	0.014	0.002	0.002	0.002
School_44	0.37	0.10	0.04	0.04	0.013	0.0003	0.003	0.002
School_45	0.46	0.03	0.14	0.13	0.017	0.0001	0.007	0.006
School_46	0.31	0.10	0.04	0.04	0.011	0.002	0.002	0.002
School_47	0.30	0.10	0.03	0.03	0.011	0.0006	0.002	0.002
School_48	0.24	0.06	0.02	0.02	0.008	0.0012	0.002	0.001
School_49	0.29	0.10	0.03	0.03	0.010	0.002	0.002	0.002
School_50	0.35	0.08	0.05	0.05	0.012	0.002	0.003	0.003
School_51	0.22	0.07	0.03	0.02	0.008	0.0004	0.002	0.001
School_52	0.22	0.07	0.02	0.02	0.008	0.0003	0.002	0.001
School_53	0.21	0.07	0.04	0.04	0.007	0.0007	0.002	0.002
School_54	0.28	0.07	0.06	0.06	0.010	-0.000010	0.003	0.003
School_55	0.59	0.20	0.02	0.01	0.019	0.002	0.002	0.002
School_56	0.36	0.08	0.03	0.02	0.012	0.002	0.002	0.002
School_57	0.24	0.07	0.04	0.04	0.008	0.0002	0.002	0.002
School_58	0.25	0.08	0.06	0.06	0.009	0.0004	0.003	0.003
School_59	0.23	0.07	0.03	0.03	0.008	0.0015	0.002	0.002
School_60	0.19	0.07	0.03	0.03	0.007	0.0015	0.002	0.001
School_61	0.23	0.06	0.03	0.03	0.008	0.00010	0.002	0.002
School_62	0.21	0.06	0.04	0.04	0.008	0.00011	0.002	0.002
School_63	0.20	0.06	0.03	0.02	0.007	0.0012	0.002	0.002
School_64	0.43	0.09	0.03	0.02	0.013	0.002	0.003	0.002
School_65	0.21	0.05	0.04	0.03	0.007	-0.00007	0.002	0.002
School_66	0.17	0.02	0.08	0.07	0.007	0.00005	0.004	0.003
School_67	0.19	0.05	0.04	0.04	0.007	0.0002	0.002	0.002
School_68	0.19	0.05	0.04	0.04	0.007	0.00003	0.002	0.002
School_69	0.18	0.04	0.03	0.03	0.006	-0.0002	0.002	0.002
School_70	0.17	0.05	0.03	0.03	0.006	0.0002	0.002	0.002
School_71	0.15	0.04	0.03	0.02	0.006	0.00009	0.002	0.001
School_72	0.33	0.02	0.03	0.02	0.011	-0.002	0.003	0.002
School_73	0.44	0.14	0.07	0.06	0.016	0.0008	0.004	0.003
School_74	0.33	0.09	0.03	0.03	0.012	0.0002	0.002	0.002
School_75	0.17	0.05	0.04	0.04	0.006	0.00013	0.002	0.002
School_76	0.26	0.09	0.03	0.03	0.009	0.002	0.002	0.002
School_77	0.28	0.10	0.04	0.04	0.010	0.002	0.002	0.002
School_78	0.46	0.10	0.04	0.03	0.014	0.002	0.003	0.002
School_79	0.22	0.07	0.04	0.03	0.008	0.0003	0.002	0.002
School_80	0.20	0.06	0.04	0.04	0.008	0.0012	0.002	0.002
School_81	0.43	0.11	0.05	0.04	0.014	0.0001	0.003	0.003
School_82	0.16	0.04	0.03	0.02	0.006	0.0001	0.002	0.001
School_83	0.14	0.03	0.03	0.03	0.005	-0.0002	0.002	0.001

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-16 (continued)
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Hospital_1	0.06	0.08	0.05	0.05	0.010	0.002	0.01	0.003
Hospital_2	0.05	0.06	0.04	0.03	0.008	0.0012	0.009	0.002
Hospital_3	0.09	-0.02	0.08	0.07	0.019	-0.0015	0.02	0.005
Hospital_4	-0.15	-0.16	-0.11	-0.15	0.016	-0.005	0.02	-0.002
Hospital_5	0.01	0.21	0.02	0.02	0.013	0.005	0.02	0.003
Hospital_6	0.04	0.08	0.04	0.04	0.007	0.002	0.01	0.002
Hospital_7	0.05	0.06	0.04	0.03	0.008	0.0012	0.01	0.002
Hospital_8	0.00	0.00	0.03	0.02	0.011	-0.0006	0.01	0.003
Hospital_9	0.05	0.06	0.04	0.03	0.008	0.0013	0.01	0.002
Hospital_10	0.05	0.07	0.04	0.04	0.008	0.002	0.01	0.002
Hospital_11	0.05	0.06	0.04	0.03	0.008	0.0013	0.01	0.002
Hospital_12	-0.04	0.03	0.05	0.04	0.020	-0.0002	0.03	0.005
Hospital_13	0.04	0.06	0.03	0.03	0.012	0.0010	0.01	0.003
Hospital_14	0.04	0.05	0.03	0.03	0.007	0.0011	0.01	0.002
Hospital_15	0.08	0.10	0.07	0.07	0.019	0.002	0.02	0.005
Hospital_16	0.05	0.08	0.05	0.04	0.008	0.002	0.01	0.003
Hospital_17	0.06	0.04	0.06	0.06	0.009	0.0008	0.01	0.003
Hospital_18	0.04	0.03	0.05	0.04	0.011	0.0003	0.01	0.003
Hospital_19	0.05	0.06	0.04	0.03	0.008	0.0012	0.01	0.002
Hospital_20	0.04	0.06	0.03	0.03	0.007	0.0012	0.01	0.002
Hospital_21	0.05	0.04	0.04	0.04	0.008	0.0007	0.01	0.002
Hospital_22	0.05	0.06	0.04	0.04	0.008	0.0013	0.01	0.002
Hospital_23	0.05	0.05	0.04	0.04	0.008	0.0011	0.01	0.002
Commercial_1	0.20	0.19	0.21	0.11	0.040	0.003	0.05	0.010
Commercial_2	0.05	0.17	0.20	0.22	0.035	0.003	0.05	0.013
Commercial_3	0.08	0.14	0.18	0.16	0.029	0.002	0.04	0.010
Commercial_4	0.02	0.16	0.01	-0.01	0.019	0.003	0.02	0.003
Commercial_5	0.11	0.11	0.22	0.20	0.026	0.002	0.03	0.011
Commercial_6	0.10	0.04	0.24	0.24	0.024	-0.00003	0.03	0.011
Commercial_7	0.07	0.16	0.14	0.14	0.018	0.003	0.02	0.007
Commercial_8	0.02	0.07	0.20	0.20	0.016	0.0009	0.02	0.009
Commercial_9	0.01	0.11	0.06	0.07	0.024	0.002	0.03	0.006
Commercial_10	-0.01	0.10	0.06	0.09	0.020	0.002	0.03	0.006
Other_1	-0.67	-1.29	-0.71	-1.33	0.080	-0.039	0.09	-0.026
Other_3	-0.02	-0.04	0.30	0.30	0.027	-0.002	0.04	0.014
Recreation_1	0.12	0.13	0.11	0.08	0.021	0.002	0.02	0.006
Recreation_2	0.09	0.12	0.08	0.07	0.015	0.003	0.02	0.005
Recreation_3	-0.12	-0.12	-0.11	-0.03	0.020	-0.004	0.02	0.003
Recreation_4	0.03	-0.02	-0.02	0.00	0.023	-0.002	0.03	0.004

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-16 (continued)
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
PROP_INT_1	-0.01	-0.17	0.43	0.44	0.031	-0.006	0.05	0.019
PROP_INT_2	-0.17	-0.10	0.31	0.32	0.020	-0.004	0.04	0.015
PROP_INT_3	-0.03	0.13	0.22	0.22	0.016	0.003	0.03	0.010
PROP_INT_4	0.01	0.15	0.03	0.01	0.018	0.003	0.02	0.003
PROP_INT_5	0.02	0.17	0.00	0.00	0.018	0.004	0.02	0.003
PROP_INT_6	0.02	0.14	-0.03	-0.01	0.019	0.003	0.02	0.003
PROP_INT_7	0.06	0.11	-0.05	-0.07	0.021	0.002	0.02	0.001
PROP_INT_8	0.05	0.08	-0.03	-0.08	0.022	0.0011	0.02	0.001
PROP_INT_9	-0.02	0.05	-0.10	-0.13	0.020	0.0002	0.02	-0.001
PROP_INT_10	-0.03	0.14	-0.07	-0.06	0.018	0.003	0.02	0.001
PROP_INT_11	-0.01	0.20	-0.03	-0.04	0.016	0.004	0.02	0.002
PROP_INT_12	-0.01	0.25	-0.04	-0.02	0.019	0.006	0.02	0.003
PROP_INT_13	-0.01	0.44	-0.01	0.03	0.021	0.010	0.02	0.005
PROP_INT_14	0.02	0.35	0.05	0.13	0.024	0.008	0.03	0.008
PROP_INT_15	-0.05	0.38	0.14	0.37	0.037	0.008	0.05	0.019
PROP_INT_16	0.14	0.11	0.31	0.19	0.049	0.0006	0.06	0.014
PROP_INT_17	0.25	-0.10	0.28	0.08	0.048	-0.005	0.06	0.010
PROP_INT_18	0.12	-0.08	0.23	0.08	0.040	-0.004	0.05	0.009
PROP_INT_19	0.03	-0.04	0.18	0.15	0.032	-0.003	0.04	0.010
PROP_INT_20	0.05	0.05	0.22	0.21	0.023	0.0003	0.03	0.011
PROP_INT_21	0.05	0.12	0.20	0.20	0.019	0.002	0.03	0.009
PROP_INT_22	0.16	-0.04	0.28	0.28	0.028	-0.002	0.04	0.013
PROP_INT_23	0.05	0.05	0.17	0.15	0.022	0.0003	0.03	0.009
PROP_INT_24	0.16	0.10	0.16	0.18	0.024	0.002	0.03	0.009
PROP_INT_25	0.07	0.08	0.21	0.22	0.022	0.0012	0.03	0.010
PROP_INT_26	0.01	0.05	0.28	0.28	0.020	0.0003	0.03	0.012
PROP_INT_27	-0.08	0.00	0.29	0.29	0.020	-0.0012	0.03	0.013
PROP_INT_28	-0.03	0.04	0.25	0.25	0.020	0.0000	0.03	0.012
PROP_INT_29	0.04	0.08	0.21	0.21	0.018	0.0011	0.03	0.010
PROP_INT_30	0.07	0.08	0.05	0.03	0.019	0.0012	0.02	0.004
PROP_INT_31	0.06	0.09	0.05	0.02	0.020	0.0015	0.02	0.004
PROP_INT_32	0.08	0.12	0.13	0.10	0.022	0.002	0.03	0.007
PROP_INT_33	-0.02	0.16	0.00	-0.01	0.020	0.003	0.02	0.003
PROP_INT_34	0.01	0.16	0.06	0.03	0.023	0.003	0.03	0.005
PROP_INT_35	-0.06	0.15	0.04	0.02	0.026	0.002	0.03	0.006
PROP_INT_36	0.09	0.15	0.09	0.09	0.031	0.002	0.04	0.008
PROP_INT_37	0.06	0.21	0.07	0.07	0.023	0.004	0.03	0.006
PROP_INT_38	0.08	0.20	0.08	0.08	0.023	0.004	0.03	0.006
PROP_INT_39	0.10	0.18	0.10	0.09	0.024	0.004	0.03	0.007
PROP_INT_40	0.17	0.10	0.19	0.18	0.033	0.0012	0.04	0.011
PROP_INT_41	0.22	0.05	0.22	0.21	0.031	0.00011	0.04	0.011
PROP_INT_42	0.27	-0.01	0.26	0.24	0.034	-0.002	0.04	0.013

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-16 (continued)
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
PROP_PRI_1	0.17	-0.01	0.24	0.23	0.029	-0.0014	0.04	0.012
PROP_PRI_2	0.21	0.00	0.35	0.35	0.031	-0.0014	0.04	0.016
PROP_PRI_3	0.12	-0.09	0.36	0.36	0.029	-0.004	0.04	0.016
PROP_PRI_4	0.02	0.25	0.00	-0.01	0.016	0.006	0.02	0.003
PROP_PRI_5	0.03	0.24	0.01	0.00	0.017	0.006	0.02	0.003
PROP_PRI_6	-0.03	0.19	-0.05	-0.04	0.017	0.004	0.02	0.002
PROP_PRI_7	0.03	0.19	0.06	0.16	0.032	0.003	0.04	0.011
PROP_PRI_8	0.07	0.40	0.08	0.16	0.032	0.009	0.04	0.010
PROP_PRI_9	0.06	0.06	0.18	0.18	0.028	0.0002	0.04	0.011
PROP_PRI_10	0.03	0.06	0.17	0.15	0.025	0.0003	0.03	0.009
PROP_PRI_11	0.07	0.07	0.22	0.22	0.022	0.0008	0.03	0.011
PROP_PRI_12	0.05	0.09	0.18	0.18	0.017	0.002	0.02	0.008
PROP_PRI_13	0.05	0.09	0.17	0.16	0.017	0.002	0.02	0.008
PROP_PRI_14	0.03	0.06	0.17	0.17	0.016	0.0007	0.02	0.008
PROP_PRI_15	0.04	0.06	0.16	0.16	0.016	0.0008	0.02	0.008
PROP_PRI_16	0.00	0.01	0.18	0.18	0.016	-0.0006	0.02	0.009
PROP_PRI_17	-0.02	0.01	0.20	0.20	0.016	-0.0006	0.03	0.009
PROP_PRI_18	0.00	0.00	0.21	0.21	0.017	-0.0009	0.03	0.010
PROP_PRI_19	0.05	0.00	0.22	0.22	0.020	-0.0010	0.03	0.010
PROP_PRI_20	-0.03	0.00	0.23	0.24	0.019	-0.0010	0.03	0.011
PROP_PRI_21	0.08	0.09	0.10	0.08	0.022	0.0014	0.03	0.006
PROP_PRI_22	0.09	0.07	0.09	0.06	0.021	0.0010	0.02	0.005
PROP_PRI_23	0.07	0.10	0.08	0.09	0.019	0.002	0.02	0.006
PROP_PRI_24	0.09	0.09	0.10	0.09	0.022	0.0014	0.03	0.006
PROP_PRI_25	0.12	0.13	0.11	0.10	0.020	0.002	0.02	0.006
PROP_PRI_26	0.19	0.09	0.28	0.31	0.028	0.0011	0.04	0.014
PROP_PRI_27	-0.14	-0.10	0.32	0.32	0.021	-0.004	0.04	0.015
PROP_PRI_28	0.04	0.08	0.16	0.16	0.017	0.0012	0.02	0.008
PROP_PRI_29	0.06	0.09	0.16	0.16	0.017	0.0015	0.02	0.008
PROP_PRI_30	0.08	0.08	0.14	0.14	0.016	0.0013	0.02	0.007
PROP_PRI_31	0.06	0.07	0.14	0.14	0.015	0.0011	0.02	0.007
PROP_PRI_32	0.06	0.07	0.14	0.14	0.015	0.0013	0.02	0.007
PROP_PRI_33	0.06	0.08	0.14	0.14	0.016	0.0013	0.02	0.007
PROP_PRI_34	0.06	0.07	0.14	0.14	0.015	0.0013	0.02	0.007
PROP_PRI_35	0.06	0.08	0.13	0.14	0.015	0.0013	0.02	0.007
PROP_PRI_36	0.06	0.09	0.13	0.13	0.015	0.0016	0.02	0.007
PROP_PRI_37	0.07	0.08	0.13	0.14	0.015	0.0013	0.02	0.007
PROP_PRI_38	0.07	0.08	0.14	0.14	0.015	0.0014	0.02	0.007
PROP_PRI_39	0.08	0.08	0.14	0.14	0.016	0.0013	0.02	0.007
PROP_PRI_40	0.07	0.07	0.08	0.08	0.016	0.0012	0.02	0.005

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-16 (continued)
Off-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
PROP_PRI_41	0.06	0.08	0.05	0.06	0.016	0.0013	0.02	0.004
PROP_PRI_42	0.08	0.13	0.06	0.04	0.021	0.003	0.02	0.005
PROP_PRI_43	0.09	0.10	0.11	0.11	0.022	0.002	0.03	0.007
PROP_PRI_44	0.02	0.07	0.06	0.02	0.021	0.0009	0.03	0.004
PROP_PRI_45	-0.04	0.07	0.03	0.00	0.019	0.0008	0.02	0.004
PROP_PRI_46	-0.03	0.09	0.02	0.00	0.019	0.0015	0.02	0.003
PROP_PRI_47	-0.01	0.12	0.02	0.00	0.018	0.002	0.02	0.003
PROP_PRI_48	-0.01	0.14	0.02	0.00	0.018	0.003	0.02	0.003
PROP_PRI_49	0.02	0.19	0.01	0.00	0.018	0.004	0.02	0.003
PROP_PRI_50	0.02	0.17	0.02	0.00	0.018	0.004	0.02	0.003
PROP_PRI_51	-0.04	0.05	0.00	-0.01	0.020	0.0002	0.02	0.003
PROP_PRI_52	0.06	0.09	0.07	0.09	0.029	0.0010	0.03	0.008
PROP_PRI_53	0.09	0.14	0.09	0.07	0.032	0.002	0.04	0.007
PROP_PRI_54	0.09	0.13	0.19	0.15	0.035	0.002	0.04	0.010
PROP_PRI_55	-0.04	-0.13	0.20	0.17	0.037	-0.005	0.05	0.012
PROP_PRI_56	-0.04	-0.02	0.23	0.18	0.037	-0.003	0.05	0.012
PROP_PRI_57	0.09	0.26	0.09	0.08	0.027	0.006	0.03	0.007
PROP_PRI_58	0.07	0.21	0.06	0.06	0.022	0.005	0.03	0.005
PROP_PRI_59	0.08	0.13	0.15	0.15	0.026	0.002	0.03	0.009
PROP_PRI_60	0.10	-0.03	0.22	0.23	0.033	-0.002	0.04	0.013
PROP_PRI_61	0.18	-0.10	0.22	0.24	0.036	-0.004	0.04	0.013
PROP_PRI_62	0.20	0.05	0.24	0.22	0.035	-0.0002	0.04	0.012
PROP_PRI_63	0.16	0.10	0.21	0.23	0.033	0.0013	0.04	0.012
PROP_PRI_64	0.16	0.14	0.21	0.22	0.032	0.002	0.04	0.012
PROP_PRI_65	0.23	0.15	0.23	0.20	0.034	0.002	0.04	0.011
PROP_PRI_66	0.22	0.12	0.37	0.37	0.033	0.002	0.04	0.017
PROP_PRI_67	0.22	0.08	0.20	0.20	0.031	0.0008	0.04	0.011
PROP_PRI_68	0.24	0.02	0.23	0.22	0.032	-0.0009	0.04	0.012
PROP_PRI_69	0.27	0.01	0.26	0.25	0.034	-0.0011	0.04	0.013

Source: CDM 2005.
[1] Includes workers at schools, hospitals, commercial/industrial sites, recreational facilities, and airport workers in non-restricted areas.

Table 5-17
On-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Minimum	-2.52	-2.11	-2.00	-2.03	0.02	-0.06	0.02	-0.04
Average	-0.05	-0.01	0.12	0.12	0.03	-0.002	0.04	0.01
Maximum	0.28	0.37	0.51	0.49	0.10	0.007	0.12	0.02
	Acrolein				Formaldehyde			
Grid Location	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
Other_2	-1.33	-1.81	-1.04	-1.50	0.10	-0.05	0.12	-0.026
SEC_PRI_1	0.21	0.09	0.26	0.25	0.03	0.001	0.04	0.01
SEC_PRI_2	0.20	0.07	0.25	0.23	0.03	0.000	0.04	0.01
SEC_PRI_3	0.19	0.09	0.35	0.35	0.03	0.001	0.04	0.02
SEC_PRI_4	0.11	-0.02	0.36	0.36	0.03	-0.002	0.04	0.02
SEC_PRI_5	-0.03	-0.05	0.43	0.44	0.03	-0.003	0.05	0.02
SEC_PRI_6	-0.21	0.08	0.34	0.34	0.02	0.001	0.04	0.02
SEC_PRI_7	-0.21	0.03	0.35	0.35	0.02	-0.001	0.05	0.02
SEC_PRI_8	-0.01	0.25	0.11	0.13	0.02	0.005	0.03	0.01
SEC_PRI_9	0.02	0.29	0.12	0.15	0.02	0.006	0.03	0.01
SEC_PRI_10	0.00	0.14	0.07	0.09	0.03	0.002	0.03	0.01
SEC_PRI_11	-0.02	0.09	0.06	0.07	0.03	0.001	0.03	0.01
SEC_PRI_12	-0.06	0.14	0.27	0.27	0.03	0.002	0.04	0.01
SEC_PRI_13	-0.06	0.13	0.20	0.21	0.03	0.002	0.04	0.01
SEC_PRI_14	-0.03	0.11	0.00	0.02	0.03	0.001	0.04	0.01
SEC_PRI_15	-0.05	0.01	0.02	0.04	0.03	-0.001	0.03	0.01
SEC_PRI_16	-0.08	-0.05	0.10	0.12	0.03	-0.003	0.04	0.01
SEC_PRI_17	-0.04	-0.07	0.05	0.06	0.03	-0.003	0.04	0.01
SEC_PRI_18	-0.10	-0.04	-0.25	-0.25	0.03	-0.003	0.03	0.00
SEC_PRI_19	-0.06	-0.11	-0.30	-0.31	0.04	-0.005	0.03	0.00
SEC_PRI_20	-0.05	-0.01	-0.09	-0.24	0.03	-0.002	0.04	0.00
SEC_PRI_21	-0.10	-0.23	-0.17	-0.37	0.04	-0.008	0.04	-0.01
SEC_PRI_22	-0.50	-0.74	-0.57	-0.67	0.04	-0.022	0.05	-0.01
SEC_PRI_23	-2.52	-2.11	-2.00	-2.03	0.05	-0.062	0.07	-0.04
SEC_PRI_24	0.28	-0.89	0.51	-0.59	0.09	-0.028	0.11	0.00
SEC_PRI_25	-1.03	-1.00	-0.81	-0.97	0.05	-0.030	0.06	-0.02
SEC_PRI_26	-0.26	0.37	-0.15	0.48	0.04	0.007	0.05	0.02
SEC_PRI_27	-0.32	0.17	-0.22	0.29	0.03	0.002	0.04	0.02
SEC_PRI_28	-0.33	0.15	-0.20	0.22	0.03	0.002	0.04	0.01
SEC_PRI_29	-0.43	0.02	-0.35	-0.04	0.03	-0.002	0.04	0.01
SEC_PRI_30	-0.47	0.30	-0.40	-0.14	0.03	0.006	0.04	0.00
SEC_PRI_31	-0.41	-0.29	-0.33	-0.29	0.03	-0.009	0.03	0.00
SEC_PRI_32	-0.39	-0.03	-0.27	-0.23	0.02	-0.002	0.03	0.00
SEC_PRI_33	-0.27	-0.05	-0.20	-0.07	0.02	-0.003	0.03	0.00
SEC_PRI_34	-0.27	0.06	-0.21	-0.06	0.02	0.000	0.03	0.00
SEC_PRI_35	-0.29	0.05	-0.17	-0.05	0.02	0.000	0.03	0.00
SEC_PRI_36	0.08	0.24	0.10	0.22	0.03	0.005	0.04	0.01
SEC_PRI_37	0.06	0.10	0.18	0.18	0.03	0.001	0.04	0.01
SEC_PRI_38	0.03	0.16	0.17	0.15	0.02	0.003	0.03	0.01
SEC_PRI_39	0.06	0.10	0.21	0.22	0.02	0.002	0.03	0.01
SEC_PRI_40	0.06	0.15	0.21	0.21	0.02	0.003	0.03	0.01

Source: CDM 2005.
[1] Includes workers in restricted areas of the airport (including ground handlers at the gates).

Table 5-17 (continued)
On-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
SEC_PRI_41	0.05	0.09	0.18	0.18	0.02	0.002	0.03	0.01
SEC_PRI_42	-0.02	0.00	0.22	0.22	0.02	-0.0008	0.03	0.01
SEC_PRI_43	-0.01	0.02	0.27	0.27	0.02	-0.0007	0.03	0.01
SEC_PRI_44	0.08	-0.03	0.28	0.27	0.03	-0.002	0.04	0.01
SEC_PRI_45	0.14	0.16	0.14	0.12	0.02	0.003	0.02	0.01
SEC_PRI_46	0.14	0.16	0.13	0.11	0.02	0.003	0.02	0.01
SEC_PRI_47	0.15	0.16	0.14	0.12	0.02	0.003	0.02	0.01
SEC_PRI_48	0.20	0.03	0.41	0.44	0.03	-0.0008	0.05	0.02
SEC_PRI_49	0.05	0.21	0.27	0.27	0.02	0.004	0.03	0.01
SEC_PRI_50	-0.02	0.13	0.26	0.26	0.02	0.003	0.03	0.01
SEC_PRI_51	0.09	0.08	0.28	0.29	0.02	0.0010	0.03	0.01
SEC_PRI_52	-0.02	0.07	0.30	0.30	0.02	0.0009	0.04	0.01
SEC_PRI_53	-0.03	0.07	0.30	0.30	0.02	0.0006	0.04	0.01
SEC_PRI_54	0.01	0.07	0.30	0.30	0.02	0.0006	0.03	0.01
SEC_PRI_55	-0.01	0.08	0.30	0.30	0.02	0.0010	0.03	0.01
SEC_PRI_56	-0.13	0.03	0.31	0.31	0.02	-0.0003	0.04	0.01
SEC_PRI_57	-0.11	0.04	0.31	0.31	0.02	-0.00013	0.04	0.01
SEC_PRI_58	-0.12	0.01	0.32	0.32	0.02	-0.0008	0.04	0.01
SEC_PRI_59	-0.13	-0.03	0.32	0.32	0.02	-0.002	0.04	0.01
SEC_PRI_60	-0.18	-0.04	0.33	0.33	0.02	-0.002	0.04	0.01
SEC_PRI_61	-0.20	-0.06	0.33	0.33	0.02	-0.003	0.04	0.02
SEC_PRI_62	-0.19	-0.06	0.34	0.34	0.02	-0.003	0.04	0.02
SEC_PRI_63	-0.28	-0.04	0.36	0.36	0.02	-0.002	0.04	0.02
SEC_PRI_64	-0.24	-0.04	0.36	0.36	0.02	-0.003	0.04	0.02
SEC_PRI_65	-0.24	-0.04	0.37	0.37	0.02	-0.002	0.04	0.02
SEC_PRI_66	-0.22	-0.05	0.36	0.36	0.02	-0.003	0.04	0.02
SEC_PRI_67	-0.08	0.05	0.30	0.30	0.02	0.000	0.04	0.01
SEC_PRI_68	-0.05	0.07	0.28	0.28	0.02	0.001	0.03	0.01
SEC_PRI_69	-0.16	-0.07	0.32	0.32	0.02	-0.003	0.04	0.01
SEC_PRI_70	0.04	0.07	0.17	0.17	0.02	0.001	0.02	0.01
SEC_PRI_71	0.05	0.08	0.17	0.17	0.02	0.001	0.02	0.01
SEC_PRI_72	0.08	0.08	0.14	0.14	0.02	0.001	0.02	0.01
SEC_PRI_73	0.07	0.07	0.08	0.08	0.02	0.001	0.02	0.01
SEC_PRI_74	0.06	0.07	0.06	0.06	0.02	0.001	0.02	0.00
SEC_PRI_75	0.08	0.14	0.06	0.04	0.02	0.003	0.02	0.00
SEC_PRI_76	0.09	0.16	0.11	0.11	0.02	0.003	0.03	0.01
SEC_PRI_77	-0.03	0.09	0.01	-0.02	0.02	0.001	0.02	0.00
SEC_PRI_78	0.06	0.09	0.07	0.09	0.03	0.001	0.03	0.01
SEC_PRI_79	0.09	0.10	0.10	0.07	0.03	0.001	0.04	0.01
SEC_PRI_80	0.09	0.08	0.19	0.15	0.03	0.0006	0.04	0.01
SEC_PRI_81	-0.04	-0.41	0.20	0.17	0.04	-0.013	0.05	0.01
SEC_PRI_82	0.18	-0.07	0.23	0.24	0.04	-0.004	0.04	0.01
SEC_PRI_83	0.20	-0.09	0.24	0.22	0.03	-0.004	0.04	0.01
SEC_PRI_84	0.16	-0.03	0.21	0.23	0.03	-0.002	0.04	0.01
SEC_PRI_85	0.16	0.14	0.21	0.22	0.03	0.002	0.04	0.01
SEC_PRI_86	0.23	0.08	0.23	0.21	0.03	0.0008	0.04	0.01
SEC_PRI_87	0.23	0.14	0.32	0.35	0.03	0.002	0.04	0.02
SEC_PRI_88	0.22	0.21	0.20	0.20	0.03	0.004	0.04	0.01
SEC_PRI_89	0.25	0.16	0.23	0.22	0.03	0.003	0.04	0.01
SEC_PRI_90	0.25	0.15	0.24	0.23	0.03	0.003	0.04	0.01

Source: CDM 2005.
[1] Includes workers in restricted areas of the airport (including ground handlers at the gates).

Table 5-17 (continued)
On-Airport Worker[1] Acute Hazard Index (HI)

	Acrolein				Formaldehyde			
	2011 No Project	2011 Project	2020 No Project	2020 Project	2011 No Project	2011 Project	2020 No Project	2020 Project
SEC_PRI_91	0.27	0.07	0.25	0.24	0.03	0.0004	0.04	0.01
SEC_PRI_92	0.26	0.15	0.24	0.23	0.03	0.003	0.04	0.012
SEC_PRI_93	0.27	0.15	0.26	0.25	0.03	0.002	0.04	0.013
SEC_INT_1	-0.01	-0.03	0.42	0.42	0.03	-0.002	0.05	0.019
SEC_INT_2	-0.06	-0.23	0.49	0.49	0.03	-0.008	0.06	0.022
SEC_INT_3	-0.28	-0.05	0.36	0.37	0.02	-0.003	0.04	0.017
SEC_INT_4	-0.24	-0.04	0.36	0.36	0.02	-0.003	0.05	0.017
SEC_INT_5	-0.09	-0.01	0.04	0.05	0.03	-0.002	0.04	0.007
SEC_INT_6	-0.26	-1.23	-0.87	-1.19	0.08	-0.037	0.07	-0.023
SEC_INT_7	-0.27	-0.09	0.39	0.42	0.03	-0.004	0.05	0.019
SEC_INT_8	0.12	0.25	0.20	0.36	0.04	0.005	0.05	0.018
SEC_INT_9	0.10	0.13	0.33	0.14	0.05	0.0012	0.06	0.012
SEC_INT_10	0.21	-0.18	0.26	0.07	0.05	-0.007	0.06	0.009
SEC_INT_11	0.08	-0.12	0.22	0.07	0.04	-0.005	0.05	0.009
SEC_INT_12	0.03	-0.08	0.18	0.16	0.03	-0.004	0.04	0.010
SEC_INT_13	0.05	0.11	0.22	0.21	0.02	0.002	0.03	0.011
SEC_INT_14	0.05	0.14	0.20	0.20	0.02	0.003	0.03	0.009
SEC_INT_15	0.08	0.04	0.18	0.17	0.02	-0.00004	0.03	0.009
SEC_INT_16	0.09	0.10	0.10	0.08	0.02	0.002	0.03	0.006
SEC_INT_17	0.17	0.12	0.18	0.18	0.02	0.002	0.03	0.009
SEC_INT_18	0.19	0.18	0.26	0.29	0.03	0.004	0.04	0.013
SEC_INT_19	-0.04	0.18	0.25	0.25	0.02	0.004	0.03	0.011
SEC_INT_20	-0.15	-0.05	0.32	0.32	0.02	-0.003	0.04	0.014
SEC_INT_21	-0.12	0.03	0.30	0.31	0.02	-0.0004	0.04	0.014
SEC_INT_22	0.00	0.06	0.22	0.24	0.02	0.0007	0.03	0.011
SEC_INT_23	0.07	0.08	0.05	0.03	0.02	0.0012	0.02	0.004
SEC_INT_24	0.06	0.11	0.04	0.02	0.02	0.002	0.02	0.004
SEC_INT_25	0.08	0.12	0.10	0.07	0.02	0.002	0.03	0.006
SEC_INT_26	0.01	0.23	0.01	0.01	0.02	0.005	0.02	0.004
SEC_INT_27	0.00	0.31	0.04	0.01	0.02	0.007	0.03	0.004
SEC_INT_28	-0.03	0.06	0.05	0.02	0.03	0.0002	0.03	0.006
SEC_INT_29	0.14	-0.12	0.23	0.21	0.04	-0.005	0.05	0.013
SEC_INT_30	0.08	-0.05	0.23	0.24	0.04	-0.003	0.05	0.014
SEC_INT_31	0.22	0.19	0.22	0.21	0.03	0.004	0.04	0.011
SEC_INT_32	0.26	0.11	0.26	0.25	0.03	0.0015	0.04	0.013

Source: CDM 2005.
[1] Includes workers in restricted areas of the airport (including ground handlers at the gates).

Residential Areas

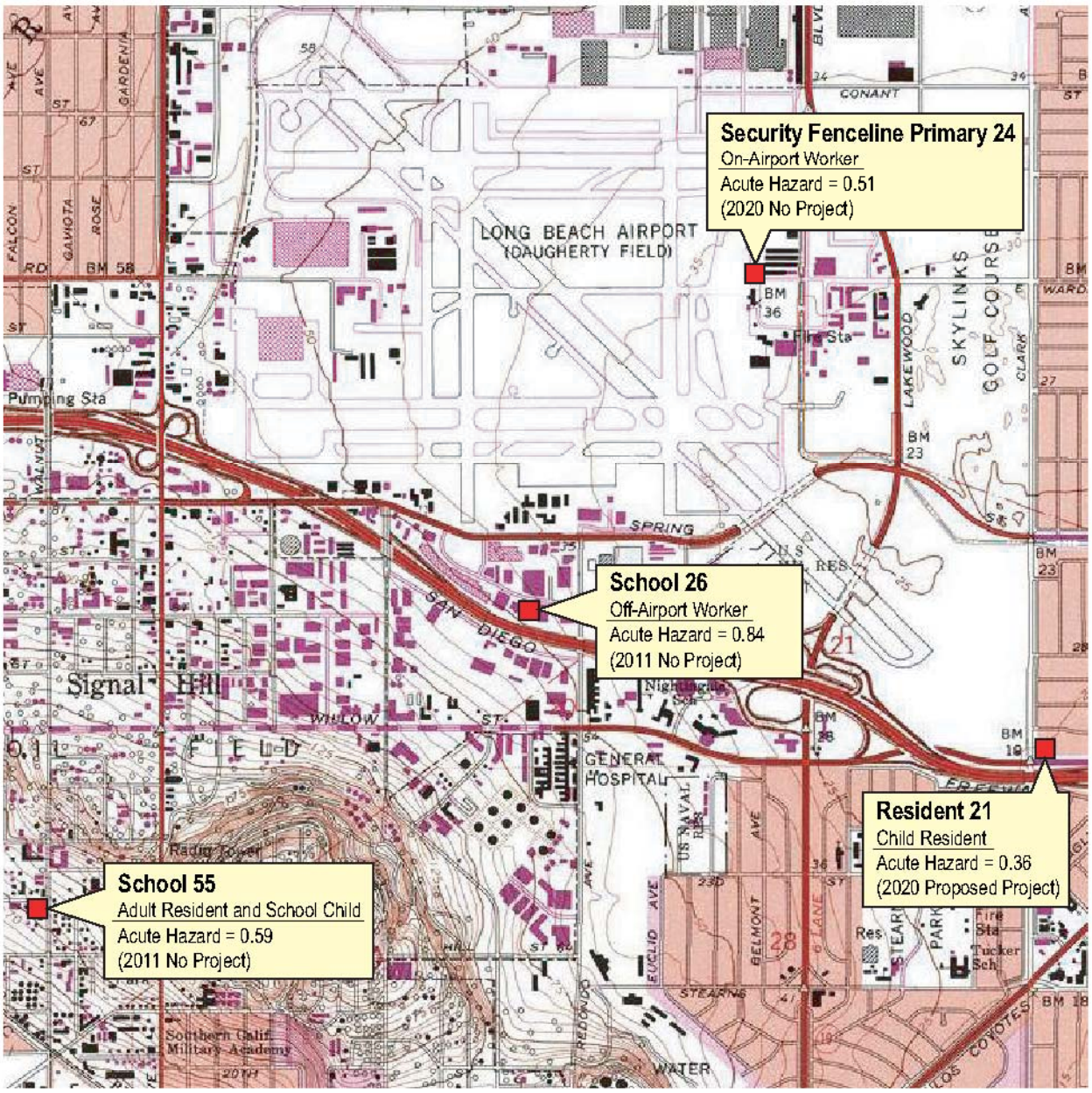
Note that the adult resident's list of grid points differs from the child resident's list because adult residents are also evaluated for school locations (as required by SCAQMD). For the 2011 No Project and Proposed Project, the highest incremental HQs due to acute (maximum one-hour) exposure to acrolein are estimated to be approximately 0.59 and 0.23, respectively, which are lower than the acute risk threshold. These HQs are located at School_55 and Signal Hill receptor points, respectively. The average incremental acute hazards in residential areas within the HHRA study area for the 2011 Project is 0.07 for adults and 0.06 for children. Therefore, at all receptor locations analyzed, the maximum incremental 1-hour concentration of acrolein would be less than the acute REL, suggesting that no irritant effects are likely. Incremental acute HQs for the 2020 No Project and Project alternatives with optimized flights are 0.35 and 0.36, respectively, also indicating that acute acrolein concentrations in 2020 will be less than the acute REL.

Schools

All incremental acute HQs are less than the acute REL. The highest incremental acute HQ for an elementary school location is 0.59 at the School_55 receptor, Signal Hill Elementary School, 2285 Walnut Avenue, southwest of the Airport for the 2011 No Project scenario (Table 5-15 and **Figure 5-10**). Generally, acute hazard estimates for school locations average about 0.07 for 2011 Project, similar to the residents, suggesting that no irritant effects are likely.

Off-Airport Commercial Areas

The highest incremental acute acrolein HQ for off-Airport worker locations is 0.84 for the 2011 No Project scenario at receptor School_26, LBUSD Support Functions, Food Services at 2222 East Airport Way, south of the Airport boundary (Table 5-16 and Figure 5-10). This location is in the parking lot. The highest incremental acute HQ for 2011 Project is 0.44 at receptor Property Line Intermediate_13. Incremental acute HQs for the 2020 scenarios are all less than equal to 0.44, less than the acute significance threshold, suggesting that no irritant effects are likely.



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CDM

Figure 5-10
Locations of Peak Impacts for Acute Hazards
Long Beach Airport

On-Airport Workers and Passengers

Incremental acute HQs were calculated for areas along the security fenceline and at grid point Other_2. Grid point Other_2 represents a location for a ground handler located at the gates (on-airport, restricted access). Incremental acute acrolein HQs in these locations are all below the threshold of one and ranged from 0.28 to 0.51 with the highest incremental acute HQs for the 2020 No Project scenario at Security Fenceline_24. The highest incremental acute HQ for the 2011 Project scenario occurs at Security Fenceline_26 and is 0.37, which is also below the significance threshold of one, as is the incremental 2020 Project acute HQ of 0.49.

As discussed above, all estimates of possible incremental acrolein acute hazards are below the significance threshold suggesting no irritant effects are likely. Conservative assumptions made in the assessment process also make potential impacts less likely. Uncertainties in acrolein assessment are further discussed in Section 6.

5.6.2.4 Evaluation of Acute Hazards from Project Construction

The air dispersion model was run to estimate one-hour TAC concentrations during construction. This modeling run included engine exhaust, architectural coating, and fugitive dust from the terminal and parking areas and all vehicles were assumed to be diesel-fueled only. Since construction vehicles are included in this modeling, the list of TACs differs from the list of TACs in Table 5-1 due to the different emission speciation. The list in Table 5-1 is also more extensive due to the inclusion of both chronic and carcinogenic compounds (whereas construction only includes compounds with acute effects). The maximum one-hour TAC concentrations during construction for all modeled grid locations are listed in **Table 5-18.**

Acute HIs are simply the ratio of a predicted concentration and a "safe" level determined by OEHHA (the acute REL). The acute RELs and resulting acute HIs are summarized on Table 5-18. Note that the acute HIs in Table 5-18 are calculated from the maximum concentrations regardless of location. Thus, exposure to all of these TACs at their maximum concentration in one location is theoretical. In addition, most, or all, receptors will either move around the Airport or be located in an area removed from the point of highest exposure. Thus, all or virtually all receptors would experience lower air-borne concentrations of TACs than those reported on Table 5-18. The analysis thus suggests little potential for unacceptable acute exposure from construction activities.

Table 5-18
TACs of Concern for Acute Exposure during Construction

TAC	Estimated 1-Hour Maximum Incremental Concentrations during Construction (ug/m^3)	Acute REL (ug/m^3)	Acute Hazard Index
Formaldehyde	7.5	94	0.08
Benzene	1.0	1,300	0.0008
Methyl Ethyl Ketone	0.76	13,000	0.00006
Toluene	0.75	37,000	0.00004
Xylenes Total	0.53	22,000	0.00007
Styrene	0.030	21,000	0.00007
Methyl Alcohol	0.015	28,000	0.0006
Isopropyl Alcohol	0.33	3,200	0.0001
Triethylamine	0.29	2,800	0.0001
Ammonia	0.22	3,200	0.00007
Arsenic	0.0039	0.19	0.02
Chlorine	0.67	210	0.003
Copper	0.022	100	0.0002
Mercury	0.0044	1.8	0.002
Nickel	0.012	6	0.002

Source: CDM 2005.

5.6.2.5 Cumulative Risks and Hazards

5.6.2.5.1 Cumulative Cancer Risks

In November 2000, the SCAQMD completed an urban air toxics monitoring and evaluation study for the South Coast Air Basin called MATES-II (SCAQMD 2000). MATES-II provides a general evaluation of cancer risks associated with TACs from all sources within the South Coast Air Basin. According to the study, cancer risks in the Basin range from 1,120 in a million to 1,740 in a million, with an average of 1,400 in a million. Based on observed data results for 1998 from the North Long Beach Monitoring Station, ambient risks for Long Beach were about 1,130 in a million. More recent (2004) observations indicate that ambient risks in Long Beach may be about 640 in a million (see Section 2, Table 2-6). Although TAC concentrations have declined in Long Beach over the last seven to eight years (as noted in Section 2.2.2.3), the cancer risk estimates are still high and indicate that current impacts associated with sources of TACs from past and present projects in the region are significant. The MATES-II study is an appropriate estimate of present cumulative impacts of TAC emissions in the South Coast Air Basin. It does not, however, have sufficient resolution to determine the fractional contribution of current Long Beach Airport operations to TACs in the airshed.

In February 2005, the City of Long Beach completed a Baseline Air Quality and Noise Human Health Risk Assessment (City of Long Beach 2005c). The purpose of this study was to address concerns concerning air and noise pollution within City limits from the emission of pollutants from the major transportation sources (freeways, ports, airport, and truck/rail traffic) and noise from the airport and their impact on residents. The following constituents were identified as major contributors to air pollution –NOx, VOCs, small particulates (PM10 and PM2.5), and air toxics. The study reported that fractional contributions from other airports in California have been reported as small compared to the cumulative impacts of other sources of criteria pollutants and air toxics. These airports are much larger than Long Beach and handle many more aircraft operations. These observations allow a qualitative analysis of potential cumulative impacts of the Project and No Project alternatives. Using the MATES-II Study, only possible incremental contributions to cumulative impacts can be assessed. That is, one can only compare the additional impact, if any of Project and No Project alternatives to total estimates of cancer risk. Overall, the analyses indicates that:

- Long Beach Airport operations would have a relatively small incremental impact (i.e., maximum of 2.6 in a million for the Project alternative with optimized flights in 2011) compared to over 600 cancer cases in a million, or less than 0.5 percent) on cumulative human cancer risks associated with working at the Airport. Incremental risks of cancer from exposure to TACs from airport operations at residential locations are less than 0.4 percent. Such an impact would probably not be measurable against urban background conditions (i.e., an additional 600 or more cancer cases in a million) in Long Beach.

- 2020 Proposed Project would reduce incremental cancer risks below those predicted for 2005 Baseline conditions. That is, the 2020 Proposed Project would result in a decrease in cumulative risks for those people living closest to the airport.

With regard to probable future projects, continued growth and development in the region would result in additional sources of TACs. Because future sources and releases of TACs are highly speculative, meaningful quantification of future cumulative health risk exposure in the Basin is not possible. However, no large increase in aircraft operations at the Airport is anticipated, so that fractional contributions to cumulative impacts in the airshed from airport operations should not increase. Thus, now and into the future, the Airport could add fractionally to total air quality impacts, but that contribution is likely to be very small.

The above comparisons do not account for possible positive changes in air quality in the South Coast Air Basin in the future. SCAQMD and other agencies are consistently working to reduce air pollution. In particular, additional regulations to reduce emission of diesel particulates are being considered for the near future. Since diesel particulates are the major contributors to estimated cancer risks, substantial reductions in diesel emissions would result in substantial reductions in cumulative cancer risks. Such reductions may not, however, have a substantial effect on estimates of Long Beach Airport contributions to cumulative risks, as efforts to reduce diesel particulate would apply to both Long Beach Airport -related and other sources. These, and other such regulations intended to reduce TAC emissions within the Basin, would serve as the basis for mitigating cumulative impacts in the region. While continued, if not increased, regulation by the SCAQMD of point sources as well as more stringent emission controls on mobile sources would reduce TAC emissions, whether such measures would alter incremental contributions of TAC releases to cumulative impacts under the Proposed Project cannot be ascertained.

5.6.2.5.2 Cumulative Chronic Non-Cancer Hazards

No study equivalent to the MATES-II study is available for assessing possible cumulative non-cancer impacts. USEPA conducted an independent study with 1996 National Air Toxics Assessment Exposure and Risk Data of possible annual average air concentrations within the South Coast Air Basin associated with a variety of TACs, including acrolein. These estimates provide a means for assessing cumulative non-cancer impacts of airport operations in much the same manner as cumulative cancer risks were assessed using the MATES-II results.

Within the study area of the HHRA, USEPA predictions for hazard indices range from 9 to 167, with an average of 21. Because of the large uncertainties associated with the USEPA estimates, the cumulative analysis for non-cancer health impacts is semi-quantitative and based on a range of possible contributions. This cumulative analysis does not address the issue of potential interactions among the criteria

pollutants. Such interactions cannot, at this time, be addressed in a quantitative fashion.

Maximum incremental hazard index for the 2011 No Project was estimated to be about 0.05 for the off-Airport worker compared to the 2005 Baseline. Hazard indices for all other scenarios and receptors were less than this value. This increment represents between 0.03 and 0.2 percent of the estimates based on USEPA modeling. Maximum incremental hazard index for the 2011 Proposed Project was estimated to be about 0.02 for the off-Airport worker. Hence, the Proposed Project could add only minimally to total average acrolein concentrations in the Basin. Hence, this suggests that no irritant effects associated with exposure to acrolein are likely.

Limited data are available describing acrolein emissions from jet aircraft engines. Therefore, estimates of non-cancer hazards are uncertain. Non-cancer hazards associated with the Proposed Project should only be used to provide a relative comparison to baseline conditions, recognizing that the uncertainties associated with acrolein emissions apply to all scenarios. These hazards should not be viewed as absolute estimates of potential health impacts. Moreover, USEPA's estimates are based on data that are now several years old. Emissions from some important sources may have been reduced as a result of continuing efforts by SCAQMD and other agencies to improve air quality in the South Coast Air Basin. Finally, the estimates do not consider degradation of TACs in the atmosphere. Degradation may be very important for relatively reactive chemicals such as acrolein.

5.6.2.5.3 Cumulative Acute Non-Cancer Hazards

Generally, predicted concentrations of TACs released from the Airport suggest that acute health hazards would not be expected. The exception might be levels of acrolein in Airport emissions. Acrolein contributes almost all of the non-cancer risk that might be associated with the Proposed Project. The REL for this TAC for evaluation of chronic exposure (0.06 µg/m3) and the REL for the evaluation of acute (short term) exposure (0.19 µg/m3) are not greatly different. Since some estimates of non-cancer hazard following chronic (long-term) exposure are fairly high, the possibility that short-term concentrations might exceed 0.19 µg/m3 was evaluated.

When USEPA annual average estimates are converted to possible 1-hour maximum concentrations, acute hazard indices associated with total acrolein concentrations are estimated to range from 12 to 211, with an average of 27, for the census tracts within the study area. Predicted maximum incremental acute hazards for 2011 Project are 0.23 and 0.44 for residential and off-Airport commercial land uses, respectively, and 0.37 for on-Airport workers. Thus, the Proposed Project could contribute between 0.1 and 2 percent above current levels at residential locations, between 0.2 and 3.7 percent above current levels at off-Airport locations, and between 0.2 and 3 percent above current levels at on-Airport locations.

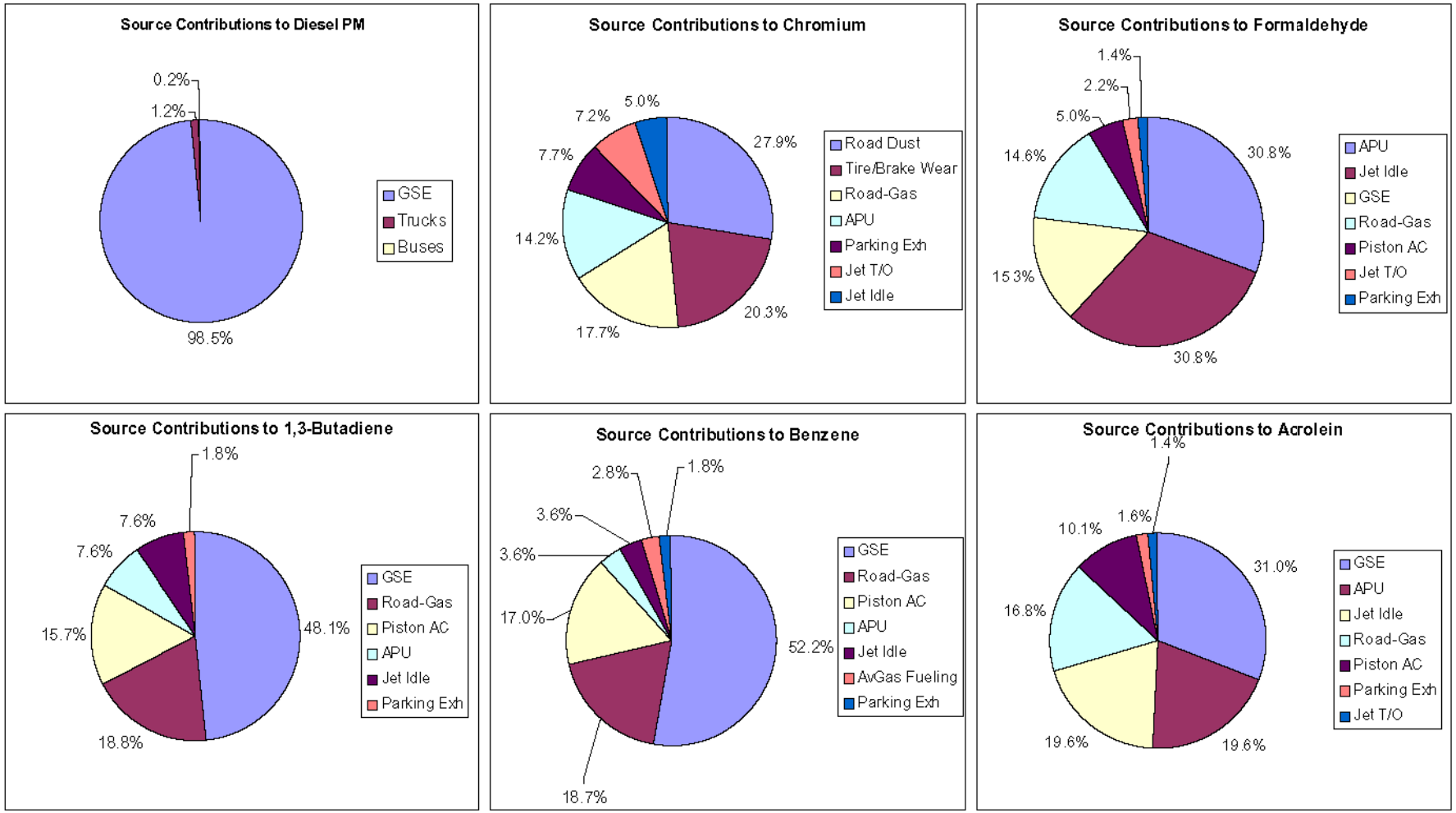
5.6.2.6 Important Emissions Sources for Human Health Risks and Hazards

A number of potentially important emissions sources for the Airport were identified in Section 3, and emissions from these sources used in the air dispersion modeling described in Section 4. The results of the risk assessment provide some insight into which of these sources is the most important in determining the magnitude of off-Airport impacts.

Looking at one of the closest residential receptors to the site (Resident_30, in Douglas Park just north of the terminal), under the 2011 Project alternative, the primary source of the major contributor to incremental cancer risks, diesel PM, is diesel-fueled GSE (**Figure 5-11**). Almost 99 percent of diesel PM concentration is associated with diesel-fueled GSE operating at the Airport. This observation indicates that the single greatest reduction in incremental cancer risks associated with Airport operations could be realized by replacing the remaining conventional GSE with low or zero emissions equipment. GSE conversion would also reduce NOx and CO, the criteria pollutants that are emitted in significant levels under the optimized flights scenario. The reductions in incremental cancer risk associated with GSE conversion are discussed further in Section 6.

The GSE sources also contribute substantially (approximately 50 percent) to the second and third highest TAC contributors to incremental cancer risk, 1,3-butadiene and benzene (Figure 5-11). Piston engine aircraft and on-road gasoline automobiles also contribute substantially to 1,3 butadiene and benzene concentrations.

Incremental non-cancer health hazards are associated with acrolein and, to a lesser extent, formaldehyde. Idling and taxiing jet aircraft, APUs, GSE, and gasoline automobiles are the top four sources contributing to acrolein and formaldehyde concentrations in Douglas Park in 2011. These results indicate that improved efficiency of aircraft operations replacement of conventional GSE with low emission equipment, minimal use of APUs due to installation and use of gate power and preconditioned air, and improved roadway and parking facilities will reduce emissions of these TACs.



Source: CDM 2005.

Figure 5-11
Source Contributions for Important TAC of Concern, 2011 Project
Based on Resident_30 receptor (located in Douglas Park)

Section 6
Uncertainties

A number of uncertainties are inherent in estimates of potential carcinogenic risk and non-carcinogenic hazard indices presented in a risk assessment. These uncertainties are inherent in assumptions, models, and extrapolations that comprise the risk assessment process. Several uncertainties that are important to understanding of the results of the risk assessment are discussed below.

In some cases, uncertainties can be addressed quantitatively using site specific data. Census data for the City of Long Beach can be used to show the sensitivity of risk and hazard calculations to differences in exposure duration. In these cases, the uncertainty analysis presents a range of reasonable risk and hazard estimates for people living near the airport

Other uncertainties are addressed only qualitatively. Examples include uncertainties in assumptions made about future land use, passenger and freight demand at the Airport, the influence of other sources of toxic air pollutants in the greater Long Beach area, air dispersion modeling in general and exposure assumptions for other parameters.

Overall, the intent of the quantitative and qualitative uncertainty analyses is to establish a level of confidence in the results of the HHRA analysis. The results of the uncertainty analysis should be considered along with the quantitative estimates for cancer risk and non-cancer hazard during the decision-making process for airport improvements.

6.1 Uncertainties Associated with Estimating Concentrations of TACs in Air

Risk estimates were based on chemical concentration estimates obtained through emissions and dispersion modeling. Emissions estimates are sensitive to the values used to represent the numerous emission source variables (e.g., future aircraft operation assumptions) and to the air toxic emission factor values used for each source. Consequently, estimated emissions values are subject to uncertainties. Different assumptions and values of variables would result in different emissions estimates. The HHRA used well-accepted methods and best available emission factor data to develop estimates of emissions, and estimates and assumptions are reasonable and appropriate. Actual emissions are unlikely to be substantially greater than those used in the analyses, and may be much less. Thus, estimates for cancer risk and noncancer hazards are unlikely to be underestimated because of uncertainties in estimating emissions.

6.1.1 Dispersion Modeling

The dispersion model used in this analysis represents current state of the art in modeling methodology using a well-developed air dispersion model (AERMOD). Results provided offer the best estimates available to predict future ambient concentrations, within the accuracy of the input data. Some uncertainties are, however, associated with dispersion modeling. The model results are sensitive to the emission source parameters and meteorological data inputs. Different assumptions, models and values or variables would result in different concentration estimates. An attempt was made to ensure that modeled concentrations would not underpredict those possible. For example, meteorological data used was taken from a dataset thought to provide generally conservative (higher than average) annual average concentrations.

Additionally, studies of Gaussian model accuracy have consistently confirmed the following conclusions:

- Dispersion models are more reliable for predicting long-term concentrations than for estimating short-term concentrations at specific locations.
- Dispersion models are reasonably reliable in predicting the magnitude of the highest concentrations occurring, without respect to a specific time or location.

USEPA's Guideline on Air Quality Models at 40 CFR 51, Appendix W Section 10 provides additional discussion of modeling uncertainties and sensitivities.

6.1.2 Estimation of Chromium VI Concentrations

Chromium VI is the form of chromium of greatest concern for possible impacts to human health. However, emissions data specifically for chromium VI (Cr(VI)) are not available, and chromium VI concentrations must be estimated from emissions data for total chromium. USEPA Region 9 conservatively estimates that 1/7th of total chromium in soil is present as Cr(VI), and this estimate was applied when calculating possible cancer risks. This assumption is highly uncertain, since no relationship exists between the processes that determine the relative amounts of CrVI in soil and jet exhaust. Thus, cancer risks associated with exposure to Cr(VI) may be either under- or overestimated.

Chromium in jet exhaust is likely to exist either due to a small amount of chromium in jet fuels or small amounts of erosion of metallic chromium from internal engine parts. Chromium in jet exhaust is likely to be at least partly elemental, though some could be present in either Cr(III) or Cr(VI) forms. After release in jet exhaust, Cr(VI) forms, which are strong oxidizing agents, would likely to be reduced to Cr(III). Thus, the amount of Cr(VI) in jet exhaust is very likely to be some fraction of the total.

Even if most chromium in jet exhaust were in the Cr(VI) state, the conclusions of the analysis would not change. For 2011 scenarios and 2020 Proposed Project, at the

locations of the highest impact, Cr(VI) is estimated to contribute from 4 to 30 percent (except for the 2011 Proposed Project for the school child where Cr(VI) contributes significantly, but the total incremental cancer risk is only 0.0003 per million) to incremental cancer risks at MEI locations from inhalation of TACs. Increasing the amount of Cr(VI) assumed to be present in jet exhaust would not substantively affect the reported risk estimates or the conclusions drawn from these estimates. For 2020 No Project, Cr(VI) contributes significantly to incremental cancer risks at MEI locations, however, even doubling the risk from Cr(VI) would not change the conclusions drawn from these estimates.

Likewise, at the locations of the highest impact, Cr(VI) contributes less than 4 percent to incremental chronic non-cancer hazards. Increasing the fraction of Cr(VI) assumed to be present in jet exhaust substantially would have negligible impact on either incremental chronic non-cancer hazard estimates or the conclusion drawn from these estimates. The issue of fraction of total chromium present as Cr(VI) is not an important one for incremental cancer risk and chronic non-cancer hazard estimates for this analysis.

6.1.3 Uncertainties Associated with Deposition of Nonvolatile TACs

Possible exposure pathways involving deposition of nonvolatile TACs onto soil were evaluated through a multi-pathway screening analysis using Cal/EPA guidance (Cal/EPA 2000a, 2003). The multi-pathway analysis considered exposures to chemicals associated with Airport operations which potentially could be deposited onto surface soil. From soils, TACs could theoretically be incidentally ingested, dermally contacted, or taken up by garden vegetables. Multi-pathway adjustment (MP) factors published by SCAQMD (2005) were used to calculate the total multi-pathway risk based on the estimated inhalation risk for residents at locations where TAC concentrations were predicted to be highest and inhalation risk was also highest. Resulting incremental multi-pathway cancer risk estimates and non-cancer hazards represent upper-range predictions of exposure and health risk associated with living near the Airport. Multi-pathway risk estimates were based on chemical concentration estimates obtained through emissions and dispersion modeling. Any uncertainty associated with TAC emissions estimates (Section 6.1.1) is reflected in risk estimates. As previously discussed, actual emissions are unlikely to be substantially greater than those used in the analyses.

Several assumptions used in the multi-pathway analysis likely overestimate actual exposures to residents living near the Airport. Exposure pathways for residents considered in the multi-pathway analysis included inhalation, soil ingestion, dermal absorption, homegrown produce, and mother's milk. TACs which could potentially contribute significantly to cancer risks associated with non-inhalation pathways are PAHs, dibenzo(a,h)anthracene, and lead. These TACs contribute less than 1 percent to the total inhalation and multi-pathway cancer risk estimate, with the exception of lead for the 2020 No Project. However, although lead contributes significantly to the risk

for the school child under this scenario, the total incremental cancer risk is only 0.003 per million and increases in the lead contribution would not change the conclusions drawn from these estimates. Even a reasonable underestimation of emissions of these TACs would not alter the total risk estimate significantly. The inhalation pathway contributes the great majority of the risk estimate for exposure associated with airport operations. Based on the multi-pathway analysis, deposition of non-volatile TACs onto soil is unlikely to represent a significant human health threat.

6.2 Evaluation of Sensitive Receptor Populations

Certain subpopulations may be more sensitive or susceptible to negative health impacts caused by environmental contaminants than the population at large. These subpopulations were also considered in the exposure assessment and two subpopulations (young children living near the Airport and school children near the Airport) were selected for quantitative evaluation. Residents are expected to spend more time in affected areas than any other population, and were therefore included in quantitative evaluations. Day care or nursery school children near the Airport represent the same age group as young children living near the Airport and are therefore adequately represented by the child resident. School children were selected, because they represent a different age group and may be present at locations with estimates for TAC concentrations that differ from the child resident locations. Moreover, these children may live at some distance from the Airport, or in a direction away from prevailing winds, but may attend school at a location where possible airport-related impacts are high.

Other populations, such as the elderly or those with chronic illnesses, were not separately evaluated. Methods to assess risks and hazards for these subpopulations are not currently available. In theory, therefore, some subpopulations not evaluated in the risk assessment could be more sensitive to certain toxic actions than is implied in the risk analysis. To some extent, this uncertainty is not further resolvable. However, toxicity criteria (cancer slope factors and reference doses) are defined by Cal/EPA and USEPA to be protective for sensitive subpopulations of people. That is, in many cases, additional safety factors are built into these toxicity criteria to ensure that sensitive humans are protected. Thus, the use of existing conservative toxicity criteria in the HHRA should account for many uncertainties related to sensitive subpopulations.

Finally, risk estimates presented in the HHRA represent a wide range of potential exposures including the highest that can be reasonably expected. Thus, even though risk estimates are not provided for all potentially sensitive receptors (such as hospitals, nursing homes, and retirement communities) in the area, populations not specifically evaluated are still expected to be reasonably assessed by the methods employed in the HHRA.

6.3 Uncertainties Associated with Toxicity Assessment

A potentially large source of uncertainty is inherent in the derivation of the Cal/EPA and USEPA toxicity criteria (i.e., oral and inhalation RfDs, and cancer slope factors). In many cases, data used to develop RfDs must be extrapolated from animals to sensitive humans by the application of uncertainty factors to estimated no-observable-adverse-effects-levels (NOAELs) or lowest-observed-adverse-effects-levels (LOAELs). While designed to be protective, in many cases these uncertainty factors overestimate the magnitude of differences that may exist between human and animals, and among humans.

In some cases, however, toxicity criteria may be based on studies that did not detect the most sensitive adverse effects. For example, many past studies have not measured possible toxic effects on the immune system. Moreover, some chemicals may cause subtle effects not easily recognized in animal studies.

Derivation of cancer slope factors often involves linear extrapolation of effects at high doses to potential effects at lower doses commonly seen in environmental exposure settings. Currently, it is not known whether linear extrapolation is appropriate. Probably, the shape of the dose-response curve for carcinogenesis varies with different chemicals and mechanisms of action. Description of any such differences in quantitative terms is problematic at this time because of difficulties in observing effects at very low exposure levels. In addressing uncertainties, USEPA recognizes that risks calculated at very low levels of exposure could be overestimated by the linear extrapolation process and may even be zero.

Uncertainties in the Cal/EPA slope factor for diesel particulates are notable because diesel exposure accounts for a large fraction of total cancer risks estimated. Recent studies of some worker populations do suggest some small increase in lung cancer overall, but does not show any dose response. One would expect that the longer the exposure and/or the higher the concentration of diesel particulates in air, the greater would be the cancer incidence in an exposed population. Such a relationship is not observed in people exposed to diesel particulate matter. This and other uncertainties have led USEPA to conclude that data are insufficient as a basis for developing a cancer slope factor.

Cal/EPA has recognized the possible importance of the above observation, along with other difficulties interpreting data on exposure to diesel particulate matter and lung cancer incidence. However, Cal/EPA has determined to develop a cancer slope factor, nevertheless. This determination by Cal/EPA is subject to challenge by reasonable scientists studying the same database. Uncertainties in the DPM cancer slope factor as applied in this HHRA are large and interpretation of the results of the assessment should consider these uncertainties.

6.3.1 Evaluation for Particulates in Jet Exhaust

Diesel exhaust is expected to be emitted in large quantities from Airport-related sources under the alternatives and the No Project, and is therefore quantitatively evaluated in the HHRA. Only diesel exhaust from ground sources (e.g., trucks and buses) is included in these evaluations. Aircraft emissions were not included in the quantification of diesel emissions because aircraft engines are not diesel engines. Information is insufficient regarding the nature and toxicity of total petroleum hydrocarbon (TPH) emissions associated with aircraft and toxicity criteria for these emissions are not available. Toxicity criteria are available for diesel exhaust in general, however, extrapolation of these criteria to TPH emitted from aircraft was not considered scientifically justifiable. Aircraft use a lighter fuel and a substantially different combustion process than do diesel engines and have therefore very different emissions.

Toxicological research indicates that the component of diesel exhaust responsible for most toxicological effects is PM and USEPA's reference concentration (RfC) for diesel exhaust is based entirely upon PM. Diesel engines produce particulate matter in large amounts. Burning of jet fuel in engines using modern turbine technology creates much less particulate matter than is created during diesel fuel combustion. Due to different fuels and combustion processes in jet engines and diesel engines, particulate emissions from both types of engines are also expected to differ chemically, physically, and therefore, toxicologically. These issues are discussed in more detail in Sections 2 and 3.

Due to expected toxicological differences, extrapolation of PM emissions from diesel exhaust to jet exhaust is not considered appropriate. This conclusion was recognized in CARB's Risk Management Guidance for Permitting of New Stationary Diesel-Fueled Engines (CARB 2000). This report stated that it may not be appropriate to use the Cal EPA Unit Risk Factor for diesel PM (3.0 x 10-4 µg/m3) when assessing toxic impacts associated with particulate emissions from turbine engines even when fueled with diesel.

The lack of quantitative evaluation of TPH emissions from aircraft results in some uncertainty in the risk estimates presented in the HHRA. However, ground sources are expected to emit large quantities of PM, and aircraft engines are expected to emit relatively little, and, therefore, any underestimation of diesel related risks, if they exist for aircraft emissions, are, in any case, still adequately characterized.

6.3.2 Assessment of 1,3-Butadiene and Acrolein

Two volatile TACs of concern dominate non-diesel associated risk estimates for the Airport emissions. 1,3-Butadiene and acrolein are "risk drivers" for cancer and non-cancer effects, and are not subject to the large uncertainties of the Cal/EPA diesel toxicity assessment. In particular, acrolein may account for essentially all non-cancer health threats estimated in the analyses. A new health assessment for 1,3-butadiene was published by USEPA in 2002, and Toxicological Excellence in Risk Assessment

(TERA) recently published a toxicological review of acrolein. Both these recent reviews were evaluated, and no new information was uncovered that would indicate that toxicological criteria for either TAC would be likely to change substantially in the near future. Thus, cancer risks and non-cancer hazards for both TACs are consistent with the most current toxicological literature. A brief summary of recent USEPA health assessments for 1,3-butadiene and acrolein, and uncertainties associated with these assessments is presented below.

6.3.2.1 1,3-Butadiene

The reassessment of 1,3-butadiene released in 2002 by USEPA (USEPA, 2002b) was based on a review of new information available since the previous health assessment of 1,3-butadiene in 1985. Based on this information, the carcinogenic classification of 1,3-butadiene was changed from B2, probable human carcinogen, to A, known human carcinogen by inhalation. 1,3-butadiene is a gas used commercially in the production of styrene-butadiene rubber, plastics, and thermoplastic resins. The major environmental source of 1,3-butadiene is the incomplete combustion of fuels in mobile sources (e.g. automobile exhaust). Although atmospheric 1,3-butadiene undergoes rapid destruction, 1,3-butadiene is almost always present in urban and suburban air at low concentrations due to constant releases from vehicle exhaust. Tobacco smoke can be a significant source of 1,3-butadiene in indoor air.

The human incremental lifetime cancer risk estimate for 1,3-butadiene is based on extrapolation from leukemias observed in an occupational epidemiological study. The specific mechanisms of 1,3-butadiene induced carcinogenesis are unknown, however, it appears that the carcinogenic effects are mediated by genotoxic metabolites of 1,3-butdiane. Despite the inevitable uncertainties in the calculated risk estimate, confidence in the excess cancer risk estimate is moderate. This confidence is based on high-quality human data, in which 1,3-butuadiene exposures were estimated for each individual in the occupation study prior to conducting the exposure-response analysis.

1,3-butadiene also causes a variety of reproductive and developmental effects in mice; no human data on these effects are available. The most sensitive effect was ovarian atrophy observed in a lifetime bioassay of female mice. Based on this critical effect and using the benchmark concentration methodology, an inhalation RfC (i.e. , a chronic exposure level presumed to be "without appreciable risk" for non-cancer effects) was calculated. The overall confidence in this RfC assessment is medium. The RfC calculation was based on data from high-quality NTP 2-year bioassay (mouse) in which many exposure levels were used, although a no-observed-adverse-effect level (NOAEL) was not achieved. On the other hand, rat studies showed no evidence of reproductive and developmental effects, and there are no human data on these effects; thus, it is uncertain how humans would respond.

6.3.2.2 Acrolein

USEPA (USEPA 2003) published the TERA toxicological review of acrolein in 2003 in support of summary information on IRIS. Acrolein is released to the air as a result of manufacturing processes, through incomplete combustion of petroleum fuels, as a component of cigarette smoke, and as a photo-oxidation product of hydrocarbon pollutants. Small amounts of acrolein can be formed and can enter the air when organic matter such as trees and other plants, including tobacco, are burned (ATSDR 1990). The major source of emissions of acrolein to the atmosphere is combustion of fuels. Acrolein has been detected in exhaust gases from both gasoline and diesel engines. Exposure of the general population occurs primarily through atmospheric contact. Concentrations of acrolein in indoor air may exceed outdoor levels in smoky environments such as bars and restaurants and in residences where wood stoves are used (Environment Canada 2000).

The only known effects of acrolein exposure in humans are general respiratory congestion and eye, nose, and throat irritation. Studies in humans have shown that eye irritation occurs with concentrations slightly lower than those that produced either nose or throat irritation (ATSDR 1990). The oral reference dose (RfD) and inhalation reference concentration (RfC) for acrolein are based on animal studies. Several studies reported acute effects of acrolein in experimental animals; generally, results confirm information provided by lethality studies that acrolein is a highly selective respiratory toxicant. The overall confidence in the RfD assessment is medium to high; a variety of studies across different durations of exposure and in several different laboratory animal species has been consistent in demonstrating that in the absence of mortality there are no clear indications of adverse effects. The overall confidence in the RfC assessment is medium. Major areas of uncertainty are the lack of adequate human data, limited reproductive toxicity data, the absence of a definite NOAEL and the paucity of chronic inhalation exposure studies in both human and animals. USEPA states that additional evaluation of immunological endpoints is warranted, especially focusing on potential contribution to asthma or compromise in respiratory response.

Under the Draft Revised Guidelines for Carcinogen Risk Assessment (USEPA 1999), the potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure. This evaluation replaces the cancer assessment (USEPA 1998b) in which acrolein was assigned a carcinogen classification of C, possible human carcinogen. The basis for this classification was increased incidence of adrenal cortical adenomas to female rats and carcinogenic potential of an acrolein metabolite (USEPA 1998b). The updated cancer characterization considered new study results and reevaluated previous studies. The highly reactive nature of acrolein and studies supporting the lack of systemic distribution of acrolein suggest that acrolein is not likely to reach potential target sites at sufficient concentration to initiate a carcinogenic process in mammalian species.

6.4 Uncertainties Associated with the Health Risk Analysis

6.4.1 Exposure Durations

Exposure duration and inhalation rate used in the HHRA were chosen to provide a conservative (protective) estimate of possible incremental cancer risks and chronic non-cancer hazards for the alternatives. Values used for these parameters differed somewhat from the OEHHA guidance for the Air Toxics "Hot Spots" Program (Cal/EPA 2003). To provide an evaluation of the possible impacts of different assumptions for exposure duration and inhalation rate, ranges of residence times (exposure durations) and inhalation rates were included in the sensitivity analyses to assist in interpretation of risk and hazard calculations.

Assumptions for exposure duration only affect estimates for incremental cancer risks for residents. Therefore, these incremental risks were re-calculated using exposure durations of 9 years and 30 years at grid point "Resident_30", the grid point where the highest incremental impacts were identified for the adult resident under the Scenario 2, 2011 Project. These exposure durations (in addition to the 70-year scenario evaluated in Section 5 of the risk assessment) are recommended for analysis by OEHHA's Air Toxics "Hot Spots" program. The 9-year scenario reflects a child's exposure from ages 0 to 9 years old, and the 30-year scenario represents a reasonable average residency time of a person residing in the vicinity of the project.

In order to further ensure that this HHRA reflected actual conditions in the Airport vicinity, an analysis of census data was performed. Year 2000 U.S. census data for the population residing within a 5-mile radius of the Airport indicates that a 30 year residency is an upper range assumption for the Airport vicinity. **Figure 6-1** shows the distribution of residence times in the Airport vicinity between 1 and 70 years. Note that estimates of 90th (23 years) and 95th (32 years) percentiles are overestimated because the census reported all residency times of greater than 30 years in one category. For the analysis, the assumption was made that all residence times between 30 and 70 years occur with equal frequency. Since actual frequency of residency times will decrease as residency becomes longer, the distribution in Figure 6-1 is skewed to the left. Thirty years represents a residency duration between the 90th and 95th percentiles. In other words, more than 90 percent of the population in the Airport vicinity have residency durations less than 30 years.

As shown in Figure 6-1, the 70-year residential scenario represents a scenario substantially higher than the 95th percentile (32 years) of residency times for the population living in the vicinity of the Airport. According to U.S. EPA (1997b), the 30-year residential scenario represents about the 90th percentile for time spent at one residence. Incremental risks for these additional exposure durations are summarized in **Table 6-1**.

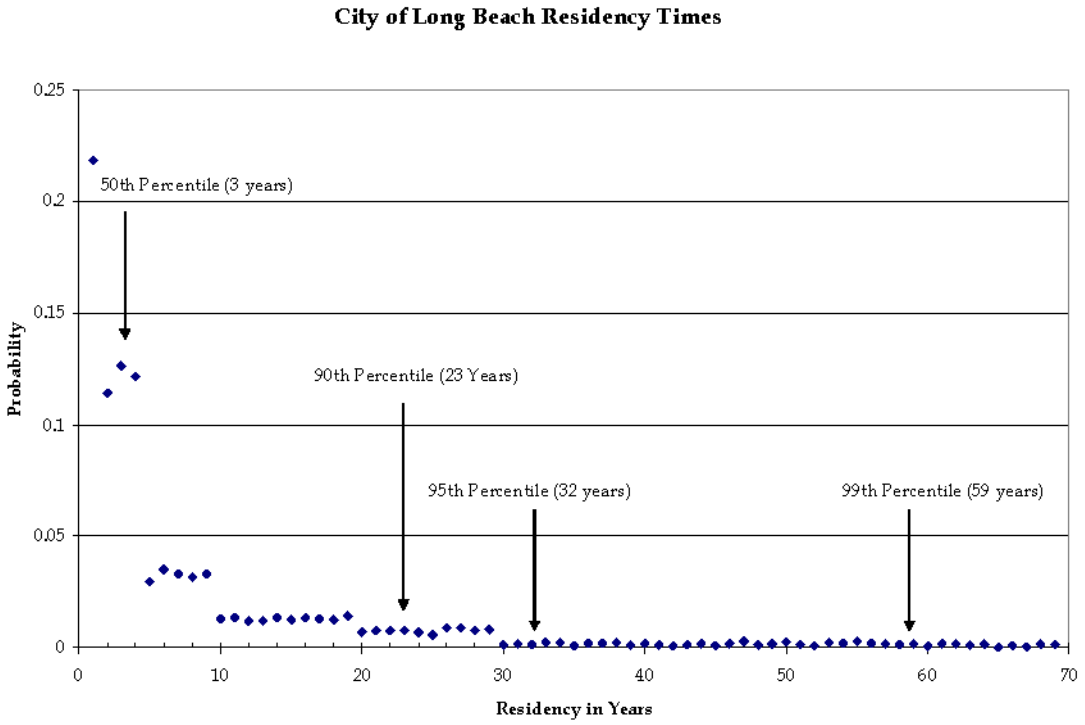


Figure 6-1
Frequency Distribution of Residency Times for Exposure Durations

Table 6-1
Estimated Incremental Cancer Risks for Exposure Durations of 9, 30, and 70 Years

Alternative	Cancer Inhalation Risks (per million individuals)				
	Child Resident		Adult Resident		
	6-year	9-year	9-year	30-year	70-year
Incremental 2011 Proposed Project	0.3	0.4	0.23	0.75	1.8

Source: CDM 2005.

As shown in the table, extending the child scenario from 6 years to 9 years does not substantially change the results shown in Section 5. Cancer risks are proportional to total exposure, and a relatively short exposure duration is expected to result in relatively low estimates of incremental cancer risk. Note that the 70-year adult exposure duration is an extreme scenario. This incremental risk might be experienced if an individual lived their entire life at the location where possible 2011 Proposed Project impacts are highest, never leaving the location for any reason, such as attending school, going to work, etc. Moreover, during this entire time the individual would inhale at a rate consistent with moderate activity, not taking into account sleep

or relative inactivity. The risk estimates are, therefore, extraordinarily conservative, and no individual is likely to experience risk at these levels.

These findings add considerable confidence that possible incremental cancer risks associated with the Proposed Project will not exceed the significance threshold of 10 in one million. The 30-year exposure duration for an adult resident is more reasonable but still conservative estimate; it demonstrates a better illustration of the highest incremental risks likely to occur, and concludes that impacts will be less than significant for the actual population living and working near the Airport.

6.4.2 Inhalation Rates

Inhalation rate for individuals can vary over a range of values for residents, off-Airport workers or other receptor groups. These ranges reflect both difference in age and level of activity. Since residents have the longest exposure frequency and duration, and therefore the greatest incremental cancer risks and chronic non-cancer hazards, they were selected for the sensitivity analysis for inhalation rates. In the Air Toxics Hot Spots Guidance, OEHHA recommended use of a range of inhalation rates for the 9-year, 30- year, 70-year scenarios, which span below and above the rates recommended by SCAQMD (2005). The SCAQMD rates were used in estimation of risks and hazards in Section 5. Rates from the OEHHA guidance were used as input values to calculations for a limited sensitivity analysis.

In this analysis, incremental cancer risks and chronic non-cancer hazard quotients were calculated for the range of inhalation rates recommended by OEHHA's Air Toxics "Hot Spots" program at grid point "Resident_30", the grid point where the highest incremental impacts were identified for the adult resident under the Scenario 2, 2011 Project. All calculations addressed estimates of incremental impact for the Scenario 2, 2011 Project. For an adult resident for the 30-year and 70-year scenarios, inhalation rate was varied from 271 L/kg BW-day to 393 L/kg BW-day. The lower end of this range is an estimate from OEHHA for inhalation rate for average activity levels. The upper end is an estimate from OEHHA for high activity levels. For an adult resident for the 9-year scenario, inhalation rate was varied from 452 L/kg BW-day to 581 L/kg BW-day. These values also represent average and high levels of activity. The incremental cancer risks and chronic non-cancer hazards for adult residents resulting from these additional inhalation rates under the 2011 scenarios are summarized in **Table 6-2.**

Table 6-2
Estimated Incremental Cancer Risks and Incremental Chronic Non-cancer Hazard Indices for Varying Inhalation Rates

Alternative	Adult Resident 9-year Scenario		Adult Resident 30-year Scenario			Adult Resident 70-year Scenario		
	Inhalation Rates (L/kg BW-day)							
	452	581	271	302	393	271	302	393
	Cancer Inhalation Risks (per million individuals)							
Incremental Scenario 2, 2011 Project	0.3	0.4	0.68	0.75	0.98	1.6	1.8	2.3
	Chronic Non-cancer Inhalation Hazard Indices							
Incremental Scenario 2, 2011 Project	0.011	0.014	0.006	0.007	0.009	0.006	0.007	0.009

Source: CDM 2005.

Varying the inhalation rate for the adult resident would not materially affect conclusions about the impact of the 2011 Project. Only the 2011 scenarios are shown in this table since the 2020 Project results shown in Tables 5-11 and 5-12 indicate a beneficial effect. Therefore, increasing or decreasing the inhalation rate for the 2020 scenarios would only change the magnitude of the benefit. The highest incremental cancer risk for an adult resident under a 70-year scenario identified in Section 5 is 1.8 in one million. Using the upper end of the range of inhalation rates for the adults only increases this estimate to about 2.3, or about 28 percent. This increase does not change the conclusions of possible impacts of the Project.

Highest incremental chronic non-cancer HIs for residents under the 2011 Project over the No Project scenario also show very little change as a result of different assumptions for inhalation rate. Again, incremental chronic non-cancer hazards might increase for residents by about 29 percent, and would remain below the significance threshold of one in all instances.

6.4.3 Incremental Analysis for Acute Hazards

Analysis of incremental impacts for acute non-cancer effects is made more difficult by the short-term nature of the predictions. The following discussion highlights complexities in the analysis and provides context for interpreting the results.

The AERMOD model calculates highest one-hour acute impacts by searching through one year of hourly data (a total of 8,760 hours) and identifying the single hour when the concentration of acrolein is at a peak level. This search for highest incremental acute non-cancer hazards is performed independently for each grid point in the modeling domain. To avoid making arbitrary decisions about when a person (receptor) may be at a given grid point location at a given time, the HHRA assumed that a receptor is continuously at each grid point for all hours analyzed. When estimating incremental acute (1-hour) non-cancer hazards, the highest hazard at each

grid point for 2011 Project for the entire one-year period is compared to highest hazard for the same grid point for the 2005 Baseline.

Highest incremental acute non-cancer hazards from these modeling calculations do not occur at the same hour or under the same weather conditions for all locations around the Airport. For instance, when the highest concentration is predicted for an area southeast of the Airport, winds must be blowing from the northwest at a speed resulting in relative high concentrations. Areas northwest of the Airport would see no impact at this time since winds would be carrying Airport emissions in the opposite direction.

Further, highest one-hour concentrations of acrolein are sensitive to activity at the Airport (i.e., numbers of aircraft operations, amount of GSE equipment, etc) that occurs at different times during the day. For example, if greater activity at the Airport occurs during the morning hours for one alternative and in the mid-afternoon for another, highest one-hour concentrations for these alternatives may occur at different locations and on different days because of varying wind speeds and directions for morning and afternoon hours.

When calculating differences between the 2011 Project and the 2005 Baseline, highest one-hour concentrations at a given grid point are subtracted, even though the conditions under which highest 1-hour concentrations occur may differ somewhat among 2011 Project and the 2005 Baseline scenarios, due to the factors just discussed. The result is a complex pattern of incremental changes unrelated to predominant wind direction. In some cases, locations with relatively high increments are found fairly close to locations with relatively low increments. This complexity is not intuitive, but is a necessary outcome of addressing possible acute impacts. The approach is a widely used and standard method for estimating the largest differences that might occur as a result of implementation of a project. An exhaustive hour-by-hour search, requiring hundreds of millions of comparisons, could theoretically find increments somewhat higher than those reported in the HHRA. Such larger increments would not change the conclusions of the analysis, that incremental acute non-cancer hazards may exceed the significance threshold of one for various areas nearest the Airport.

6.4.4 Evaluation of Acute Non-Cancer Hazards Associated with Acrolein

Recent studies suggest that predicted concentrations of acrolein in air associated with airport operations may be over-estimated. Acrolein is unlikely to be transported over long distances because of its high reactivity and estimated short half-life in air. A recent study at Chicago O'Hare International Airport found that acrolein was not a significant TAC associated with airport operations (IEPA 2002). The Illinois EPA measured airborne levels of various air contaminants in the vicinity of the O'Hare International Airport as well as at other locations in the Chicago area over a seven-month period in 2000. An objective of the air toxics monitoring program was to

determine if emissions associated with O'Hare International Airport had a measurable impact on air quality in areas adjacent to the Airport. Acrolein was not reported at measurable levels in air at locations near the Airport during the air toxic monitoring program.

Acute non-cancer hazards associated with acrolein are also highly uncertain because of the paucity of data on acrolein emissions from jet aircraft engines. Dependence on regulatory databases with estimated acrolein emissions may have substantially overestimated possible releases of acrolein during Airport operations. A recent study (Gerstle et. al., 1999), of jet aircraft emissions indicates that emissions of acrolein during taxi and queue operations, when most acrolein is released, may have been overestimated by nearly 80 percent in past studies. If true, estimated annual average and maximum 1-hour acrolein concentrations used in this analysis may overstate acrolein concentrations by up to 5 times.

Estimates of acute and chronic non-cancer hazards should be viewed as upper-bound, or ceiling, estimates of possible hazards. Actual potential for irritation effects of mucous membranes (eyes and upper respiratory tract) is probably much lower, and could even be less that the significance threshold.

6.4.5 Evaluation of Cumulative Chronic Non-Cancer Hazards

Cumulative hazards for chronic exposure to TACs from the Airport could not be assessed on a quantitative basis. The only estimates for possible hazards for past and current projects in South Coast Air Basin come from very general modeling predictions made by USEPA on the basis of emissions estimates from USEPA's Toxic Release Inventory and other sources. The predictions are valid only on a regional or state level and are too uncertain to be used for quantitative estimates on a local scale. Moreover, USEPA's estimates are based on data that are now several years old. Emissions from some important sources may have been reduced as a result of continuing efforts by SCAQMD and other agencies to improve air quality in the South Coast Air Basin. Finally, the estimates do not consider degradation of TACs in the atmosphere. Degradation may be very important for relatively reactive chemicals such as acrolein.

A semi-quantitative evaluation was performed for the HHRA by taking a range of possible hazards calculated from USEPA estimates for census tracts in the study area, and comparing these estimates to hazards predicted from modeling of the Airport's emissions. The resulting comparisons are then used only to establish a range of possible relative contributions of Airport operations. These comparisons are subject to high uncertainty and could either under- or overestimate the possible impacts of the Airport on cumulative chronic hazards. These uncertainties make it scientifically indefensible to establish a significance threshold for cumulative impacts. Estimated cumulative hazards can only be used to make general statements on the possible magnitude of relative contributions, and cannot be used as estimates of actual cumulative hazards for any locations around the Airport.

6.4.6 Evaluation of Cumulative Acute Non-Cancer Hazards

Cumulative hazards for acute exposure to TACs from the Airport could not be assessed on a quantitative basis. In fact, uncertainties for the analysis of possible cumulative acute hazards are even more uncertain than those for cumulative chronic non-cancer hazards. The only estimates for possible hazards for past and current projects in South Coast Air Basin come from very general modeling predictions made by USEPA on the basis of emissions estimates from USEPA's Toxic Release Inventory and other sources. The predictions are valid only on a regional or state level and are too uncertain to be used for quantitative estimates on a local scale. Further, the USEPA estimates are only for annual average concentrations. These concentrations had to be converted to an estimate of maximum 1-hour concentrations by applying a generic factor. This factor (12.5) is intended to convert annual average concentrations (error on the high end) to conservative 1-hour maximum concentrations. Reversing the process might result in estimates for 1-hour maximum concentrations that are too low if the starting concentrations are not already a conservatively high estimate of annual average. Given the uncertainties in the USEPA modeling, the range of 1-hour maximum concentrations calculated for the USEPA data could underestimate possible actual 1-hour maximum concentrations. If 1-hour maxima are underestimated, the incremental impact of the Airport operations could be overestimated.

The semi-quantitative evaluation of acute hazards performed for the HHRA must be interpreted with great caution. The process included taking a range of possible annual average acrolein concentrations from USEPA estimates, subject to high uncertainty, for census tracts in the study area, converting these values to 1- hour maximum concentrations, and comparing these estimates to 1-hour maxima from modeling of the Airport emissions. Each of these steps compounds uncertainties, and resulting comparisons can only be viewed as a general assessment of relative impacts that may substantially overestimate the contribution of the Airport operations. Uncertainties make it scientifically indefensible to establish a significance threshold for cumulative impacts. Estimated cumulative hazards cannot be used as estimates of actual cumulative hazards for any locations around the Airport.

Recent studies suggest that predicted concentrations of acrolein in air associated with the Airport operations may be over-estimated. Acrolein is unlikely to be transported over long distances because of its high reactivity and estimated short half-life in air. A recent study at Chicago O'Hare Airport (IEPA 2002) found that acrolein was not a significant TAC associated with airport operations. The Illinois EPA measured airborne levels of various air contaminants in the vicinity of the O'Hare Airport as well as at other locations in the Chicago area over a seven-month period in 2000. An objective of the air toxics monitoring program was to determine if emissions associated with O'Hare Airport had a measurable impact on air quality in areas adjacent to the airport. Acrolein was not reported at measurable levels in air at locations near the airport during the air toxic monitoring program.

Acute cumulative effects are highly uncertain because of the paucity of data on acrolein emissions from jet aircraft engines. Dependence on regulatory databases with estimated acrolein emissions may have substantially overestimated possible releases of acrolein during the Airport operations. A recent study of jet aircraft emissions indicates that emissions of acrolein during taxi and queue operations, when most acrolein is released, may have been overestimated by nearly 80 percent, suggesting that both acute and chronic non-cancer hazards may be substantially overestimated in the current analysis.

6.5 Summary

Human health risk was evaluated for the Long Beach Airport using site-specific calculations to evaluate risk. Based on the available data and the conservative exposure assumptions used in this evaluation, TACs for the Proposed Project do not pose a significant cancer risk to human health. The risk evaluation findings are summarized as follows:

- PEL-TWA comparisons were made for the maximum on-Airport concentrations regardless of location. The three TACs of concern that could achieve the highest 8-hour maximum concentrations are formaldehyde, manganese, and lead. In each case, estimated air concentrations are less than one percent of their PEL-TWAs. The analysis thus suggests little potential for unacceptable exposure for on-Airport workers.

- Chronic non-cancer hazards for adult and child resident, school child, and off-airport worker were each below the significance threshold of one (1) for both the 2011 and 2020 scenarios. The non-cancer hazard drivers were acrolein, manganese, and formaldehyde.

- Cancer risks for the adult and child resident and the school child, and the off-airport worker were each below the significance threshold of 1×10^{-5} or 10 in a million for both the 2011 and 2020 scenarios. Cancer risks for the off-airport worker for the 2011 and 2020 scenarios were below the significance threshold. The risk drivers were diesel particulates and Cr(IV) with a lesser contribution from benzene, 1,3-butadiene, and formaldehyde.

- Acute hazards from acrolein and formaldehyde are below the significance threshold of one for all receptors under both the 2011 and 2020 scenarios. In addition, there is little potential for unacceptable acute exposure from construction activities.

- Long Beach Airport operations would have a relatively small impact (i.e., maximum of 2.6 in a million for the 2011 Project alternative with optimized flights) compared to over 600 cancer cases in a million, or less than 0.5 percent) on cumulative human cancer risks associated with living in the City of Long Beach.

Such an impact would probably not be measurable against urban background conditions (i.e., an additional 600 or more cancer cases in a million) in Long Beach.

- The Proposed Project is not expected to significantly add to total average acrolein concentrations in the Basin. Hence, this suggests that no irritant effects associated with exposure to acrolein are likely.

- Although several uncertainties regarding the risk calculations were identified, overall, the exposure and model assumptions tend to overestimate instead of underestimate risk. As such, the risk and hazard estimates in this evaluation are considered protective of receptors in the vicinity of the Long Beach Airport.

Section 7
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Attachments

Attachment A
Final AQIA and HHRA Protocol

City of Long Beach

FINAL: Protocol for Conducting an Air Quality Impact Analysis and Human Health Risk Assessment for the Long Beach Airport

September 13, 2005

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List of Acronyms

AAC	Airport Advisory Commission
AERMIC	American Meteorological Society/Environmental Protection Agency Regulatory Model Improvement Committee
AERMOD	AERMIC Dispersion Model
APU	Auxiliary Power Units
AVGAS	Aviation Gasoline
SCAQMD	South Coast Air Quality Management District
Cal/EPA	California Environmental Protection Agency
Cal/OSHA	California Occupational Safety and Health Administration
CalTrans	California Department of Transportation
CAPCOA	California Air Pollution Control Officers Association
CARB	California Air Resources Board
CATEF	California Air Toxics Emission Factor
CEQA	California Environmental Quality Act
CAA	Clean Air Act
CNEL	Community Noise Exposure Level
CNG	Compressed Natural Gas
COPC	Chemical of Potential Concern
DPM	Diesel (Exhaust) Particulate Matter
DTSC	Department of Toxic Substances Control
EDMS	Emissions and Dispersion Modeling System
EIR	Environmental Impact Report
EIS	Environmental Impact Statement

EMFAC	Emission Factor Model for On-Road Mobile Sources
FAA	Federal Aviation Administration
FEIR	Final Environmental Impact Report
FOA	First Order Approximation (of aircraft PM emissions)
GA	General Aviation
GSE	Ground Support Equipment
HC	Hydrocarbon (also Total Hydrocarbon)
HHRA	Human Health Risk Assessment
ICAO	International Civil Aviation Organization
IRIS	Integrated Risk Information System
ISCST3	Industrial Source Complex Short-Term Model, Version 3.0
LGB	Long Beach Airport
LOS	Level of Service
LPG	Liquid Propane Gasoline
LTO	Landing/Takeoff Operation
MAP	Million Annual Passengers
MRI	Midwest Research Institute
NCDC	National Climatic Data Center
NCP	National Contingency Plan
NOP	Notice of Preparation
OEHHA	Office of Environmental Health Hazard Assessment
PEL	Permissible Exposure Limit
PM	Particulate Matter
RAGS	Risk Assessment Guide for Superfund

REL	Reference Exposure Level
RfD	Reference Dose
TAC	Toxic Air Contaminant
TIM	Time in Mode
TSA	Transportation Security Administration
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
US/OSHA	United States Occupational Safety and Health Administration
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compound
χ/Q	Chi-Over-Q, Concentration-to-Emissions Ratio

Section 1
Background

1.1 Introduction

The City of Long Beach ("City") is the owner and operator of Long Beach Airport ("LGB" or "Airport"). The City has determined that it will prepare an Environmental Impact Report ("EIR") for the proposed Long Beach Airport Terminal Improvement Project (the "project" or the "proposed project"). The proposed project is described more specifically in Section 1.4 below. Additional information regarding the project may be found in the Notice of Preparation issued on April 14, 2005.

This section of the Protocol for Conducting an Air Quality Impact Analysis and Human Health Risk Assessment for the Long Beach Airport ("Protocol") provides general information on the project background, physical aspects, and alternatives. Section 2 discusses the methodology for estimating project emissions, Section 3 describes the methodology for estimating pollutant concentrations, Section 4 provides the health risk analysis methodology, and Section 5 lists the references used in developing this Protocol.

1.2 Project Background

In June 2003, the City of Long Beach approved a scope of work for the preparation of an EIR to analyze the potential environmental impacts of possible improvements to the Airport's terminal area to accommodate passenger and cargo activity provided for under the existing Airport Noise Compatibility Ordinance. The project would also provide for required provisions for new security measures. The approved scope provided an opportunity for the City Council to reevaluate the scope of work after the project scoping process was complete to ensure the issues raised during the scoping process that were associated with the proposed improvements would be adequately addressed in the EIR.

The City held scoping meetings to solicit public input on October 11 and 16, 2003. Approximately 100 people attended the Saturday (October 11th) scoping meeting and approximately 200 people attended the Thursday (October 16th) scoping meeting. In addition, the City received 217 responses to the Notice of Preparation (a combination of letters, postcards and emails). The key issues raised through the scoping process were flight operations, air quality, health risk, noise, cumulative impacts, and land value. Recognizing the intense public interest, the City Council referred the scope of project and the scope of the EIR to the Airport Advisory Commission ("AAC") for consideration.

The AAC held a series of meetings, open to the public, from November 2003 through July 2004 to consider recommendations on possible airport improvements and to advise on certain issues regarding scoping of the EIR. The AAC made recommendations regarding the project and technical studies to be prepared for the EIR. The City Council considered these recommendations on February 1 and 8, 2005.

As a result of this process, changes were made to the improvements that would constitute the proposed project and be addressed in the EIR. The original 2003 scope of work focused just on impacts associated with construction of the facilities (i.e., a "bricks and mortar" project). Key changes to the EIR scope of work as a result of the AAC process and City Council action include providing a health risk assessment and providing a discussion of the environmental impacts associated with the operational environment at the Airport that could be accommodated within the existing Airport Noise Compatibility Ordinance. While the project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport, it was determined that the EIR should assess the impacts associated with the introduction of 25 commuter flights that could be accommodated at the Airport under the existing terms of the Airport Noise Compatibility Ordinance, even though these operations do not currently occur at the Airport.

The EIR will also address the impacts associated with up to 52 commercial flights. This is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft, and still be within the noise limits ("noise bucket") permitted by the Airport Noise Compatibility Ordinance[1] . Both the addition of 25 commuter flights at the Airport and the potential increase of up to 11 commercial flights over current operational levels at the Airport (which are the minimum number of commercial flights allowed by the Airport Noise Compatibility Ordinance) are not causally related to the project proposed facilities improvements, and any impacts would be applicable to all alternatives, including the No Project Alternative, because they could occur without any project-proposed improvements. If they occur, they will result from carrier decisions to optimize flight operations under the Airport Noise Compatibility Ordinance, rather than the availability of specific terminal facilities.

1.3 Project Location and Surrounding Uses

The project would be implemented at LGB in the City of Long Beach, Los Angeles County. The Airport is located on approximately 1,166 acres in central Long Beach. The street address for the Airport is 4100 East Donald Douglas Drive, Long Beach, California. Aviation activities are located just north of Interstate-405 ("I-405") and generally bound by Cherry Avenue to the west, City of Lakewood and the future Douglas Park project to the north, and Lakewood Boulevard to the east. A site location map is provided in Figure 1-1.

[1] The permitted number of flights per day may be increased in each operator flight restriction category as long as the flights operate below the Community Noise Exposure Level (CNEL) budgets. In order for the number of flights to be increased and still comply with the Airport Noise Compatibility Ordinance the airlines would have to optimize their flight operations. This would include using quieter aircraft and reducing the number of late night operations. Under optimal conditions, which have never been achieved at LGB, the estimated number of increased flights would range between seven and eleven flights. The EIR will consider 11 flights as a worst-case scenario.

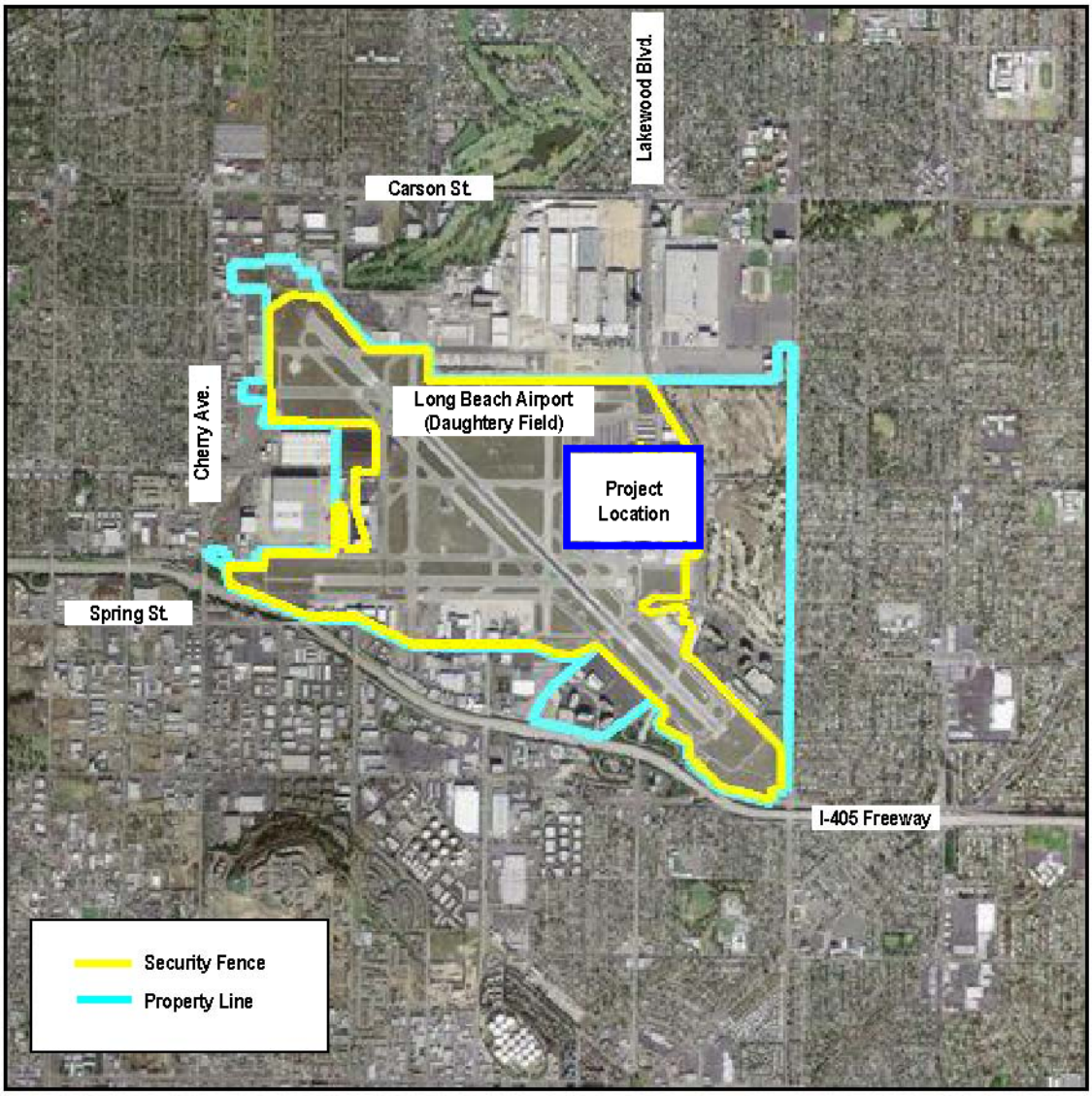

Figure 1-1

Site Location Map

Presently, LGB has five (5) runways, the longest being 10,000 feet. The Airport serves commercial carriers, general aviation, and air cargo. The area surrounding the Airport is generally urban in character. The layout of the existing facilities in the terminal area is provided in Exhibit 3.

Surrounding uses include existing Boeing property and industrial uses in City of Lakewood to the north. The City has approved a reuse plan titled "Douglas Park" for a portion of the Boeing property. That plan, which was approved in December 2004, provides for 261 acre of mixed-use development, including 3.3 million commercial and office space 200,000 square feet of retail space, 1,400 residential units, 400 hotel rooms and 11 acres of park. The Skylinks Golf Course and the Airport Business Park are located to the east, and industrial and commercial uses to the south and west of the Airport. I-405 and several arterials surround the Airport; however, public access to the terminal area is gained only from Lakewood Boulevard on the east side of the Airport.

In 1941, the existing airport terminal was built to serve commercial carrier passengers. In 1984, a new concourse area and pre-boarding lounge were constructed immediately south of the existing terminal building. The 1984 improvements provided capacity for the City's 15 daily flights, better accessibility for patrons with disabilities, improved mobility in the passenger screening process, and improved ticketing and check-in processing of airport users.

Between August 2001 and 2004, the number of passengers increased from 600,000 annual passengers to almost 3,000,000 annual passengers. The facilities at the Airport were not designed to adequately accommodate this level of increased number of passengers. To help accommodate the growth, the Airport constructed two temporary holdrooms, temporary remote parking, and a new baggage claim area.

Transportation Security Administration ("TSA") started operations at LGB in October 2002 with the screening of passengers. On January 1, 2003, TSA initiated the screening of baggage at the Airport. They currently have 134 employees working at the Airport screening luggage and passengers. In addition, TSA currently has 17 ETD machines at the Airport for screening luggage and six stations for screening passengers.

1.4 Existing Conditions

Existing conditions for the Airport in 2005 will be used as the CEQA Baseline. Aircraft, ground support equipment, and ground access vehicle activity and locations in 2005 will be determined from records and data provided by the City or its planning consultants. The intent of the City is to represent actual operations and facilities, as they existed in 2005, based on available records and air quality modeling capabilities. In addition, the discussion of existing conditions in the EIR technical documentation will address trends in criteria and toxic air pollutant emissions and concentrations in the South Coast Air Basin. Ambient measurements collected at the North Long Beach

monitoring station (SCAQMD Station No. 072) will be used to quantify existing air quality in the airport vicinity.

1.5 Proposed Project

1.5.1 Project Description

The proposed project description is provided in the Notice of Preparation (NOP) included as Attachment A to this protocol.

1.5.2 Operations

As previously indicated, the EIR will analyze the impacts associated with the introduction of up to 25 commuter flights that could operate at the Airport consistent with the terms of the Airport Noise Compatibility Ordinance. The EIR will also analyze the impacts associated with up to 52 commercial flights (an increase of 11 flights), which is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft and still be within the "noise bucket" of the Airport Noise Compatibility Ordinance. The project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport. These flight levels will be the basis for determining potential environmental impacts for all alternatives, even the No Project Alternative since the flight increase could occur with or without the proposed improvements.

1.5.3 Project Phasing

The project is designed to accommodate the current minimum permitted number of flights and passenger levels at the Airport. The phasing of the project would be determined based on availability of funding and service priorities. Design of the improvements would begin following the completion of the EIR. Pending funding, it is anticipated that construction of the improvements would begin approximately one year following completion of the EIR. The construction would be phased to minimize impacts to operations at the Airport. Implementation of improvements to serve commuter service would be phased depending on the level of commuter services at the Airport.

1.5.4 Project Objectives

The key project objective is to be able to provide airport terminal facilities to accommodate the minimum permitted number of flights at LGB and the associated number of passengers served on those flights, in full compliance with all applicable fire, building, safety codes and other applicable standards. Associated with that objective is the commitment to compliance with the existing Airport Noise Compatibility Ordinance adopted for the Airport and maintaining the current character of the Airport as a Long Beach Cultural Heritage Landmark.

1.6 Project Alternatives

The City of Long Beach will also evaluate project alternatives providing various levels of facilities improvements. The level of analysis for the air quality and health risk assessment will vary from a comprehensive evaluation of the proposed project to a qualitative evaluation, which discusses similarities and potential differences between the proposed project and the alternatives. The EIR will consider four project alternatives as well as the proposed project, which is the most intense of the options being evaluated. The characteristics of the alternatives compared to the proposed project are presented in NOP (see Attachment A).

Alternative A assumes the size of the terminal facility would be slightly less than the size for the proposed project. The nature of the improvements would generally be the same as the proposed project, though compared to the proposed project, there are minor reductions in square footage in all except the following categories:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- The amount of airport office space is increased compared to the proposed project.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative A as for the proposed project.

Alternative B assumes the terminal facility is further reduced. Similar to Alternative A, the nature of the improvements would generally be the same, though reduced in size compared to the proposed project, with the following exceptions:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- No additional airport office space is assumed as part of this alternative.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative B as for the proposed project.

Alternative C is the No Project Alternative. This alternative assumes no change to existing conditions. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed.

Qualitative analysis with regard to air quality and health risk will be conducted for a fourth alternative. Alternative D is a roll-back alternative in that it assumes no new facilities would be provided and that the temporary facilities currently in use would be removed. The terminal would be limited to the original terminal building. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed and the leased parking spaces are assumed not to be available because of the nature (month-to-month) of the lease.

Section 2
Emission Estimates

This section describes the methodology proposed for estimating criteria air pollutant and toxic air contaminant (TAC) emissions from air emission sources located at LGB.

Criteria air pollutants associated with airport operation include: carbon monoxide (CO), lead (Pb), nitrogen dioxide (NO_2), ozone (O_3), particulate matter (PM10 and PM2.5), and sulfur dioxide (SO_2). One of these pollutants, O_3, is a photochemical oxidant that is not directly emitted, but forms from precursor compounds that react in the presence of sunlight. Therefore, the analysis of O_3 will be accomplished by estimating emissions of its precursors: volatile organic compounds (VOC) and oxides of nitrogen (NOx).

For the TAC emission inventories, the chemicals of potential concern (COPCs) generated by sources located on airport property will be included. The COPCs will consist of those TACs that are known or expected to be emitted by sources at the airport which are also listed Federal hazardous air pollutants (HAPs) identified in the Clean Air Act (CAA) and/or the State of California's AB-2588 "Toxic Hot Spots" program. Emissions from both aircraft and non-aircraft activities will be estimated, as described below, for the 2005 Existing Conditions, and 2025 Project and alternative scenarios. An interim year analysis for the Project may also be prepared. Hydrocarbon (HC) and particulate matter (PM) emissions will be developed for both aircraft and non-aircraft sources, with the latter including both metals and diesel exhaust PM (DPM). Specific COPC emission rates will then be estimated through use of speciation profiles suitable for each source/pollutant.

The remainder of this section describes the approaches to be used in estimating pollutant-specific emission rates for the following types of sources operated at LGB:

- aircraft and auxiliary power units (APU),
- ground support equipment (GSE),
- ground access vehicles (passenger, employee, cargo),
- fuel storage and handling,
- maintenance facilities,
- utility plants, and
- construction equipment and other construction activities that generate air emissions.

The primary emission models used to develop criteria air pollutant inventories for LGB will include the FAA's Emissions and Dispersion Modeling System (EDMS), Version 4.2 or later (FAA 2004) for aircraft and APU sources; CARB's OFFROAD model (CARB 2001) for GSE and construction equipment, and CARB's EMFAC2002 model (CARB 2002a) for on-road motor vehicles. The PM10 and PM2.5 size fractions from airport sources will be determined using the CARB-approved California Emission Inventory and Reporting System (CEIDARS)(CARB 2002b). These models

may be supplemented with AP-42 emission factors (USEPA 1995a) and SCAQMD annual inventories for stationary sources, and CARB's URBEMIS 2002 model (CARB 2003a) for miscellaneous area, stationary and mobile sources.

Initial TAC emission estimates presented recently completed human health risk assessments (HHRAs) for commercial airports in California (City of Los Angeles 2004, Orange County 2001, Port of Oakland 2003) indicate that diesel-driven equipment and aircraft are major contributors to TAC impacts from airport sources. Therefore, an emphasis will be placed on characterizing aircraft engine and diesel engine emissions from on-road and off-road sources.

2.1 Aircraft Emissions Estimation

Aircraft emissions are primarily dependent on the following:

- category of operation and number of operations for each category (Section 2.1.1),
- operational mode and time spent in each mode (Section 2.1.2),
- criteria pollutant emission factors for the type and size of engines used (Section 2.1.3), and
- speciation profiles or other methods to determine TAC emissions (Section 2.1.4).

Internal combustion turbines and reciprocating (piston) engines are the primary engines found in aircraft today. Turbine engines tend to be turbofans or turboprops, although turbojets are found on some military aircraft and turboshafts are used to power helicopters. However, the major difference in the exhaust composition is between the turbine and piston engines. Section 2.1.3 identifies the approach to determine emission factors.

These emissions are estimated from the mode-specific emission factors, the number of engines, the TIM, the number of landing/takeoff operations (LTOs) for a given hour or year, and the temporal variations associated with each category of aircraft.

2.1.1 Fleet Mix and Operational Activity

Aircraft operations will be determined for the following flight categories: 1) air carrier 2) air cargo, 3) industrial (aircraft manufacturing/maintenance), 4) commuter, 5) charter, 6) general aviation (GA), and 7) military/government. Data sources used to develop activity estimates for each flight category are discussed below.

Air Carrier and Commuter Categories

Fleet and activity information for these flight categories will be obtained from recent ANOMS data for the 2005 Existing Conditions and forecasts for the 2025 alternatives

(HNTB 2004)[2]. The aircraft types for these categories are included in the ANOMS and forecast reports.

Air Cargo, Industrial, Charter, General Aviation, and Military/Government Categories

For these flight categories, the activity levels will be assumed the same as the 2005 Existing Conditions. The project does not expand facilities or components for these categories. The fleet mix for air cargo and industrial categories will be based on the ANOMS data for 2004. The fleet mix for the other three categories will be based on past field surveys, where available, conducted at LGB.

2.1.2 Time in Mode

Emissions occur during four basic modes of aircraft operation: 1) taxi/idle, 2) takeoff, 3) climb-out, and 4) approach. The time spent in each mode, time-in-mode (or TIM), affects the magnitude of pollutant emissions from that mode of operation.

A fifth mode, reverse thrust, has been included in some analyses. Reverse thrust will have similar emissions as climbout or takeoff modes. Reverse thrust emissions for this analysis will be indirectly estimated by assuming that all aircraft departing from LGB are fully loaded (depart at maximum takeoff weight) and thus spend more time in the takeoff and climbout modes than aircraft departing at the airport-average takeoff weight. The calculation of the differences in takeoff and climbout time between aircraft at maximum takeoff weight and those at 90 percent of maximum takeoff weight are presented in Attachment B.

Data used to determine TIM will be obtained from two sources. Taxi/idle times for LGB will be estimated at 10 minutes per LTO (EEA 1999). TIMs for the other three modes will be the same as those calculated in EDMS - Version 4.2 (FAA 2004), for each airframe/engine combination analyzed.

2.1.3 Emission Factors

Mode-specific CO, VOC, NOx, and SO2 emission factors from EDMS 4.2 for both turbine and piston aircraft engines will be used. Where an engine is not available in the EDMS database, both the International Civil Aviation Organization (ICAO) and EDMS databases will be queried to find a suitable substitute. This selection will be made based upon manufacturer, engine type (turbofan, turboprop, turboshaft, piston), engine family, and thrust. Where two or more equally plausible choices exist, the aircraft manufacturer using the engine for which data was not in the databases will be consulted to determine an appropriate substitute engine for this analysis.

[2] The forecast provided by HNTB (2004) was developed for 2020. However, due to the restrictions of the Airport Noise Compatibility Ordinance, a 2025 forecast would be identical to the 2020 forecast. Therefore, a revised forecast is not required and the HNTB forecast will be used to represent 2025 operations.

Mode-specific total PM emissions for aircraft turbine engines will be determined based on the FAA First Order Approximation (FOA) method contained in Wayson, et al. (2003), modified as suggested by FAA (Pehrson 2005). The aerodynamic diameter of PM from aircraft are typically much less than 2.5 micrometers (μm) (Anderson, et al. 2003; Petzold et al. 2003), thus PM10 and PM2.5 emissions from aircraft engines are assumed to be equal. Engine-specific PM emission indices, in mg/kg fuel, developed using the FOA are presented in Attachment C (Pehrson 2003, 2005).

2.1.4 Chemical Speciation

To estimate chemical-specific emissions for aircraft in each of the flight categories, the following information will be used: 1) HC and PM emission factors for each engine, 2) fleet mix and operational activity for each flight category, 3) TIM, and 4) chemical speciation for aircraft VOC and PM emissions.

Emissions of individual TACs in the VOC emitted by aircraft will be calculated using "speciation profiles." California Air Resources Board (CARB) had developed an organic speciation profile (No. 586) for aircraft engines, based on data presented in a report prepared in the early 1980s (Spicer, et al. 1984). More recently, the Port of Oakland (2003) developed aircraft mode-specific organic speciation profiles in coordination with CARB (CARB 2003b, 2003c). Those speciation profiles were developed for turbine aircraft based on an average of available source test reports (Gerstle, et al. 1999; Spicer, et al. 1984; Spicer, et al. 1987; Spicer, et al 1988; Spicer, et al. 1990). The mode-specific speciation profiles for organic TACs are presented in Attachment D (Port of Oakland 2003) and will be used for the LGB impact analysis.

Piston aircraft VOC speciation will be accomplished through use of CARB's profile number 413 (CARB 2003d).

Metal speciation profiles will be distinct for turbine and piston aircraft. For piston aircraft, lead is the only major metal pollutant, due to the use of leaded aviation gas. The primary aviation gasoline sold at LGB is 100 octane low-lead (100LL). Therefore, the lead specification for 100LL (0.56 g/gal) will be used to estimate lead emissions from piston aircraft. For turbines, a profile will be developed from elemental analysis of Jet A fuel conducted by the U.S. Navy (Shumway 2000). The elemental analysis is presented in Attachment E.

2.2 Auxiliary Power Unit Emissions

Criteria pollutant emissions from auxiliary power units (APUs) will be estimated using EDMS APU assignments to aircraft types. Since LGB does not use jet ramps (only external stairs), APUs will be assumed to operate for 26 minutes per LTO (the EDMS default operating time for APUs).

APU speciated TAC emissions will be based on profiles used for aircraft engines, since APUs are small turbines fired on jet fuel

2.3 Ground Service Equipment Emissions Estimation

GSE emissions of criteria pollutants will be calculated using the LGB-specific GSE population and fuel type, and CARB's OFFROAD model emissions, activity, load factor, and horsepower data (CARB 2005). The South Coast GSE Memorandum of Understanding (MOU) signed by the airlines operating in the South Coast and by CARB will be accounted for in the GSE emissions inventory. GSE emission inventories will be developed for 2005 and for each alternative in 2025.

The TAC inventories from GSE VOC emissions will be developed from CARB Profile No. 413 for gasoline-fueled equipment and from Profile No. 719 for propane or natural gas-fueled equipment. The TAC inventories from GSE PM emissions will be developed from CARB Profile No. 399 for gasoline-fueled equipment. DPM will be assessed as a single TAC for the diesel-fueled equipment, and is assumed to provide representative health risk impacts from total diesel engine exhaust. PM emissions from propane or natural gas-fueled equipment are negligible and, therefore, will not be assessed for TACs.

2.4 Ground Access Vehicle Emissions Estimation

Ground access vehicles include on-road vehicle activity associated with air passenger activity, air cargo activity, and general aviation activity. Gasoline and diesel passenger automobiles, various types of vans, buses, and trucks of different weight classes will all be included.

VOC from engine exhaust and fuel system evaporation, and PM from engine exhaust, tire wear, brake wear, and re-entrained road dust contribute to TAC emissions. Diesel exhaust PM will be treated as a single TAC in accordance with current state guidance (Cal EPA 2002a,b).

The daily mass emissions for each criteria pollutant are estimated as the product of an emission factor and the amount of travel occurring on the airport, expressed in vehicle miles traveled (VMT). The VMT itself is a product of the number of vehicles traveling on each airport roadway and the length of these routes.

CARB's EMFAC2002 model, Version 2.2 (CARB 2002), will be used to estimate emission factors for the typical driving conditions typical around the airport. Speeds and VMT will be obtained from City staff or the traffic consultant, and supplemented with traffic data contained in recently completed Douglas Park Final EIR (City of Long Beach 2004). Temperature and humidity parameters will be selected to represent annual averages. All other modeling parameters (e.g. fuel specifications, fleet mix) will rely on EMFAC's defaults for Los Angeles County. Re-entrained road dust emission factors will be estimated from a Midwest Research Institute report (MRI 1996) using county average precipitation and silt loading values.

Gasoline exhaust start, running, and evaporative hydrocarbons will be estimated on a VOC basis and will be further subdivided into specific TACs using CARB Profile

No. 888 for engine exhaust in 2005, No. 894 for engine exhaust in 2025, and No. 906 for evaporative emissions in both years. Gasoline PM emissions will be fractionated according to CARB Profile No. 400.

Evaporative emissions are assumed to be negligible for diesel vehicles. As previously mentioned diesel engine exhaust will be treated as a single TAC, DPM.

Finally, elemental TACs from paved road dust will be developed using CARB Profile No. 471, from tire wear using Profile No. 472, and from brake wear using Profile No. 473.

2.5 Fuel Storage and Handling Emissions Estimation

Evaporative emissions from the storage and transfer of Jet A fuel, aviation and motor vehicle gasoline, and diesel will be estimated based upon fuel use logs provided by the City for existing conditions. Future Jet A use will be based on the aircraft activity and fleet mix in 2025 relative to the 2005 existing conditions. Aviation gasoline use will be assumed constant from 2005 to 2025 since general aviation activity is not expected to change during that period.

Fugitive VOC emissions from the fuel facility storage tanks will be calculated using the USEPA TANKS 4.09b (USEPA 1999, USEPA 2001) program. Fuel truck loading and aircraft fueling fugitive emissions will be based on emission factors found in AP-42, Section 5.2 "Transportation and Marketing of Petroleum Liquids" (USEPA 1995a).

The VOC emissions will be speciated according to CARB Profile No. 100 for Jet A, Profile No. 906 for gasoline, and Profile No. 760 for diesel.

2.6 Maintenance Facilities and Utility Plants Emissions Estimates

Maintenance facility and utility plant emissions will be determined for those facilities and plants that are likely to be impacted by the proposed LGB Terminal Improvement Project. Differences in emissions between 2005 and 2025 at these facilities will be developed from changes in activity (passenger and aircraft operations) and changes in onsite structures (square feet of building floor space).

Changes in the floor space will result in changes in demand for electricity and building heating/air conditioning. Therefore, estimates of natural gas combustion emissions for heating and power will be estimated from URBEMIS 2002 (CARB 2003) emissions data and supplemented if necessary by USEPA AP-42 factors (USEPA 1995) and/or SCAQMD annual emission inventory reports.

Commercial aircraft maintenance operations at LGB may include cleaning (degreasing) and painting (coating) activities. These activities, if found to occur at LGB, will be assumed to be proportional to aircraft operations. Emission factors from

USEPA AP-42 (USEPA 1995a), data from Material Safety Data Sheets (MSDS) for compounds used at LGB, or SCAQMD annual emission inventory reports will be utilized in developing criteria pollutant and TAC emission inventories.

2.7 Construction Equipment Emissions Estimate

Criteria pollutant emissions from construction activities will be estimated using the URBEMIS 2002 model (CARB 2003). Construction activities will include demolition of several existing structures and construction of new permanent facilities and a parking structure. If deemed appropriate for this project, a refinement to emission factors for construction equipment may be used. This refinement would consist of incorporating CARB OFFROAD model emission factors into the construction emission calculations, and would be coordinated with CARB and SCAQMD.

The project will be constructed in phases as funding becomes available and is obtained. The period of construction for a given phase is anticipated to be limited, typically between one and three years. Therefore, only TACs with acute impact thresholds, as defined by the California Office of Environmental Health Hazard Assessment (OEHHA), will be analyzed for health risk.

The TAC inventories from construction equipment VOC emissions will be developed from CARB Profile No. 413 for gasoline-fueled equipment and from Profile No. 818 for diesel-fueled equipment. The TAC inventories from construction equipment PM emissions will be developed from CARB Profile No. 399 for gasoline-fueled equipment and from Profile No. 425 for diesel-fueled equipment. TACs from construction dust will be estimated from CARB Profile No. 420.

Section 3
Air Dispersion Modeling

Air dispersion modeling will be used to estimate ambient criteria pollutant and TAC concentrations for 2005 and the 2025 alternatives listed in Section 1.0. The project-related ambient concentrations will be added to measured (2005) or estimated (2025) background concentrations for comparison to the National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS).

The predicted incremental difference in TAC concentrations between the 2025 alternatives and the 2005 Existing Conditions will then be used to assess the project specific incremental health risks to the potentially exposed populations described in Section 4.0.

The air dispersion analysis will be performed in accordance with USEPA, CARB, and SCAQMD modeling guidelines. The results of the air dispersion analysis will be used in conjunction with the chemical specific emissions rates discussed in Section 2.0 to estimate ambient criteria pollutant and TAC concentrations. The air dispersion analysis requires the following: 1) selection of the dispersion model, 2) evaluation of potential terrain considerations, 3) selection of appropriate dispersion coefficients based on land use, 4) selection and/or preparation of meteorological data, 5) identification of source locations and modeling parameters, 6) selection of receptor locations, and 7) selection of appropriate averaging time periods. Each of these steps is described in greater detail in the sections that follow.

3.1 Model Selection

The first step in an air dispersion analysis is the selection of an applicable model. The most commonly used air models for dispersion of pollutant emissions from airports are FAA's EDMS program, which uses USEPA's AERMOD model, and USEPA's Industrial Source Complex Short-Term 3 (ISCST3) dispersion model.

The FAA has developed EDMS for analyzing airport criteria pollutant emissions. In the current release, EDMS Versions 4.0 and later implement AERMOD (USEPA 1998a), an air dispersion model developed by the American Meteorological Society/ Environmental Protection Agency Regulatory Model Improvement Committee (AERMIC). AERMIC's objective is to develop a replacement for USEPA's ISCST3 air dispersion model (USEPA 1995b and c) that meets the following criteria: 1) adopts ISCST3's input/output computer architecture; 2) updates, where practical, ISCST3 model algorithms with newly developed or current state-of-the-art modeling techniques; and 3) insures that the source and atmospheric processes presently modeled by ISCST3 will continue to be handled by AERMOD (USEPA 1998a and 2002a).

For this project, the EDMS/AERMOD system has been tentatively selected for the following reasons:

- EDMS will be used to estimate emissions from aircraft and APU, and by simply clicking a button on the EDMS pull down menu the program will generate the input file for AERMOD.
- The FAA requires EDMS be used to assess air quality impacts at airports (63FR18068).
- Using AERMOD avoids running two different models for the same project.

If project-related concentrations of criteria pollutants are to be calculated, they will be calculated directly from AERMOD, with the following possible exceptions: CO concentrations at roadway intersections would be analyzed using CALINE4; and the annual NO_2 NAAQS and 1-hour NO_2 CAAQS determination may require supplemental analyses since the EDMS/AERMOD model calculates total NOx emissions and concentrations, not NO_2 impacts. The supplemental NO_2 approaches will include the Multi-tiered Screening Approach for the annual NO_2 analysis described in 40 CFR 51 Appendix W, and, possibly, the ozone-limiting-method (OLM) for the 1-hour NO_2 analysis. Both of these approaches would rely on hourly averaged monitoring data collected at the SCAQMD Long Beach monitoring station (SCAQMD Station No. 072). Use of these supplemental approaches will be coordinated with the SCAQMD, if the initial screening analysis based on 100 percent conversion of NOx to NO_2 does not meet the appropriate NAAQS or CAAQS.

To develop concentrations for the 15 to 20 TACs typically considered at airports, we propose to determine dispersion factors, sometimes called chi-over-Q ("χ/Q") values, using a Gaussian air dispersion model for each group of similar sources identified in Section 2.0. These χ/Q values represent the ratio between concentration and emission rate as expressed as units of concentration per unit of emissions. The χ/Q values will be developed for each group of sources that have similar dispersion characteristics and speciation profiles. The χ/Q values will be used with chemical-specific emission rates to determine TAC concentrations at each receptor modeled.

Therefore, χ/Q values will be calculated for each emission source group using the USEPA's AERMOD air dispersion model included in EDMS. USEPA default model settings, will be used except that the missing data processing routines will be used (see discussion in Section 3.4). EDMS/AERMOD program will be used to derive the source parameter information as discussed below.

Building downwash is the effect of structures on the dispersion of emissions from nearby point (stack) sources. No point sources within the terminal improvement area have been identified as significant emission sources of TACs. Therefore, an analysis of building downwash will not be conducted.

3.2 Terrain

Another important consideration in an air dispersion modeling analysis is whether the terrain in the modeling area is simple or complex (i.e., terrain above the effective height of the emission point). Complex terrain can affect the results of a dispersion

analysis involving point and volume sources, but does not affect the predicted results for area sources (USEPA 1995c). Terrain elevations were obtained from digital elevation model (DEM) files[3] of the United States Geological Survey (USGS) maps for the following 7.5 Minute Quadrangles: Long Beach, Los Alamitos, Torrance, and San Pedro. The proposed modeling area contains both simple and complex terrain. USGS elevation information will be used in the air dispersion modeling analysis to identify the terrain height of modeled sources and receptor points.

3.3 Land Use

Another important consideration in an air dispersion modeling analysis is the selection of rural or urban dispersion coefficients. Auer's (Auer 1978) method of classifying land-use as either rural or urban will be used to analyze the surrounding region. This method calls for analysis of a three-kilometer radius around a facility to determine if the majority of the land can be classified as either rural (i.e., undeveloped) or urban. Our review of Long Beach, Lakewood, and Signal Hill zoning maps as well as aerial photos indicates that over 50 percent of the land within 3 kilometers of the LGB is urban and, therefore, urban dispersion coefficients will be used in the modeling.

3.4 Meteorological Data

For air dispersion modeling purposes, USEPA requires the use of at least 1 year of on-site or 5 years of nearby meteorological data at a minimum (40 CFR Part 51, Appendix W: *Guideline on Air Quality Models*), and recommends that additional (up to 5 years) data be included if it is available. The SCAQMD maintains a monitoring station in North Long Beach (SCAQMD Station No. 072) and has developed a representative year of hourly meteorological data for use in the ISCST3 model. However, the meteorological data needs of AERMOD will require the surface and upper air data sets be processed with the AERMET preprocessor. Therefore, the most recent year of available hourly meteorological data for LGB will be used.

Both surface meteorological and upper air soundings data are necessary to model air dispersion. USEPA has established criteria for the use of meteorological data for modeling purposes in its *Meteorological Monitoring Guidance for Regulatory Modeling Applications* (USEPA 2000b). The surface meteorological data will be taken from a recent year that has 90 percent or more complete data.

USEPA's *Procedures for Substituting Values for Missing NWS Meteorological Data for Use in Regulatory Air Quality Models* (Atkinson and Lee 1992) will be followed to interpolate missing data, unless more than 5 consecutive hours are missing. Missing data codes will be placed in the blocks of data missing 5 or more consecutive hours. Note that the missing data processing routines selected for use in AERMOD modeling will eliminate hours with missing meteorological data from predicted average dispersion factors.

[3] Obtained from: http://data.geocomm.com/catalog/US/61069/2389/group4-3.html , March 2005.

The surface and the upper air data will be combined using the USEPA's AERMET computer program to develop the meteorological data files required by AERMOD.

3.5 Source Parameters

The following emission sources identified in the emission inventories described in Section 2.0 will be modeled: 1) aircraft, 2) APU, 3) GSE, 4) ground access vehicles, 5) fuel storage. The location of the sources will be determined from the airport layout plan, maps, aerial photos and other information provided by the City for existing sources at LGB, as well as plans for the 2025 Project and alternatives. All sources require the identification of modeling source parameters, including any temporal variations in emissions. The identification of this information is described in greater detail in the following sections.

3.5.1 Aircraft

Aircraft emissions occur in four distinct modes as described in Section 2.1: taxi/idle, approach, climbout, and takeoff. The dispersion of emissions from aircraft operations at the Airport will be modeled as area sources in AERMOD, as generated in EDMS. It should be noted that recent communications with both the FAA and USEPA indicate that the area-source approach currently incorporated in EDMS (4.0 through 4.2) is very conservative and may be modified (to volume sources) in future releases of EDMS after completion of current jet plume dispersion studies (Pehrson 2002).

Actively used taxiways, runways, and approach/departure paths will be entered into EDMS generate aircraft and APU emissions for each operating mode, TIM for takeoff, climbout and approach. The TIM for taxi/idle will be developed from estimates provided by City staff or the airport planning consultants. Aircraft PM emissions for each operating mode will be developed following procedures cited in Section 2.1.3. EDMS 4.2 does not calculate PM emissions from aircraft, therefore, the emissions file created by EDMS and used as input to the AERMOD dispersion analysis does not include aircraft PM. Therefore, PM emissions from aircraft will be added to the PM dispersion analysis by explicitly providing PM emission rates for each of the aircraft sources in the AERMOD input file.

As discussed previously, aircraft emissions occur in four operating modes (taxi/idle, approach, takeoff, and climbout). For operations at each field, taxiway source groups will be used to model the emissions from taxi/idle mode, runway source groups to model emissions during takeoff mode, approach source groups to model emissions during approach, and departure source groups to model the emissions during climbout modes.

Emissions from the different aircraft categories (e.g., air carrier, air cargo, commuter, general aviation, etc.) vary according to different temporal patterns during the day. Temporal patterns (by hour-of-day, day-of-week, and month-of-year) for each aircraft category will be provided by the City or its planning consultants.

3.5.2 Ground Access

3.5.2.1 CO Hot Spot Analysis

Dispersion analysis of CO concentrations at roadway intersections will be conducted for up to 10 intersections identified by the City or traffic consultant as the most likely to be impacted by the project. The analysis will be conducted following the recommended California Department of Transportation methodology (CalTrans 1997), using the CALINE4 model (Benson 1989). Additional intersections may be added to the analysis if they are shown to have a greater than 2 percent increase in volume between the project and the baseline and the level of service (LOS) is D or worse.

3.5.2.2 On-Airport Roadway/Parking Dispersion

The locations of ground access sources (traffic and parking) will be determined from the airport layout plan or recent aerial photos and maps. Roadways and parking facilities located within airport property will be modeled as area sources, as generated by EDMS. The emissions will calculated based on the defined fleet mix using EMFAC2002. Temporal patterns (by hour-of-day, day-of-week, and month-of-year) for traffic will be estimated from aircraft temporal patterns, or will be provided by the City staff or traffic consultants.

3.5.3 Ground Support Equipment (GSE)/Auxiliary Power Unit (APU)

Pollutant emissions from GSE/APU operations will be modeled using the EDMS/AERMOD model. The locations of GSE/APU sources are at gate and cargo areas. Pollutant emissions from GSE/APU sources vary throughout the day. The temporal pattern for air carrier aircraft will be applied to GSE/APU sources at the passenger terminal area.

3.5.4 Stationary Sources

Stationary sources that may be affected by the project will be modeled. These sources may include fuel farms, utility plants, and/or maintenance facilities. If included, fugitive emissions from tanks in the fuel farms will be modeled as elevated area sources (at the tank height elevation), utility plants will be modeled as one or more point (stack) sources, and maintenance facilities will be modeled as point or volume sources, depending on the facility configuration.

3.5.5 Construction Sources

Construction source dispersion will be modeled following the general methodologies presented in the SCAQMD's Localized Significance Threshold Methodology document (SCAQMD 2003). Either URBEMIS2002 or OFFROAD will be used to estimate emissions, as noted in Section 2.7.

3.6 Receptor Locations

Locations of the receptor points at which air concentrations will be estimated must also be specified in an air dispersion analysis. Approximately 200 discrete receptor points will be placed at locations of the nearest receptors of each type, including sensitive receptors (see Section 4).

3.7 Dispersion Factor Averaging Time

The calculation of criteria pollutant concentrations will be based on the averaging period(s) included in the NAAQS and/or CAAQS for each of the pollutants analyzed.

Calculation of TAC concentrations for use in HRA exposure analysis requires the selection of appropriate concentration averaging times. At least two averaging periods will be used in the HRA dispersion analysis. The annual average concentrations for the meteorological data period will be calculated for each TAC to be used in estimating cancer and chronic non-cancer risk. Maximum one-hour concentrations will be calculated for use in estimating acute non-cancer risk.

3.8 Concentrations of Toxic Air Pollutants

As discussed above, airborne off-site transport of vapor phase and particulate bound TACs from the facility to the receptors identified in Section 3.6 and 4 will be analyzed. In summary, a three-step process will be used to estimate the off-site ambient air concentrations of TACs. First, total VOC or PM emission rates estimated for aircraft, ground access, GSE/APU, construction, and on-airport stationary sources (as discussed in Section 2.0) will be multiplied by the TAC-specific weight fraction from the appropriate source speciation profile to estimate TAC-specific emission rates for each source. Second, the annual average and one-hour maximum dispersion factors, χ/Q's, at the receptors of concern will be obtained from the air dispersion analysis as discussed above. Third, these χ/Q factors will be multiplied by the TAC-specific emission rates determined in the first step to obtain TAC-specific air concentrations at the receptors of concern from airport emissions for each scenario. The incremental TAC dispersion analysis will evaluate the TAC concentrations from each future 2025 Project scenario minus the 2005 Existing Conditions results.

Section 4
Health Risk Analysis

This section describes methodology for evaluation of possible human health risks that may result from estimated releases of chemicals of potential concern (COPCs) emitted from Airport facilities. Specifically, the purpose of the risk assessment will be to estimate potential risks to human health associated with uses of the subject site and facility under various projected scenarios. Risk assessment methods described below are consistent with guidelines provided by the California Environmental Protection Agency (Cal/EPA), Department of Toxic Substances Control (DTSC) in *Supplemental Guidance for Human Health Multimedia Risk Assessment Hazardous Waste Sites and Permitted Facilities* (Cal/EPA 1992); Cal/EPA, Office of Environmental Health Hazard Assessment (Cal/EPA) in *Air Toxic Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* and its four technical support documents, Cal/EPA (1999, 2000a, 2000b, 2002b, and 2003); and US Environmental Protection Agency (USEPA) in *Risk Assessment Guidance for Superfund (RAGS)* (USEPA 1989) and supplements. The SCAQMD Rules (particularly Rules 1401 and 1402) were also consulted during preparation of this document.

The approach used to quantify potential health risks includes four elements: (1) identification of COPCs; (2) exposure assessment; (3) dose-response assessment; and (4) risk characterization. This section is organized to reflect these four elements of a risk assessment.

4.1 Identification of Chemicals of Potential Concern

This process identifies chemicals that may be of potential concern and involves gathering and analyzing data relevant to the human health risk assessment. COPCs are those constituents that are carried through the risk assessment process and for which carcinogenic risks and non-carcinogenic hazards are estimated.

Consistent with USEPA risk assessment guidance (USEPA 1989), a selection process may be applied in a human health risk assessment to identify COPCs. According to USEPA (1989), a concentration-toxicity screen is one of the COPC selection procedures that may be employed to reduce the number of COPCs carried through a risk assessment to a manageable number while still maintaining a health protective approach. "The objective of this screening procedure is to identify chemicals in a particular medium that – based on concentration and toxicity – are most likely to contribute significantly to risks calculated for exposure scenarios involving that medium, so that the risk assessment is focused on the most significant chemicals" (USEPA 1989). By focusing efforts on the "most significant" chemicals, one improves the level of confidence and ease of interpretation of emission estimation, air dispersion modeling, and risk assessment results.

A potency-weighted emissions screening method, which is analogous to the concentration-toxicity screen procedures recommended by USEPA (1989), will be

applied to develop a list of COPCs for the risk assessment. Applying this method, a list of COPCs is identified following a four-step screening process. First, all airport facility-related chemicals are identified. Second, the total estimated emission rate for each chemical is calculated. Third, toxicological information is reviewed to select appropriate potency criteria for each facility-related chemical identified. Fourth, each individual chemical is scored according to its emission and potency. Chemicals determined to contribute significantly to the overall risk (for example, chemicals whose risk account for 99 percent of the carcinogenic risk or non-carcinogenic hazard) are identified as COPCs and are carried through the risk assessment.

The above screening will provide a means to identify those chemicals that should be evaluated for health risks via inhalation exposure. A second screening mechanism will be used to establish COPCs that should be evaluated for health risks via indirect pathways. Some chemicals may deposit onto soils and other surfaces around the Airport. People living, working or going to school could be exposed to these chemicals through direct contact with soil or dust, through ingestion of mother's breast milk, and/or through exposure to chemicals taken up into homegrown produce.

Selection of COPCs for indirect pathways involving deposition will be performed in three steps for non-volatile chemicals for which emissions estimates are available. First, a generic deposition velocity will be applied to concentrations of COPCs estimated from dispersion modeling at residential, worker and school child locations. Second, estimated deposition per unit time will be used to estimate a possible soil concentration by summing deposition over 70 years, and assuming that the total summed deposition will be mixed in the top 2 inches of soil. Third, the resulting estimated concentrations will be compared to the ranges of background concentrations reported in the "Kearney Study" (University of California 1996) for metals, and to regional specific and/or generic urban background for polycyclic aromatic hydrocarbons (PAHs) and other SVOCs. Where estimated contributions to background from Airport emissions are at the lower end of the ***range*** of background estimates, chemicals will be eliminated as COPCs for indirect pathways. Where estimated contributions fall above mean background ***minus*** two standard deviations, chemicals will be retained as COPCs for indirect pathways. Chemicals with high bioaccumulation potential in homegrown produce also will be retained as COPCs for indirect pathways. Where background concentrations are unavailable or unacceptable to SCAQMD, or where statistics are unreliable, chemicals will be evaluated individually and eliminated or retained as COPCs justified on a case-by-case basis in consultation with SCAQMD.

This approach is functionally the same as estimating risks, then making background comparisons, since estimated soil concentrations and associated risks are proportional. Background issues are important and recognized in all risk assessment guidance (USEPA 1989, CalEPA 1992, USEPA 1998b, and many others).

Chemicals retained as COPCs will be carried through a multi-pathway risk assessment consistent with SCAQMD and OEHHA guidance described as in general terms below. Because deposition onto soils or other surfaces surrounding the Airport is not expected to result in significant incremental increases in background concentrations, based on results of past analyses at other airports (LAX and OAK), all details of this risk assessment process are not provided in this protocol. Such details will be developed in consultation with SCAQMD if the above screening suggests that some COPCs should, in fact, be carried through a more detailed analysis.

4.2 Exposure Assessment

To estimate risks associated with potential exposure to chemical emissions from Airport operations, human populations that might be exposed are identified along with important exposure pathways (inhalation, soil contact, etc.). Theoretical chemical intakes for each potentially exposed population will then be estimated using equations from the Cal/EPA and USEPA. Standard exposure assumptions for use in these calculations, taken from Cal/EPA and USEPA are presented in Table 4-1. Additional details of the exposure assessment approach are provided below.

4.2.1 Potentially Exposed Populations

The HHRA will analyze off-site and on-site populations. Based on human activity and land-use patterns in the vicinity of the Airport[4] the following off-site populations will be evaluated: residential adults and children, workers, people recreating near the airport, and elementary school children. Children in daycare could also be an exposed population. However, current information suggests that residences are located close to the Airport. Evaluation of residential exposure will include young children (birth to 9 years of age). Children that may live more distant from the Airport, but attend daycare near the Airport would not receive higher exposures than children in the closest residences. Thus, protection of nearby residents will also protect children in daycare.

Elementary school children are included in this assessment since standard risk assessment guidance does not specifically include elementary school-aged children. Some population of elementary school children could live at locations where exposures are relatively low, but could attend school close to the Airport where exposure may be higher.

[4] The airport vicinity is shown on Figure 1-1 in Section 1 of this protocol. This vicinity map is intended to identify the limits of the HRA, thus any receptor described as near or close to the Airport could be located on this figure.

Table 4-1
Exposure Assumptions To Estimate Exposures to TACs of Concern

Exposure Pathway	*Off-Airport Receptors*			
Inhalation of Particulates and Gases	*Off-site Resident*		*Off-site School Child*	*Off-site Worker*
	Adult	*Child*		
Daily Breathing Rate (L/kg-day) [1]	581/302/302 [f,g]	581 [f]	112 [e]	149 [f]
Exposure Frequency (days/yr)	350 [b,f]	350 [b,f]	200 [c]	245 [f]
Exposure Duration (years)	9/30/70 [2] [f]	9 [f]	7 [c]	40 [f]
Body Weight (kg)	63 [a,f]	18 [e]	31	70 [a,f]
Averaging Time - Non-cancer (days) [1]	3,285/ 10,950/ 25,550 [a,f]	3,285 [a]	2,555 [a]	14,600 [a]
Averaging Time - Cancer (days)	25,550 [a,f]	25,550 [a,f]	25,550 [a,f]	25,550 [a,f]

1 – Inhalation and daily breathing rates and non-cancer averaging time are shown for each exposure duration – 9 yrs/30 yrs/70 yrs

2 - 70 year exposure duration will be used as basis for determining significance.

Sources: a – USEPA, 1989a. Risk Assessment Guidance for Superfund. Volume I - Human Health Evaluation Manual, Part A. EPA/540/1-89/002. Office of Emergency and Remedial Response. Washington D.C.

b – USEPA, 1991. Human Health Evaluation Manual, Supplemental Guidance: Standard Default Exposure Factors. Office of Solid Waste and Emergency Response. Washington D.C. August.

c – Site-specific. Professional judgment. See text.

d – Cal/EPA 1992. Supplemental Guidance for Human Health Multimedia Risk Assessment of Hazardous Waste Sites and Permitted Facilities. Sacramento. California. July.

e – USEPA, 1997. Exposure Factors Handbook. EPA/600/P-95/002F

f – Cal/EPA 2003. Air Toxic Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments. August.

g – SCAQMD 2005b. Risk Assessment Procedures for Rules 1401 and 212. July.

Other onsite workers and passengers are assumed to have much lower exposure potential. Workers at concessions in terminals, airline counter staff, airport administration and other office workers will spend most of their time indoors where air quality can be assumed to be better than on the airfield near gates. These workers could spend short times outdoors on breaks, but probably not in areas where toxic air pollutants are expected to be in highest concentrations. Short amounts of time will also be spent outdoors coming to and from work, but, again, locations will be away from those areas where highest impacts from emissions are expected. The combination of short times outdoors and expected lower concentrations indoors and in break and "commuting" areas suggests that these workers will experience lower exposures than workers on the tarmac.

Passengers at the Airport would also experience lower exposures to airport-related air toxics than would outdoor workers at the gates. These people visit the Airport only intermittently and for relatively short periods of time. Most of their time is spent indoors, and outdoor time is limited to areas removed from the tarmac, i.e. traveling from parking or shuttles to cars and terminals. Exposures to passengers are expected to be among the lowest for on-site receptors. Workers that visit the Airport for deliveries might also experience intermittent, short-term exposures such as those envisioned for passengers. Some of these workers might visit the Airport more often than passengers, but overall their exposure should still be much less than outdoor Airport workers.

The above considerations suggest that evaluation of passengers and workers, other than those involved in outdoor work at and near the gates, is not necessary for protection of workers and Airport users. Quantitative estimates of health risks for these receptor groups will not be part of the risk assessment. However, possible risks for these groups will be qualitatively discussed.

4.2.2 Exposure Pathways

The primary exposure pathway identified for potentially exposed populations within the vicinity of the Airport identified above is inhalation. In essence, all important emissions are to air, based on experience with other airports where deicing is not a factor, and many important COPCs for airports are volatile chemicals found in jet exhaust, that do not deposit onto soils. For this reason, potential human health risks associated with estimated inhalation exposure will be quantified for each project scenario. Exposure assumptions used to evaluate the inhalation pathway are described in detail in Section 4.2.3.

Non-inhalation pathways may be considered in a multi-pathway screening level evaluation, if the screening process described in Section 4.1 identifies COPCs for indirect pathways. A multi-pathway analysis includes evaluation of potential exposures to chemicals emitted from a facility and deposited onto surface soil. Methods for conducting a multi-pathway analysis are presented in the Air Toxics Hot Spots Risk Assessment Guidelines Part IV (Cal/EPA 2000a) and in the final guidance (Cal/EPA 2003). SCAQMD has revised its multi-pathway adjustment factors in its Risk Assessment Procedures for Rules 1401 and 212, Version 7, dated July 2005. The multipliers were revised to be consistent with current CARB guidance. These multipliers will be included in the screening analysis for non-inhalation pathways. Specifics of a detailed multi-pathway analysis will be determined, with SCAQMD input, if the need arises. Exposure assumptions for non-inhalation pathways are not included in this protocol at this time.

In general, evaluation of non-inhalation pathways will consider direct contact with soil (dermal contact and incidental ingestion), and possible exposure via uptake into vegetables grown in soils near the Airport. Evaluation of direct contact pathways is the subject of considerable guidance and default exposure parameters for soil

ingestion rates, dermal contact rates, body surface areas, and dermal absorption factors from Cal/EPA (OEHHA) guidance will be used for this evaluation.

Exposure involving homegrown produce will not be included for quantitative evaluation. This pathway will only be evaluated if a chemical of potential concern for non-inhalation pathways is also listed in the final guidance (Cal/EPA 2003) as potentially important for this pathway (see Table 5.1 of this guidance). .

4.2.3 Exposure Assumptions

Exposure parameters used in the intake equations are based on reports and assumptions regarding land use in the vicinity of the Airport, and human activity and physiology. Exposure parameters common to all intake equations including exposure frequency, exposure time, exposure duration, body weight, and averaging time are discussed in Section 4.2.3.1. Section 4.2.3.2 describes exposure parameters specific to the inhalation pathway.

4.2.3.1 Exposure Time, Exposure Frequency, and Exposure Duration

The four parameters – exposure time, exposure frequency, exposure duration, and contact rate (inhalation rate) – together define the extent of contact with pollutants in air. Contact rate, in this case the amount of air a receptor breathes per unit time, is further discussed below. Exposure time is the number of hours per day that a receptor is present at an exposure point. Exposure frequency is the number of days per year that exposure occurs. Exposure duration is the total number of years over which exposure occurs.

In this human health risk assessment, off-site workers are assumed to be exposed to Airport chemicals 8 hours per day for 245 days per year (Cal/EPA 2003). This exposure frequency corresponds to working 5 days/week for 49 weeks/year. An exposure duration of 40 years will be used for off-site workers (Cal/EPA 2003). On-site workers (e.g. baggage handlers) might have similar exposure frequencies and durations. These receptors will be evaluated by comparison with occupational standards as discussed below (Section 4.4.4).

For residents, exposure is assumed to occur 24 hours per day via the inhalation pathway (USEPA 1991). Consistent with USEPA (1991) and Cal/EPA (2003) guidance, an exposure frequency of 350 days per year is assumed for both the adult and child residents. This corresponds to residents being present in their home seven days a week for 50 weeks a year (or about 96 percent of the time) with approximately two weeks (or 15 days) spent away from home.

Exposure durations of 9 years, 30 years, and 70 years will evaluated and presented. In accordance with SCAQMD policy for CEQA significance determination, the analysis will focus on an exposure duration for 70 years for residents when estimating exposure to carcinogens. The "70-year" scenario recommended by OEHHA's Air Toxics "Hot Spots" program is often used for permitting purposes. Use of an exposure

duration of 70 years will provide estimates of potential cancer risks that are in the upper range of those possible. This exposure duration will be combined with assumptions that residents spend 24 hours a day outside at their residences 350 days per year for their entire lives. The assessment does not account for days away at day care, school, work, recreation or other myriad common activities. The assessment also does not account for time spent indoors, where concentrations of TACs released to ambient (outside) air are commonly lower.

The document also will present the health risk results assuming exposure durations of 9 years and 30 years for carcinogenic effects, as recommended by OEHHA's Air Toxics "Hot Spots" program. According to USEPA (1997b), an exposure duration of 30 years is about the 90th percentile for time spent at one residence. As such, a 30-year scenario is likely to provide a more accurate assessment of risks for the potential receptors than a 70-year scenario. The 30 year residence estimate will be compared with census data for the population residing within a 3-mile radius of the Airport to determine the current geographic mobility of the residents within the vicinity of the Airport. The 9-year scenario will provide more of an average estimate of risks. This risk estimate will provide some indication of the typical risks that people living in the vicinity of the Airport might experience. These additional exposure durations will be included in the uncertainties analysis (see Section 4.6, Uncertainties Associated with the Health Risk Analysis).

Exposure duration for estimating non-cancer hazards is assumed to be 9 years and applies only to children. Exposures to non-carcinogens are averaged only over the duration of exposure. The lower body weights of young children more than offset their somewhat lower inhalation rates, resulting in higher exposure estimates for these children that for adults in the same environment.

To evaluate potential carcinogenic effects, an age-adjusted method is used to take into account the differences in route-specific intake rates, body weights, and exposure duration for children and adults. The 70-year residential exposure duration for carcinogenic effects is a composite of exposure assumptions for nine years as a child and 61 years as an adult. These assumptions allow for the possibility that the 70 years an individual is assumed to live in the area may cover from childhood to adulthood. Regulatory guidance recommends this age-adjusted approach (USEPA 1991, Cal/EPA 1992, 1994). The lower body weights in this age-adjusted approach will generally lead to higher exposure estimates. A second 70-year scenario will be analyzed, based on adult parameters only for the entire period, at residential and school sites consistent with SCAQMD health risk assessment guidance (SCAQMD 2005a and 2005b).

School children are assumed to spend 7 years (i.e., ages 6 to 12 years old) in elementary school. These children are assumed to attend school from 8:00 a.m. to 2:00 p.m. (6 hours) each day, for 200 days per year. These assumptions are based on professional judgment, but reflect general knowledge of school hours and numbers of school days per year.

4.2.3.2 Body Weight

In accordance with USEPA guidance (1989), the value for body weight is the average weight of the receptor over the exposure period. For estimating potential exposures to the adult resident, a body weight of 63 kilograms (kg) will be used as recommended by Cal/EPA (2003). For estimating potential exposures to the worker, a body weight of 70 kilograms (kg) will be used as recommended by USEPA (1989, 1991) and Cal/EPA (2003).

The child resident (0 to 8 years of age) is assumed to have a body weight of 18 kg (Cal/EPA 2003). An average value of 31 kg was calculated for the elementary school child (6 to 12 years of age), based on the mean male and female body weights presented in one-year incremental age groups in USEPA guidance (1997b, 2000c).

4.2.3.3 Averaging Time

Consistent with USEPA guidance (USEPA 1989), averaging time for the assessment of chronic non-carcinogenic effects is equal to the exposure duration times 365 days per year. Carcinogenic exposures are averaged (amortized) over a lifetime. Thus, averaging time is the number of days in a 70-year lifetime, or 25,550 days.

4.2.3.4 Inhalation Pathway-specific Assumptions

The inhalation rate used to estimate an inhaled dose or intake for a given chemical is dependent on the activity level of the potential receptor. For this assessment, inhalation rates corresponding to OEHHA's high-end daily breathing rate (Cal/EPA 2003) for a 9-year exposure duration (581 liters per kilogram per day [L/kg-day]), will be used. The 80th percentile of exposure daily breathing rate of 302 L/kg-day will be used for 30-year and 70-year exposure duration calculations (SCAQMD 2005a and 2005b).

USEPA recommends inhalation rates for outdoor (off-site) workers for use in risk assessment of 1.1 m^3/hr for slow activities, 1.3 m^3/hr as an average, 1.5 m^3/hr for moderate activity and 2.5 m^3/hr for heavy activity (USEPA 1997b). OEHHA (Cal/EPA 2003) recommends using the average inhalation rate for outdoor workers. Therefore, a worker inhalation rate of 1.3 m^3/hr will be used in assessing exposures for outdoor workers. This rate is equivalent to a daily breathing rate of 149 L/kg-day for a 70 kg worker that works 8 hours per day.

For child residents, breathing rates for children in the birth to 9-year age group range from 4.5 m^3/day for infants to 10 m^3/day for 6 to 8 year olds. OEHHA's high-end daily breathing rate for the 9-year scenario is 581 L/kg day (2003). This value is equivalent to 10.5 m3/day and will represent the upper range of risks for assessment of exposure to young children.

An inhalation rate for an elementary school child (0.58 m^3/hr) is taken from recommendations by USEPA for male children ages 9 to 11 years old. This age group will provide a conservative estimate of inhalation rate for all children in the 6 to 13

year old age group. This inhalation rate is higher than that for children engaged in sedentary activities (0.4 m^3/hr) (USEPA 1997b) as is appropriate for children engaged mainly in indoor classroom activities, but with some relatively short periods of greater activity during lunch, recess or other non-classroom pursuits.

4.3 Dose-Response Assessment

Dose-response assessment (also referred to as the toxicity assessment) examines the potential for a chemical to cause adverse health effects in exposed individuals. It also presents the relationship between the magnitude of exposure and potential adverse effects. Toxicity values that can be used to estimate the likelihood of adverse effects occurring in humans at different exposure levels are identified as part of the dose-response task within the risk assessment process.

The hierarchy of sources of the toxicity values used in this assessment will be as follows:

1. Cal/EPA cancer unit risks and cancer potency factors, chronic reference exposure levels (RELs), and [acute RELs] (Cal/EPA 2005),

2. USEPA Integrated Risk Information System (IRIS) (USEPA 2005),

3. National Center for Environmental Assessment (NCEA 2000)

No toxicity factors outside of those obtained from the above sources will be sought or derived for this assessment. In past assessments performed for airports the most important toxic air pollutants were all common, relatively well-studied chemicals for which at least one, and often more than one, of the above sources provide toxicity criteria.

For purposes of this health risk analysis, Cal/EPA chronic RELs will be converted to reference doses (RfDs) using standard practice. Cal/EPA chronic RELs, in units of micrograms per m^3 ($\mu g/m^3$) can be converted to inhalation RfDs by dividing RELs by 70 kg (an assumed body weight) and a unit conversion factor of 1,000 $\mu g/mg$, and multiplying by 20 m^3/day (an assumed inhalation rate). The resulting RfD, in units of mg/kg-d, is then used in estimates of health hazards due to exposure to non-carcinogenic agents or carcinogenic agents with other potential health threats.

For evaluation of possible exposures to outdoor airport workers, California Occupational Safety and Health Administration (Cal/OSHA) established permissible exposure limits (PELs) (Cal/OSHA 2002) and United States OSHA established PELs (OSHA 2001) will be compared to concentrations of COPCs estimated within the site boundary as described in Section 4.4.4. These comparisons will provide the means of assessing impacts of occupational exposures to on-site airport workers.

4.4 Risk Characterization

Risk characterization is a two-step process. The first step combines and analyzes results of the exposure assessment and toxicity assessment in order to characterize the potential for adverse health effects to occur as a result of site-specific exposures. The second step of the process identifies the critical uncertainties in the estimated risks. This section presents the methods that will be used to estimate carcinogenic risks and non-carcinogenic hazards associated with off-site exposures to COPCs emitted from Airport operations. As stated previously, potential impacts to on-site workers will be evaluated by comparing site concentrations to Cal/OSHA and US/OSHA established Permissible Exposure Levels.

4.4.1 Carcinogenic Risks

Carcinogenic risks are estimated as the incremental probability that an individual will develop cancer over a lifetime as a direct result of exposure to potential carcinogens (USEPA 1989). The estimated risk is expressed as a unitless probability. The equation used to calculate the potential excess cancer risk for each carcinogenic chemical is:

$$Risk_i = C_i \times CF \times \frac{IR \times EF \times ED}{BW \times AT} \times CSF_i$$

Where:

$Risk_i$	=	Lifetime Excess Cancer Risk from exposure to chemicali
C_i	=	Annual Average Air Concentration for chemicali (µg/m3)
CF	=	Conversion Factor (1 mg/1000 µg)
IR	=	Inhalation Rate (m^3/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body weight (kg)
AT	=	Averaging Time (days)
CSF_i	=	Cancer Slope or Potency Factor (mg/kg-day)-1

An estimate of an individual's incremental excess cancer risk from potential exposure to multiple chemicals emitted from the Airport is then calculated by summing the chemical-specific excess cancer risks (i.e., Total risk = $\Sigma Risk_i$).

The OEHHA guidance (OEHHA 2003) has a similar formula that uses a daily breathing rate in L/kg-day, which combines the inhalation rate with the body weight. This formula is provided in Attachment F.

4.4.2 Chronic Non-carcinogenic Hazards

For COPCs that are not classified as carcinogens and for those carcinogens known to cause adverse health effects in addition to cancer, the potential for exposure to result in non-carcinogenic effects is evaluated by comparing the estimated daily dose to the

chemical-specific non-cancer reference dose (RfD). The non-cancer RfD represents the average daily exposure concentrations at (or below) which no adverse health effects are anticipated. When calculated for a single chemical, the comparison yields a ratio termed a hazard quotient. To evaluate the potential for non-carcinogenic adverse health effects from simultaneous exposure to multiple chemicals, hazard quotients for all chemicals that affect the same target organs are summed yielding hazard indices.

Equations used to calculate the chemical-specific hazard quotients and the overall hazard index are:

$$HQ_i = \frac{C_i \times CF \times \frac{IR \times EF \times ED}{BW \times AT}}{RfD_i}$$

$$HI = \Sigma HQ_i$$

Where:

HI	=	Hazard Index
HQ_i	=	Hazard Quotient for chemical$_i$
C_i	=	Average Daily Air Concentration for chemical$_i$ ($\mu g/m^3$)
CF	=	Conversion Factor (1 mg/1000 µg)
IR	=	Inhalation Rate (m^3/day)
EF	=	Exposure Frequency (days/year)
ED	=	Exposure Duration (years)
BW	=	Body weight (kg)
AT	=	Averaging Time (days)
RfD_i	=	Non-cancer Chronic Reference Dose for chemical$_i$ (mg/kg-day)

Again, OEHHA guidance (OEHHA 2003) uses a similar formula; however, it uses a daily breathing rate in L/kg-day, which combines the inhalation rate with body weight. This formula is presented in Attachment F.

4.4.3 Acute Effects

The potential for acute effects will be evaluated by a simple comparison of estimates of one-hour maximum concentrations with acute RELs developed by Cal/EPA (2005). Acute hazard quotients will be estimated for those chemicals for which an REL is available. The equation used to calculate acute hazard quotients is as follows:

$$HQ_i = \frac{C_i}{REL_i}$$

Where:

HQ_i = Acute Hazard Quotient for chemical$_i$

C_i = One-Hour Maximum Air Concentration for chemical$_i$ ($\mu g/m^3$)
REL_i = Acute Non-cancer Reference Exposure Level for chemical$_i$ ($\mu g/m^3$)

4.4.4 On-site Occupational Risk

Potential impacts to on-site workers will be evaluated by comparing estimated exposure concentrations to benchmarks established by the California Occupational Safety and Health Administration (Cal/OSHA) and the U.S. Occupational Safety and Health Administration (US/OSHA). Both Cal/OSHA and US/OSHA have established chemical-specific PELs at which no adverse effects are expected. The more stringent of these PELs will be used for the purposes of comparison to modeled on-site concentrations. Acute impacts from construction will also be analyzed.

4.5 Risk Characterization Results

USEPA and Cal/EPA guidelines will be described to aid in the interpretation of risk assessment results. The National Contingency Plan (NCP) (40 CFR § 300) is commonly cited as the basis for target risk and hazard levels. According to the NCP, lifetime incremental cancer risks posed by a site should not exceed one in a million (1×10^{-6}) to one hundred in a million (1×10^{-4}), and non-carcinogenic chemicals should not be present at levels expected to cause adverse health effects (i.e., hazard index [HI] greater than one). As a risk management policy, the Cal/EPA generally considers 1×10^{-6} to be a point of departure for purposes of making risk management decisions, with most approved remediation achieving incremental risk levels of ten in one million (1×10^{-5}). A public notification threshold of ten in one million (1×10^{-5}) is suggested in the California Air Pollution Control Officers Association (CAPCOA) Air Toxics "Hot Spots" Program Public Notification Guidelines (CAPCOA 1992). The California Safe Drinking Water and Toxic Enforcement Act considers 1×10^{-5} as a no significant risk level.

For purposes of the EIR, a significance threshold of an incremental cancer risk of ten in one million (1×10^{-5}) will be used in this HHRA for purposes of measuring risks to off-site residents, school children and off-site workers. This threshold is consistent with CAPCOA guidelines directed at toxic air pollutants, falls within the acceptable risk range used by USEPA, is also consistent with final remediation targets for other State of California statutes. The more stringent of Cal/OSHA or US/OSHA standards will be used as the significance threshold for on-site workers.

Also for purposes of the EIR, a hazard index significance threshold for non-cancer effects of an incremental hazard index of one (1) for any specific target organ system will be used in this HHRA for purposes of measuring non-cancer hazards to off-site residents, school children, and off-site workers. The threshold is therefore consistent with SCAQMD regulatory guidelines (Rule 1402) for assessing risks for existing facilities. Again, the more stringent of Cal/OSHA or US/OSHA standards will be used as the significance threshold for on-site workers.

4.6 Uncertainties Associated with the Health Risk Analysis

A number of uncertainties are inherent in estimates of potential carcinogenic risk and non-carcinogenic hazard indices presented in a risk assessment. These uncertainties are generally associated with assumptions, models, and extrapolations that comprise the risk assessment process. In particular, emissions estimates for aircraft engines are based on relatively few data from a subset of the engine types currently used in commercial aircraft. Sensitivity of risk and hazard estimates on emissions for some important chemicals identified in the risk assessment will be evaluated quantitatively. Based on past airport evaluations, chemicals such as acrolein, benzene, 1,3-butadiene, and diesel exhaust particulates are likely to be the most important contributors to potential human health risks. In particular, acrolein may account for essentially all non-cancer health threats estimated in the analyses. The range of possible emissions for acrolein and other important COPCs, based on available data, will be used to generate a range for on and off-site air concentrations, which in turn will be used to develop a range of possible risks and hazards. These analyses will aid in interpretation of potential health risks estimated in the assessment.

Other important uncertainties will also be included in the sensitivity analysis. For example, ranges of residence times (exposure durations) and inhalation rates may will be included in the sensitivity analysis to assist in interpretation of risk and hazard calculations. Risks will be calculated using exposure durations of 9 years and 30 years for all locations where risks and hazards are estimated based on an exposure duration of 70 years. These exposure durations (in addition to the 70-year scenario evaluated in the primary portion of the risk assessment) are recommended by OEHHA's Air Toxics "Hot Spots" program. The 9-year scenario reflects a child's exposure from ages 0 to 9 years old, and the 30-year scenario represents a high-end estimate of residence time. According to USEPA (1997b), the 30-year residential scenario represents about the 90th percentile for time spent at one residence.

Quantitative risk and hazard estimates will be calculated for approximately 20 off-airport locations. These locations will be selected to reflect the range of land use and the areas of maximum potential impacts to air quality. Some locations will also be chosen to reflect potential risk and hazards in all directions from the airport to provide a better overall reflection of impacts to communities in the airport vicinity.

Note that no attempt will be made to develop a full probabilistic risk assessment using Monte Carlo techniques. Such an analysis would be beyond the scope of what is essential and useful for the health risk assessment currently contemplated.

Uncertainties not included in the sensitivity analysis will be evaluated qualitatively and described. Examples could include uncertainties in assumptions made about future land use, passenger and freight demand at the Airport, the influence of other sources of toxic air pollutants in the greater Long Beach area, air dispersion modeling in general and exposure assumptions for other parameters.

The intent of the quantitative and qualitative uncertainty analyses will be to establish a level of confidence in the results of the HHRA analysis. These results will aid in decisions concerning future airport development, operations, and mitigation strategies.

Section 5
Significance Thresholds

The CEQA significance thresholds for the air quality impact analysis and human health risk assessment have been developed by SCAQMD as part of its CEQA Air Quality Handbook (SCAQMD 1993) and are presented in Table 5-1. In addition, all National Ambient Air Quality Standards (NAAQS) and California Ambient Air Quality Standards (CAAQS) are presented in Table 5-2.

Table 5-1
SCAQMD Air Quality and Health Risk Significance Thresholds

Daily Mass Thresholds		
Pollutant	**Construction**	**Operation**
Oxides of Nitrogen (NOx)	100 lbs/day	55 lbs/day
Volatile Organic Compounds (VOC)	75 lbs/day	55 lbs/day
Respirable Particulate Matter (PM10)	150 lbs/day	150 lbs/day
Sulfur Oxides (Sox)	150 lbs/day	150 lbs/day
Carbon Monoxide (CO)	550 lbs/day	550 lbs/day
Lead (Pb)	3 lbs/day	3 lbs/day
Toxic Air Contaminants (TACs)		
TACs (including carcinogens and non-carcinogens)	Maximum Incremental Cancer Risk ≥ 10 in 1 million	
	Hazard Index ≥ 1.0 (project increment) for any specific target organ system	
Ambient Air Quality for Criteria Pollutants [a.]		
Nitrogen Dioxide (NO_2) [b.]	0.25 ppm 1-Hour Average CAAQS	
	0.053 ppm Annual Average NAAQS	
Respirable Particulate Matter (PM10)	10.4 $\mu g/m^3$ 24-Hour Average – Construction [c.]	
	2.5 $\mu g/m^3$ 24-Hour Average – Operations	
	20 $\mu g/m^3$ Annual Arithmetic Average – All	
Carbon Monoxide (CO) [b.]	20 ppm 1-Hour Average CAAQS	
	9.0 ppm 8-Hour Average CAAQS & NAAQS	

Source: SCAQMD (1993).
Notes for Table 5-1:
a. - Ambient air quality thresholds for criteria pollutants based on SCAQMD Rule 1303, Table A-2 unless otherwise stated.
b. - SCAQMD is in attainment; project is significant if it causes or contributes to an exceedance of the attainment standards listed.
c. - Ambient air quality threshold based on SCAQMD Rule 403.
lbs/day = pounds per day.
ppm = parts per million by volume.
$\mu g/m^3$ = micrograms per cubic meter.

Table 5-2
National and California Ambient Air Quality Standards

Pollutant	Averaging Time	CAAQS [a.]	NAAQS Primary [b.,c.]	NAAQS Secondary [b.,d.]
Ozone (O_3)	1 Hour	0.09 ppm (180 μg/m^3)	None [e.]	None [e.]
	8 Hour	0.070 ppm [f.] (137 μg/m^3)	0.08 ppm (157 μg/m^3)	Same as Primary
Carbon Monoxide (CO)	1 Hour	9.0 ppm (10 mg/m^3)	9 ppm (10 mg/m^3)	None
	8 Hour	20 ppm (23 mg/m^3)	35 ppm (40 mg/m^3)	None
Nitrogen Dioxide (NO_2)	1 Hour	0.25 ppm (470 μg/m^3)	None	None
	AAM	None	0.053 ppm (100 μg/m^3)	Same as Primary
Sulfur Dioxide (SO_2)	1 Hour	0.25 ppm (655 μg/m^3)	None	None
	3 Hour	None	None	0.5 ppm 1300 μg/m^3)
	24 Hour	0.04 ppm (105 μg/m^3)	0.14 ppm (365 μg/m^3)	None
	AAM	None	0.030 ppm (80 μg/m^3)	None
Respirable Particulate Matter (PM10)	24 Hour	50 μg/m^3	150 μg/m^3	Same as Primary
	AAM	20 μg/m^3	50 μg/m^3	Same as Primary
Fine Particulate Matter (PM2.5)	24 Hour	None	65 μg/m^3	Same as Primary
	AAM	12 μg/m^3	15 μg/m^3	Same as Primary
Lead (Pb) [g.]	30 Day	1.5 μg/m^3	None	None
	Quarter	None	1.5 μg/m^3	Same as Primary
Sulfates	24 Hour	25 μg/m^3	None	None
Hydrogen Sulfide (H_2S)	1 Hour	0.03 ppm (42 μg/m^3)	None	None
Vinyl Chloride [g.]	24 Hour	0.01 ppm (26 μg/m^3)	None	None
Visibility Reducing Particles	8 Hour	Extinction Coeff of 0.23/km – visibility of >10 mi due to particles when RH <70%	None	None

Source: CARB 2005.
Notes for Table 5-2:
a. – CAAQS for ozone, carbon monoxide, sulfur dioxide (1 and 24 hour), nitrogen dioxide, respirable and fine particulate matter, and visibility reducing particles, are values that are not to be exceeded. All others are not be equaled or exceeded. CAAQS are listed in the Table of Standards in Section 70200 of Title 17 of the California Code of Regulations.
b. – NAAQS (other than ozone, particulate matter, and those based on annual averages or annual arithmetic mean) are not to be exceeded more than once per year. The ozone standard is attained when the fourth highest eight-hour concentration in a year, averaged over three years, is equal to or less than the standard. For PM10, the 24-hour standard is attained when the expected number of days per calendar year with a 24-hour average concentration above 150 μg/m^3 is equal to or less than one. For PM2.5, the 24-hour standard is attained when 98

percent of the daily concentrations, averaged over three years, are equal to or less than the standard.

c. – National Primary Standards – The levels of air quality necessary, with an adequate margin of safety, to protect the public health.

d. – National Secondary Standards – The levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.

e. – The one-hour ozone NAAQS was rescinded on June 15, 2005.

f. – This concentration was approved by CARB on April 28, 2005 and is expected to become effective in early 2006.

g. – CARB has identified lead and vinyl chloride as 'toxic air contaminants' with no threshold level of exposure for adverse health effects determined. These actions allow for the implementation of control measures at levels below the ambient concentrations specified for these pollutants.

ppm = parts per million by volume.

$\mu g/m^3$ = micrograms per cubic meter.

RH = relative humidity.

Section 6
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Attachment A

Notice of Preparation

NOTICE OF PREPARATION AND SCOPING

Date: April 14, 2005

Project Title: Long Beach Airport Terminal Improvement Project

Project Proponent/Lead Agency: City of Long Beach

The City of Long Beach ("City") is the owner and operator of Long Beach Airport ("LGB" or "Airport"). The City has determined that it will prepare an Environmental Impact Report ("EIR") in connection with the consideration by the City Council of development of terminal improvements at the Airport (the "project" or the "proposed project"). The proposed project is described more specifically below.

An initial study has been prepared and is attached to this notice or is available for public review at the Airport offices at the location provided below. The City is the lead agency for the project and will prepare the EIR under the terms and requirements of the California Environmental Quality Act ("CEQA") (Pub.Res.Code §§21000, *et seq.*), and the implementing "guidelines" ("Guidelines") (14 Cal.Code Regs. §§15000, *et seq.*).

The purpose of this notice is: (1) to serve as the Notice of Preparation ("NOP") to potential "Responsible Agencies" required by section 15082 of the CEQA Guidelines; and (2) to advise and solicit comments and suggestions regarding the preparation of the EIR, environmental issues to be addressed in the EIR, and any related issues from interested parties other than potential "Responsible Agencies," including interested or affected members of the public. The City requests that any potential Responsible or Trustee Agency responding to this notice do so in a manner consistent with CEQA Guidelines section 15082(b).

An initial NOP was circulated for agency and public comment on September 22, 2003. Scoping meetings were also held in October 2003. Additionally, the Airport Advisory Commission held 15 meetings from November 2003 through July 2004 to help define the scope of the project. This NOP informs agencies and the community of modifications that have been made to the proposed project as a result of the scoping process held in connection with the initial NOP circulated for public comment in September 2003, and provides another opportunity for input on the issues to be addressed in the EIR. The EIR will include copies of all of the comments received in response to the September 2003 NOP and at the October 2003 scoping meetings, as well as comments received as part of the current (2005) NOP process. In addition, the EIR will address, to the extent possible, issues raised during both of the NOP public comment processes (2003 and 2005).

Pursuant to CEQA section 21080.4, Responsible Agencies must submit any comments in response to this notice not later than thirty (30) days after receipt. The City will accept comments from others regarding this notice through the close of business, May 16, 2005.

ALL COMMENTS OR OTHER RESPONSES TO THIS NOTICE SHOULD BE SUBMITTED IN WRITING TO:

Ms. Angela Reynolds, Environmental Officer
Planning and Building
City of Long Beach
333 West Ocean Boulevard
Long Beach, CA 90802

IN ADDITION, the City will accept responses to this notice by e-mail received through the close of business, **May 16, 2005**. If e-mail comments are submitted with attachments, any attachments should be delivered separately, in writing, and in person or by regular mail, to the address specified above. The virus protection measures of the City's e-mail system, and the variety of potential formats for attachments, limits the ability for the attachments to be delivered by e-mail. Responses to this notice may be sent to: **airporteir@longbeach.gov.** The web site contains directions on how to provide comments via e-mail.

PUBLIC SCOPING MEETINGS

Public scoping meetings for the proposed Airport Terminal Improvement Project will be held on April 28 and May 7, 2005. The meetings will be held in the Energy Department Auditorium, located at 2400 Spring Street, Long Beach. The Thursday, April 28th, meeting will be held from 6:00 p.m. to 9:00 p.m. The meeting on Saturday, May 7th, will be held from 10:00 a.m. to 1:00 p.m. The purpose of the scoping meetings is to obtain input from the public on the issues to be addressed in the EIR. The technical studies have not been completed; therefore, no technical data will be available for distribution at the meeting. A brief presentation on the project will be provided at the beginning of the meeting, after which the representatives of the consultant team will provide an overview of the technical studies that will be prepared. There will also be the opportunity to provide formal comments at the meeting either verbally or in writing. A stenographer will prepare a transcript of the meeting, which will become part of the administrative record.

INITIAL STUDY

LONG BEACH AIRPORT
TERMINAL IMPROVEMENT PROJECT

CITY OF LONG BEACH
333 West Ocean Boulevard
Long Beach, CA 90802
Phone: 562-570-6555

April 14, 2005

Glossary[1] and Acronym List

GLOSSARY

Air Carrier – A scheduled carrier, certificated under Federal Aviation Regulations ("FAR") Parts 121, 125, or 135, operating aircraft having a certificated maximum takeoff weight of seventy-five thousand (75,000) pounds or more, transporting passengers or cargo.

California Noise Standards – The Noise Standards for California Airports, as set forth in 21 California Code of Regulations, Sections 5000, *et seq*. Unless otherwise stated, the terms used in this Chapter shall have the same meanings as set forth in the Noise Standards.

Charter operation – A revenue producing takeoff or landing, operated by a person or entity that is neither an Air Carrier nor a Commuter Carrier, using an aircraft having a certificated maximum takeoff weight of seventy-five thousand (75,000) pounds or more and transporting passengers or cargo.

Commuter and commuter carrier – A scheduled carrier, certificated under FAR Part 121 or 135, operating aircraft having a certificated maximum takeoff weight less than seventy-five thousand (75,000) pounds and transporting passengers or cargo.

Flight – One arrival and one departure by an aircraft.

Freight – Goods to be sent as air cargo.

General aviation – Aviation activity other than operations by Air Carriers, Commuter Carriers, Industrial operators, Charter operators, and "public" (i.e., government owned) aircraft.

Industrial Operation – One takeoff or one landing of an aircraft having a certificated maximum gross takeoff weight of seventy-five thousand (75,000) pounds or more for purposes of production, testing, remanufacturing, or delivery by or under the control of a manufacturer based at the Airport. This definition does not include flights into or out of Long Beach for purposes of maintenance, retrofit, or repair.

Operation – A takeoff or a landing of an aircraft at the Airport.

[1] Definitions, with the exception of freight, are from the adopted Noise Ordinance – Chapter 16.43 of the Municipal Code

ACRONYM LIST

AAC	Airport Advisory Commission
ANCA	Airport Noise and Capacity Act
ANOMS	Airport Noise and Operations Monitoring System
ARB	Air Resources Board
ATSA	Aviation and Transportation Security Act
BMPs	Best Management Practices
CEQA	California Environmental Quality Act
CDMG	California Division of Mines and Geology
CNEL	Community Noise Equivalent Level
EDS	Explosives Detection System
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
ETD	Explosives Trace Detection
FAA	Federal Aviation Administration
FAR	Federal Aviation Regulation
GANC	General Aviation Noise Committee
LGB	Long Beach Airport
MAP	Million Annual Passengers
MEI	Maximum Exposed Individuals
ND	Negative Declaration
NPDES	National Pollutant Discharge Elimination System
RON	Remaining Overnight
RWQCB	Regional Water Quality Control Board
SEIR	Supplemental Environmental Impact Report
SENEL	Single Event Noise Exposure Levels
TSA	Transportation Security Administration

1.0 Introduction

An Initial Study ("IS") has been prepared to evaluate the potential for the proposed Long Beach Airport Terminal Improvement Project ("project" or "proposed project") to result in significant environmental impacts consistent with the requirements of the California Environmental Quality Act ("CEQA") (Pub. Res. Code §§21000, *et seq.*), and the implementing CEQA guidelines (14 Cal. Code Regs. §§15000, *et seq.*) ("Guidelines"). The proposed project may result in potentially significant environmental impacts. For that reason, and as discussed below, an Environmental Impact Report ("EIR") will be prepared for the proposed project.

1.1 Project Summary and Overview

The proposed project would provide improvements to the existing terminal and related facilities at LGB in order to accommodate recent increases in flight activity at the Airport as well as increases which may occur in the future consistent with operational limitations of the Airport Noise Compatibility Ordinance and the 1995 Settlement Agreement. The proposed project includes construction of, or alteration to facilities in the thirteen areas listed and described below:

- Holdrooms
- Concession Area
- Passenger Security Screening
- Baggage Security Screening
- Baggage Claim Devices
- Baggage Service Office
- Restrooms
- Office Space
- Ticketing Facilities
- Airline Gates
- Aircraft Parking Positions
- Vehicular Parking
- Traffic and Pedestrian Circulation

In addition, the EIR will address the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft and still be within the noise limits (“noise bucket”) permitted by the Airport Noise Compatibility Ordinance.

1.2 Purpose of This Initial Study

This Notice of Preparation ("NOP") and IS have been prepared in accordance with the requirements of CEQA to evaluate the potential for the proposed project to result in significant environmental impacts. As described in Section 15063 of the CEQA Guidelines, an IS can be used to:

1. Provide a preliminary analysis of potential project-specific and cumulative environmental effects of a proposed project; and

2. Identify environmental issue areas where the proposed project may have the potential to result in significant impacts that should be evaluated in a project-specific EIR.

1.3 Anticipated Project Approvals

The City of Long Beach ("City") is the lead agency for the proposed project. This EIR will serve as the environmental analysis for the project, permitting full consideration by the City of possible terminal improvements at the Airport, and, if approved, construction of the terminal. The City would be responsible for the following approvals as a condition of project implementation:

- Cultural Heritage Committee Review
- Certification of the EIR by the City Planning Commission
- Project selection by the City Council

After certification of the EIR and selection and approval of a project, and after preparation of development plans, the project would be subject to Site Plan Review by the Planning Commission for a height variance due to the anticipated height of the parking structure.

1.4 Anticipated Schedule

The project schedule, as currently envisioned, anticipates a draft EIR to be available for public review in Fall 2005. A forty-five (45) day public review period will be provided, after which responses to comments received on the draft EIR will be prepared. Hearings on the project are anticipated in Fall 2005/Winter 2006, with the Planning Commission taking action on the project shortly thereafter.

1.5 Probable Environmental Effects of the Proposed Project

Until the EIR analysis is completed, it is not possible to identify with precision the "probable environmental effects of the proposed project." However, the City has performed an IS, a copy of which is attached to this notice, to identify the potential adverse environmental effects of the proposed project that the City believes require further and more detailed analysis in the EIR. The City has identified the following specific topics as requiring detailed EIR analysis:

- Aesthetics
- Air Quality
- Cultural Resources
- Hazards and Hazardous Materials
- Health Risk Assessment
- Land Use and Planning
- Noise
- Public Services
- Transportation

Based on the IS, the proposed project would not result in any potentially significant effects with the following areas, and they do not require further analysis in the EIR:

- Agriculture
- Biological Resources
- Geology and Soils
- Hydrology and Water Quality
- Mineral Resources
- Population and Housing
- Recreation
- Utilities and Service Systems

1.6 Conclusion

The City requests your careful review and consideration of this IS, and invites any and all input and comments from interested agencies and persons regarding the issues to be addressed in the draft EIR.

2.0 Project Background And Regulatory Setting

2.1 Regulatory Setting

In 1981, the City of Long Beach adopted a noise control ordinance affecting LGB that limited the number of air carrier flights at the Airport to 15 flights per day and required the use of quieter aircraft. The purpose of the ordinance was to reduce the "cumulative" noise generated by the Airport. The ordinance was challenged by the commercial airlines in federal court. Following an injunction by the court, the City formed a task force and prepared an Airport Noise Compatibility Program, pursuant to Federal Aviation Administration ("FAA") regulations. The task force recommended allowing air carrier flights to increase to 41 daily flights provided certain noise limits could be met.

In 1986, the City adopted a second aircraft noise ordinance that established noise limits and restricted the number of air carrier operations to 32 flights per day[2]. The federal court rejected this ordinance, finding that the limitation on the number of flights was too restrictive. The federal court ultimately ordered the City to permit a minimum of 41 commercial air carrier flights and 25 commuter flights per day. The City appealed the federal court's order; however, in January 1992, the Ninth Circuit Court of Appeals upheld the trial court's decision.

In an effort to resolve the protracted litigation, the City and the airlines entered into a stipulated settlement agreement. In February 1995, the City of Long Beach City Council certified Negative Declaration (ND-19-94), which analyzed the proposed settlement of long-standing airport noise litigation between the City of Long Beach and a number of air carriers and other users of the Long Beach Municipal Airport titled *Alaska Airlines et al v. City of Long Beach*. Under the settlement, the City Council would adopt a new Airport Noise Compatibility Ordinance (see Section 2.2 for a summary of the settlement provisions. For the period from adoption of the new ordinance through 2001, no party to the settlement would be allowed to challenge the ordinance, and the City would not be allowed to amend the Airport Noise Compatibility Ordinance so as to make it more restrictive on aircraft operations. The court approved the settlement and entered a final judgment on June 13, 1995.

As a result of the settlement, the City enacted Chapter 16.43 of the Municipal Code. Chapter 16.43 permits air carriers to operate a minimum of 41 airline flights per day while commuter carriers are permitted to operate a minimum of 25 flights per day. There are provisions in the Airport Noise Compatibility Ordinance allowing the number of flights to be increased if the air carrier flights and commuter flights operate below their respective Community Noise Equivalent Level ("CNEL") limits[3].

In 1990, while the City's appeal to the Ninth Circuit Court of Appeals was pending, Congress passed the *Airport Noise and Capacity Act* ("ANCA"), which limited an airport operator's right to

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[2] To provide CEQA compliance for the noise ordinance, the City of Long Beach certified the Final Environmental Impact Report (EIR-45-85/EIS-82-85) for the Airport Noise Compatibility Program FAR Part 150 Study at Long Beach Airport (SCH No. 86012911).

[3] The Noise Compatibility Ordinance can be viewed at the Airport web site at www.lgb.org.

control Stage 3 aircraft[4]. ANCA's specific objective was to stop local municipalities from imposing new restrictions on aircraft operations without complying with significant procedural requirements and obtaining federal approval. Included within the ANCA legislation is a "grandfather" provision, which permits the City to continue to enforce the flight and noise restrictions that are contained in the Airport Noise Compatibility Ordinance (Chapter 16.43). In May 2003, the FAA reaffirmed the "grandfather" status of the Airport Noise Compatibility Ordinance under ANCA.

2.2 Summary of the Principal Terms of the Existing Settlement Stipulation

As indicated in Section 2.1, the settlement agreement provisions were incorporated into the City's Airport Noise Compatibility Ordinance. The principal terms of the settlement reached in May 1995 and approved in June 1995 by Federal District Court, include the following:

1. Provide flight activity limits at the Airport of 41 daily airline flights and 25 daily commuter flights, assumed to be all Stage 3 aircraft;

2. Provide an increase in the flight activity limits only if the City determines that flights can be added without airlines or commuters exceeding their allocated portion of the CNEL noise budget based on baseline year of 1989 to 1990;

3. Require flight activity of general aviation, charter, and manufacturing operations to stay within their portion of the baseline year CNEL budget;

4. Require monitoring of Single Event Noise Exposure Levels ("SENEL") at the 18 monitoring stations provided by the Airport Noise and Operations Monitoring System ("ANOMS");

5. Provide for SENEL limits that are more stringent during 6:00 a.m. to 7:00 a.m., 10:00 p.m. to 11:00 p.m., and very stringent during 11:00 p.m. to 6:00 a.m.;

6. Provide limitations on hours of training and run ups, including early curtailment on weekends and holidays, and all but one runway closed during late night hours;

7. Require the formation of a General Aviation Noise Committee ("GANC") and require GANC to monitor and manage the general aviation noise budget;

8. Require implementation of a noise abatement program with a multi-step violation process that includes notifications, noise abatement plans, administrative penalties and possible criminal prosecution; and

9. Require the creation of pilot education programs and processes.

2.3 Transportation Security Administration

On November 19, 2001, the President of the United States signed into law the Aviation and Transportation Security Act ("ATSA"), which, among other things, established the new Transportation Security Administration ("TSA") within the Department of Transportation. This Act established a series of challenging but critically important milestones toward achieving a secure air travel system.

[4] A "Stage 3 airplane" means an airplane that has been shown to comply with Stage 3 noise levels prescribed in FAR Part 36, Appendix C.

The TSA is directly responsible for developing increased air travel security programs. They have developed enhanced screening procedures at airports across the country. For example, each passenger must go through two stages of screening known as baggage checkpoints and passenger checkpoints, described below. Some passengers may go through an additional stage of screening, gate screening.

As of January 1, 2003, TSA began screening 100 percent of checked baggage at all 429 commercial airports across the United States. Several methods are being used to screen the checked baggage. The most common methods involve electronic screening either by an Explosives Detection System ("EDS") or Explosives Trace Detection ("ETD") device. The EDS machines are the large machines that can be over 20 feet long and weigh up to three tons. Currently, TSA uses ETD equipment to screen baggage at the airport. However, it is likely that in-line EDS equipment will be installed in the future.

The passenger checkpoint includes three primary steps: (1) all carry-on baggage must be placed on the belt of the X-ray machine; and (2) all passengers must walk through a metal detector. If an alarm is set off, the passenger will undergo a secondary screening; and (3) secondary screening includes a hand-wand inspection in conjunction with a pat-down inspection, as well as hand search of all carry on luggage.

The ultimate goal of the TSA is to create an atmosphere that aligns with the passenger's need to be secure while ensuring freedom of movement for people and commerce. Their mission is to protect our nation's transportation systems – aviation, waterways, rails, highways, and public transit.

2.4 Project Background

In June 2003, the City of Long Beach approved a scope of work for the preparation of an EIR to analyze the potential environmental impacts of possible improvements to the Airport's terminal area to accommodate passenger and cargo activity provided for under the existing Airport Noise Compatibility Ordinance. The project would also provide for required provisions for new security measures. The approved scope provided an opportunity for the City Council to reevaluate the scope of work, after the project scoping process was complete, to ensure the issues raised during the scoping process that were associated with the proposed improvements would be adequately addressed in the EIR.

The City held scoping meetings to solicit public input on October 11 and October 16, 2003. Approximately 100 people attended the Saturday (October 11th) scoping meeting and approximately 200 people attended the Thursday (October 16th) scoping meeting. In addition, the City received 217 responses to the NOP (a combination of letters, postcards, and emails). The key issues raised through the scoping process were flight operations, air quality, health risk, noise, cumulative impacts, and land value. Recognizing the intense public interest, the City Council referred the scope of project and the scope of the EIR to the Airport Advisory Commission ("AAC") for consideration.

The AAC held a series of meetings, open to the public, from November 2003 through July 2004 to consider recommendations on possible airport improvements and to advise on certain issues regarding scoping of the EIR. The AAC made recommendations regarding the project and technical studies to be prepared for the EIR. The City Council considered these recommendations on February 1 and February 8, 2005. As a result of this process, changes were made to the improvements that would constitute the proposed project and be addressed in the EIR The original 2003 scope of work focused just on impacts associated with construction of the facilities (i.e., a "bricks and mortar" project). Key changes to the EIR scope of work, as a

result of the AAC process and City Council action, include providing a health risk assessment and providing a discussion of the environmental impacts associated with the operational environment at the Airport that could be accommodated within the existing Airport Noise Compatibility Ordinance. While the project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport, it was determined that the EIR should assess the impacts associated with the introduction of 25 commuter flights that could be accommodated at the Airport under the existing terms of the Airport Noise Compatibility Ordinance, even though these operations do not currently occur at the Airport.

The EIR will also address the impacts associated with up to 52 commercial flights. This is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft, and still be within the noise limits ("noise bucket") permitted by the Airport Noise Compatibility Ordinance[5]. Both the addition of 25 commuter flights at the Airport and the potential increase of up to 11 commercial flights over current operational levels at the Airport (which are the minimum number of commercial flights allowed by the Airport Noise Compatibility Ordinance) are not causally related to the project proposed facilities improvements, and any impacts would be applicable to all alternatives, including the No Project Alternative, because they could occur without any project-proposed improvements. If they occur, they will result from carrier decisions to optimize flight operations under the Airport Noise Compatibility Ordinance, rather than the availability of specific terminal facilities.

3.0 Environmental Setting

3.1 Local and Regional Setting

The project would be implemented at Long Beach Airport in the City of Long Beach, Los Angeles County. The Airport is located on approximately 1,166 acres in central Long Beach. The street address for the Airport is 4100 East Donald Douglas Drive, Long Beach, California 90808. Aviation activities are located just north of Interstate-405 ("I-405") and generally bound by Cherry Avenue to the west, City of Lakewood and the future Douglas Park project to the north, and Lakewood Boulevard to the east. A regional vicinity map and a site location map are provided as Exhibits 1 and 2, respectively.

3.2 Project Site and Surrounding Uses

Presently, LGB covers 1,166 acres and has five (5) runways, the longest being 10,000 feet. The Airport serves commercial carriers, general aviation, and air cargo. The area surrounding the Airport is generally urban in character. The layout of the existing facilities in the terminal area is provided in Exhibit 3.

Surrounding uses include existing Boeing property and industrial uses in City of Lakewood to the north. The City has approved a reuse plan titled "Douglas Park" for a portion of the Boeing property. That plan, which was approved in December 2004, provides for 261 acres of mixed-use development, including 3.3 million commercial and office space, 200,000 square feet of retail space, 1,400 residential units, 400 hotel rooms, and 11 acres of park. The Skylinks Golf Course and the Airport Business Park are located to the east, and industrial and commercial

[5] The permitted number of flights per day may be increased in each operator flight restriction category as long as the flights operate below the CNEL budgets. In order for the number of flights to be increased and still comply with the Noise Compatibility Ordinance the airlines would have to optimize their flight operations. This would include using quieter aircraft and reducing the number of late night operations. Under optimal conditions, which have never been achieved at LGB, the estimated number of increased flights would range between seven and 11 flights. The EIR will consider 11 flights as a worst-case scenario.

Regional Location

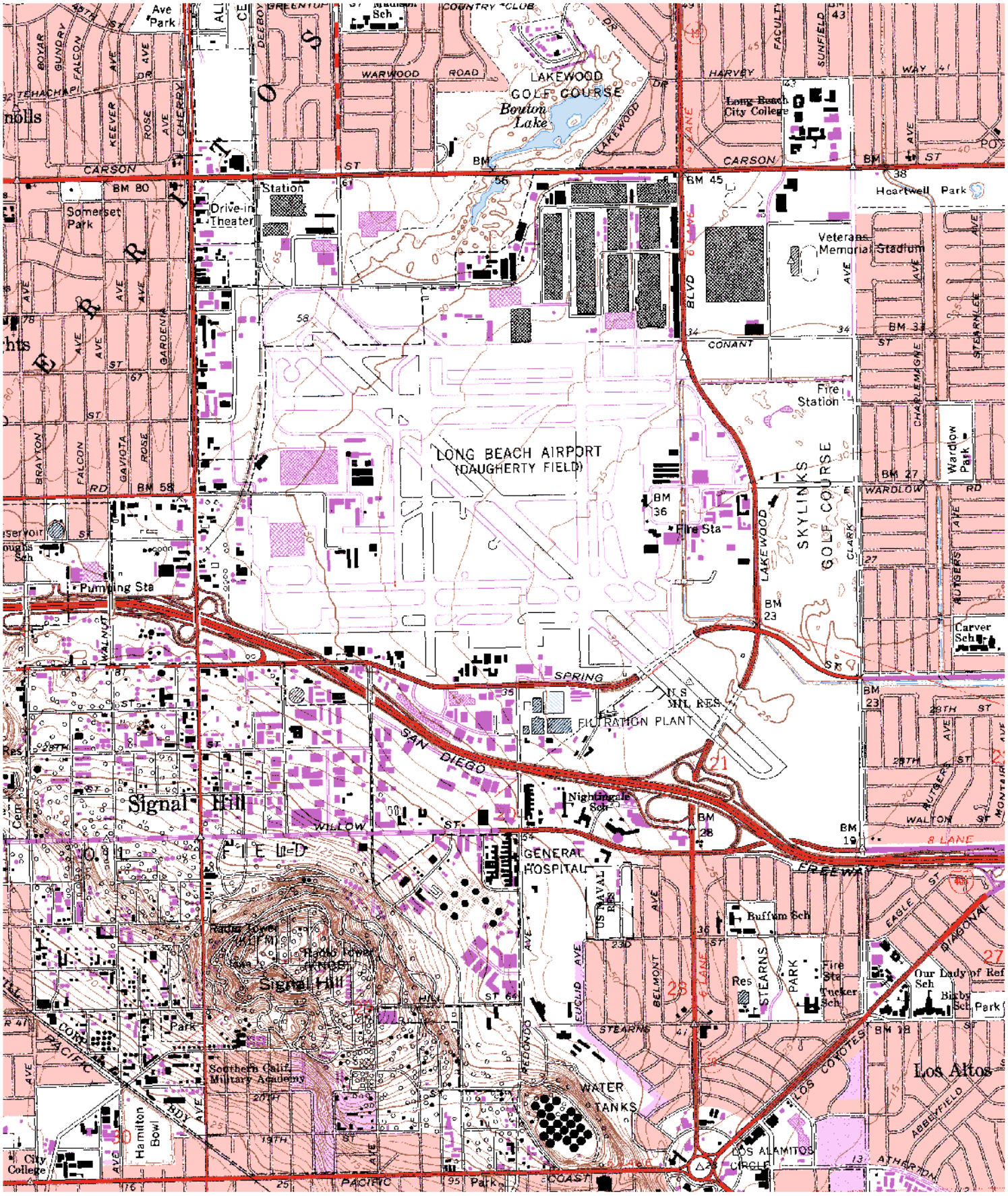
Exhibit 1

Long Beach Airport Terminal Improvements Project

10 5 0 10 Miles

BonTerra CONSULTING

S:/GIS_Exhibits/LBJ001_RL_082103.pdf



Source: USGS 7.5 Minute Long Beach Quadrangle, 1964

Local Vicinity

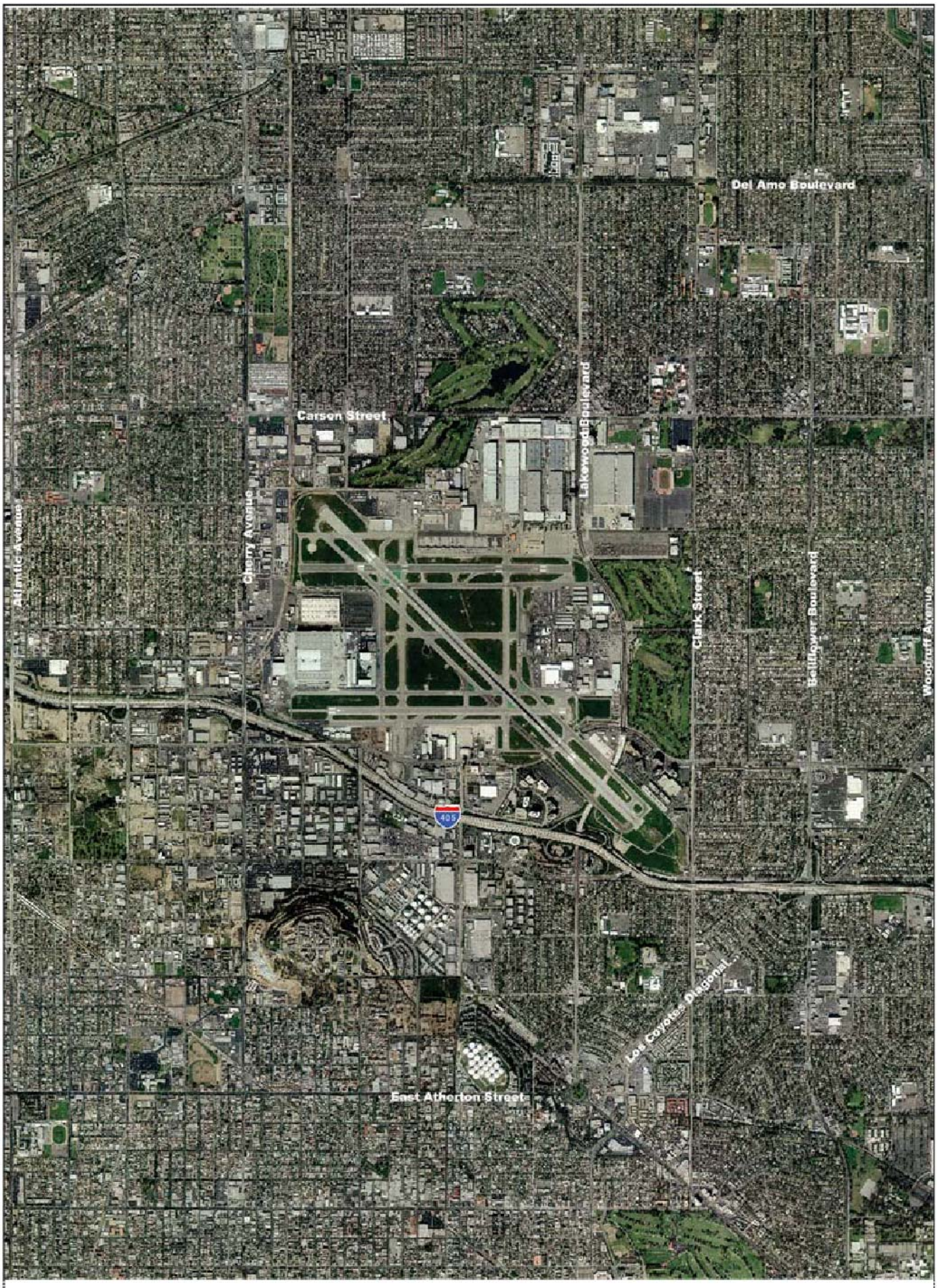
Exhibit 2

Long Beach Airport Terminal Improvements Project

1000 0 1000 2000 Feet

BonTerra CONSULTING

S:/GIS_Exhibits/LBJ001_LV_062503.pdf



Source: Aerials Express, 2003

Aerial Photograph

Exhibit 3

Long Beach Airport Terminal Improvements Project

2000 0 2000 Feet

Terra CONSULTING

uses to the south and west of the Airport. I-405 and several arterials surround the Airport; however, public access to the terminal area is gained only from Lakewood Boulevard on the east side of the Airport.

In 1941, the existing airport terminal was built to serve commercial carrier passengers. In 1984, a new concourse area and pre-boarding lounge were constructed immediately south of the existing terminal building. The 1984 improvements provided capacity for the City's 15 daily flights, better accessibility for patrons with disabilities, improved mobility in the passenger screening process, and improved ticketing and check-in processing of airport users.

Between August 2001 and 2004, the number of passengers increased from 600,000 annual passengers to almost 3,000,000 annual passengers. The facilities at the Airport were not designed to adequately accommodate this level of increased number of passengers. To help accommodate the growth, the Airport constructed two temporary holdrooms, temporary remote parking, and a new baggage claim area.

TSA started operations at LGB in October 2002 with the screening of passengers. On January 1, 2003, TSA initiated the screening of baggage at the Airport. They currently have 134 employees working at the Airport screening luggage and passengers. In addition, TSA currently has 17 ETD machines at the Airport for screening luggage and six stations for screening passengers.

4.0 Description of the Proposed Project

4.1 Physical Improvements

The proposed project provides improvements to the existing terminal and related facilities at LGB in order to accommodate recent increases in flight activity at the Airport as well as increases which may occur in the future consistent with operational limitations of the Airport Noise Compatibility Ordinance and the 1995 Settlement Agreement. The proposed project includes construction of, or alteration to, the 13 areas listed and described below:

- Holdrooms
- Concession Area
- Passenger Security Screening
- Baggage Security Screening
- Baggage Claim Devices
- Baggage Service Office
- Restrooms
- Office Space
- Ticketing Facilities
- Airline Gates
- Aircraft Parking Positions
- Vehicular Parking
- Traffic and Pedestrian Circulation

The anticipated improvements are described below in more detail; however, during final design, the precise size and configuration of the proposed improvements may vary to ensure compliance with the applicable fire and building codes and with refinement of planning data. The overall size of the terminal facilities would not exceed the square footage requirements discussed below. The terminal improvements are being designed to accommodate the 41 airline flights and 25 commuter flights, passengers associated with those flights, and security requirements imposed by TSA. This flight level is anticipated to result in approximately

3.8 million annual passengers ("MAP") being served at LGB. Considering all terminal improvements, the size of the terminal space would increase from 58,320 square feet to 102,850 square feet. The proposed improvements are discussed below and shown in Table 1. Table 1 also shows the proposed improvements in comparison to other alternatives that will be evaluated in the EIR.

Holdrooms

Currently, the airport holdrooms are comprised of both the permanent terminal building and temporary modular structures. As part of the proposed project, the 13,150 square feet of temporary holdroom would be replaced with 21,171 square feet of new permanent floor space in the terminal. This, combined with the existing approximately 6,500 square feet of permanent holdrooms, would result in a total of 27,671 square feet of holdroom to accommodate the existing and projected passenger levels. This is a net increase of 8,021 square feet. The square footage for the holdrooms may be split between two structures–north and south holdrooms, similar to what currently exists.

Concession Area

Expanded concession areas are proposed as an adjunct to the new holdroom areas and in the baggage claim area/public circulation areas to serve the anticipated number of passengers. Currently, there are 5,460 square feet of concessions at the Airport. The proposed project would add an additional 9,541 square feet for this purpose. This would result in a total of 15,001 square feet for concessions. If the holdroom area were split into two separate buildings, the square footage for the concessions would also be split.

Passenger Security Screening

The existing security screening of both passengers and baggage would be designed to meet the requirements of the TSA for serving the passengers resulting from the minimum number of flights allowed by the Airport Noise Compatibility Ordinance. Currently, there is 3,900 square feet of passenger security screen area. With the proposed project, there would be an additional 7,000 square feet devoted to passenger security screening or a total of 10,900 square feet. If the new holdroom square footage is split into two structures, this additionally required square footage for passenger security screening would also be split into two areas

Baggage Security Screening

Currently, the Airport does not provide any structure for conducting baggage screening. It has been done under a canopy outside the south holdroom area. The TSA has indicated that this situation is not sufficient because of the sensitivity of the equipment being used. The proposed project would provide a 7,000-square foot structure for security screening of baggage. This structure would house the explosive detection equipment, which includes an in-line baggage conveyor. This facility would need to be located between the terminal building and the aircraft parking positions.

Baggage Claim Devices

The Airport has 226 linear feet of passenger side baggage claim devices and 180 linear feet for airline loading. The proposed baggage claim area would provide a total of 510 linear feet for passenger side baggage claim and 310 linear feet for airline baggage loading, for a total of 820 linear feet of baggage claim device.

Baggage Service Office and Multi-purpose Room

The Airport does not have a baggage service office. The proposed project would allocate a total of 1,200 square feet for this use. This would be comprised of 900 square feet for a baggage service office and 300 square feet for a multi-purpose room. This area would provide a holding place for unclaimed bags, bags that were misdirected, or for reporting lost baggage. The multipurpose room provides on-site meeting space for shift briefings, training, and other meetings for airport and tenant staff whose job duties do not allow them to leave the terminal area.

Restrooms

Currently, the Airport has 1,330 square feet of restroom area in non-secure portions of the terminal. As part of the project, there would be an increase of 2,000 square feet in restrooms in non-secure area, for a total of 3,330 square feet of restroom area.

Office Space for Security, Airport, and Airline Support Staff

Office space, to serve the needs of the TSA, the airlines and airport administration, would be provided within the proposed terminal area. Request for space from the TSA and the airlines are 30,000, and 10,000 square feet, respectively. Though the project would not provide additional space at the requested levels, additional square footage to meet these needs, as well as those of airport staff, has been incorporated into the project. The office space would fall into three categories: TSA, Airlines Operation offices, and Airport administration office and conference area.

TSA currently occupies 3,600 square feet in a temporary modular building. This would be replaced with permanent facilities and augmented with an additional 1,591 square feet, for a total of 5,191 square feet.

Airlines operation offices are currently housed in 2,000 square feet within the terminal building. An additional 3,784 square feet would be allocated for this use, resulting in a total of 5,784 square feet.

Airport offices and conference areas would be increased from 6,970 square feet to 11,970 square feet.

Overall, combined office space (i.e., all three categories) at the terminal would increase 10,375 square feet from the current 12,570 square feet to 22,945 square feet.

Ticketing Facilities

Expansion of the existing ticketing facilities is also proposed to accommodate the existing demand at the Airport. The ticketing facilities can be broken into four categories: (1) ticket counter area; (2) ticket counter queuing area; (3) airline ticket office; and (4) circulation area for the ticketing area.

Ticket counter area is proposed to increase by 680 square feet from 1,250 to 1,930 square feet. Ticket counter queuing area is proposed to increase from 1,400 to 2,800 square feet. The airline ticket office area is proposed to increase by six percent. It would increase from 4,360 square feet to 4,603 square feet.

Circulation area for the ticketing counter area is proposed to increase by 4,100 square feet from 1,400 to 5,500 square feet. Overall, the combined space for ticketing operations (i.e., all four categories) at the terminal would increase 6,423 square feet from the current 8,410 square feet to 14,833 square feet.

Airline Gates

The Airport currently has eight aircraft gates for the boarding, loading and unloading of aircraft. With the proposed project this would be increased to 11 gates. At Long Beach Airport, the term "gates" is used to identify the doors in the holdrooms that are used for passenger boarding.

Aircraft Parking Positions

The Airport currently has 10 aircraft parking positions. The EIR will address increasing the number of aircraft parking positions from 10 to as many as 14 aircraft parking positions.

This increase would result in the take-back of property currently leased to Million Air and/or Gulfstream and the displacement of some general aviation parking on the Million Air leasehold and/or aircraft manufacturing facilities on the Gulfstream leasehold. Parking for the displaced aircraft would be provided elsewhere at the Airport.

Vehicular Parking

Vehicular parking at the Airport is available both onsite (surface lots and parking structure) and offsite in parking lots leased by the Airport from Boeing (Lot D). There are currently 2,835 permanent parking spaces at the Airport and 2,100 leased spaces. The leased spaces are leased on a month-to-month basis. The project proposes construction of a new parking structure which, combined with the existing parking structure and surface parking, would provide a total of 6,286 spaces. This would eliminate the need for the offsite leased parking spaces. The project would provide 1,351 spaces above the existing number of spaces currently available for airport use.

Improvements to the parking structure would include the construction of a new parking structure that would also result in onsite roadway modifications and architectural modifications to the existing parking structure. These modifications would include the following components:

a) A new parking structure designed for an estimated 4,000 spaces would be constructed east of the existing parking structure in the area currently used for surface parking. The precise number of parking spaces would be refined during the design of the structure. The structure's location would require the relocation of the east side of the Donald Douglas Drive loop. With the construction of the parking structure, the Airport parking spaces currently leased from Boeing and at Veteran's Stadium would no longer be needed for airport use. Approximately 1,000 parking spaces would be impacted during the construction of the parking structure.

b) Proposed modifications to the existing parking structure would include a new façade to match the new parking structure and complement the architecture of the Terminal Building. The façades of the Terminal Building and parking structures would provide a unified appearance and enhance the aesthetics of the terminal area and the terminal's identification as a Cultural Heritage Landmark. Other improvements include replacement of the existing elevator, modifications to the entrances and exits, and, constructed in and/or adjacent to the parking structure, offices for the parking

management company and offices and public counters for the car rental agencies along with vehicle preparation and ready return vehicle parking areas.

c) Proposed modifications to surface lots would include modified access points, refencing, restriping, signage, etc.

Traffic and Pedestrian Circulation Improvements

Proposed improvements would include the extension of the south side of the Donald Douglas Drive loop to exit onto Lakewood Boulevard and the addition and/or modifications of signage, lighting, and pavement markings to aid in the safe movement of vehicular and pedestrian traffic through the parking structures, lots and Terminal area. Also proposed are additional and/or modified walkways, some of which would be covered canopies, on the public side of the terminal building, connecting the parking lots to the terminal.

4.2 Operations

As previously indicated, the EIR will analyze the impacts associated with the introduction of up to 25 commuter flights that could operate at the Airport consistent with the terms of the Airport Noise Compatibility Ordinance. The EIR will also analyze the impacts associated with up to 52 commercial flights (an increase of 11 flights), which is the maximum reasonable flight level that could potentially occur with optimized operational procedures and aircraft and still be within the "noise bucket" of the Airport Noise Compatibility Ordinance. The project does not propose any changes to the Airport Noise Compatibility Ordinance or other means of directly increasing flight operations at the Airport. These flight levels will be the basis for determining potential environmental impacts for all alternatives, even the No Project Alternative, since the flight increase could occur with or without the proposed improvements.

4.3 Project Phasing

The project is designed to accommodate the current minimum permitted number of flights and passenger levels at the Airport. The phasing of the project would be determined based on availability of funding and service priorities. Design of the improvements would begin after the completion of the EIR. Pending funding, it is anticipated that construction of the improvements would begin approximately one year following completion of the EIR. The construction would be phased to minimize impacts to operations at the Airport. Implementation of improvements to serve commuter service would be phased depending on the level of commuter services at the Airport.

4.3 Project Objectives

The key project objective is to provide airport terminal facilities to accommodate the minimum permitted number of flights at LGB and the associated number of passengers served on those flights, in full compliance with all applicable fire, building, safety codes and other applicable standards. Associated with that objective is the commitment to compliance with the existing Airport Noise Compatibility Ordinance adopted for the Airport, and maintaining the current character of the Airport as a Long Beach Cultural Heritage Landmark.

5.0 Project Alternatives

The City of Long Beach will also evaluate project alternatives providing various levels of facilities improvements. The level of analysis will vary from a comprehensive evaluation to a "fatal flaw" evaluation, which discusses why certain alternatives were not carried forward. The

EIR will consider four project alternatives as well as the proposed project, which is the most intense of the options being evaluated. The characteristics of the alternatives compared to the proposed project are presented in Table 1.

Alternative A reflects the improvements proposed in the 2003 NOP, with minor modifications. The 2003 NOP assumed 16 aircraft parking spaces. However, the City Council determined in February 2005 that no more than 14 aircraft parking spaces would be evaluated in the EIR; therefore, the 16 aircraft parking spaces have been reduced 14 spaces. Alternative A assumes the terminal facility would be a maximum of 97,545 square feet. The nature of the improvements would generally be the same as the proposed project, though compared to the proposed project, there are minor reductions in square footage in all except the following categories:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- The amount of airport office space is increased compared to the proposed project.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative A as for the proposed project.

Alternative B assumes the terminal facility is further reduced. This alternative assumes the terminal facility would be a maximum of 79,725 square feet. Similar to Alternative A, the nature of the improvements would generally be the same, though reduced in size compared to the proposed project, with the following exceptions:

- Baggage security screening would be the same as the proposed project.
- No additional space is assumed for ticketing facilities.
- No additional airport office space is assumed as part of this alternative.

Other aspects of the project, such as the number of gates, aircraft parking and vehicular parking would be the same for Alternative B as for the proposed project.

Alternative C is the No Project Alternative. This alternative assumes no change to existing conditions. The terminal area, including temporary holdrooms, would be 58,320 square feet. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed.

Alternative D is a roll-back alternative. It assumes that no new facilities would be provided and that the temporary facilities currently in use would be removed. The terminal would be limited to the original terminal building and would be 34,570 square feet. There would only be eight airline gates and 10 aircraft parking positions. No new vehicular parking is assumed and the leased parking spaces are assumed not to be available because of the nature (month-to-month) of the lease.

TABLE 1
LONG BEACH AIRPORT PASSENGER TERMINAL IMPROVEMENTS
EIR ALTERNATIVES

Description	Proposed Project	Alternative A (9/22/03 NOP)	Alternative B (Reduced Facilities)	Alternative C (No Project)	Alternative D[1]
Holdrooms					
Permanent Space[2]	6,500 sf	6,500 sf	6,500 sf	6,500 sf	6,500 sf
Temporary Space[3]	0 sf	0 sf	0 sf	13,150 sf	0 sf
Proposed Additional Space[4]	21,171 sf	20,000 sf	17,580 sf	0 sf	0 sf
Subtotal	**27,671 sf**	**26,500 sf**	**24,080 sf**	**19,650 sf**	**6,500 sf**
Passenger Security Screening					
Existing	3,900 sf	3,900 sf	3,900 sf	3,900 sf	3,900 sf
Proposed Additional Space[5]	7000 sf	6,000 sf	5,600 sf	2,000 sf	0 sf
Subtotal	**10,900 sf**	**9,900 sf**	**9,500 sf**	**5,900 sf**	**3,900 sf**
Concession Area					
Permanent Space[2]	5,460 sf	5,460 sf	5,460 sf	5,460 sf	5,460 sf
Proposed Additional Space[4]	9,541 sf	8,000 sf	6,400 sf	0 sf	0 sf
Subtotal	**15,001 sf**	**13,460 sf**	**11,860 sf**	**5,460 sf**	**5,460 sf**
Baggage Security Screening[5]	**7,000 sf**	**7,000 sf**	**7,000 sf**	**5,000 sf**	**0 sf**
Baggage Claim Devices					
Passenger Side	510 lf	380 lf	380 lf	226 lf	130 lf
Airline Loading Side	310 lf	250 lf	250 lf	180 lf	90 lf
Subtotal	**820 lf**	**630 lf**	**630 lf**	**406 lf**	**220 lf**
Baggage Service Office	900 sf	825 sf	825 sf	0 sf	0 sf
Multi-Purpose Rooms	300 sf	300 sf	300 sf	0 sf	0 sf
Subtotal	**1,200 sf**	**1,125 sf**	**1,125 sf**	**0 sf**	**0 sf**
Restrooms (non-secure)					
Permanent Space[2]	1,330 sf	1,330 sf	1,330 sf	1,330 sf	1,330 sf
Temporary Space[3]	0 sf	0 sf	0 sf	0 sf	0 sf
Proposed Additional Space[4]	2,000 sf	850 sf	850 sf	0 sf	0 sf
Subtotal	**3,330 sf**	**2,180 sf**	**2,180 sf**	**1,330 sf**	**1,330 sf**
Office Space					
TSA					
Temporary Space	3,600 sf	3,600 sf	3,600 sf	3,600 sf	0 sf
Proposed Additional Space	1,591 sf	1,400 sf	0 sf	0 sf	0 sf
	5,191 sf	5,000 sf	3,600 sf	3,600 sf	0 sf
Airlines (Operations Offices)					
Permanent Space	2,000 sf	2,000 sf	2,000 sf	2,000 sf	2,000 sf
Temporary Space	0 sf	0 sf	0 sf	0 sf	0 sf
Proposed Additional Space	3,784 sf	5,000 sf	3,000 sf	0 sf	0 sf
	5,784 sf	7,000 sf	5,000 sf	2,000 sf	2,000 sf
Airport (Office & Conference)					
Permanent Space	6,970 sf	6,970 sf	6,970 sf	6,970 sf	6,970 sf
Temporary Space	0 sf	0 sf	0 sf	0 sf	0 sf
Proposed Additional Space	5,000 sf	10,000 sf	0 sf	0 sf	0 sf
	11,970 sf	16,970 sf	6,970 sf	6,970 sf	6,970 sf
Subtotal	**22,945 sf**	**28,970 sf**	**15,570 sf**	**12,570 sf**	**8,970 sf**
Ticketing Facilities					
Ticket Counter Area (Existing)	1,250 sf	1,250 sf	1,250 sf	1,250 sf	1,250 sf
Proposed Additional Space	680 sf	0 sf	0 sf	0 sf	0 sf
	1,930 sf	1,250 sf	1,250 sf	1,250 sf	1,250 sf

TABLE 1
LONG BEACH AIRPORT PASSENGER TERMINAL IMPROVEMENTS
EIR ALTERNATIVES

Description	Proposed Project	Alternative A (9/22/03 NOP)	Alternative B (Reduced Facilities)	Alternative C (No Project)	Alternative D[1]
Ticket Counter Queuing (Existing)	1,400 sf	1,400 sf	1,400 sf	1,400 sf	1,400 sf
Proposed Additional Space	1,400 sf	0 sf	0 sf	0 sf	0 sf
	2,800 sf	1,400 sf	1,400 sf	1,400 sf	1,400 sf
Airline Ticket Office (Existing)	4,360 sf	4,360 sf	4,360 sf	4,360 sf	4,360 sf
Proposed Additional Space	243 sf	0 sf	0 sf	0 sf	0 sf
	4,603 sf	4,360 sf	4,360 sf	4,360 sf	4,360 sf
Circulation Ticketing (Existing)	1,400 sf	1,400 sf	1,400 sf	1,400 sf	1,400 sf
Proposed Additional Space	4,100 sf	0 sf	0 sf	0 sf	0 sf
	5,500 sf	1,400 sf	1,400 sf	1,400 sf	1,400 sf
Subtotal	**14,833 sf**	**8,410 sf**	**8,410 sf**	**8,410 sf**	**8,410 sf**
TOTAL	**102,850 sf**	**97,545 sf**	**79,725 sf**	**58,320 sf**	**34,570 sf**
Airline Gates	**11**	**11**	**11**	**8**	**8**
Aircraft Parking Positions	**12 to 14**	**12 to 14[6]**	**12 to 14**	**10**	**10**
Vehicular Parking					
Permanent Non-Leased Spaces	2,835	2,835	2,835	2,835	2,835
Leased Spaces	2,100[7]	2,100[7]	2,100[7]	2,100	0
Proposed Additional Spaces	1,351	1,351	1,351	0	0
Total	**6,286**	**6,286**	**6,286**	**4,935**	**2,835**

sf square feet
lf linear feet
1 Represents terminal area as it existed before modulars and parking capacity without leased spaces
2 Permanent floor space in terminal building
3 Temporary floor space in modulars
4 Temporary (modular) space would be replaced with permanent facilities
5 2/08/05 City Council action reflected a range of sf for these areas. The lower end is presented here. Up to 3,000 sf may be added.
6 The 9/22/03 NOP programmed 16 aircraft parking positions. This number was reduced to 12 to 14 by City Council action on 2/08/05.
7 Leased space would be replaced with new parking structure

ENVIRONMENTAL ANALYSIS CHECKLIST

GENERAL INSTRUCTIONS

A. All answers must take account of the whole action involved, including off-site as well as onsite, cumulative as well as project-level, indirect as well as direct, and construction as well as operational impacts.

B. A brief explanation is required for all answers except "No Impact" answers that are adequately supported by information sources cited by the lead agency. (See "No Impact" portion of Response Column Heading Definition section below).

C. Supporting Information Sources: A source list should be attached, and other sources used or individuals contacted should be cited in the discussion.

D. This is only a suggested form, and lead agencies are free to use different formats; however, lead agencies should normally address the questions from this checklist that are relevant to a project's environmental effects in whatever format is selected.

E. The explanation of each issue should identify:

1. The basis/rationale for the stated significance determination; and
2. The mitigation measure identified, if any, to reduce the impact to less than significant.

F. Lead agencies are encouraged to incorporate into the checklist references to information sources for potential impacts (*e.g.*, general plans, zoning ordinances). Reference to a previously prepared or outside document should, where appropriate, include a reference to the page or pages where the statement is substantiated.

RESPONSE COLUMN HEADING DEFINITIONS

A. **Potentially Significant Impact** is appropriate if there is substantial evidence that an effect may be significant. If there are one or more "Potentially Significant Impact" entries when the determination is made, an EIR is required.

B. **Less than Significant with Mitigation Incorporated** applies where the implementation of mitigation measures would reduce an effect from "Potentially Significant Impact" to a "Less Than Significant Impact." The lead agency must describe the mitigation measure(s), and briefly explain how they reduce the effect to a less than significant level (mitigation measures from earlier analyses may be cross-referenced).

C. **Less Than Significant Impact** applies where the project creates no significant impacts, only Less than Significant Impacts.

D. **No Impact** applies where a project does not create an impact in that category. "No impact" answers do not require an explanation if they are adequately supported by the information sources cited by the lead agency which show that the impact simply does not apply to projects like the one involved (*e.g.*, the project falls outside a fault rupture zone). A "No Impact" answer should be explained where it is based on project-specific factors as well as general standards (*e.g.*, the project will not expose sensitive receptors to pollutants, based on a project specific screening analysis).

ENVIRONMENTAL INITIAL STUDY FOR THE LONG BEACH AIRPORT TERMINAL IMPROVEMENTS

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
I. AESTHETICS–Would the project:				
a) Have a substantial adverse effect on a scenic vista?	☐	☐	☐	☒
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?	☐	☐	☐	☒
c) Substantially degrade the existing visual character or quality of the site and its surroundings?	☐	☐	☒	☐
d) Create a new source of substantial light or glare which would adverse affect day or nighttime views in the area?	☐	☐	☒	☐
II. AGRICULTURAL RESOURCE–Would the project:				
a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?	☐	☐	☐	☒
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?	☐	☐	☐	☒
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?	☐	☐	☐	☒
III. AIR QUALITY–Would the project:				
a) Conflict with or obstruct implementation of the applicable air quality plan?	☒	☐	☐	☐
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?	☒	☐	☐	☐
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions which exceed quantitative thresholds for ozone precursors)?	☒	☐	☐	☐
d) Expose sensitive receptors to substantial pollutant concentrations?	☒	☐	☐	☐
e) Create objectionable odors affecting a substantial number of people?	☐	☐	☐	☒
IV. BIOLOGICAL RESOURCES–Would the project:				
a) Have a substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?	☐	☐	☐	☒
c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?	☐	☐	☐	☒
d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native nursery sites?	☐	☐	☐	☒

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?	☐	☐	☐	☒
f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan?	☐	☐	☐	☒
V. CULTURAL RESOURCES–Would the project:				
a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?	☐	☐	☒	☐
b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?	☐	☒	☐	☐
c) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?	☐	☒	☐	☐
d) Disturb any human resources, including those interred outside of formal cemeteries?	☐	☒	☐	☐
VI. GEOLOGY AND SOILS–Would the project:				
a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:	☐	☐	☒	☐
i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.	☐	☐	☒	☐
ii) Strong seismic ground shaking?	☐	☐	☒	☐
iii) Seismic-related ground failure, including liquefaction?	☐	☐	☒	☐
iv) Landslides?	☐	☐	☒	☐
b) Result in a substantial soil erosion or the loss of topsoil?	☐	☐	☒	☐
c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse?	☐	☐	☒	☐
d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?	☐	☐	☒	☐
e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?	☐	☐	☐	☒
VII. HAZARDS AND HAZARDOUS MATERIALS–Would the project:				
a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?	☐	☐	☒	☐
b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?	☒	☐	☐	☐
c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter-mile of an existing or proposed school?	☒	☐	☐	☐
d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?	☒	☐	☐	☐

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard or people residing or working in a project area?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?	☐	☐	☐	☒
g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?	☐	☐	☐	☒
h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?	☐	☐	☐	☒
VIII. HYDROLOGY AND WATER QUALITY–Would the project:				
a) Violate any water quality standards or waste discharge requirements?	☐	☐	☒	☐
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?	☐	☐	☒	☐
c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation onsite or offsite?	☐	☐	☒	☐
d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite?	☐	☐	☒	☐
e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of pollutant runoff?	☐	☐	☒	☐
f) Otherwise substantially degrade water quality?	☐	☐	☒	☐
g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?	☐	☐	☐	☒
h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?	☐	☐	☐	☒
i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?	☐	☐	☐	☒
j) Inundation by seiche, tsunami, or mudflow?	☐	☐	☐	☒
IX. LAND USE AND PLANNING–Would the project:				
a) Physically divide an established community?	☐	☐	☐	☒
b) Conflict with any applicable land use plans, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?	☒	☐	☐	☐
c) Conflict with any applicable habitat conservation plan or natural community conservation plan?	☐	☐	☐	☒

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
X. MINERAL RESOURCES–Would the project:				
a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?	☐	☐	☐	☒
b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?	☐	☐	☐	☒
XI. NOISE–Would the project result in:				
a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?	☐	☐	☒	☐
b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?	☐	☐	☐	☒
c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?	☐	☐	☒	☐
e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☒	☐
f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?	☐	☐	☐	☒
XII. POPULATION AND HOUSING–Would the project:				
a) Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through the extension of roads or other infrastructure)?	☐	☐	☐	☒
b) Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
c) Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?	☐	☐	☐	☒
XIII. PUBLIC SERVICES				
a) Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:				
Parks	☐	☐	☐	☒
Fire Protection?	☐	☐	☒	☐
Police Protection	☐	☐	☒	☐
School?	☐	☐	☐	☒
Other public facilities?	☐	☐	☒	☐
XIV. RECREATION				
a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?	☐	☐	☐	☒
b) Does the project include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment?	☐	☐	☐	☒

ENVIRONMENTAL ISSUES	Potentially Significant Impact	Less Than Significant With Mitigation	Less Than Significant Impact	No Impact
XV. TRANSPORTATION/TRAFFIC–Would the project:				
a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?	☒	☐	☐	☐
b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?	☒	☐	☐	☐
c) Result in a change in air traffic patterns, including either an increase in traffic levels or change in location that results in substantial safety risks?	☒	☐	☐	☐
d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?	☒	☐	☐	☐
e) Result in inadequate emergency access?	☒	☐	☐	☐
f) Result in inadequate parking capacity?	☒	☐	☐	☐
g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?	☒	☐	☐	☐
XVI. UTILITIES AND SERVICE SYSTEMS–Would the project:				
a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?	☐	☐	☒	☐
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?	☐	☐	☒	☐
d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?	☐	☐	☒	☐
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?	☐	☐	☒	☐
f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs	☐	☐	☒	☐
g) Comply with federal, state, and local statutes and regulations related to solid waste?	☐	☐	☒	☐
MANDATORY FINDINGS OF SIGNIFICANCE				
a. Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of rare or endangered plants or animals, or eliminate important examples of the major periods of California history or prehistory?	☐	☐	☒	☐
b. Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects)?	☐	☐	☒	☐
c. Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?	☐	☐	☒	☐

DETERMINATION:

Based upon the evidence in light of the whole record documented in the attached environmental checklist explanation, cited incorporations and attachments, I find that the proposed project:

COULD NOT have a significant effect on the environment, and a negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

COULD have a significant effect on the environment, there will not be a significant effect in this case because the mitigation measures have been added to the project. A negative declaration (ND) will be prepared pursuant to CEQA Guidelines Article 6, 15070 through 15075. ☐

MAY have a significant effect on the environment which has not been analyzed previously. Therefore, an environmental impact report (EIR) is required. ☒

Signature: _____

Printed Name: Angela Reynolds Date: April 13, 2005

City of Long Beach
Telephone: 562-570-6357

NOTE: All referenced and/or incorporated documents may be reviewed by appointment only, at the City of Long Beach, Planning and Building, 333 W. Ocean Boulevard, Long Beach, California, unless otherwise specified. An appointment can be made by contacting the CEQA Contact Person identified above.

ENVIRONMENTAL ANALYSIS AND EXPLANATION OF CHECKLIST RESPONSES

I. Aesthetics – Would the project:

a) Have a substantial adverse effect on a scenic vista?
b) Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway?

No Impact – The project is not located within the viewshed of a designated scenic vista. The area surrounding the site is urbanized and relatively flat. Interstate-405 ("I-405") and commercial and industrial development border the Airport. Improvements would be limited to the area surrounding the existing terminal and would have minimal affect outside the immediate area. The project would not impact any trees or rock outcroppings. The project is not within viewshed of a state scenic highway. The EIR will not discuss visual impacts associated with these scenic resources.

c) Substantially degrade the existing visual character or quality of the site and its surroundings?

Less Than Significant Impact – The LGB main terminal building was named a City of Long Beach Cultural Heritage Landmark in 1990. The proposed improvements would not directly involve the main terminal building, but would be in the immediate vicinity of the terminal. Additionally, the improvements would be visible from the main terminal building. A project design feature involves providing a complementary architectural façade of the parking structures with the existing terminal building. This would be an enhancement to the aesthetics of the terminal area. Though not a significant impact, the EIR will address the potential visual affects of the project so the decision-makers have a full understanding of the potential change in visual character of the terminal area. There are no sensitive uses, such as residential development, within the project viewshed; therefore, the visual evaluation in the EIR will focus on the changes in the vicinity of the terminal.

d) Create a new source of substantial light or glare, which would adverse affect day or nighttime views in the area?

Less Than Significant Impact – The project would result in new lighting at the Airport including, but not limited to, the lighting surrounding the holdrooms, on pedestrian walkways, the parking structure, and apron areas. The improvements and associated lighting would be limited to the area immediately adjacent to the terminal. This lighting would be adequate for operation, but would not result in an adverse affect on day or night views in the area because lighting would be required to comply with FAA rules and regulations pertaining to minimizing glare and shielding lighting from pilots. As a result, there would be minimal spillover lighting to offsite uses. The terminal area is set back from other uses off the Airport and is not directly visible from view sensitive uses, such as residential development. The closest existing residential development to the terminal area is approximately 3,300 feet away and is separated by commercial uses and the Skylinks Golf Course. There are no sensitive uses in proximity to the proposed improvements that would be affected by lighting associated with the project. No further discussion of lighting impacts will be provided in the EIR.

II. Agriculture Resources – Would the project:

a) Convert Prime Farmland, Unique Farmland, or Farmland of Statewide Importance (Farmland), as shown on the maps prepared pursuant to the Farmland Mapping and Monitoring Program of the California Resources Agency, to non-agricultural use?
b) Conflict with existing zoning for agricultural use, or a Williamson Act contract?
c) Involve other changes in the existing environment which, due to their location or nature, could result in conversion of Farmland, to non-agricultural use?

No Impact – The proposed project would not result in any impacts to farmlands listed as "Prime," "Unique," or of "Statewide Importance" based on the 1998 Los Angeles County Important Farmland Map prepared by the Department of Conservation. The study area is generally designated as "Urban and Built-Up Land." No farmland exists in proximity to the project. No part of the project site or adjacent areas is subject to the Williamson Act. The project would not conflict with existing zoning for agricultural uses and would not result in pressures to convert farmlands to other uses. The EIR will not address agricultural impacts.

III. Air Quality – Would the project:

a) Conflict with or obstruct implementation of the applicable air quality plan
b) Violate any air quality standard or contribute substantially to an existing or projected air quality violation?
c) Result in a cumulatively considerable net increase of any criteria pollutant for which the project region is in non-attainment under an applicable federal or state ambient air quality standard (including releasing emissions, which exceed quantitative thresholds for ozone precursors)?
d) Expose sensitive receptors to substantial pollutant concentrations?

Potentially Significant Impact – The proposed project would result in the construction of terminal area improvements. These activities may result in emissions that exceed the standards established by the South Coast Air Quality Management District. To fully address the potential impacts, the EIR will:

- Determine existing ambient air quality in the vicinity of the Airport;
- Quantify existing emissions at the Airport;
- Predict future emissions and ambient air quality concentrations with the project and its alternatives, and the associated air quality impacts regionally and in the vicinity of the Airport;
- Determine consistency of the project with applicable air quality plans and policies; and
- Propose mitigation measures to reduce the potential impacts associated with the project, if necessary, and to the extent reasonable and feasible.

In addition, the EIR will include a health risk assessment. The modeling that will be used in developing emission inventories, conducting air dispersion analyses, and evaluating health risks associated with on-airport source operations and modifications will include the FAA Emissions and Dispersion Modeling System, the Air Resources Board ("ARB") on-road emission factor model, the ARB OFFROAD mobile source emission model, and the U.S. Environmental Protection Agency dispersion models. Approximately 20 toxic compounds will be analyzed at up to 220 receptor locations. The receptors to be analyzed will include several onsite locations that represent worker (ground handler) exposure points, and 200 discrete receptors located at the airport boundary and beyond to assess impacts to residential, school child, offsite worker, and other sensitive receptor locations.

The potential incremental chronic cancer risks and non-cancer hazards for the set of critical receptors previously determined (fenceline, maximum exposed individuals ("MEI") on- and offsite, school children) will be estimated. Incremental risks and hazards reflect the increase or decrease of potential exposure of build scenarios relative to existing baseline.

e) Create objectionable odors affecting a substantial number of people?

No Impact. The project proposes the construction of terminal area improvements that would serve passengers at the Airport. The project would not create objectionable odors because it would not change the operations or function of the facilities in the terminal area. The project is designed to serve permitted passengers. No new uses would be introduced to the area.

IV. Biological Resources – Would the project:

a) Have a substantial adverse effect, either directly or through habitat modification, on any species identified as a candidate, sensitive, or special status species in local or regional plans, policies, or regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

b) Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, regulations, or by the California Department of Fish and Game or U.S. Fish and Wildlife Service?

c) Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means?

d) Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native nursery sites?

No Impact – The proposed airport improvements would be constructed on a portion of the Airport that is currently developed/paved to support airport-associated activities. The project would not have any direct impact on biological resources because it would not result in the removal of any sensitive habitat or impact any sensitive species. The project would not change the type of operations or operational procedures at the Airport; therefore, the project would not result in substantial interference with the movement of wildlife or migration of birds. Though there are some wildlife species that occupy the Airport area (e.g., red foxes, rabbits, raptors, and other avian species), these species are not located in the portion of the Airport where improvements are proposed. Given the history of flights at the Airport, it can be assumed that the existing wildlife has habituated to the noise and other indirect impacts associated with aircraft operations. Additionally, the Airport has incorporated measures, such as a Bird Hazard Reduction Plan, to reduce potential direct impacts to wildlife species. The Airport has also contracted with a falconer who traps and relocates raptors from the runways and approach ends of the Airport. The project would not alter the implementation of these programs, which have been designed to reduce potential direct impacts to wildlife from Airport operations.

The area surrounding the airport is also highly urbanized. There are no designated critical habitat areas or wildlife refuge areas surrounding the Airport. Therefore, no significant biological impacts are anticipated from the project. This issue will not be addressed in the EIR.

e) Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance?

f) Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional or state habitat conservation plan?

No Impact – The project would not result in the removal of any resources that would be protected by a local ordinance or policy. As previously indicated, the locations where improvements are proposed do not support any sensitive resources. Additionally, the Airport is not included in a local, regional, or state habitat conservation plan. The project would not change the operational characteristics of the Airport; therefore, the project would not conflict with the requirements of the Migratory Bird Act. No further analysis of local biological planning programs will be discussed in the EIR.

V. Cultural Resources – Would the project:

a) Cause a substantial adverse change in the significance of a historical resource as defined in §15064.5?

Less Than Significant Impact – As previously indicated, the terminal building has been designated as a Cultural Historical Landmark. The proposed project would not have any direct impacts on the terminal building. The EIR will incorporate the findings of a study by an architectural historian on the potential indirect impacts and the effects of the project on the historical attributes of the building and its environment.

b) Cause a substantial adverse change in the significance of an archaeological resource pursuant to §15064.5?

c) Directly or indirectly destroy a unique paleontological resource or site or unique geological feature?

d) Disturb any human resources, including those interred outside of formal cemeteries?

Less Than Significant Impact with Mitigation – The project would not be expected to have an impact on archaeological or paleontological resources because the project site is currently developed. However, there is the potential for subsurface resources. Given that the area is currently paved or covered by buildings, this is difficult to determine. An archaeological record search will be conducted as part of the analysis in the EIR. Mitigation measures, such as construction monitoring when subsurface work is conducted, will be developed as part of the EIR to address protection of potential archaeological and paleontological resources.

VI. Geology and Soils – Would the project:

a) Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving:

- **i) Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the State Geologist for the area or based on other substantial evidence of a known fault? Refer to Division of Mines and Geology Special Publication 42.**
- **ii) Strong seismic ground shaking?**
- **iii) Seismic-related ground failure, including liquefaction?**
- **iv) Landslides?**

b) Result in a substantial soil erosion or the loss of topsoil?

c) Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in onsite or offsite landslide, lateral spreading, subsidence, liquefaction, or collapse?

d) Be located on expansive soil, as defined in Table 18-1-B of the Uniform Building Code (1994), creating substantial risks to life or property?

Less Than Significant Impact – The area of the proposed improvements is relatively flat and is currently covered by an impervious surface. Construction activities would expose the underlying soils; however, the overall area exposed would be limited. Additionally, since the area is currently designed for runoff to drain away from the existing structures, the area would be exposed to limited wind or water erosion. The project site would not be prone to geotechnical constraints such as slope instability or landslides because the site is relatively flat. There are no slopes, either natural or man-made, located within the immediate project area. Based on information in the Long Beach Seismic Safety Element of the General Plan, the site would have a low potential for liquefaction. A recent geotechnical survey conducted by the City of Long Beach for the existing parking structure at the Airport concluded that the potential for the site to be impacted by earthquakes, seismic ground shaking, liquefaction, landslides, substantial soil erosion, or unstable or expansive soil is negligible. The geographic characteristics of the study area are identical to those of the parking garage. No further discussion of these issues will be contained in the EIR.

e) Have soils incapable of adequately supporting the use of septic tanks or alternative waste water disposal systems where sewers are not available for the disposal of waste water?

No Impact – The project would not rely on septic tanks or alternative waste water disposals systems; therefore, the soils ability to support septic tanks is not applicable.

VII. Hazards and Hazardous Materials – Would the project:

a) Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials?

Less Than Significant Impact – The project would not result in a significant hazard from the transport of hazardous materials. The project does not propose the alteration of airport practices regarding the handling of hazardous materials, fueling, or other maintenance or operational procedures. The project would not require the routine transport of any hazardous materials. During construction materials identified as having a hazardous component, such as paints and other construction materials, would be brought to the site; however, handling of these materials in compliance with existing regulations would provide a sufficient safeguard to public safety. No further discussion of this issue will be contained in the EIR.

b) Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials into the environment?

d) Be located on a site which is included on a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would it create a significant hazard to the public or the environment?

Potentially Significant Impact – Hazardous materials have been located and used on the project site and surrounding uses. The EIR will review and summarize the findings of a hazardous materials government records search identifying location of past spills, leaking tanks, or other potential safety risks. The records search is a radius search of governmental records

for Phase I preliminary site assessments. Maps and site-specific detail information identify risk sites by their distance from the project site will be incorporated. Available information on methane gas and subsoil materials will be incorporated into the EIR.

c) Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter-mile of an existing or proposed school?

Potentially Significant Impact – The project site is not within one quarter-mile of any existing or proposed schools. However, a human health risk assessment will be prepared as part of the EIR that will address potential impacts on schools in close proximity to the airport.

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project result in a safety hazard for people residing or working in a project area?

Less Than Significant Impact – The project is located at an airport. The project is consistent with the provisions of the Airport land use plan, in that it is providing facilities to support the ongoing airport operations. The project does not propose any changes in the number of flights, the flight patterns, or the operational procedures at the Airport that would result in increased safety hazards offsite. The EIR will not analyze these safety issues.

f) For a project within the vicinity of a private airstrip, would the project result in a safety hazard for people residing or working in the project area?

No Impact – The project is not within the vicinity of a private airstrip; therefore, this does not apply.

g) Impair implementation of or physically interfere with an adopted emergency response plan or emergency evacuation plan?

No Impact – The project would not alter or interfere with an adopted emergency response plan or emergency evacuation plan. Improvements would be limited to on-airport property and would not alter the access. Access to the project site is off of Lakewood Avenue, which is not designated as an evacuation route. No further discussion of emergency evacuation or response plans will be in the EIR.

h) Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands?

No Impact – The project site is not located in an area subject to wildland fires. The area surrounding the Airport is urbanized and the conditions for wildland fires do not exist in close proximity. This issue will not be analyzed in the EIR.

VIII. Hydrology and Water Quality – Would the project:

a) Violate any water quality standards or waste discharge requirements?
b) Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted?

c) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner which would result in substantial erosion or siltation onsite or offsite?

d) Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite?

e) Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of pollutant runoff?

f) Otherwise substantially degrade water quality?

Less Than Significant Impact – The proposed project involves the development of improvements to the Airport terminal area. The area proposed for development is currently paved or covered by structures. As a result, the improvements would not result in a substantial increase in impervious soil, or result in increased runoff. This development would not alter the existing drainage pattern of the site or affect the quality or quantity of the groundwater table.

The Federal Clean Water Act establishes a framework for regulating potential surface water quality impacts, mandating sewage treatment, and regulating wastewater discharges, and requires communities and industries to obtain National Pollutant Discharge Elimination System ("NPDES") permits to discharge storm water to urban storm sewer systems. The NPDES program is administered by the California Regional Water Quality Control Boards ("RWQCB"). The project would be required to comply with the requirements of the existing NPDES permits. Construction activities would need to comply with the requirements of the General Permit for Discharges of Storm Water Associated with Construction Activity (Construction General Permit, 99-08-DWQ), which requires the preparation of a Storm Water Pollution Prevention Plan. The SWPPP is required to identify Best Management Practices (BMP) for the control of potential erosion, siltation, and other water quality impacts that may occur during construction. A SWPPP typically contains a list of target structural and non-structural best management practices, which would be used to control, prevent, remove, or reduce pollution. In addition to the requirements of the NPDES program, provisions of the Uniform Building Code, grading permits requirements, and Fire Code provisions include elements that also require reduction of erosion and sedimentation impacts.

The operation of the Airport would be required to comply with the Municipal Storm Water permit issued to the City of Long Beach (NPDES Permit No. 99-060; CAS004003/CI 8052). To comply with the requirements of the Clean Water Act and the State Porter-Cologne Water Quality Control Act, the City has developed the Long Beach Storm Water Management Program, which contains measures aimed at reducing or eliminating pollutants in storm water to the maximum extent practicable. These include post-construction structural or treatment control BMP design to mitigate (infiltrate or treat) runoff produced from a 0.75-inch storm event prior to discharging to a storm water conveyance system. By treating the “first flush” from a storm, the highest concentrations of pollutants are removed from the water entering into the storm drain system. Full compliance with applicable local, state, and federal water quality standards by the applicant would reduce water quality impacts to a less than significant level.

The project would not result in the alteration of the course of a stream or river in a manner that would result in substantial erosion or siltation onsite or offsite. Neither is it anticipated that project implementation would alter the existing drainage pattern of the site or area through the alteration of the course of a stream or river.

The EIR will not analyze these issues related to hydrology and water quality.

g) Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map?

h) Place within a 100-year flood hazard area structures which would impede or redirect flood flows?

i) Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam?

j) Inundation by seiche, tsunami, or mudflow?

No Impact – The proposed project consists of terminal improvements and does not lie within a 100-year flood hazard area nor would it alter the flood zone. As such, project implementation would not place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or Flood Insurance Rate Map or other flood hazard delineation map. No structures that would impede or redirect flood flows would be placed within a 100-year flood hazard area because the proposed project does not lie within a 100-year flood hazard area. Additionally, people and structures would not be exposed to a significant risk of loss injury or death involving flooding, including flooding as a result of the failure of a levee or dam. The proposed project does not lie in close proximity to a levee or dam. Neither is there a risk of inundation by seiche, tsunami or mudflow; therefore, no impact is expected. These issues will not be analyzed in the EIR.

IX. Land Use and Planning – Would the project:

a) Physically divide an established community?

No Impact – The proposed improvements would occur on the airport property and would not result in modifications to land uses offsite. The project would not physically divide any established communities because all improvements would be limited to airport property. The EIR will not include any further discussion of physical impacts on an established community. However, the EIR will address potential onsite land use impacts, including the relocation of existing general aviation tie-down area.

b) Conflict with any applicable land use plans, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect?

Potentially Significant Impact – The EIR will document existing land uses on and surrounding the Airport. The EIR will evaluate the consistency of the project with the applicable policies in the *Long Beach General Plan* and the applicable Planned Development zoning designation. At a minimum, the Land Use Element, Noise Element, Open Space Element, and Public Safety Element will be evaluated. In addition to applicable goals and policies from the General Plan, the analyses would include applicable planning policies identified in regional planning documents, such as the *Regional Comprehensive Plan and Guide* and *Regional Transportation Plan* that will need to be addressed.

c) Conflict with any applicable habitat conservation plan or natural community conservation plan?

No Impact – The project is not located in a reserve area of a habitat conservation plan or natural community conservation plan. The project site and surrounding areas are developed and do not support substantial amounts of sensitive resources.

X. Mineral Resources – Would the project:

a) Result in the loss of availability of a known mineral resource that would be of value to the region and the residents of the state?

b) Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan?

No Impact – The California Division of Mines and Geology ("CDMG") is the state agency with the responsibility to oversee the management of mineral resources in California. The CDMG considers a site to be significant in regard to mineral commodities if the site can be mined commercially and there must be enough of the resource to be economically viable. There are no such resources onsite. There would be no significant impacts to mineral resources from the proposed project. The EIR will not analyze impacts to mineral resources.

XI. Noise – Would the project result in:

a) Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies?

c) A substantial permanent increase in ambient noise levels in the project vicinity above levels existing without the project?

d) A substantial temporary or periodic increase in ambient noise levels in the project vicinity above levels existing without the project?

e) For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, would the project expose people residing or working in the project area to excessive noise levels?

Less Than Significant Impact – The proposed project would not be expected to have a significant impact on the noise environment because it does not propose changes in operations that would result in "noise bucket" established by the Airport Noise Compatibility Ordinance being exceeded. The EIR will document the existing noise environment and the future noise environment with and without the project. This analysis will use noise data collected at the LGB noise monitoring stations to establish existing cumulative CNEL noise levels and representative single event noise levels. The evaluation will also utilize the maximum CNEL contours permitted by current City regulations. The EIR will explain the noise budget that operates at LGB. The EIR will also address short-term construction noise associated with the proposed improvements. The LGB noise budget serves as a mitigation measure.

b) Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels?

f) For a project within the vicinity of a private airstrip, would the project expose people residing or working in the project area to excessive noise levels?

No Impact – The project does not propose changes to the type of operations at LGB; therefore, it would not result in excessive groundborne vibration during operation. However, there is the potential for construction noise and vibration. The project is not in the vicinity of a private airstrip. As indicated above, the EIR will analyze the noise environment surrounding the airport facility.

XII. Population and Housing – Would the project:

a) **Induce substantial population growth in an area, either directly (for example, by proposing new homes and businesses) or indirectly (for example, through the extension of roads or other infrastructure)?**
b) **Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere?**
c) **Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere?**

No Impact – The project would not result in substantial growth inducing impacts or result in changes in population projections for the project study area. The improvements proposed at LGB are designed to serve the approved flight levels at the Airport. It would not result in increased flight levels or employment levels that would result in an increased demand for housing in the area. Improvements would occur on airport property so there would not be any displacement of existing housing to permit the terminal area improvements. Therefore, there would be no need for construction of replacement housing. Additionally, the project would not change the noise budget for LGB resulting in potential displacement of housing to achieve noise/land use compatibility. No further discussion of population or housing is proposed in the EIR.

XIII. Public Services

Would the project result in substantial adverse physical impacts associated with the provision of new or physically altered government facilities, need for new or physically altered government facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times, or other performance objectives for any of the public services:

Parks?
Schools?

No Impact – The proposed terminal improvements would not result in an increase in demand for schools and parks. The project would not result in an increase in population or other characteristics that would increase the demand for these facilities. Since the project would not change the number of flights, the type of aircraft, or the operational procedures at the Airport, there would not be any increase in noise from the Airport and the associated indirect impact to parks and schools.

Fire protection?
Police protection?

Less Than Significant Impact – The project would not be expected to substantially increase the demand for fire and police services. However, this issue will be addressed in the EIR. The EIR will document the anticipated change in emergency response times and need for additional services as a result of the proposed terminal improvements.

Other public facilities?

Less Than Significant Impact – The project would result in additional maintenance responsibilities for the Airport because of the increased size of the facilities; however, this would not be expected to be a significant increase and the additional cost associated with maintenance would be covered through the use of airport fees. City General Funds would not be used to

provide maintenance of airport facilities. No further discussion of increased maintenance demand will be addressed in the EIR.

XIV. Recreation

a) Would the project increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated?

b) Does the project include recreational facilities or require the construction or expansion of recreational facilities, which might have an adverse physical effect on the environment?

No Impact – The project would not generate any increase in population or provide development that would result in increased usage of existing neighborhood and regional parks. There would not be any physical deterioration to existing recreation facilities due to the project. This issue will not be analyzed in the EIR.

XV. Transportation/Traffic – Would the project:

a) Cause an increase in traffic which is substantial in relation to the existing traffic load and capacity of the street system (i.e., result in a substantial increase in either the number of vehicle trips, the volume to capacity ratio on roads, or congestion at intersections)?

b) Exceed, either individually or cumulatively, a level of service standard established by the county congestion management agency for designated roads or highways?

c) Result in a change in air traffic patterns, including either an increase in traffic levels or change in location that results in substantial safety risks?

d) Substantially increase hazards due to a design feature (e.g., sharp curves or dangerous intersections) or incompatible uses (e.g., farm equipment)?

e) Result in inadequate emergency access?

f) Result in inadequate parking capacity?

g) Conflict with adopted policies, plans, or programs supporting alternative transportation (e.g., bus turnouts, bicycle racks)?

Potentially Significant Impact – The EIR will address the potential traffic impacts associated with the project. The evaluation will compare existing and future conditions with and without the terminal improvements. The analysis will include peak hour trip distribution patterns of the proposed airport terminal improvements project based on likely origins and destinations of passengers and employees. The evaluation will also include a freeway link analysis. Additionally, the future conditions evaluation will take into consideration traffic generated by other proposed projects in the study area.

The EIR will include an evaluation of parking requirements and how the project and alternatives address them. Zoning will be the basis for determining the applicable parking requirements. The short-term construction impacts on parking, including the identification of locations for replacement parking to mitigate the impacts of parking that would be displaced during construction of the parking structure, will also be addressed.

XVI. Utilities and Service Systems – Would the project:

a) Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board?
b) Require or result in the construction of new water or wastewater treatment facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?
c) Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects?

Less Than Significant Impact. Wastewater service is provided by the Long Beach Water Department. The project would be expected to have an incremental increase in water demand because there would be additional facilities, including new restroom facilities, at the airport. The project may result in slightly increased peak flow rates, though the overall increase would not be substantial enough to require expansion of existing facilities. For the Airport, the number of passengers being served is more of a determining factor in the generation for wastewater rather than the size of the facilities. Given that the number of passengers being served would be the same with any of the alternatives, including the No Project Alternative, the project would not be expected to substantially increase the amount of wastewater generated. Sufficient wastewater treatment capacity exists to serve the level of demand anticipated from the proposed project. Impacts associated wastewater treatment would be less than significant and will not be analyzed in the EIR.

d) Have sufficient water supplies available to serve the project from existing entitlements and resources, or are new or expanded entitlements needed?
e) Result in a determination by the wastewater treatment provider which serves or may serve the project that it has adequate capacity to serve the project's projected demand in addition to the provider's existing commitments?

Less Than Significant Impact. Water service to the project site is provided by the Long Beach Water Department, which obtains its water supply from a combination of groundwater wells and water purchased from the Metropolitan Water District. The project would be expected to have an incremental increase in water demand because there would be additional facilities at the airport. However, the number of passengers being served is more of a determining factor in the overall demand for water service rather than the size of the facilities. Given that the number of passengers being served would be the same with any of the alternatives, including the No Project Alternative, the project would not be expected to substantially increase the demand for water beyond the current entitlements. The project would not require a water supply assessment pursuant to Senate Bill 610 because the size of the improvements is well below the thresholds used in SB 610 or the State Water Code. As part of routine plan check, a Fire Flow Test may be required, though based on discussion with the Long Beach Water Department, the 12 inch water main in Lakewood Boulevard would have sufficient capacity to provide necessary water supply to meet demand. Impacts on water resources would be less than significant and will not be analyzed in the EIR.

f) Be served by a landfill with sufficient permitted capacity to accommodate the project's solid waste disposal needs?
g) Comply with federal, state, and local statutes and regulations related to solid waste?

Less Than Significant Impact. The project would have the potential to increase the amount of solid waste both through construction and operation of the new facilities. Though the number of

passengers would be consistent for each of the project alternatives (including the No Project Alternative), it is reasonable to assume that additional waste would be generated with the new facilities because there would be increased concessions and better facilities where passengers may be more inclined to use the concession areas. However, this incremental increase would not be expected to result in a significant impact.

In compliance with the California Integrated Waste Management Act passed in 1989 [State Assembly Bill (AB) 939], the City of Long Beach has developed programs to divert the amount of refuse that is sent to landfills through waste reduction, recycling, and business and government source reduction programs. Each trash hauler is required to have a City-approved recycling program to ensure that the goal of 50 percent reduction in solid waste streams mandated by AB 939 is achieved. One way that the City of Long Beach achieves this reduction is a majority of solid waste collected from within the City of Long Beach is disposed of at the Southeast Resource Recovery Facility (SERRF), a transformation facility owned and operated by the Sanitation Districts of Los Angeles County located in the City of Long Beach.

The SERRF, which receives the majority of the City's solid waste, has a permitted capacity of 2,240 tonnage per day. The refuse sent to the SERRF is incinerated in boilers, creating steam that is used to drive a turbine generator, which in turn, produces electricity. This energy is used to power SERRF operations, and the remainder is sold to the Southern California Edison Company for public use. The City of Long Beach receives a ten percent waste diversion credit through use of the SERRF, thereby raising the City's waste diversion rate to 55 percent. This program would continue to apply ongoing operations at the airport.

The seven Class III landfills that receive the majority of solid waste from the City of Long Beach have a combined capacity of approximately 170 million tons. The permit expiration for these facilities extends from January 2007 for Bradley Landfill in Los Angeles to January 2040 for the Prima Deshecha Landfill in San Juan Capistrano. The project would not significantly impact the capacity of these combined facilities.

The construction activities would also generate inert debris, such as concrete and materials from demolition. Senate Bill 1374 (Construction and Demolition Waste Material: Diversion Requirements), passed in 2002 focuses on the reduction of construction and demolition waste sent to landfills. To comply with this bill, a standard specification in all City contracts requires that the contractor recycle such wastes. This ensures this material is not disposed of in landfills.

With the implementation of the standard conditions and regulations that are already in place, the project would not have a significant impact on solid waste facilities and would comply with all federal, state and local requirements pertaining to solid waste disposal. No further discussion of solid waste disposal needs will be addressed in the EIR.

Mandatory Findings of Significance

a) Does the project have the potential to degrade the quality of the environment, substantially reduce the habitat of a fish or wildlife species, cause a fish or wildlife population to drop below self-sustaining levels, threaten to eliminate a plant or animal community, reduce the number or restrict the range of rare or endangered plants or animals, or eliminate important examples of the major periods of California history or prehistory?

b) Does the project have impacts that are individually limited, but cumulatively considerable? ("Cumulatively considerable" means that the incremental effects of a project are considerable when viewed in connection with the effects of past

projects, the effects of other current projects, and the effects of probable future projects)?

c) Does the project have environmental effects which will cause substantial adverse effects on human beings, either directly or indirectly?

Less Than Significant

The project has the potential of having significant effects directly and indirectly on human beings. It is anticipated that there would be significant construction air quality impacts. The EIR will evaluate the potential cumulative impacts associated with other projects in the study area.

References

City of Long Beach, Department of Planning and Building. *Conservation Element, City of Long Beach General Plan Program.* April 1973.

-----. *Environmental Impact Report for Douglas Park (formerly PacifiCenter@Long Beach) State Clearinghouse Number 200105048.* December 2004.

-----. *Final Environmental Impact Report E-45-85 for the Airport Part 150 Noise Compatibility Study, State Clearinghouse Number 86012911.* June 1986.

-----. *Initial Study and Subsequent Negative Declaration for the Proposed Amendments to the Long Beach Noise Ordinance Pertaining to Operations at the Long Beach Airport.* February 1995.

-----. *Land Use Element of the Long Beach General Plan.* April 1997.

-----. *Public Safety Element, General Plan Program.* May 1975.

-----. Water Department. Personal Communication with Larry Oaks. April 2005.

United States Department of Agriculture, Wildlife Services. *Wildlife Hazards Assessment for Long Beach Airport Los Angeles County, California (March 2001-February 2002).* 2002.

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Attachment B

Takeoff & Climbout Times-in-Mode (TIM) - Difference between Maximum and 90% of Maximum Takeoff Weight

Takeoff & Climbout Times-in-Mode (TIM) - Difference between Maximum and 90% of Maximum Takeoff Weight

Table 1 - Times Based on Maximum Weight of Aircraft

Airframe	Weight (lbs)	Takeoff Time (sec)	Climbout Time (sec)
A320	162,000	59.2189	39.42205
757PW	222,000	56.6751	43.40284
737700	154,500	63.5106	33.55775

Climbout Distance Assumptions		
EDMS	2,000	ft
LGB	1,300	ft
Ratio	0.65	

Table 2 - Times Based on 90% Maximum Weight of Aircraft

Airframe	Weight (lbs)	Takeoff Time (sec)	Climbout Time (sec)
A320	145,800	51.2881	34.7352
757PW	199,800	49.0596	38.1415
737700	139,050	54.7829	29.6702

Mixing Height Assumptions		
EDMS (a)	3,000	ft
LGB (a,b)	2,300	ft

Notes:
(a) Initial 1000 ft of elevation in takeoff mode
(b) From EEA 1999

Table 3 - Difference in Times Based on Weight

Airframe	Takeoff Time (sec)	Climbout Time (sec)	Total Time (sec)
A320	7.9308	4.6869	12.6177
757PW	7.6155	5.2613	12.8768
737700	8.7277	3.8875	12.6152

Notes:
(1) Airframe for 757 assumed to be 757-200 (757PW in EDMS 4.2 database).
(2) The data provided above is summarized from EDMS 4.2 database (DEPARTRS.dbf)
(3) Mixing Height for Long Beach assumed to be 2,300 ft; EDMS assumes default of 3,000 ft.
(4) A ratio of 65% was applied to climbout time to adjust time to LGB mixing height (2,300 ft vs. 3,000 ft)
(5) Since linear relationship between takeoff time and weight, trend equation used to calculate times at 90% maximum weight.

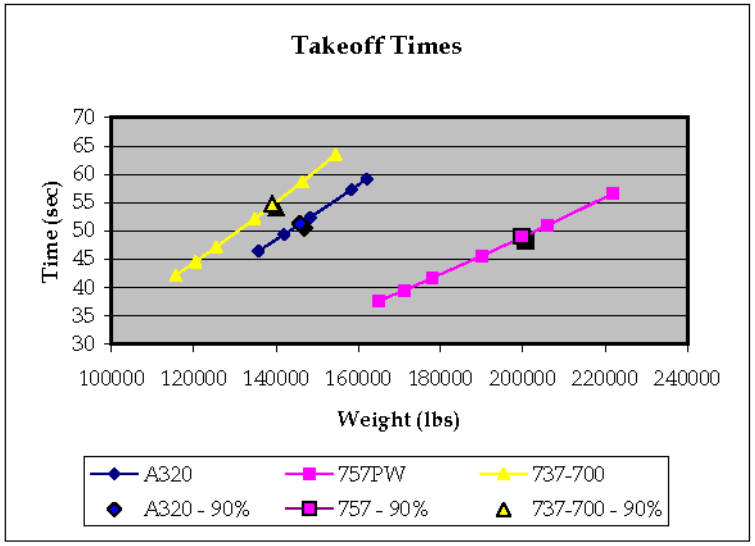
Energy and Environmental Analysis, Inc. (EEA) 1999. "South Coast Aircraft Emission Inventory: Baseline for 1997," prepared for South Coast AQMD, December 1999.

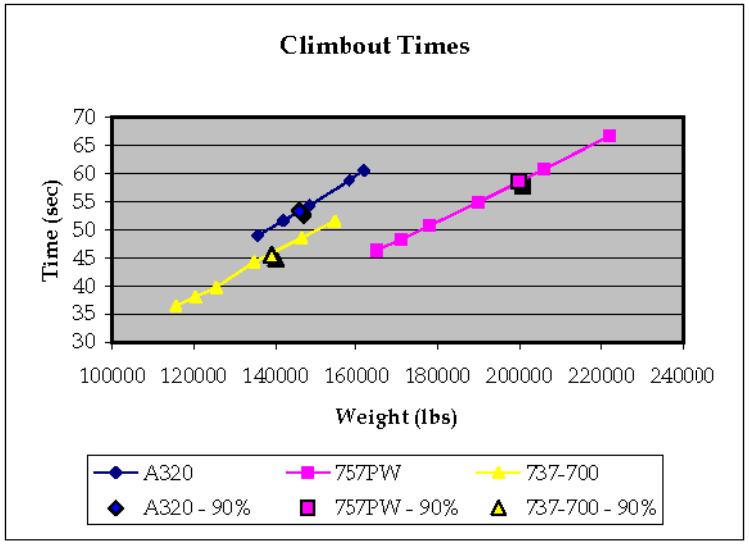
Weight, Takeoff TIM and Climbout TIM from EDMS 4.2 (September 2004).

		Takeoff TIM			
INM_NAME	STAGE	WEIGHT_LBS	TIME_1000	TIME_3000	Climb TIM
A320	1	162000	59.2189	119.8682	60.6493
A320	2	158300	57.3276	116.2596	58.9320
A320	3	148300	52.3966	106.8176	54.4210
A320	4	141900	49.3603	101.0332	51.6729
A320	5	135700	46.4764	95.5682	49.0918
757PW	1	222000	56.6751	123.4487	66.7736
757PW	2	206000	50.9651	111.8158	60.8507
757PW	3	190000	45.5634	100.5435	54.9801
757PW	4	178000	41.7133	92.5227	50.8094
757PW	5	171000	39.5338	87.8446	48.3108
757PW	6	165000	37.6933	84.0959	46.4026
737700	1	154500	63.5106	115.1379	51.6273
737700	2	146400	58.7027	107.3282	48.6255
737700	3	134800	52.1727	96.5725	44.3998
737700	4	125500	47.2096	87.0238	39.8142
737700	5	120400	44.5837	82.7170	38.1333
737700	6	115600	42.1823	78.7759	36.5936

Airframe	Weight (90% Max) (lbs)	Takeoff TIM TIME_1000 (sec)	TIME_3000 (sec)	Climb TIM (sec)
A320	145800	51.2881	104.7268	53.4387
757PW	199800	49.0596	107.7389	58.6793
737700	139050	54.7829	100.4294	45.6465

Note: Climbout time-in-mode (Climb TIM) is calculated by subtracting the time to reach 1000 ft above ground (TIME_1000, which is equal to the Takeoff TIM) from the time to reach 3000 ft above ground (TIME_3000). Times are in seconds.





Attachment C

Summary of PM Emission Indices

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
	Allied Signal				
1AS001	TFE731-2-2B	175.72	143.36	109.06	123.26
1AS002	TFE731-3	175.84	143.47	109.15	123.38
	Allison Engine Company / Rolls-Royce Corporation				
4AL003	AE3007A	2.40	2.40	2.40	2.40
4AL002	AE3007A1 series	2.40	2.40	2.40	2.40
3AL001	AE3007C	2.40	2.40	2.40	2.40
6AL004	AE3007C1	2.40	2.40	2.40	2.40
	AO 'Aviadgatel'				
1AA001	D-30 (II series)	1298.78	1443.89	905.04	101.34
1AA002	D-30KP-2	414.65	503.82	352.88	69.74
1AA003	D-30KU	672.85	672.85	672.85	672.85
1AA004	D-30KU-154	720.23	795.18	801.01	698.85
1AA005	PS-90A	242.83	242.83	242.83	242.83
	BMW Rolls-Royce				
3BR001	BR700-710A1-10	180.65	117.61	0.10	0.10
4BR008	BR700-710A1-10	277.13	207.73	0.26	0.85
4BR009	BR700-710A2-20	276.06	206.17	0.23	0.87
4BR002	BR700-715A1-30	19.92	14.63	2.27	2.03
4BR005	BR700-715A1-30	33.57	28.58	1.50	0.05
4BR003	BR700-715B1-30	23.48	16.31	2.53	1.95
4BR006	BR700-715B1-30	36.84	30.83	2.23	0.02
4BR004	BR700-715C1-30	28.84	18.29	2.80	1.87
4BR007	BR700-715C1-30	41.32	32.59	2.94	0.01
	CFM International				
1CM001	CFM56-2A series	99.07	31.77	12.49	8.36
1CM002	CFM56-2B-1	60.38	17.34	13.40	9.92
1CM003	CFM56-2-C5	60.38	17.34	13.40	9.92
1CM004	CFM56-3-B1	29.10	12.49	12.49	9.92
1CM005	CFM56-3B-2	60.38	17.34	12.49	9.92
1CM006	CFM56-3C (Rerated)	17.34	11.60	12.49	9.12
1CM007	CFM56-3C-1	94.60	27.81	12.49	10.75
1CM008	CFM56-5-A1	344.98	277.49	34.55	10.75
1CM009	CFM56-5A3	385.27	299.26	40.41	14.34
4CM035	CFM56-5A4	273.93	117.89	19.84	20.48
4CM036	CFM56-5A5	288.28	154.61	20.49	20.21
2CM012	CFM56-5B1	115.43	165.33	10.00	12.58
2CM016	CFM56-5B1/2	39.65	49.73	10.05	11.92
3CM020	CFM56-5B1/2P	0.69	0.27	0.69	9.12
3CM023	CFM56-5B1/P	49.95	43.84	9.84	13.04
2CM013	CFM56-5B2	105.94	154.17	10.12	12.45
2CM017	CFM56-5B2/2	39.65	53.75	10.13	11.82

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
4CM037	CFM56-5B2/2P	0.69	0.27	0.69	9.92
3CM024	CFM56-5B2/P	49.95	49.05	9.93	12.83
4CM038	CFM56-5B3/2P	0.69	0.27	0.69	10.75
3CM025	CFM56-5B3/P	49.95	55.11	10.02	12.70
2CM014	CFM56-5B4	151.43	200.88	9.71	13.26
2CM018	CFM56-5B4/2	39.65	35.09	9.77	12.34
3CM021	CFM56-5B4/2P	0.27	0.27	0.69	8.36
3CM026	CFM56-5B4/P	49.95	31.60	9.64	13.49
3CM027	CFM56-5B5/P	49.95	19.62	9.56	14.39
2CM019	CFM56-5B6/2	25.29	24.04	9.65	12.97
3CM022	CFM56-5B6/2P	0.27	0.27	73.65	6.91
3CM028	CFM56-5B6/P	49.95	22.45	9.55	14.10
1CM010	CFM56-5C2	182.72	113.02	2.40	2.85
1CM011	CFM56-5C3	203.99	127.79	2.40	2.85
2CM015	CFM56-5C4	228.90	146.02	2.53	2.85
3CM029	CFM56-7B18	171.04	12.10	2.50	2.65
3CM030	CFM56-7B20	191.71	14.83	2.57	2.62
4CM039	CFM56-7B20/2	5.10	14.38	2.59	2.59
3CM031	CFM56-7B22	210.25	21.46	2.71	2.56
4CM040	CFM56-7B22/2	1.23	20.79	2.74	2.56
3CM032	CFM56-7B24	229.55	28.98	2.83	2.53
4CM041	CFM56-7B24/2	1.11	27.93	2.81	2.53
3CM033	CFM56-7B26	302.96	43.82	3.00	2.49
4CM042	CFM56-7B26/2	1.30	41.82	2.97	2.49
3CM034	CFM56-7B27	341.06	53.93	3.10	2.47
4CM043	CFM56-7B27/2	1.43	51.44	3.11	2.48
	General Electric				
1GE034	CF34-3A	620.88	130.33	18.39	18.39
1GE035	CF34-3A1	620.88	130.33	18.39	18.39
5GE083	CF34-8C1	48.79	4.86	0.00	0.00
5GE084	CF34-3B	449.39	130.33	18.39	18.39
3GE067	CF6-45A	198.11	209.62	3.59	4.40
1GE005	CF6-45A2	16.31	9.92	16.31	37.43
3GE068	CF6-45A2	198.11	209.62	3.59	4.40
3GE069	CF6-50A	195.66	211.20	4.92	4.40
1GE006	CF6-50C	27.81	13.40	15.31	35.97
3GE070	CF6-50C	192.01	204.92	5.66	4.40
3GE073	CF6-50C1	178.30	201.50	5.72	4.40
1GE007	CF6-50C1, -C2	30.42	14.34	14.34	35.97
3GE074	CF6-50C2	178.30	201.50	5.72	4.40
3GE078	CF6-50C2B	184.80	198.42	5.47	4.40
1GE008	CF6-50C2R	27.81	13.40	15.31	35.97
3GE072	CF6-50C2R	192.01	204.92	5.66	4.40
3GE071	CF6-50CA	192.01	204.92	5.66	4.40
3GE075	CF6-50E	178.30	201.50	5.72	4.40
3GE076	CF6-50E1	178.30	201.50	5.72	4.40

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
1GE009	CF6-50E2	30.42	14.34	14.34	35.97
3GE077	CF6-50E2	178.30	201.50	5.72	4.40
3GE079	CF6-50E2B	184.80	198.42	5.47	4.40
1GE001	CF6-6D	29.10	17.34	17.34	29.10
1GE002	CF6-6D1A	29.10	17.34	17.34	29.10
1GE003	CF6-6K	29.10	17.34	17.34	29.10
1GE004	CF6-6K2	29.10	17.34	17.34	29.10
1GE010	CF6-80A	210.25	151.43	8.36	8.36
1GE011	CF6-80A1	210.25	151.43	8.36	8.36
1GE012	CF6-80A2	210.25	151.43	8.36	8.36
1GE013	CF6-80A3	210.25	151.43	8.36	8.36
1GE014	CF6-80C2A1	105.94	33.87	11.46	11.46
2GE036	CF6-80C2A1	79.69	38.90	11.46	11.46
1GE015	CF6-80C2A2	69.74	1.97	11.46	11.46
1GE016	CF6-80C2A2	69.74	1.97	11.46	11.46
2GE037	CF6-80C2A2	56.80	19.48	11.46	11.46
1GE017	CF6-80C2A3	96.82	40.55	11.46	11.46
1GE018	CF6-80C2A3	96.82	40.55	11.46	11.46
2GE038	CF6-80C2A3	77.65	43.49	11.46	11.46
1GE019	CF6-80C2A5	96.82	50.45	11.46	11.46
1GE020	CF6-80C2A5	96.82	50.45	11.46	11.46
2GE039	CF6-80C2A5	78.46	49.28	11.46	11.46
3GE056	CF6-80C2A5F	88.07	46.67	11.46	11.46
1GE021	CF6-80C2A8	105.94	33.87	11.46	11.46
2GE040	CF6-80C2A8	79.07	38.90	11.46	11.46
1GE022	CF6-80C2B1	81.75	36.82	11.12	16.15
2GE041	CF6-80C2B1	73.65	31.77	11.15	16.10
1GE023	CF6-80C2B1F	81.75	38.80	11.16	15.70
1GE024	CF6-80C2B1F	81.75	38.19	11.13	15.99
2GE045	CF6-80C2B1F	77.65	35.97	11.21	15.99
1GE025	CF6-80C2B2	56.80	31.88	11.05	16.36
2GE042	CF6-80C2B2	53.33	18.39	11.06	16.48
1GE026	CF6-80C2B2F	90.22	24.07	11.60	12.49
2GE046	CF6-80C2B2F	55.05	18.39	11.07	16.59
1GE027	CF6-80C2B4	83.83	42.51	11.21	15.99
2GE043	CF6-80C2B4	77.65	35.97	11.19	15.89
1GE028	CF6-80C2B4F	85.94	38.90	10.75	10.75
2GE047	CF6-80C2B4F	77.65	35.97	11.21	15.99
3GE057	CF6-80C2B5F	88.07	46.67	11.40	15.65
1GE029	CF6-80C2B6	96.82	48.56	11.35	15.60
2GE044	CF6-80C2B6	77.65	49.95	11.29	15.70
1GE030	CF6-80C2B6F	105.94	49.95	10.75	21.72
2GE048	CF6-80C2B6F	77.65	48.30	11.34	15.79
2GE054	CF6-80C2B7F	105.94	49.95	10.75	21.72
2GE055	CF6-80C2B7F	77.65	48.30	11.34	15.79
3GE058	CF6-80C2B8FA	83.83	46.67	11.36	15.70
1GE031	CF6-80C2D1F	105.94	53.33	10.75	22.88

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
2GE049	CF6-80C2D1F	79.69	51.63	11.46	11.46
1GE032	CF6-80E1A1	143.35	77.65	11.46	11.46
2GE050	CF6-80E1A1	77.65	64.05	11.46	11.46
1GE033	CF6-80E1A2	148.71	83.83	11.46	11.46
2GE051	CF6-80E1A2	75.64	69.74	11.46	11.46
5GE085	CF6-80E1A3	154.17	115.43	11.46	11.46
4GE080	CF6-80E1A4	153.89	102.71	11.46	11.46
4GE081	CF6-80E1A4	58.58	51.63	11.46	11.46
2GE052	GE90-76B	17.34	17.34	17.34	148.71
3GE062	GE90-76B	0.69	0.69	0.69	0.69
5GE086	GE90-76B	15.31	6.91	16.31	12.49
6GE087	GE90-76B	15.31	6.91	16.31	12.49
3GE059	GE90-77B	16.13	6.85	16.19	147.10
3GE063	GE90-77B	0.69	0.69	0.69	0.69
6GE088	GE90-77B	16.31	6.91	16.31	12.49
2GE053	GE90-85B	17.34	17.34	17.34	140.70
3GE064	GE90-85B	0.69	0.69	0.69	0.69
6GE089	GE90-85B	20.58	11.60	17.34	12.49
3GE060	GE90-90B	23.57	14.22	19.34	135.47
3GE065	GE90-90B	0.69	0.69	0.69	0.69
6GE090	GE90-90B	24.07	14.34	19.48	12.49
3GE061	GE90-92B	25.23	16.42	19.60	132.89
3GE066	GE90-92B	0.69	0.69	0.69	0.69
6GE091	GE90-94B	25.29	16.31	19.48	12.49
	International Aero Engines				
1IA001	V2500-A1	22.88	22.88	22.88	22.88
3IA006	V2522-A5	125.27	125.27	125.27	125.27
3IA007	V2524-A5	125.27	125.27	125.27	125.27
1IA002	V2525-D5	125.27	125.27	125.27	125.27
1IA003	V2527-A5	125.27	125.27	125.27	125.27
1IA004	V2528-D5	125.27	125.27	125.27	125.27
1IA005	V2530-A5	125.27	125.27	125.27	125.27
3IA008	V2533-A5	125.27	125.27	125.27	125.27
	KKBM				
1KK001	NK-8-2U	704.91	704.91	704.91	704.91
1KK002	NK-8-2U	704.91	620.11	743.36	768.99
1KK003	NK-86	631.13	631.13	631.13	631.13
1KK004	NK-86A	738.88	594.00	610.09	563.99
1KK005	NK-86MA	148.71	148.71	148.71	148.71
	Pratt & Whitney Aircraft Group				
1PW035	JT15D-1 series	314.18	314.18	314.18	314.18
1PW036	JT15D-4 series	281.06	281.06	281.06	281.06
1PW037	JT15D-5, -5A, -5B	458.27	458.27	458.27	458.27
1PW038	JT15D-5C	397.74	317.96	397.74	397.74

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
1PW001	JT3D-3B	3204.24	3204.24	3204.24	3204.24
1PW003	JT3D-7 series	436.22	436.22	436.22	436.22
1PW002	JT3D-7 series	2944.54	2944.54	2944.54	2944.54
1PW008	JT8D-11	678.14	678.14	678.14	678.14
1PW010	JT8D-15	341.06	341.06	341.06	341.06
1PW009	JT8D-15	721.19	721.19	721.19	721.19
1PW011	JT8D-15A	341.06	341.06	341.06	341.06
1PW013	JT8D-17	385.27	385.27	385.27	385.27
1PW012	JT8D-17	732.14	732.14	732.14	732.14
1PW014	JT8D-17A	385.27	385.27	385.27	385.27
1PW015	JT8D-17AR	508.48	508.48	508.48	508.48
1PW016	JT8D-17R	508.48	508.48	508.48	508.48
1PW017	JT8D-209	182.72	182.72	182.72	182.72
4PW068	JT8D-217	62.20	62.20	62.20	62.20
1PW018	JT8D-217 series	249.60	253.01	253.01	253.01
4PW069	JT8D-217A	62.20	62.20	62.20	62.20
4PW070	JT8D-217C	62.20	62.20	62.20	62.20
4PW071	JT8D-219	77.65	77.65	77.65	77.65
1PW019	JT8D-219	288.28	295.58	295.58	295.58
1PW005	JT8D-7 series	138.07	138.07	138.07	138.07
1PW004	JT8D-7 series	636.28	636.28	636.28	636.28
1PW007	JT8D-9 series	154.17	154.17	154.17	154.17
1PW006	JT8D-9 series	678.14	678.14	678.14	678.14
1PW031	JT9D-20	219.81	138.07	12.49	1.26
1PW032	JT9D-20J	630.84	166.97	5.10	2.85
1PW033	JT9D-59A	955.74	227.77	5.12	2.86
1PW020	JT9D-7	207.11	125.27	12.49	1.26
1PW034	JT9D-70A	955.74	227.77	5.12	2.86
1PW021	JT9D-7A	219.81	138.07	12.49	1.26
1PW022	JT9D-7F	390.33	108.13	4.53	2.89
1PW023	JT9D-7F	352.88	113.33	4.53	2.86
1PW024	JT9D-7J	630.84	166.97	5.10	2.85
1PW025	JT9D-7Q	955.74	227.77	5.12	2.86
1PW026	JT9D-7R4D, -7R4D1	37.43	82.73	6.14	2.93
1PW027	JT9D-7R4E, -7R4E1	43.49	95.44	4.82	2.89
1PW028	JT9D-7R4E4, -E1(H)	33.15	132.59	4.69	2.89
1PW029	JT9D-7R4G2	75.64	155.74	4.88	2.88
1PW030	JT9D-7R4H1	92.40	227.33	5.63	2.85
1PW039	PW2037	191.71	191.71	191.71	191.71
4PW072	PW2037	165.33	165.33	165.33	165.33
1PW040	PW2040	203.99	203.99	203.99	203.99
4PW073	PW2040	171.04	171.04	171.04	171.04
1PW042	PW4056	96.82	96.82	96.82	96.82
1PW041	PW4056	288.28	288.28	288.28	288.28
1PW043	PW4060	108.28	108.28	108.28	108.28
2PW060	PW4074	67.82	67.82	67.82	67.82
3PW063	PW4074D	21.49	21.49	21.49	21.49

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
2PW061	PW4077	88.07	88.07	88.07	88.07
3PW064	PW4077D	26.03	26.03	26.03	26.03
2PW062	PW4084	165.33	165.33	165.33	165.33
3PW065	PW4084D	49.28	49.28	49.28	49.28
3PW066	PW4090	82.16	82.16	82.16	82.16
5PW076	PW4098	133.66	133.66	133.66	133.66
1PW045	PW4152	79.69	79.69	79.69	79.69
1PW044	PW4152	232.84	232.84	232.84	232.84
1PW047	PW4156	96.82	96.82	96.82	96.82
1PW046	PW4156	288.28	288.28	288.28	288.28
1PW048	PW4158	103.63	103.63	103.63	103.63
1PW049	PW4164	20.58	20.58	20.58	20.58
1PW050	PW4168	29.10	29.10	29.10	29.10
5PW075	PW4168	232.84	232.84	232.84	232.84
4PW067	PW4168A	29.10	29.10	29.10	29.10
1PW051	PW4256	288.28	288.28	288.28	288.28
1PW052	PW4460	108.28	108.28	108.28	108.28
1PW053	PW4x50	75.64	75.64	75.64	75.64
1PW054	PW4x52	85.94	85.94	85.94	85.94
1PW055	PW4x56	113.02	113.02	113.02	113.02
1PW056	PW4x58	127.79	127.79	127.79	127.79
5PW074	PW4X58	197.80	197.80	197.80	197.80
1PW057	PW4x60	140.70	140.70	140.70	140.70
1PW059	PW4x62	154.17	154.17	154.17	154.17
1PW058	PW4x62	110.64	110.64	110.64	110.64
	Rolls-Royce Ltd				
1RR001	M54H-01	2389.22	1706.11	176.84	14.34
1RR002	RB211-22B	302.96	239.48	101.34	18.39
1RR003	RB211-22B	657.06	657.06	657.06	657.06
1RR004	RB211-524B series	431.86	259.90	14.34	1.99
1RR005	RB211-524B series	219.81	219.81	219.81	219.81
1RR006	RB211-524C2	295.58	295.58	295.58	295.58
1RR007	RB211-524D4	216.60	216.60	216.60	216.60
1RR008	RB211-524D4	219.81	219.81	219.81	219.81
1RR009	RB211-524G	27.81	27.81	27.81	27.81
1RR010	RB211-524G	27.81	27.81	27.81	27.81
4RR036	RB211-524G-T	48.95	48.95	48.95	48.95
1RR011	RB211-524H	27.81	27.81	27.81	27.81
4RR037	RB211-524H-T	48.95	48.95	48.95	48.95
1RR012	RB211-535C	101.34	101.34	101.34	101.34
1RR013	RB211-535E4	6.24	6.24	6.24	6.24
1RR014	RB211-535E4	6.24	6.24	6.24	6.24
3RR028	RB211-535E4	6.91	6.91	6.91	6.91
5RR038	RB211-535E4	85.94	85.94	85.94	85.94
3RR034	RB211-535E4B	7.19	7.19	7.19	7.19
5RR039	RB211-535E4B	85.94	85.94	85.94	85.94

Summary of PM Emission Indices (Revised FOA)					
		----------PM Emission Index ----------			
UID	Engine	T/O	C/O	App	Idle
No	Identification	----------(mg/kg fuel)----------			
4RR035	Spey 555	964.40	964.40	964.40	964.40
1RR015	SPEY Mk511	4547.32	4547.32	4547.32	4547.32
1RR016	SPEY Mk511	620.88	620.88	620.88	620.88
1RR017	SPEY Mk555	851.30	838.17	830.17	696.15
1RR018	SPEY Mk555	833.92	833.92	833.92	833.92
3RR031	TAY 650	147.90	147.90	147.90	147.90
3RR032	TAY 651	147.90	147.90	147.90	147.90
3RR033	TAY 651	414.65	414.65	414.65	414.65
1RR019	TAY Mk611-8	590.60	590.60	590.60	590.60
1RR020	TAY Mk620-15	590.60	590.60	590.60	590.60
1RR021	TAY Mk650-15	418.92	418.92	418.92	418.92
6RR041	Trent 556-61	10.25	9.05	2.49	1.46
2RR022	Trent 768	3.64	3.64	3.64	3.64
3RR029	Trent 768	8.36	8.36	8.36	8.36
2RR023	Trent 772	3.64	3.64	3.64	3.64
3RR030	Trent 772	8.36	8.36	8.36	8.36
2RR024	Trent 875	48.95	48.95	48.95	48.95
2RR025	Trent 877	48.95	48.95	48.95	48.95
2RR026	Trent 884	48.95	48.95	48.95	48.95
2RR027	Trent 892	48.95	48.95	48.95	48.95
5RR040	Trent 895	48.95	48.95	48.95	48.95
	Textron Lycoming				
1TL001	ALF 502L-2	108.28	232.84	117.85	16.31
1TL002	ALF 502R-3	230.54	210.25	51.12	9.38
1TL003	ALF 502R-5	259.90	232.84	55.05	10.75
1TL004	LF507-1F, -1H	159.70	156.92	77.65	75.64
	ZMKB				
1ZM001	D-36	306.68	306.68	306.68	n/a

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
	Allied Signal								
1AS001	TFE731-2-2B	3.602E+01	2.480E+01	7.307E+00	2.958E+00	0.205	0.173	0.067	0.024
1AS002	TFE731-3	3.956E+01	2.668E+01	7.859E+00	3.208E+00	0.225	0.186	0.072	0.026
	Allison Engine Company / Rolls-Royce Corporation								
4AL003	AE3007A	9.048E-01	7.560E-01	2.808E-01	1.176E-01	0.377	0.315	0.117	0.049
4AL002	AE3007A1 series	9.120E-01	7.656E-01	2.808E-01	1.200E-01	0.380	0.319	0.117	0.050
3AL001	AE3007C	6.720E-01	5.616E-01	2.184E-01	9.360E-02	0.28	0.234	0.091	0.039
6AL004	AE3007C1	7.728E-01	6.456E-01	2.376E-01	1.008E-01	0.322	0.269	0.099	0.042
	AO 'Aviadgatel'								
1AA001	D-30 (II series)	1.494E+03	1.408E+03	3.168E+02	1.317E+01	1.150	0.975	0.350	0.130
1AA002	D-30KP-2	6.925E+02	7.154E+02	1.729E+02	1.464E+01	1.67	1.42	0.49	0.210
1AA003	D-30KU	1.023E+03	8.747E+02	3.364E+02	1.447E+02	1.520	1.300	0.500	0.215
1AA004	D-30KU-154	1.023E+03	8.747E+02	3.364E+02	1.447E+02	1.420	1.100	0.420	0.207
1AA005	PS-90A	4.223E+02	3.475E+02	1.187E+02	4.322E+01	1.739	1.431	0.489	0.178
	BMW Roll-Royce								
3BR001	BR700-710A1-10	1.277E+02	6.916E+01	2.175E-02	8.799E-03	0.707	0.588	0.220	0.089
4BR008	BR700-710A1-10	1.976E+02	1.234E+02	5.533E-02	7.522E-02	0.713	0.594	0.214	0.089
4BR009	BR700-710A2-20	1.971E+02	1.227E+02	4.865E-02	7.766E-02	0.714	0.595	0.214	0.089
4BR002	BR700-715A1-30	1.665E+01	1.010E+01	5.566E-01	1.944E-01	0.836	0.690	0.245	0.096
4BR005	BR700-715A1-30	2.789E+01	1.961E+01	3.598E-01	4.516E-03	0.831	0.686	0.240	0.100
4BR003	BR700-715B1-30	2.125E+01	1.212E+01	6.556E-01	1.907E-01	0.905	0.743	0.259	0.098
4BR006	BR700-715B1-30	3.353E+01	2.312E+01	5.731E-01	2.062E-03	0.910	0.750	0.257	0.103
4BR004	BR700-715C1-30	2.826E+01	1.461E+01	7.651E-01	1.887E-01	0.980	0.799	0.273	0.101
4BR007	BR700-715C1-30	4.066E+01	2.624E+01	8.005E-01	7.676E-04	0.984	0.805	0.272	0.105
	CFM International								
1CM001	CFM56-2A series	1.104E+02	2.895E+01	3.971E+00	1.086E+00	1.114	0.911	0.318	0.130

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
1CM002	CFM56-2B-1	5.947E+01	1.420E+01	4.168E+00	1.270E+00	0.985	0.819	0.311	0.128
1CM003	CFM56-2-C5	5.947E+01	1.420E+01	4.168E+00	1.270E+00	0.985	0.819	0.311	0.128
1CM004	CFM56-3-B1	2.753E+01	9.891E+00	3.622E+00	1.131E+00	0.946	0.792	0.290	0.114
1CM005	CFM56-3B-2	6.376E+01	1.522E+01	3.921E+00	1.181E+00	1.056	0.878	0.314	0.119
1CM006	CFM56-3C (Rerated)	1.512E+01	8.494E+00	3.409E+00	1.013E+00	0.872	0.732	0.273	0.111
1CM007	CFM56-3C-1	1.092E+02	2.653E+01	4.196E+00	1.333E+00	1.154	0.954	0.336	0.124
1CM008	CFM56-5-A1	3.626E+02	2.392E+02	1.005E+01	1.087E+00	1.051	0.862	0.291	0.1011
1CM009	CFM56-5A3	4.357E+02	2.768E+02	1.240E+01	1.497E+00	1.131	0.925	0.307	0.1044
4CM035	CFM56-5A4	2.457E+02	8.724E+01	5.178E+00	1.946E+00	0.897	0.74	0.261	0.095
4CM036	CFM56-5A5	2.802E+02	1.235E+02	5.656E+00	1.980E+00	0.972	0.799	0.276	0.098
2CM012	CFM56-5B1	1.569E+02	1.840E+02	3.640E+00	1.471E+00	1.359	1.113	0.364	0.117
2CM016	CFM56-5B1/2	5.333E+01	5.490E+01	3.707E+00	1.537E+00	1.345	1.104	0.369	0.129
3CM020	CFM56-5B1/2P	9.098E-01	2.940E-01	2.550E-01	1.095E+00	1.32	1.07	0.37	0.12
3CM023	CFM56-5B1/P	6.468E+01	4.638E+01	3.395E+00	1.434E+00	1.295	1.058	0.345	0.11
2CM013	CFM56-5B2	1.511E+02	1.785E+02	3.804E+00	1.482E+00	1.426	1.158	0.376	0.119
2CM017	CFM56-5B2/2	5.575E+01	6.084E+01	3.817E+00	1.549E+00	1.406	1.132	0.377	0.131
4CM037	CFM56-5B2/2P	9.580E-01	3.050E-01	2.688E-01	1.290E+00	1.39	1.11	0.39	0.13
3CM024	CFM56-5B2/P	6.798E+01	5.391E+01	3.535E+00	1.450E+00	1.361	1.099	0.356	0.113
4CM038	CFM56-5B3/2P	1.013E+00	3.160E-01	2.757E-01	1.397E+00	1.47	1.15	0.4	0.13
3CM025	CFM56-5B3/P	7.143E+01	6.288E+01	3.667E+00	1.461E+00	1.430	1.141	0.366	0.115
2CM014	CFM56-5B4	1.766E+02	1.930E+02	3.166E+00	1.418E+00	1.166	0.961	0.326	0.107
2CM018	CFM56-5B4/2	4.679E+01	3.421E+01	3.273E+00	1.493E+00	1.180	0.975	0.335	0.121
3CM021	CFM56-5B4/2P	3.133E-01	2.611E-01	2.343E-01	1.003E+00	1.14	0.95	0.34	0.12
3CM026	CFM56-5B4/P	5.654E+01	2.954E+01	3.008E+00	1.403E+00	1.132	0.935	0.312	0.104
3CM027	CFM56-5B5/P	4.450E+01	1.456E+01	2.486E+00	1.352E+00	0.891	0.742	0.260	0.094
2CM019	CFM56-5B6/2	2.524E+01	1.988E+01	3.041E+00	1.439E+00	0.998	0.827	0.315	0.111
3CM022	CFM56-5B6/2P	2.666E-01	2.226E-01	2.283E+01	7.605E-01	0.970	0.81	0.31	0.11
3CM028	CFM56-5B6/P	4.800E+01	1.794E+01	2.626E+00	1.367E+00	0.961	0.799	0.275	0.097
1CM010	CFM56-5C2	2.390E+02	1.216E+02	8.539E-01	3.348E-01	1.308	1.076	0.3558	0.1175
1CM011	CFM56-5C3	2.801E+02	1.445E+02	8.880E-01	3.428E-01	1.373	1.131	0.370	0.1203
2CM015	CFM56-5C4	3.333E+02	1.745E+02	9.770E-01	3.533E-01	1.456	1.195	0.386	0.124

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
3CM029	CFM56-7B18	1.461E+02	8.636E+00	6.507E-01	2.572E-01	0.854	0.714	0.260	0.097
3CM030	CFM56-7B20	1.750E+02	1.129E+01	7.047E-01	2.616E-01	0.913	0.761	0.274	0.100
4CM039	CFM56-7B20/2	4.605E+00	1.085E+01	7.209E-01	2.646E-01	0.903	0.754	0.278	0.102
3CM031	CFM56-7B22	2.147E+02	1.811E+01	8.079E-01	2.691E-01	1.021	0.844	0.298	0.105
4CM040	CFM56-7B22/2	1.241E+00	1.740E+01	8.312E-01	2.691E-01	1.008	0.837	0.303	0.105
3CM032	CFM56-7B24	2.532E+02	2.637E+01	8.951E-01	2.753E-01	1.103	0.910	0.316	0.109
4CM041	CFM56-7B24/2	1.204E+00	2.520E+01	8.800E-01	2.753E-01	1.089	0.902	0.313	0.109
3CM033	CFM56-7B26	3.699E+02	4.378E+01	1.015E+00	2.817E-01	1.221	0.999	0.338	0.113
4CM042	CFM56-7B26/2	1.559E+00	4.136E+01	9.918E-01	2.817E-01	1.203	0.989	0.334	0.113
3CM034	CFM56-7B27	4.379E+02	5.625E+01	1.080E+00	2.865E-01	1.284	1.043	0.349	0.116
4CM043	CFM56-7B27/2	1.809E+00	5.313E+01	1.093E+00	2.849E-01	1.265	1.033	0.351	0.115
	General Electric								
1GE034	CF34-3A	2.527E+02	4.357E+01	2.189E+00	9.123E-01	0.4070	0.3343	0.1190	0.0496
1GE035	CF34-3A1	2.527E+02	4.357E+01	2.189E+00	9.123E-01	0.4070	0.3343	0.1190	0.0496
5GE083	CF34-8C1	2.948E+01	2.402E+00	0.000E+00	0.000E+00	0.6042	0.4941	0.1681	0.0690
5GE084	CF34-3B	1.794E+02	4.285E+01	2.134E+00	8.994E-01	0.3991	0.3288	0.1160	0.0489
3GE067	CF6-45A	4.016E+02	3.486E+02	2.123E+00	7.169E-01	2.027	1.663	0.592	0.163
1GE005	CF6-45A2	3.357E+01	1.703E+01	9.510E+00	7.485E+00	2.058	1.716	0.583	0.200
3GE068	CF6-45A2	4.016E+02	3.486E+02	2.123E+00	7.169E-01	2.027	1.663	0.592	0.163
3GE069	CF6-50A	4.242E+02	3.774E+02	3.075E+00	7.169E-01	2.168	1.787	0.625	0.163
1GE006	CF6-50C	6.615E+01	2.566E+01	9.847E+00	7.627E+00	2.379	1.915	0.643	0.212
3GE070	CF6-50C	4.380E+02	3.842E+02	3.625E+00	7.169E-01	2.281	1.875	0.641	0.163
3GE073	CF6-50C1	4.210E+02	3.909E+02	3.792E+00	7.169E-01	2.361	1.940	0.663	0.163
1GE007	CF6-50C1, -C2	7.567E+01	2.833E+01	9.467E+00	7.734E+00	2.487	1.975	0.660	0.215
3GE074	CF6-50C2	4.210E+02	3.909E+02	3.792E+00	7.169E-01	2.361	1.940	0.663	0.163
3GE078	CF6-50C2B	4.454E+02	3.962E+02	3.647E+00	7.169E-01	2.410	1.997	0.667	0.163
1GE008	CF6-50C2R	6.615E+01	2.566E+01	9.847E+00	7.627E+00	2.379	1.915	0.643	0.212
3GE072	CF6-50C2R	4.380E+02	3.842E+02	3.625E+00	7.169E-01	2.281	1.875	0.641	0.163
3GE071	CF6-50CA	4.380E+02	3.842E+02	3.625E+00	7.169E-01	2.281	1.875	0.641	0.163
3GE075	CF6-50E	4.210E+02	3.909E+02	3.792E+00	7.169E-01	2.361	1.940	0.663	0.163

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
3GE076	CF6-50E1	4.210E+02	3.909E+02	3.792E+00	7.169E-01	2.361	1.940	0.663	0.163
1GE009	CF6-50E2	7.567E+01	2.833E+01	9.467E+00	7.734E+00	2.487	1.975	0.660	0.215
3GE077	CF6-50E2	4.210E+02	3.909E+02	3.792E+00	7.169E-01	2.361	1.940	0.663	0.163
3GE079	CF6-50E2B	4.454E+02	3.962E+02	3.647E+00	7.169E-01	2.410	1.997	0.667	0.163
1GE001	CF6-6D	5.052E+01	2.481E+01	8.390E+00	5.029E+00	1.736	1.431	0.4839	0.1728
1GE002	CF6-6D1A	5.273E+01	2.604E+01	8.566E+00	5.122E+00	1.812	1.502	0.494	0.176
1GE003	CF6-6K	5.052E+01	2.481E+01	8.390E+00	5.029E+00	1.736	1.431	0.4839	0.1728
1GE004	CF6-6K2	5.273E+01	2.604E+01	8.566E+00	5.122E+00	1.812	1.502	0.494	0.176
1GE010	CF6-80A	4.510E+02	2.718E+02	5.140E+00	1.254E+00	2.145	1.795	0.615	0.150
1GE011	CF6-80A1	4.510E+02	2.718E+02	5.140E+00	1.254E+00	2.145	1.795	0.615	0.150
1GE012	CF6-80A2	4.739E+02	2.854E+02	5.357E+00	1.254E+00	2.254	1.885	0.641	0.150
1GE013	CF6-80A3	4.739E+02	2.854E+02	5.357E+00	1.254E+00	2.254	1.885	0.641	0.150
1GE014	CF6-80C2A1	2.543E+02	6.614E+01	7.290E+00	2.281E+00	2.400	1.953	0.636	0.199
2GE036	CF6-80C2A1	1.955E+02	7.738E+01	7.462E+00	2.304E+00	2.453	1.989	0.651	0.201
1GE015	CF6-80C2A2	1.476E+02	3.436E+00	6.648E+00	2.166E+00	2.117	1.745	0.580	0.189
1GE016	CF6-80C2A2	1.476E+02	3.436E+00	6.648E+00	2.166E+00	2.117	1.745	0.580	0.189
2GE037	CF6-80C2A2	1.222E+02	3.449E+01	6.763E+00	2.201E+00	2.152	1.771	0.590	0.192
1GE017	CF6-80C2A3	2.379E+02	8.122E+01	7.439E+00	2.315E+00	2.457	2.003	0.649	0.202
1GE018	CF6-80C2A3	2.379E+02	8.122E+01	7.439E+00	2.315E+00	2.457	2.003	0.649	0.202
2GE038	CF6-80C2A3	1.954E+02	8.876E+01	7.588E+00	2.327E+00	2.516	2.041	0.662	0.203
1GE019	CF6-80C2A5	2.499E+02	1.050E+02	7.875E+00	2.373E+00	2.581	2.082	0.687	0.207
1GE020	CF6-80C2A5	2.499E+02	1.050E+02	7.875E+00	2.373E+00	2.581	2.082	0.687	0.207
2GE039	CF6-80C2A5	2.024E+02	1.033E+02	7.703E+00	2.350E+00	2.580	2.096	0.672	0.205
3GE056	CF6-80C2A5F	2.316E+02	9.828E+01	7.921E+00	2.522E+00	2.630	2.106	0.691	0.22
1GE021	CF6-80C2A8	2.656E+02	6.614E+01	7.508E+00	2.350E+00	2.507	1.953	0.655	0.205
2GE040	CF6-80C2A8	1.933E+02	7.738E+01	7.462E+00	2.304E+00	2.444	1.989	0.651	0.201
1GE022	CF6-80C2B1	1.868E+02	6.896E+01	6.848E+00	3.165E+00	2.285	1.873	0.616	0.196
2GE041	CF6-80C2B1	1.723E+02	6.107E+01	7.026E+00	3.171E+00	2.340	1.922	0.630	0.197
1GE023	CF6-80C2B1F	1.924E+02	7.422E+01	7.052E+00	3.218E+00	2.353	1.913	0.632	0.205
1GE024	CF6-80C2B1F	1.914E+02	7.260E+01	6.911E+00	3.183E+00	2.341	1.901	0.621	0.199
2GE045	CF6-80C2B1F	1.881E+02	7.134E+01	7.289E+00	3.183E+00	2.422	1.983	0.650	0.199

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
1GE025	CF6-80C2B2	1.211E+02	5.613E+01	6.374E+00	3.142E+00	2.131	1.761	0.577	0.192
2GE042	CF6-80C2B2	1.133E+02	3.230E+01	6.469E+00	3.131E+00	2.124	1.756	0.585	0.190
1GE026	CF6-80C2B2F	1.869E+02	4.097E+01	6.481E+00	2.313E+00	2.071	1.702	0.5585	0.1852
2GE046	CF6-80C2B2F	1.183E+02	3.269E+01	6.564E+00	3.119E+00	2.148	1.777	0.593	0.188
1GE027	CF6-80C2B4	2.037E+02	8.425E+01	7.289E+00	3.183E+00	2.430	1.982	0.650	0.199
2GE043	CF6-80C2B4	1.871E+02	7.069E+01	7.170E+00	3.194E+00	2.409	1.965	0.641	0.201
1GE028	CF6-80C2B4F	2.027E+02	7.419E+01	6.597E+00	2.070E+00	2.359	1.907	0.6138	0.1926
2GE047	CF6-80C2B4F	1.888E+02	7.134E+01	7.289E+00	3.183E+00	2.432	1.983	0.650	0.199
3GE057	CF6-80C2B5F	2.365E+02	1.009E+02	7.947E+00	3.224E+00	2.685	2.162	0.697	0.206
1GE029	CF6-80C2B6	2.497E+02	1.011E+02	7.788E+00	3.230E+00	2.579	2.081	0.686	0.207
2GE044	CF6-80C2B6	2.003E+02	1.047E+02	7.590E+00	3.218E+00	2.580	2.096	0.672	0.205
1GE030	CF6-80C2B6F	2.691E+02	1.009E+02	6.911E+00	4.264E+00	2.540	2.020	0.643	0.1963
2GE048	CF6-80C2B6F	2.014E+02	1.016E+02	7.731E+00	3.206E+00	2.594	2.104	0.682	0.203
2GE054	CF6-80C2B7F	2.691E+02	1.009E+02	6.911E+00	4.264E+00	2.54	2.02	0.64	0.20
2GE055	CF6-80C2B7F	2.014E+02	1.016E+02	7.731E+00	3.206E+00	2.594	2.104	0.682	0.203
3GE058	CF6-80C2B8FA	2.184E+02	9.880E+01	7.816E+00	3.218E+00	2.605	2.117	0.688	0.205
1GE031	CF6-80C2D1F	2.750E+02	1.101E+02	7.061E+00	4.485E+00	2.596	2.065	0.657	0.196
2GE049	CF6-80C2D1F	2.095E+02	1.098E+02	7.886E+00	2.350E+00	2.629	2.126	0.688	0.205
1GE032	CF6-80E1A1	3.873E+02	1.708E+02	8.184E+00	2.591E+00	2.702	2.199	0.714	0.226
2GE050	CF6-80E1A1	2.098E+02	1.408E+02	8.184E+00	2.591E+00	2.702	2.199	0.714	0.226
1GE033	CF6-80E1A2	4.115E+02	1.882E+02	8.299E+00	2.613E+00	2.767	2.245	0.724	0.228
2GE051	CF6-80E1A2	2.093E+02	1.566E+02	8.299E+00	2.613E+00	2.767	2.245	0.724	0.228
5GE085	CF6-80E1A3	4.608E+02	2.755E+02	8.654E+00	2.602E+00	2.989	2.387	0.755	0.227
4GE080	CF6-80E1A4	4.469E+02	2.400E+02	8.528E+00	2.602E+00	2.904	2.337	0.744	0.227
4GE081	CF6-80E1A4	1.701E+02	1.206E+02	8.528E+00	2.602E+00	2.904	2.337	0.744	0.227
2GE052	GE90-76B	4.907E+01	4.040E+01	1.352E+01	4.461E+01	2.83	2.33	0.78	0.30
3GE062	GE90-76B	1.946E+00	1.593E+00	5.383E-01	1.930E-01	2.824	2.311	0.781	0.280
5GE086	GE90-76B	4.259E+01	1.576E+01	1.245E+01	3.334E+00	2.781	2.280	0.763	0.267
6GE087	GE90-76B	4.259E+01	1.576E+01	1.245E+01	3.334E+00	2.781	2.28	0.763	0.267
3GE059	GE90-77B	4.577E+01	1.591E+01	1.253E+01	4.339E+01	2.837	2.321	0.774	0.295
3GE063	GE90-77B	1.952E+00	1.607E+00	5.424E-01	1.937E-01	2.832	2.332	0.787	0.281

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
6GE088	GE90-77B	4.577E+01	1.591E+01	1.253E+01	3.359E+00	2.806	2.301	0.768	0.269
2GE053	GE90-85B	5.531E+01	4.508E+01	1.474E+01	4.221E+01	3.19	2.60	0.85	0.30
3GE064	GE90-85B	2.184E+00	1.780E+00	5.872E-01	2.013E-01	3.169	2.583	0.852	0.292
6GE089	GE90-85B	6.412E+01	2.959E+01	1.443E+01	3.522E+00	3.115	2.55	0.832	0.282
3GE060	GE90-90B	8.060E+01	3.920E+01	1.710E+01	4.240E+01	3.419	2.756	0.884	0.313
3GE065	GE90-90B	2.353E+00	1.911E+00	6.196E-01	2.068E-01	3.414	2.772	0.899	0.3
6GE090	GE90-90B	8.060E+01	3.920E+01	1.710E+01	3.634E+00	3.348	2.733	0.878	0.291
3GE061	GE90-92B	8.887E+01	4.646E+01	1.768E+01	4.199E+01	3.523	2.830	0.902	0.316
3GE066	GE90-92B	2.423E+00	1.960E+00	6.320E-01	2.095E-01	3.515	2.844	0.917	0.304
6GE091	GE90-94B	8.887E+01	4.646E+01	1.768E+01	3.697E+00	3.514	2.848	0.908	0.296
	International Aero Engines								
1IA001	V2500-A1	2.547E+01	2.114E+01	7.643E+00	2.838E+00	1.113	0.924	0.334	0.124
3IA006	V2522-A5	1.216E+02	1.023E+02	3.896E+01	1.478E+01	0.971	0.817	0.311	0.118
3IA007	V2524-A5	1.305E+02	1.087E+02	4.109E+01	1.541E+01	1.042	0.868	0.328	0.123
1IA002	V2525-D5	1.319E+02	1.102E+02	3.996E+01	1.603E+01	1.053	0.880	0.319	0.128
1IA003	V2527-A5	1.319E+02	1.102E+02	3.996E+01	1.603E+01	1.053	0.880	0.319	0.128
1IA004	V2528-D5	1.515E+02	1.248E+02	4.422E+01	1.679E+01	1.209	0.996	0.353	0.134
1IA005	V2530-A5	1.667E+02	1.349E+02	4.723E+01	1.729E+01	1.331	1.077	0.377	0.138
3IA008	V2533-A5	1.787E+02	1.434E+02	4.887E+01	1.707E+01	1.426	1.1447	0.3901	0.1363
	KKBM								
1KK001	NK-8-2U	1.234E+03	8.247E+02	4.088E+02	1.692E+02	1.75	1.17	0.58	0.24
1KK002	NK-8-2U	1.234E+03	8.247E+02	4.088E+02	1.692E+02	1.75	1.33	0.55	0.22
1KK003	NK-86	1.515E+03	1.010E+03	3.661E+02	1.325E+02	2.40	1.60	0.58	0.21
1KK004	NK-86A	1.515E+03	1.010E+03	3.661E+02	1.325E+02	2.050	1.700	0.600	0.235
1KK005	NK-86MA	3.049E+02	2.528E+02	8.923E+01	3.495E+01	2.050	1.700	0.600	0.235
	Pratt & Whitney Aircraft Group								
1PW035	JT15D-1 series	4.650E+01	3.896E+01	1.602E+01	7.226E+00	0.148	0.124	0.051	0.023
1PW036	JT15D-4 series	4.770E+01	4.019E+01	1.658E+01	7.336E+00	0.1697	0.143	0.059	0.0261

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
1PW037	JT15D-5, -5A, -5B	9.413E+01	7.914E+01	3.025E+01	1.356E+01	0.2054	0.1727	0.0660	0.0296
1PW038	JT15D-5C	8.555E+01	5.730E+01	2.697E+01	1.098E+01	0.2151	0.1802	0.0678	0.0276
1PW001	JT3D-3B	3.762E+03	2.986E+03	1.109E+03	4.326E+02	1.174	0.932	0.346	0.135
1PW003	JT3D-7 series	5.470E+02	4.502E+02	1.697E+02	5.584E+01	1.254	1.032	0.389	0.128
1PW002	JT3D-7 series	3.692E+03	3.039E+03	1.145E+03	3.769E+02	1.254	1.032	0.389	0.128
1PW008	JT8D-11	7.602E+02	6.196E+02	2.264E+02	9.867E+01	1.121	0.9136	0.3339	0.1455
1PW010	JT8D-15	4.018E+02	3.223E+02	1.160E+02	5.037E+01	1.178	0.9450	0.3402	0.1477
1PW009	JT8D-15	8.496E+02	6.815E+02	2.454E+02	1.065E+02	1.178	0.9450	0.3403	0.1477
1PW011	JT8D-15A	3.803E+02	3.054E+02	1.064E+02	4.679E+01	1.115	0.8955	0.3120	0.1372
1PW013	JT8D-17	4.797E+02	3.841E+02	1.364E+02	5.679E+01	1.245	0.9970	0.3540	0.1474
1PW012	JT8D-17	9.115E+02	7.299E+02	2.592E+02	1.076E+02	1.245	0.997	0.354	0.147
1PW014	JT8D-17A	4.519E+02	3.600E+02	1.273E+02	5.398E+01	1.173	0.9344	0.3304	0.1401
1PW015	JT8D-17AR	6.941E+02	5.324E+02	1.817E+02	7.510E+01	1.365	1.047	0.3574	0.1477
1PW016	JT8D-17R	7.205E+02	5.609E+02	1.909E+02	7.881E+01	1.417	1.103	0.3755	0.1550
1PW017	JT8D-209	2.176E+02	1.796E+02	6.563E+01	2.381E+01	1.191	0.9828	0.3592	0.1303
4PW068	JT8D-217	8.211E+01	6.705E+01	2.384E+01	8.534E+00	1.320	1.078	0.3833	0.1372
1PW018	JT8D-217 series	3.295E+02	2.727E+02	9.698E+01	3.471E+01	1.320	1.078	0.3833	0.1372
4PW069	JT8D-217A	8.211E+01	6.705E+01	2.384E+01	8.534E+00	1.320	1.078	0.3833	0.1372
4PW070	JT8D-217C	7.974E+01	6.500E+01	2.258E+01	8.522E+00	1.282	1.045	0.363	0.137
4PW071	JT8D-219	1.051E+02	8.425E+01	2.964E+01	1.044E+01	1.354	1.085	0.3817	0.1344
1PW019	JT8D-219	3.903E+02	3.207E+02	1.128E+02	3.973E+01	1.354	1.085	0.3817	0.1344
1PW005	JT8D-7 series	1.366E+02	1.120E+02	3.950E+01	1.783E+01	0.9892	0.8113	0.2861	0.1291
1PW004	JT8D-7 series	6.294E+02	5.162E+02	1.820E+02	8.214E+01	0.9892	0.8113	0.2861	0.1291
1PW007	JT8D-9 series	1.603E+02	1.303E+02	4.590E+01	2.040E+01	1.040	0.8453	0.2977	0.1323
1PW006	JT8D-9 series	7.053E+02	5.737E+02	2.021E+02	8.951E+01	1.040	0.846	0.298	0.132
1PW031	JT9D-20	4.614E+02	2.470E+02	7.730E+00	2.665E-01	2.099	1.789	0.619	0.211
1PW032	JT9D-20J	1.460E+03	3.176E+02	3.465E+00	6.794E-01	2.315	1.902	0.679	0.238
1PW033	JT9D-59A	2.334E+03	4.554E+02	3.483E+00	6.769E-01	2.4419	1.9996	0.6804	0.2370
1PW020	JT9D-7	4.314E+02	2.210E+02	7.605E+00	2.652E-01	2.083	1.764	0.609	0.210
1PW034	JT9D-70A	2.334E+03	4.554E+02	3.483E+00	6.769E-01	2.4419	1.9996	0.6804	0.2370
1PW021	JT9D-7A	4.614E+02	2.470E+02	7.730E+00	2.665E-01	2.099	1.789	0.619	0.211

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle	T/O	C/O	App	Idle
		----------(mg/s)----------				----------(kg/sec)----------			
1PW022	JT9D-7F	8.459E+02	1.907E+02	2.824E+00	6.333E-01	2.1672	1.7640	0.6237	0.2190
1PW023	JT9D-7F	7.626E+02	2.016E+02	2.828E+00	6.645E-01	2.161	1.779	0.624	0.232
1PW024	JT9D-7J	1.460E+03	3.176E+02	3.465E+00	6.794E-01	2.315	1.902	0.679	0.238
1PW025	JT9D-7Q	2.334E+03	4.554E+02	3.483E+00	6.769E-01	2.4419	1.9996	0.6804	0.2370
1PW026	JT9D-7R4D, -7R4D1	7.691E+01	1.388E+02	4.661E+00	6.023E-01	2.055	1.678	0.7593	0.2054
1PW027	JT9D-7R4E, -7R4E1	9.210E+01	1.645E+02	3.146E+00	6.380E-01	2.118	1.724	0.6529	0.2210
1PW028	JT9D-7R4E4, -E1(H)	7.352E+01	2.425E+02	3.000E+00	6.368E-01	2.218	1.829	0.6400	0.2205
1PW029	JT9D-7R4G2	1.837E+02	2.928E+02	3.218E+00	6.449E-01	2.429	1.880	0.6590	0.2239
1PW030	JT9D-7R4H1	2.321E+02	4.544E+02	4.072E+00	6.982E-01	2.512	1.999	0.7227	0.2454
1PW039	PW2037	2.948E+02	2.427E+02	7.649E+01	2.703E+01	1.538	1.266	0.399	0.141
4PW072	PW2037	2.597E+02	2.161E+02	7.572E+01	2.513E+01	1.571	1.307	0.458	0.152
1PW040	PW2040	3.592E+02	2.954E+02	1.006E+02	3.162E+01	1.761	1.448	0.493	0.155
4PW073	PW2040	2.997E+02	2.472E+02	8.484E+01	2.720E+01	1.752	1.445	0.496	0.159
1PW042	PW4056	2.268E+02	1.869E+02	6.371E+01	2.014E+01	2.342	1.93	0.658	0.208
1PW041	PW4056	7.060E+02	5.711E+02	1.865E+02	5.420E+01	2.449	1.981	0.647	0.188
1PW043	PW4060	2.866E+02	2.258E+02	7.612E+01	2.306E+01	2.647	2.085	0.703	0.213
2PW060	PW4074	1.966E+02	1.606E+02	5.391E+01	1.546E+01	2.899	2.368	0.795	0.228
3PW063	PW4074D	6.338E+01	5.192E+01	1.741E+01	5.136E+00	2.949	2.416	0.81	0.239
2PW061	PW4077	2.659E+02	2.159E+02	7.187E+01	2.043E+01	3.019	2.452	0.816	0.232
3PW064	PW4077D	8.024E+01	6.527E+01	2.174E+01	6.352E+00	3.082	2.507	0.835	0.244
2PW062	PW4084	5.639E+02	4.446E+02	1.447E+02	4.001E+01	3.411	2.689	0.875	0.242
3PW065	PW4084D	1.730E+02	1.366E+02	4.470E+01	1.272E+01	3.511	2.771	0.907	0.258
3PW066	PW4090	3.203E+02	2.446E+02	7.863E+01	2.202E+01	3.898	2.977	0.957	0.268
5PW076	PW4098	5.531E+02	4.337E+02	1.437E+02	4.290E+01	4.138	3.245	1.075	0.321
1PW045	PW4152	1.697E+02	1.421E+02	4.885E+01	1.618E+01	2.129	1.783	0.613	0.203
1PW044	PW4152	5.069E+02	4.156E+02	1.381E+02	4.121E+01	2.177	1.785	0.593	0.177
1PW047	PW4156	2.268E+02	1.869E+02	6.371E+01	2.014E+01	2.342	1.93	0.658	0.208
1PW046	PW4156	7.060E+02	5.711E+02	1.865E+02	5.420E+01	2.449	1.981	0.647	0.188
1PW048	PW4158	2.571E+02	2.077E+02	7.068E+01	2.187E+01	2.481	2.004	0.682	0.211
1PW049	PW4164	5.405E+01	4.485E+01	1.552E+01	4.323E+00	2.626	2.179	0.754	0.210
1PW050	PW4168	8.253E+01	6.772E+01	2.322E+01	6.431E+00	2.836	2.327	0.798	0.221

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle		T/O	C/O	App	Idle
		----------(mg/s)----------					----------(kg/sec)----------			
5PW075	PW4168	6.715E+02	5.502E+02	1.884E+02	5.821E+01		2.884	2.363	0.809	0.25
4PW067	PW4168A	8.253E+01	6.772E+01	2.322E+01	6.431E+00		2.836	2.327	0.798	0.221
1PW051	PW4256	7.060E+02	5.711E+02	1.865E+02	5.420E+01		2.449	1.981	0.647	0.188
1PW052	PW4460	2.866E+02	2.258E+02	7.612E+01	2.306E+01		2.647	2.085	0.703	0.213
1PW053	PW4x50	1.533E+02	1.273E+02	4.379E+01	1.460E+01		2.027	1.683	0.579	0.193
1PW054	PW4x52	1.828E+02	1.510E+02	5.156E+01	1.702E+01		2.127	1.757	0.600	0.198
1PW055	PW4x56	2.657E+02	2.161E+02	7.267E+01	2.351E+01		2.351	1.912	0.643	0.208
1PW056	PW4x58	3.172E+02	2.547E+02	8.498E+01	2.722E+01		2.482	1.993	0.665	0.213
5PW074	PW4X58	4.937E+02	3.954E+02	1.311E+02	4.193E+01		2.496	1.999	0.663	0.212
1PW057	PW4x60	3.691E+02	2.920E+02	9.652E+01	3.067E+01		2.623	2.075	0.686	0.218
1PW059	PW4x62	4.266E+02	3.339E+02	1.091E+02	3.438E+01		2.767	2.166	0.708	0.223
1PW058	PW4x62	3.162E+02	2.391E+02	8.021E+01	2.401E+01		2.858	2.161	0.725	0.217
	Rolls-Royce Ltd									
1RR001	M54H-01	1.190E+03	7.097E+02	2.582E+01	7.602E-01		0.498	0.416	0.146	0.053
1RR002	RB211-22B	5.653E+02	3.693E+02	5.604E+01	5.095E+00		1.866	1.542	0.553	0.277
1RR003	RB211-22B	1.233E+03	1.016E+03	3.719E+02	1.478E+02		1.877	1.546	0.566	0.225
1RR004	RB211-524B series	1.029E+03	5.040E+02	9.940E+00	5.400E-01		2.383	1.939	0.693	0.272
1RR005	RB211-524B series	4.858E+02	3.935E+02	1.385E+02	5.275E+01		2.21	1.79	0.63	0.24
1RR006	RB211-524C2	7.330E+02	5.971E+02	2.187E+02	8.867E+01		2.48	2.02	0.74	0.30
1RR007	RB211-524D4	5.437E+02	4.354E+02	1.603E+02	6.498E+01		2.51	2.01	0.74	0.30
1RR008	RB211-524D4	5.143E+02	4.198E+02	1.429E+02	5.715E+01		2.34	1.91	0.65	0.26
1RR009	RB211-524G	7.285E+01	5.784E+01	1.946E+01	7.229E+00		2.62	2.08	0.70	0.26
1RR010	RB211-524G	7.285E+01	5.784E+01	1.946E+01	7.229E+00		2.62	2.08	0.70	0.26
4RR036	RB211-524G-T	1.283E+02	1.028E+02	3.623E+01	1.273E+01		2.62	2.10	0.74	0.26
1RR011	RB211-524H	7.591E+01	6.034E+01	1.974E+01	7.229E+00		2.73	2.17	0.71	0.26
4RR037	RB211-524H-T	1.376E+02	1.087E+02	3.769E+01	1.273E+01		2.81	2.22	0.77	0.26
1RR012	RB211-535C	1.824E+02	1.490E+02	5.472E+01	2.027E+01		1.80	1.47	0.54	0.20
1RR013	RB211-535E4	1.160E+01	9.419E+00	3.555E+00	1.185E+00		1.86	1.51	0.57	0.19
1RR014	RB211-535E4	1.160E+01	9.419E+00	3.555E+00	1.185E+00		1.86	1.51	0.57	0.19
3RR028	RB211-535E4	1.286E+01	1.044E+01	3.595E+00	1.244E+00		1.86	1.51	0.52	0.18

UID	Engine	----------PM EF ----------					----------Fuel Flow----------		
No	Identification	T/O	C/O	App	Idle		T/O	C/O	App	Idle
		----------(mg/s)----------					----------(kg/sec)----------			
5RR038	RB211-535E4	1.590E+02	1.289E+02	4.469E+01	1.547E+01		1.85	1.5	0.52	0.18
3RR034	RB211-535E4B	1.496E+01	1.187E+01	3.956E+00	1.367E+00		2.08	1.65	0.55	0.19
5RR039	RB211-535E4B	1.779E+02	1.409E+02	4.727E+01	1.633E+01		2.07	1.64	0.55	0.19
4RR035	Spey 555	7.088E+02	5.719E+02	2.131E+02	9.297E+01		0.735	0.593	0.221	0.0964
1RR015	SPEY Mk511	4.043E+03	3.301E+03	1.269E+03	5.411E+02		0.889	0.726	0.279	0.119
1RR016	SPEY Mk511	5.532E+02	4.508E+02	1.726E+02	7.885E+01		0.891	0.726	0.278	0.127
1RR017	SPEY Mk555	6.129E+02	4.937E+02	1.843E+02	8.006E+01		0.720	0.589	0.222	0.115
1RR018	SPEY Mk555	6.129E+02	4.937E+02	1.843E+02	8.006E+01		0.735	0.592	0.221	0.096
3RR031	TAY 650	1.272E+02	1.050E+02	3.698E+01	1.775E+01		0.86	0.71	0.25	0.12
3RR032	TAY 651	1.287E+02	1.065E+02	3.846E+01	1.775E+01		0.87	0.72	0.26	0.12
3RR033	TAY 651	3.607E+02	2.985E+02	1.078E+02	4.976E+01		0.87	0.72	0.26	0.12
1RR019	TAY Mk611-8	4.489E+02	3.721E+02	1.358E+02	6.497E+01		0.76	0.63	0.23	0.11
1RR020	TAY Mk620-15	4.489E+02	3.721E+02	1.358E+02	6.497E+01		0.76	0.63	0.23	0.11
1RR021	TAY Mk650-15	3.661E+02	2.995E+02	1.064E+02	4.985E+01		0.874	0.715	0.254	0.119
6RR041	Trent 556-61	2.296E+01	1.655E+01	1.542E+00	3.368E-01		2.24	1.83	0.62	0.23
2RR022	Trent 768	1.070E+01	8.804E+00	2.911E+00	9.459E-01		2.94	2.42	0.80	0.26
3RR029	Trent 768	2.482E+01	2.031E+01	6.769E+00	2.256E+00		2.97	2.43	0.81	0.27
2RR023	Trent 772	1.146E+01	9.386E+00	3.056E+00	9.823E-01		3.15	2.58	0.84	0.27
3RR030	Trent 772	2.674E+01	2.156E+01	7.104E+00	2.340E+00		3.2	2.58	0.85	0.28
2RR024	Trent 875	1.518E+02	1.258E+02	4.308E+01	1.371E+01		3.10	2.57	0.88	0.28
2RR025	Trent 877	1.571E+02	1.302E+02	4.406E+01	1.371E+01		3.21	2.66	0.90	0.28
2RR026	Trent 884	1.743E+02	1.415E+02	4.749E+01	1.518E+01		3.56	2.89	0.97	0.31
2RR027	Trent 892	1.914E+02	1.518E+02	4.895E+01	1.469E+01		3.91	3.10	1.00	0.30
5RR040	Trent 895	1.973E+02	1.562E+02	5.140E+01	1.615E+01		4.03	3.19	1.05	0.33
	Textron Lycoming									
1TL001	ALF 502L-2	4.330E+01	7.535E+01	1.381E+01	7.781E-01		0.3999	0.3236	0.1172	0.0477
1TL002	ALF 502R-3	8.013E+01	6.055E+01	5.250E+00	4.054E-01		0.3476	0.2880	0.1027	0.0432
1TL003	ALF 502R-5	9.307E+01	6.880E+01	5.693E+00	4.385E-01		0.3581	0.2955	0.1034	0.0408
1TL004	LF507-1F, -1H	5.714E+01	4.647E+01	8.409E+00	3.426E+00		0.3578	0.2961	0.1083	0.0453

UID	Engine	----------PM EF ----------					----------Fuel Flow----------			
No	Identification	T/O	C/O	App	Idle		T/O	C/O	App	Idle
		----------(mg/s)----------					----------(kg/sec)----------			
	ZMKB									
1ZM001	D-36	1.944E+02	1.635E+02	6.471E+01	3.208E+00		0.634	0.533	0.211	-
Fuel flow rate from ICAO Aircraft Engine Emissions Data Bank,										
http://www.caa.co.uk/default.aspx										
Revised First Order Approximation obtained by multiplying original FOA by 4 to account for volatile fraction of PM.										

Attachment D

Turbine Aircraft Total Hydrocarbon (THC) Speciation Profiles for LGB

Total Hydrocarbon (THC) Speciation Profiles for LGB				
	TAC Mass Fractions (lb/lb THC)			
TAC	*Taxi/Idle*	*Approach*	*Climbout*	*Takeoff*
1,3-Butadiene	1.35E-02	7.12E-03	2.22E-03	1.03E-02
Acetaldehyde	1.53E-02	1.57E-02	1.97E-02	1.21E-02
Acrolein	7.92E-03	4.88E-03	5.13E-03	4.85E-03
Benzene	1.59E-02	1.54E-02	1.39E-02	7.55E-03
Benzo(a)anthracene	1.38E-07	7.77E-07	2.50E-06	1.21E-06
Benzo(a)pyrene	1.74E-07	7.61E-07	8.43E-07	5.21E-07
Benzo(b)fluoranthene	5.55E-07	5.01E-07	6.74E-07	4.85E-07
Benzo(k)fluoranthene	5.55E-07	5.01E-07	6.74E-07	4.85E-07
Chrysene	1.74E-07	4.84E-07	2.37E-06	1.91E-06
Dibenzo(a,h)anthracene	7.49E-07	6.32E-07	9.14E-07	9.59E-07
Ethylbenzene	2.17E-03	1.82E-03	1.43E-03	1.95E-03
Formaldehyde	9.28E-02	1.12E-01	9.73E-02	4.05E-02
Indeno(1,2,3-cd)pyrene	6.01E-07	5.02E-07	7.36E-07	6.44E-07
Naphthalene	3.69E-03	2.15E-03	1.96E-03	4.87E-03
Phenol	2.34E-03	2.34E-03	1.77E-03	1.54E-03
Styrene	3.28E-03	2.48E-03	1.76E-03	3.87E-03
Toluene	1.37E-02	7.98E-03	5.39E-03	5.03E-03
Xylene, o-	2.77E-03	1.79E-03	1.85E-03	2.61E-03
Xylenes, m- and p-	7.13E-03	5.48E-03	4.71E-03	4.68E-03

Sources: Port of Oakland 2003; Gerstle et al. 1999; Spicer et al. 1990; Spicer et al. 1988; Spicer et al. 1987; Spicer et al. 1984.

Attachment E

Elemental Mass Fractions in Jet A for LGB Turbine Aircraft

Elemental Mass Fractions in Jet A for LGB Turbine Aircraft	
TAC	***TAC Mass Fractions (ppb)***
Barium	3
Calcium	555
Chromium (Total)	26
Copper	5
Iron	210
Lead	11
Manganese	6
Mercury	Not detected
Nickel	Not detected
Scandium	11
Strontium	12
Sulfur[(1)]	1220
Tin	10
Titanium	100
Vanadium	Not detected
Zirconium	16

Source: Shumway 2000.

LGB = Long Beach Airport

ppb = parts per billion (by weight)

TAC = Toxic Air Contaminant

[(1)] Final sulfur dioxide emissions were based on EDMS-assumed fuel sulfur concentrations of 500 parts per million (ppm) in Jet A and 55 ppm in aviation gasoline.

Attachment F

OEHHA Formulas

OEHHA Formulas

The Hot Spots guidance (OEHHA 2003) uses a variation of the USEPA formula in which the inhalation rate is combined with the body weight and called a daily breathing rate with units of L/kg body weight-day for the estimation of exposure through inhalation. The formula for dose inhalation is:

$$Dose - inh = \frac{C_{air} \text{ x DBR x A x EF x ED x } 10^{-6}}{AT}$$

Where:

Dose-inh = Dose through inhalation (mg/kg-d)

C_{air} = Concentration in air ($\mu g/m^3$)

DBR = Daily breathing rate (L/kg body weight – day)

A = Inhalation absorption factor (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

10^{-6} = Conversion factor of micrograms to milligrams and liters to cubic meters

AT = Averaging time (days)

Cancer risk is then calculated using the following formula:

$$Cancer\ Risk = Dose - inh\ x\ Cancer\ Potency$$

Where:

Dose-inh = Dose through inhalation (mg/kg-d)

Cancer Potency = Cancer Slope or Potency Factor $(mg/kg\text{-}day)^{-1}$

Attachment B
Hourly, Daily, and Monthly Temporal Profiles

Long Beach Airport - Terminal Improvement Project EIR

Hourly Temporal Profiles - 2005 Baseline

	Hour of Day																							
	Morning												Afternoon/Evening											
Profile Name	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**
320	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.25	0.25	0.75	0.25	0.25	0.00	0.25	0.75	0.25	1.00	0.00	0.25	0.25	1.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	1.00	1.00	0.00	1.00	1.00	1.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
73G	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CR7	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	0.67	1.00	0.67	0.67	0.67	0.33	0.67	0.00	0.33	1.00	0.67	0.33	0.00	0.00	0.00	0.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Parking	0.98	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.98	0.99	0.99	1.00	0.97	0.96	0.00
Terminal-1	0.02	0.02	0.01	0.02	0.15	0.82	0.84	0.82	0.99	0.75	0.94	0.62	0.85	1.00	0.96	0.60	0.66	0.61	0.74	0.68	0.85	0.73	0.32	0.12
Terminal-2	0.05	0.03	0.01	0.02	0.10	0.53	0.59	0.61	0.75	0.77	0.83	0.78	0.68	0.75	1.00	0.83	0.64	0.64	0.74	0.72	0.69	0.79	0.62	0.26

Long Beach Airport - Terminal Improvement Project EIR

Hourly Temporal Profiles - 2011 Project (with Optimized Flights)

	Hour of Day																							
	Morning												Afternoon/Evening											
Profile Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
320	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.75	0.25	0.25	0.00	0.25	0.75	0.50	1.00	0.00	0.25	0.25	1.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
73G	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CR7	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	1.00	0.67	0.67	0.67	0.67	0.33	0.33	0.33	0.33	1.00	0.67	0.33	0.00	0.00	0.00	0.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Parking	0.98	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.98	0.99	0.99	1.00	0.97	0.96	0.00
Terminal-1	0.02	0.02	0.01	0.02	0.15	0.82	0.84	0.82	0.99	0.75	0.94	0.62	0.85	1.00	0.96	0.60	0.66	0.61	0.74	0.68	0.85	0.73	0.32	0.12
Terminal-2	0.05	0.03	0.01	0.02	0.10	0.53	0.59	0.61	0.75	0.77	0.83	0.78	0.68	0.75	1.00	0.83	0.64	0.64	0.74	0.72	0.69	0.79	0.62	0.26

Hourly Temporal Profiles - 2020 Project (with Optimized Flights)

	Hour of Day																							
	Morning												Afternoon/Evening											
Profile Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
320	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.75	0.25	0.25	0.00	0.25	0.75	0.50	1.00	0.00	0.25	0.25	1.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
73G	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CR7	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	1.00	0.67	0.67	0.67	0.67	0.33	0.33	0.33	0.33	1.00	0.67	0.33	0.00	0.00	0.00	0.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Parking	0.98	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.98	0.99	0.99	1.00	0.97	0.96	0.00
Terminal-1	0.02	0.02	0.01	0.02	0.15	0.82	0.84	0.82	0.99	0.75	0.94	0.62	0.85	1.00	0.96	0.60	0.66	0.61	0.74	0.68	0.85	0.73	0.32	0.12
Terminal-2	0.05	0.03	0.01	0.02	0.10	0.53	0.59	0.61	0.75	0.77	0.83	0.78	0.68	0.75	1.00	0.83	0.64	0.64	0.74	0.72	0.69	0.79	0.62	0.26

Long Beach Airport - Terminal Improvement Project EIR

Hourly Temporal Profiles - 2011 No Project (with Optimized Flights)

	Hour of Day																							
	Morning												Afternoon/Evening											
Profile Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
320	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.75	0.25	0.25	0.00	0.25	0.75	0.50	1.00	0.00	0.25	0.25	1.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
73G	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CR7	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	1.00	0.67	0.67	0.67	0.67	0.33	0.33	0.33	0.33	1.00	0.67	0.33	0.00	0.00	0.00	0.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Parking	0.98	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.98	0.99	0.99	1.00	0.97	0.96	0.00
Terminal-1	0.02	0.02	0.01	0.02	0.15	0.82	0.84	0.82	0.99	0.75	0.94	0.62	0.85	1.00	0.96	0.60	0.66	0.61	0.74	0.68	0.85	0.73	0.32	0.12
Terminal-2	0.05	0.03	0.01	0.02	0.10	0.53	0.59	0.61	0.75	0.77	0.83	0.78	0.68	0.75	1.00	0.83	0.64	0.64	0.74	0.72	0.69	0.79	0.62	0.26

Hourly Temporal Profiles - 2020 No Project (with Optimized Flights)

	Hour of Day																							
	Morning												Afternoon/Evening											
Profile Name	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
320	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.50	0.50	0.75	0.25	0.25	0.00	0.25	0.75	0.50	1.00	0.00	0.25	0.25	1.00	0.00	0.00	0.00
757	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	1.00	0.00	1.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00
73G	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.50	0.50	0.00	0.00	0.00	1.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CR7	0.00	0.00	0.00	0.00	0.00	0.33	1.00	0.00	1.00	0.67	0.67	0.67	0.67	0.33	0.33	0.33	0.33	1.00	0.67	0.33	0.00	0.00	0.00	0.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	0.00	0.00	0.00	0.00	0.00
Parking	0.98	0.98	0.98	0.98	0.99	1.00	1.00	1.00	1.00	0.99	0.99	1.00	0.98	0.99	0.99	0.98	1.00	0.98	0.99	0.99	1.00	0.97	0.96	0.00
Terminal-1	0.02	0.02	0.01	0.02	0.15	0.82	0.84	0.82	0.99	0.75	0.94	0.62	0.85	1.00	0.96	0.60	0.66	0.61	0.74	0.68	0.85	0.73	0.32	0.12
Terminal-2	0.05	0.03	0.01	0.02	0.10	0.53	0.59	0.61	0.75	0.77	0.83	0.78	0.68	0.75	1.00	0.83	0.64	0.64	0.74	0.72	0.69	0.79	0.62	0.26

Long Beach Airport - Terminal Improvement Project EIR

Daily Temporal Profiles - 2005 Baseline

Profile Name	Day of the Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Commercial	1.00	1.00	1.00	1.00	1.00	0.95	1.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Daily Temporal Profiles - 2011 Project (with Optimize Flights)

Profile Name	Day of the Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Commercial	1.00	1.00	1.00	1.00	1.00	0.95	1.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Daily Temporal Profiles - 2020 Project (with Optimize Flights)

Profile Name	Day of the Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Commercial	1.00	1.00	1.00	1.00	1.00	0.95	1.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Daily Temporal Profiles - 2011 No Project (with Optimize Flights)

Profile Name	Day of the Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Commercial	1.00	1.00	1.00	1.00	1.00	0.95	1.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Daily Temporal Profiles - 2020 No Project (with Optimize Flights)

Profile Name	Day of the Week						
	Mon	Tue	Wed	Thu	Fri	Sat	Sun
Commercial	1.00	1.00	1.00	1.00	1.00	0.95	1.00
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00

Long Beach Airport - Terminal Improvement Project EIR

Monthly Temporal Profiles - 2005 Baseline

Profile Name	Month of the Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	0.73	0.67	0.91	0.91	0.72	0.66	0.78	0.80	0.97	0.91	1.00	0.88
Commercial	0.97	0.90	0.96	0.96	0.99	0.99	0.99	1.00	0.93	0.97	0.87	0.90
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.83	0.81	0.87	0.90	0.97	0.93	1.00	0.96	0.89	0.79	0.86	0.69

Monthly Temporal Profiles - 2011 Project (with Optimized Flights)

Profile Name	Month of the Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	0.73	0.67	0.91	0.91	0.72	0.66	0.78	0.80	0.97	0.91	1.00	0.88
Commercial	0.97	0.90	0.96	0.96	0.99	0.99	0.99	1.00	0.93	0.97	0.87	0.90
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.83	0.81	0.87	0.90	0.97	0.93	1.00	0.96	0.89	0.79	0.86	0.69

Monthly Temporal Profiles - 2020 Project (with Optimized Flights)

Profile Name	Month of the Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	0.73	0.67	0.91	0.91	0.72	0.66	0.78	0.80	0.97	0.91	1.00	0.88
Commercial	0.97	0.90	0.96	0.96	0.99	0.99	0.99	1.00	0.93	0.97	0.87	0.90
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.83	0.81	0.87	0.90	0.97	0.93	1.00	0.96	0.89	0.79	0.86	0.69

Monthly Temporal Profiles - 2011 No Project (with Optimized Flights)

Profile Name	Month of the Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	0.73	0.67	0.91	0.91	0.72	0.66	0.78	0.80	0.97	0.91	1.00	0.88
Commercial	0.97	0.90	0.96	0.96	0.99	0.99	0.99	1.00	0.93	0.97	0.87	0.90
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.83	0.81	0.87	0.90	0.97	0.93	1.00	0.96	0.89	0.79	0.86	0.69

Monthly Temporal Profiles - 2020 No Project (with Optimized Flights)

Profile Name	Month of the Year											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Cargo	0.73	0.67	0.91	0.91	0.72	0.66	0.78	0.80	0.97	0.91	1.00	0.88
Commercial	0.97	0.90	0.96	0.96	0.99	0.99	0.99	1.00	0.93	0.97	0.87	0.90
DEFAULT	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Other	0.83	0.81	0.87	0.90	0.97	0.93	1.00	0.96	0.89	0.79	0.86	0.69

Attachment C
Baseline Aircraft Operations Summary

LGB Flight Summary for Year 2004

ANOMS DATA:

Average Daily Operations

AIRLINE/AIRCRAFT		QTR1 2004	QTR 2 2004	QTR 3 2004	QTR 4 2004	Total 2004	Annual Operations
Air Carrier:							
AAL	B757	12.8	11.4	9.6	3	9.2	3358
ABX	B767	1.4	1.4	1.4	1.4	1.4	511
AAL	MD80	0.4	2	3.6	7.8	3.5	1259.25
ASA	MD80	0.2	0.2	0	0.6	0.3	91.25
FDX	A330/A31	1.4	1.4	1.4	1.4	1.4	511
FDX	B727/B727S	1.4	1.2	1.2	1.2	1.3	456.25
J8U	A320	42.6	43.4	43.4	42	42.9	15640.25
AAL	B738	0	0	0	0	0.0	0
AWE	CRJ7	0.4	0.4	0.2	0	0.3	91.25
AWE	CRJ9	7.2	6.6	5.6	5.6	6.3	2281.25
ASA	B734	2.2	1.8	0.4	0	1.1	401.5
ASA	B737	3	3.6	5.4	5.2	4.3	1569.5
UPS	B757	0	0	0	0	0.0	0
UPS	B76S	2.6	2.4	2.6	2.4	2.5	912.5
UPS	DCH8	0	0	0	0	0.0	0
Subtotal Air Carriers:		**75.4**	**76.8**	**76.6**	**72.4**	**75.3**	**27484.5**
Industrial:		0	0	0	0	0.0	0.0
BOE	B717	0.2	0.4	0.4	0.6	0.4	146.0
GLF	G5	1.4	1.8	1.6	2.2	1.8	638.8
Subtotal Industrial:		**1.8**	**2.2**	**1.8**	**2.8**	**2.2**	**784.8**
Charter:		0	0	0	0	0.0	0.0
Subtotal Charter:		**0.4**	**0.4**	**0.6**	**1**	**0.6**	**219.0**
Commuter:		0	0	0	0	0.0	0.0
Subtotal Commuter:		**0**	**0**	**0**	**0**	**0.0**	**0.0**
General Aviation:		0	0	0	0	0.0	0.0
BUSJETS		30	30.4	30.4	29.2	30.00	10950.0
GA Prop*		36.6	36.8	26.4	31.6	32.85	11990.3
Subtotal GA*:		**66.6**	**67**	**56.6**	**60.8**	**62.75**	**22903.8**
Military and Government:		0	0	0	0	0.0	0.0
MILITARY		2	2.2	1.6	1.4	1.8	657.0
GOV		2.8	3	2	2.8	2.7	967.3
Subtotal MIL & GOV:		**4.8**	**5.2**	**3.6**	**4**	**4.4**	**1606.0**
TOTAL		**148.8**	**151.6**	**139.4**	**141**	**145.2**	**52998.0**

note: GA counts by ANOMS does not include all VFR operations by small aircraft.

TOWER OPERATIONS

AIRPORT TRAFFIC RECORD

	ITENERANT					LOCAL				Special Use
Mo-Yr	AC	AT	GA	MI	Total Itenerant	Civil	Mil	Total Local	Total Operations	
Jan-08	2,346	562	11,540	81	14,529	12,399	1	12,400	26,929	26
Feb-08	2,187	584	10,690	70	13,531	12,569	0	12,569	26,100	12
Mar-08	2,397	662	11,280	78	14,417	13,817	0	13,817	28,234	141
Apr-08	2,324	704	11,289	61	14,378	14,520	4	14,524	28,902	22
May-08	2,391	694	12,250	70	15,405	15,744	0	15,744	31,149	0
Jun-08	2,376	706	11,598	61	14,741	15,296	0	15,296	30,037	36
Jul-08	2,407	715	12,245	95	15,462	16,586	2	16,588	32,050	15
Aug-08	2,441	629	12,192	46	15,308	15,465	2	15,467	30,775	72
Sep-08	2,344	534	11,422	46	14,346	14,307	0	14,307	28,653	43
Oct-08	2,408	581	11,834	55	14,878	10,930	0	10,930	25,808	180
Nov-08	2,221	543	11,087	105	13,956	13,808	0	13,808	27,764	43
Dec-08	2,251	469	9,475	31	12,226	10,595	0	10,595	22,821	36
Total:	28,093	7,383	136,902	799	173,177	166,036	9	166,045	339,222	626

LGB Flight Summary for Year 2004

Summary:	
ANOMS Total:	52,998
Tower Total:	339,222
Difference:	286,224.0

Therefore, the GA prop numbers in the ANOMS table should be adjusted upward by 286,224 to a total of : 298,214

Adjusted ANOMS TABLE of Operations

AIRLINE/AIRCRAFT		Total Daily 2004	Annual Operations	Annual LTOs			
Air Carrier:	*Revised Air Carrier Activity*					*Original Values*	
AAL	B757	9.34	3,409	1,705	12.40%	9.20	3,358
ABX	B767	1.42	518	259	1.89%	1.40	511
AAL	MD80	3.5	1,278	639	4.65%	3.45	1,259
ASA	MD80	0.25	91	45	0.34%	0.25	91
FDX	A330/A31	1.42	518	259	1.89%	1.40	511
FDX	B727/B727S	1.27	464	232	1.68%	1.25	456
J8U	A320	43.49	15,874	7,937	57.75%	42.85	15,640
AAL	B738	0	0	0	0.00%	0.00	0
AWE	CRJ7	0.25	91	45	0.34%	0.25	91
AWE	CRJ9	6.34	2,314	1,157	8.42%	6.25	2,281
ASA	B734	1.12	409	205	1.48%	1.10	402
ASA	B737	4.36	1,591	796	5.80%	4.30	1,570
UPS	B757	0	0	0	0.00%	0.00	0
UPS	B76S	2.54	927	464	3.37%	2.50	913
UPS	DCH8	0	0	0	0.00%	0.00	0
Subtotal Air Carriers:		**75.30**	**27,485**	**13,743**		**75.30**	**27,485**
Industrial:					100.00%	74.20	27,484
BOE	B717	0.4	146	73			
GLF	G5	1.8	639	319			
Subtotal Industrial:		**2.2**	**785**	**392**			
Charter:							
Subtotal Charter:		**0.6**	**219**	**110**			
Commuter:							
Subtotal Commuter:		**0.0**	**0**	**0**			
General Aviation:							
BUSJETS		30.0	10,950	5475			
GA Prop*		817.0	298,214	149107			
Subtotal GA*:		**847.0**	**309,164**	**154,582**			
Military and Government:							
MILITARY		1.78	650	325	40.45%	1.80	657
GOV		2.62	956	478	59.55%	2.65	967
Subtotal MIL & GOV:		**4.40**	**1,606**	**803**		**4.4**	**1,606**
TOTAL		**929.5**	**339,258**	**169,630**		4.45	1,606

note: GA prop counts have been adjusted to match Tower Counts

Attachment D
2020 Forecast Operations Report

PASSENGER ACTIVITY FORECAST
LONG BEACH AIRPORT

DRAFT

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Prepared by

HNTB

PASSENGER ACTIVITY FORECAST
LONG BEACH MUNICIPAL AIRPORT

Passenger activity forecasts for Long Beach Municipal Airport (LGB) were prepared to serve as the basis for estimating the facility requirements used to assess the potential impact of the alternative options for developing the terminal. The facility analyses are provided in HNTB's "Facility Requirements Analysis – Long Beach Airport" dated May 14, 2004.

The structure of this study differs from a typical airport forecast. Typically, unconstrained activity levels are projected for 5-, 10-, and 20-year time horizons. In this instance, the Airport is already operating close to the capacity allowed by the Long Beach Airport Noise Compatibility Ordinance (Noise Ordinance) under which it operates. Consequently, this effort is focused on identifying the maximum reasonable activity levels that could occur given the Noise Ordinance and the market-driven distribution of that activity throughout the day.

Forecasts were developed for two scenarios. Scenario 1 assumes that LGB continues to operate with the current set of restrictions, namely 41 daily air carrier flights and 25 daily commuter carrier flights. Each flight consists of one takeoff and one landing, and commuter carrier flights are defined as those performed by aircraft with a certificated maximum takeoff weight of less than 75,000 pounds. Scenario 2 assumes that flights are added under the terms of the Noise Ordinance. To determine a reasonable number of additional flights that could be realized, an analysis was performed to identify the "airline ideal operating conditions/lowest noise per flight" scenario. Estimates prepared by the Airport's noise consultant (Mestre Greve) indicate that an additional six to eleven daily air carrier flights could operate without exceeding the noise budget (see Appendix A). Based on the noise budget allotted commuter carrier flights by the Noise Ordinance, it is assumed that there is no reasonable probability of having more than 25 commuter flights.

The report begins with a discussion of forecast assumptions. Next, the steps used to forecast airline schedules under Scenarios 1 and 2 are outlined. Derivative forecasts including peak hour passenger enplanements and deplanements are then described. The forecast concludes with an estimate of gate and aircraft parking requirements.

Historical Background

Table 1 presents activity levels at LGB over the past two decades. As shown, passenger enplanements ranged between 500,000 and 1 million from 1984 through 1991. Passenger traffic at LGB dropped after 1991 as the economy and airline sector slumped. There has been a significant increase since 2002 as JetBlue Airways has made Long Beach one of its main focus cities. Since 1981, total aircraft operations at LGB have gradually declined, mainly because of a decrease in general aviation activity.

Assumptions

The following assumptions were used to help guide the forecast:

Time Horizon

The forecasts are developed to represent the activity levels permitted by the Noise Ordinance, and as such, do not require a specific forecast year. For the purpose of providing a context for developing the remaining assumptions, such as fleet mix, 2020 was adopted as the general time horizon.

Noise Ordinance

No change in the Noise Ordinance is assumed.

Passenger Demand

Passenger traffic is assumed to be sufficient to justify service up to the levels permitted by the Noise Ordinance. Currently, LGB accounts for approximately 5 percent of origin-destination passengers in the Los Angeles Basin (see Table 2). According to a report prepared for Los Angeles World Airports (LAWA), approximately 20 percent of Los Angeles Basin origin-destination passengers are closer to LGB than any other commercial airport, and 50 percent of Los Angeles Basin origin-destination passengers are within a 60 minute drive of LGB.[1] Therefore, there is more than sufficient passenger demand to attain the levels set by the Noise Ordinance.

Cargo Flights

It is assumed that the number of air carrier slots used by cargo operators will neither increase nor decrease.

Commuter Flights

It is assumed that by 2020, the 25 commuter slots will be fully utilized.

Airlines

No consolidation among the airlines currently operating at LGB is assumed. It is possible that one or more of the airlines could merge or enter bankruptcy and cease operations, but there is currently no reasonable way to accurately predict which airline(s) may be involved.

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[1] Los Angeles World Airports, Air Transportation in the Los Angeles Region, prepared by Landrum & Brown, Inc., June 14, 2000.

Future Slot Allocation

Under Scenario 2, in which potential additional air carrier slots are accounted for, it is assumed that the slots will be allocated according to the terms of the February 5, 2003 agreement between the City of Long Beach and American Airlines, JetBlue Airways, and Alaska Airlines. The agreement established a priority allocation procedure should supplemental slots become available. For calendar year 2004, American Airlines would receive the first available supplemental slot, Alaska the second, and JetBlue the third. For the remaining term of the agreement, the allocation priority rotates among the three airlines.

Fleet Mix

It is assumed that the airlines will operate aircraft currently in their fleet or on order.

Load Factor

It is assumed that average load factors will increase at the same rate as projected by the FAA.[2]

Forecast Schedules

Scenario 1

Under Scenario 1, no change is anticipated in the 36 slots currently allocated to passenger carriers.[3] Therefore, the question is how the airlines are likely to use their current allocation of slots in the future.

JetBlue has no aircraft in their fleet or on order that are larger than the A-320 they currently operate at LGB. Most of their existing flights from LGB are long-haul, and since long-haul flights typically generate the most revenue per flight this is likely to remain the case. As they develop their route network, some trans-continental destinations may change, but because of time zone differences, the flight schedule characteristics should remain similar.

American Airlines has a number of wide-body aircraft larger than the Boeing 757 it currently flies out of LGB. Except for a few large trans-continental markets like New York John F. Kennedy International Airport (JFK)-Los Angeles International Airport (LAX) and JFK-San Francisco International Airport (SFO), it uses its wide-body aircraft on international routes. Therefore, it was considered unlikely that it would introduce wide-body aircraft to LGB. Consequently, they are not expected to use any aircraft larger than the 757.

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[2] Federal Aviation Administration, FAA Aerospace Forecasts: Fiscal Years 2003-2014, March 2003.
[3] Currently, 5 slots are allocated to cargo carriers.

Alaska Airlines flies no aircraft larger than the Boeing 737. For the projected schedule it was assumed that they continue to fly the LGB-Seattle International Airport (SEA) route with mostly 737-700 aircraft and add additional capacity with Horizon CRJ-700s to increase frequency (under the commuter slots).

As the airline market improves, it is expected that America West will change from RJ-90 aircraft back to A-320 aircraft. Since LGB-Phoenix International Airport (PHX) is a short-haul market it was considered unlikely that they would upguage all the way to a 757 aircraft.

Regional (commuter) carrier service was estimated with consideration of the following factors, 1) the role of regional carriers in the airline system, 2) the size and distance of potential markets, and 3) competitive factors.

The current function of regional carriers in almost all cases is to help feed an air carrier connecting hub. LGB is not a connecting hub and the principle carrier at the Airport, JetBlue, does not operate regional carrier aircraft. Consequently, the most likely role of regional carriers at LGB would be to feed another hub from LGB. Because of the performance limits of regional carrier aircraft, they are unlikely to fly to markets much more than 1,000 miles distant.

Table 2 shows the twenty-five largest origin-destination markets for the Los Angeles Basin. Each was considered in turn as a possibility for regional carrier service to LGB. Based on the above criteria the following types of regional carrier service were considered most likely for LGB:

- Supplemental frequencies to Las Vegas (LAS) and PHX by an America West regional affiliate;
- High frequency service to San Jose by American Eagle connecting the high technology complexes in Long Beach with those in Silicon Valley;
- Supplemental frequencies to Seattle by Horizon, Alaska Airlines' regional affiliate;
- New service to Denver by Frontier's regional carrier affiliate;
- New service to Portland by Horizon, Alaska Airlines' regional affiliate; and
- Service to Salt Lake City by Delta's regional carrier affiliate.

Most of the major origin-destination markets that were excluded from consideration were excluded because of distance. Oakland is an unlikely prospect because of the strong low-cost carrier competition from JetBlue and from Southwest to other Los Angeles airports. Sacramento (SMF) is excluded because of the strong competition from Southwest to other Los Angeles airports and because regional carrier service from LGB to SMF would not logically fit in any airline's current route structure.[4] No service by United Express is

[4] It is unlikely that JetBlue would add LGB-SMF service because the frequencies required to be competitive with Southwest would require it to reallocate several slots from its transcontinental service.

assumed because United Airlines has no mainline presence at LGB and because it has already made such a heavy investment at nearby LAX.

Appendix B shows the projected schedule for Scenario 1. Flight times for new service were prepared by considering the connecting bank structure of destination airports, the reasonableness of arrival and departure times at the destination airports, the need by airlines to fully utilize their aircraft throughout the day, and the need to fill gaps in existing service to markets for which supplemental service is projected.

Existing average peak month load factors were increased at FAA projected rates to represent the future year. Peak month load factors for new regional carrier service were assumed to be 85 percent based on Horizon's historical experience and the FAA growth rates.

Table 3 shows the estimated hourly distribution of flights and passengers resulting from the estimate schedule.

Scenario 2

As noted earlier, the Airport's noise consultant (Mestre Greve) has estimated that from six to eleven additional air carrier flights could be accommodated without exceeding the noise budget; although these additional flights would only be achievable under a set of ideal airline operating conditions and low noise per aircraft variables. The number of additional flights that could be accommodated would depend on the types of aircraft added. It could be seven A-320's, nine Boeing 737's or ten Boeing 757's. The three airlines that would be entitled to the additional slots under the current airline agreement collectively fly a mix of these three aircraft. Therefore it was assumed that nine additional slots could be added without exceeding the noise budget. The projected schedule will be tested to see if it exceeds the noise budget and, if so, adjustments will be made for the final forecast report.

It was assumed that JetBlue would use its three additional slots to add frequencies to the two markets in which it has one existing daily frequency, Salt Lake City and Fort Lauderdale. It was assumed that they would use their remaining slot to increase Boston from two frequencies to three frequencies, since Boston is a business market for which high frequency is an asset.

It was assumed that American Airlines would use its three additional slots to add service to Chicago O'Hare, its remaining major hub.

It was assumed that Alaska Airlines would use its three slots to upguage three of the regional carrier flights assumed under Scenario 1 to mainline jets, thereby increasing its total air carrier flights from three to six. The three Horizon slots that would now not be used by Horizon under Scenario 2 were assumed to go to American and Frontier regional affiliates for frequencies to San Jose and Denver in addition to those already assumed under Scenario 1.

The methods used to estimate flight schedule times, aircraft types, and load factors were similar to those used for Scenario 1. The estimated schedule is presented in Appendix C and the hourly distribution of passengers is presented in Table 4. Figure 1 compares the hourly distribution of existing (April 2004) passengers (enplanements plus deplanements) with Scenarios 1 and 2.

Comparison with Other Airports

A comparison with other airports was performed to ensure that the hourly distribution of activity estimated for Scenarios 1 and 2 is realistic. Other major commercial West Coast airports, excluding those with a strong international presence such as LAX, San Francisco, and Seattle, were selected for the comparison. Overseas international service is generally confined to small windows of activity because of differences in time zones, and therefore airports with a strong international component would not provide good comparisons. Many of the remaining airports have a strong Southwest Airlines presence, unlike LGB. Since Southwest provides high frequency short haul service, it causes airport peaks to diminish as a percentage of total activity. Therefore, Southwest Airline operations were deleted prior to making the comparison.

Table 5 shows the results of the comparison. The basis for comparison was hourly seat arrivals and departures, which is a rough proxy for hourly passenger activity.

Peak hour seat arrivals at LGB are projected to account for 14.6 percent of daily activity under Scenario 1 and for 14.1 percent of daily activity under Scenario 2. This is higher than the average peak for seat arrivals, but still lower than the peak at Burbank. The peak hour for seat arrivals at LGB occurs between 9:00 and 10:00 pm, before the nighttime operation restrictions become effective. Therefore, airline operations that would normally occur after 10:00 pm are moved up, intensifying the peak at LGB.

Peak hour seat departures at LGB are projected to account for 11.6 percent of daily activity under Scenario 1 and for 10.4 percent of daily activity under Scenario 2. This is lower than the average peak for seat departures for the comparison airports. However, the 60 minute enplanement peak at LGB is significantly higher, 16.2 percent for Scenario 1 and 13.7 percent for Scenario 2. This peak begins just before 7:00 am, and is also intensified by the nighttime noise restrictions.

Peak hour seat arrivals plus seat departures at LGB account for 12.7 percent of daily activity in Scenario 1 and for 11.6 percent in Scenario 2. Again, these are slightly higher than the corresponding numbers for the comparison airports. The total passenger peak at LGB also occurs between 9:00 and 10:00 pm and is intensified by the nighttime operation restrictions.

In general, the hourly peaks in the projected LGB schedules are slightly more intense than in the comparison airports, but this is reasonable given the compression of activity

during the early morning and late evening peaks caused by the nighttime operational restrictions.

Summary

Table 6 summarizes the results of the Scenario 1 and 2 forecasts and includes derivative forecasts. It also provides a comparison with existing (April 2004) activity.

The 20-minute peak, 60-minute peak[5], and average day peak month (ADPM) projections are derived from the schedules and Tables 3 and 4. Peak month passenger projections are calculated by multiplying the ADPM projections by 31 days. Annual passengers were calculated by multiplying the peak month projections by twelve months and then adjusting by the existing ratio of annual to peak month load factor for LGB. This results in an annual enplanement projection of 2.1 million (4.2 MAP) for Scenario 1 and an annual enplanement projection of 2.5 million (5.0 MAP) for Scenario 2. Projected annual enplanements under the two scenarios are higher than current levels (2.9 MAP) because 1) all slots are assumed to fully utilized which was not the case in 2003, 2) larger aircraft are assumed for America West, 3) load factors are assumed to increase in accordance with FAA projections, 4) the commuter carrier slots are assumed to be fully utilized.[6]

Based on the projected schedule, 11 gates would be required under Scenario 1, including 2 757-size gates, 6 other narrow-body aircraft gates and 3 regional jet gates. Compared to Scenario 1, Scenario 2 would result in a requirement of two additional narrow-body gates for a total of thirteen. Existing gate requirements are the same as for Scenario 1, except that there are no regional carrier gate requirements.

Aircraft parking requirements would be 16 for Scenario 1 and 19 for Scenario 2. Figures 2 and 3 show the aircraft requirements by hour for each scenario. The number of parking positions is based on the combination of required parking positions for gates and remaining overnight aircraft (RON), plus one position for a spare aircraft, and one position to accommodate off-schedule aircraft. As shown on Figures 2 and 3, the maximum parking position requirement occurs during hour 2100 in Scenario 1 and hours 0600 and 2100 in Scenario 2. Based on the April 2004 schedule, the current aircraft parking requirement is ten spaces.

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[5] The 60-minute peak differs from the peak hour because it represents the busiest consecutive 60 minutes. The peak hour represents the busiest hourly period beginning at the start of each hour. For example, under Scenario, peak hour passenger deplanements (964) extend from 2100-2159. Peak 60-minute passenger deplanements (1074) extend from 2050-2149.

[6] The new Scenario 1 annual projections differ from earlier Airport estimates (3.8 MAP) because load factors are assumed to be higher in this analysis, consistent with recent Airport experience, and because regional aircraft are assumed to have 70 seats rather than 50 seats.

Table 1

LONG BEACH AIRPORT

Historical Passenger and Aircraft Operation Activity at Long Beach Airport

	Passenger Enplanements			Operations					
Year	Air Carrier	Regional Carrier	Total	Air Carrier	Regional Carrier	Cargo	General Aviation	Military	Total
1981 (a)	101,574	13,181	114,755	6,132	3,518		580,647	1,590	591,887
1982 (a)	218,008		218,008	n/a	n/a	n/a	461,287	n/a	476,455
1983 (a)	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1984 (a)	530,148	11,527	541,675	8,380	17,926		420,649	2,253	449,208
1985 (a)	551,789	5,019	556,808	7,930	9,878		370,313	1,519	389,640
1986 (a)	564,894		564,894	12,771			395,655	2,129	410,555
1987 (a)	611,332		611,332	20,202			414,459	2,489	437,150
1988 (a)	564,460	27,835	592,295	17,757	7,735		410,980	3,131	439,603
1989 (a)	645,985	47,550	693,535	22,722	6,946	226	432,987	2,749	465,630
1990 (a)	712,913	25,514	738,427	23,848	3,386	3,930	463,886	2,332	497,382
1991 (a)	675,552	9,691	685,243	24,696	6,126		406,222	2,281	439,325
1992 (a)	419,953	1,834	421,787	15,318	3,328		415,182	2,148	435,976
1993 (a)	298,541	9,060	307,601	12,260	2,366		414,284	1,994	430,904
1994 (b)	205,030		205,030	9,648	610		476,457	1,598	488,313
1995 (b)	111,170		111,170	7,266	3,282		462,675	3,493	476,716
1996 (b)	121,349		121,349	8,145	4,968		462,609	1,642	477,364
1997 (b)	260,210		260,210	9,360	4,932		434,677	1,543	450,512
1998 (b)	304,891	6	304,897	11,104	6,608		452,034	1,837	471,583
1999 (b)	302,798	77	302,875	14,964	6,602		475,364	2,160	499,090
2000 (b)	304,422	17,668	322,090	12,140	6,111		360,135	1,013	379,399
2001 (b)	278,086	56	278,142	9,488	7,378		340,897	745	358,508
2002 (b)	678,807	9,720	688,527	16,434	8,349		325,313	817	350,913
2003 (c)	n/a	n/a	1,437,852	28,410	7,347		302,075	975	338,807

(a) Airports Council International, North American Airport Traffic Report.
(b) USDOT T-100 data for passengers; FAA ATADS data base for aircraft operations. Air cargo operations included in air carrier category.
(c) Long Beach Airport. Total passengers divided by 2. Operations data from FAA ATADS data base.

Sources: As noted and HNTB analysis.

Table 2

LONG BEACH AIRPORT

Origin-Destination Traffic and Average Fares: Los Angeles Metropolitan Area and LGB
Twelve Months Ending September 2003

Market	Airport Code	Origin-Destination Passengers: Metro Area Total	Metro Area Percent	LGB Total	LGB Percent	Average Fare: Metro Area	Average Fare: LGB
Metropol Oakland CA	OAK	4,092,940	8.4%	482,950	19.0%	62.82	52.04
McCarran Intl NV	LAS	3,044,690	6.2%	215,430	8.5%	54.51	43.97
Sky Harbor Intl AZ	PHX	2,218,020	4.5%	31,000	1.2%	60.82	72.15
Sacramento Metro CA	SMF	2,165,820	4.4%	150	0.0%	68.66	143.59
San Jose Muni CA	SJC	2,138,750	4.4%	-	0.0%	68.23	-
John F Kennedy In NY	JFK	2,095,150	4.3%	810,410	31.9%	226.02	154.59
Seattle/Tacoma In WA	SEA	1,950,230	4.0%	74,160	2.9%	120.95	117.25
O'Hare Intl IL	ORD	1,550,180	3.2%	32,220	1.3%	155.46	117.51
Honolulu (Intl)	HNL	1,194,420	2.4%	-	0.0%	176.50	-
Denver Intl CO	DEN	1,132,350	2.3%	6,660	0.3%	149.84	137.77
Newark Intl NY	EWR	1,125,820	2.3%	4,670	0.2%	209.99	239.84
Portland	PDX	1,113,880	2.3%	4,220	0.2%	110.11	116.69
Dallas/Ft Wor Int TX	DFW	1,097,860	2.2%	19,805	0.8%	180.12	175.10
San Francisco In CA	SFO	1,097,760	2.2%	-	0.0%	111.56	-
Salt Lake Intl UT	SLC	1,060,280	2.2%	89,790	3.5%	81.55	61.65
Wm B Hartsfield GA	ATL	1,010,260	2.1%	86,730	3.4%	167.87	115.83
Dulles Intl DC	IAD	806,850	1.6%	251,040	9.9%	244.07	142.39
Logan Intl MA	BOS	709,910	1.4%	5,440	0.2%	219.30	205.09
Wayne County MI	DTW	678,860	1.4%	10,120	0.4%	162.14	140.78
Baltimore/Wash Intl	BWI	658,950	1.3%	3,360	0.1%	152.33	198.37
Philadelphia Intl PA	PHL	624,490	1.3%	5,000	0.2%	195.39	226.85
Orlando Intl FL	MCO	612,660	1.3%	4,930	0.2%	166.94	214.13
St Paul Intl MN	MSP	610,970	1.2%	4,480	0.2%	181.04	181.85
George Bush Intc TX	IAH	586,570	1.2%	8,110	0.3%	184.21	196.41
Kahului, Maui	OGG	586,930	1.2%	-	0.0%	181.64	-
Other		15,001,300	30.6%	386,965	15.2%	-	-
Total		48,965,900	100.0%	2,537,640	100.0%	132.05	121.94

Sources: USDOT Origin-Destination Survey and HNTB analysis.

Table 3

LONG BEACH AIRPORT

Hourly Distribution of Activity: Average Day Peak Month
Scenario 1

	Aircraft Operations			Passengers			Percent Distribution		
	Arrivals	Departures	Total	Deplanements	Enplanements	Total	Deplanements	Enplanements	Total
0000-0059	-	-	-	-	-	-	0.0%	0.0%	0.0%
0100-0159	-	-	-	-	-	-	0.0%	0.0%	0.0%
0200-0259	-	-	-	-	-	-	0.0%	0.0%	0.0%
0300-0359	-	-	-	-	-	-	0.0%	0.0%	0.0%
0400-0459	-	-	-	-	-	-	0.0%	0.0%	0.0%
0500-0559	-	-	-	-	-	-	0.0%	0.0%	0.0%
0600-0659	-	4	4	-	493	493	0.0%	7.4%	3.7%
0700-0759	1	**7**	8	148	714	862	2.2%	10.7%	6.5%
0800-0859	2	1	3	206	148	354	3.1%	2.2%	2.7%
0900-0959	6	4	10	637	427	1,064	9.6%	6.4%	8.0%
1000-1059	4	**7**	11	472	**785**	1,257	7.1%	**11.8%**	9.4%
1100-1159	6	5	11	530	529	1,059	8.0%	7.9%	7.9%
1200-1259	1	3	4	60	265	325	0.9%	4.0%	2.4%
1300-1359	3	2	5	368	117	484	5.5%	1.8%	3.6%
1400-1459	5	3	8	538	370	908	8.1%	5.5%	6.8%
1500-1559	2	5	7	208	538	746	3.1%	8.1%	5.6%
1600-1659	4	1	5	479	148	627	7.2%	2.2%	4.7%
1700-1759	4	6	10	367	729	1,096	5.5%	10.9%	8.2%
1800-1859	4	3	7	325	176	501	4.9%	2.6%	3.8%
1900-1959	6	3	9	739	265	1,004	11.1%	4.0%	7.5%
2000-2059	5	2	7	627	208	835	9.4%	3.1%	6.3%
2100-2159	**8**	5	**13**	**964**	755	**1,719**	**14.5%**	11.3%	**12.9%**
2200-2259	-	-	-	-	-	-	0.0%	0.0%	0.0%
2300-2359	-	-	-	-	-	-	0.0%	0.0%	0.0%
Total	61	61	122	6,667	6,667	13,333	100.0%	100.0%	100.0%
Peak Hour	8	7	13	964	785	1,719	14.5%	11.8%	12.9%
Peak 60 Minutes	9	10	14	1,074	1,083	1,828	16.1%	16.2%	13.7%

Sources: Appendix B and HNTB analysis.

Table 4

LONG BEACH AIRPORT

Hourly Distribution of Activity: Average Day Peak Month
Scenario 2

	Aircraft Operations			Passengers			Percent Distribution		
	Arrivals	Departures	Total	Deplanements	Enplanements	Total	Deplanements	Enplanements	Total
0000-0059	-	-	-	-	-	-	0.0%	0.0%	0.0%
0100-0159	-	-	-	-	-	-	0.0%	0.0%	0.0%
0200-0259	-	-	-	-	-	-	0.0%	0.0%	0.0%
0300-0359	-	-	-	-	-	-	0.0%	0.0%	0.0%
0400-0459	-	-	-	-	-	-	0.0%	0.0%	0.0%
0500-0559	-	-	-	-	-	-	0.0%	0.0%	0.0%
0600-0659	-	4	4	-	493	493	0.0%	6.2%	3.1%
0700-0759	1	**7**	8	148	714	862	1.9%	9.0%	5.5%
0800-0859	3	3	6	265	458	723	3.4%	5.8%	4.6%
0900-0959	6	6	12	637	635	1,272	8.1%	8.0%	8.0%
1000-1059	4	**7**	11	514	**828**	1,342	6.5%	**10.5%**	8.5%
1100-1159	7	5	12	692	529	1,221	8.8%	6.7%	7.7%
1200-1259	1	4	5	60	427	487	0.8%	5.4%	3.1%
1300-1359	3	2	5	368	117	484	4.7%	1.5%	3.1%
1400-1459	5	3	8	581	370	951	7.4%	4.7%	6.0%
1500-1559	5	6	11	620	683	1,303	7.8%	8.6%	8.2%
1600-1659	5	4	9	538	518	1,056	6.8%	6.6%	6.7%
1700-1759	4	6	10	367	729	1,096	4.6%	9.2%	6.9%
1800-1859	4	3	7	325	176	501	4.1%	2.2%	3.2%
1900-1959	6	3	9	739	265	1,004	9.4%	3.4%	6.4%
2000-2059	7	2	9	937	208	1,145	11.9%	2.6%	7.2%
2100-2159	**9**	5	**14**	**1,112**	755	**1,867**	**14.1%**	9.5%	**11.8%**
2200-2259	-	-	-	-	-	-	0.0%	0.0%	0.0%
2300-2359	-	-	-	-	-	-	0.0%	0.0%	0.0%
Total	70	70	140	7,903	7,903	15,806	100.0%	100.0%	100.0%
Peak Hour	9	7	14	1,112	828	1,867	14.1%	10.5%	11.8%
Peak 60 Minutes	9	10	14	1,187	1,083	1,867	15.0%	13.7%	11.8%

Sources: Appendix C and HNTB analysis.

Figure 1

LONG BEACH AIRPORT

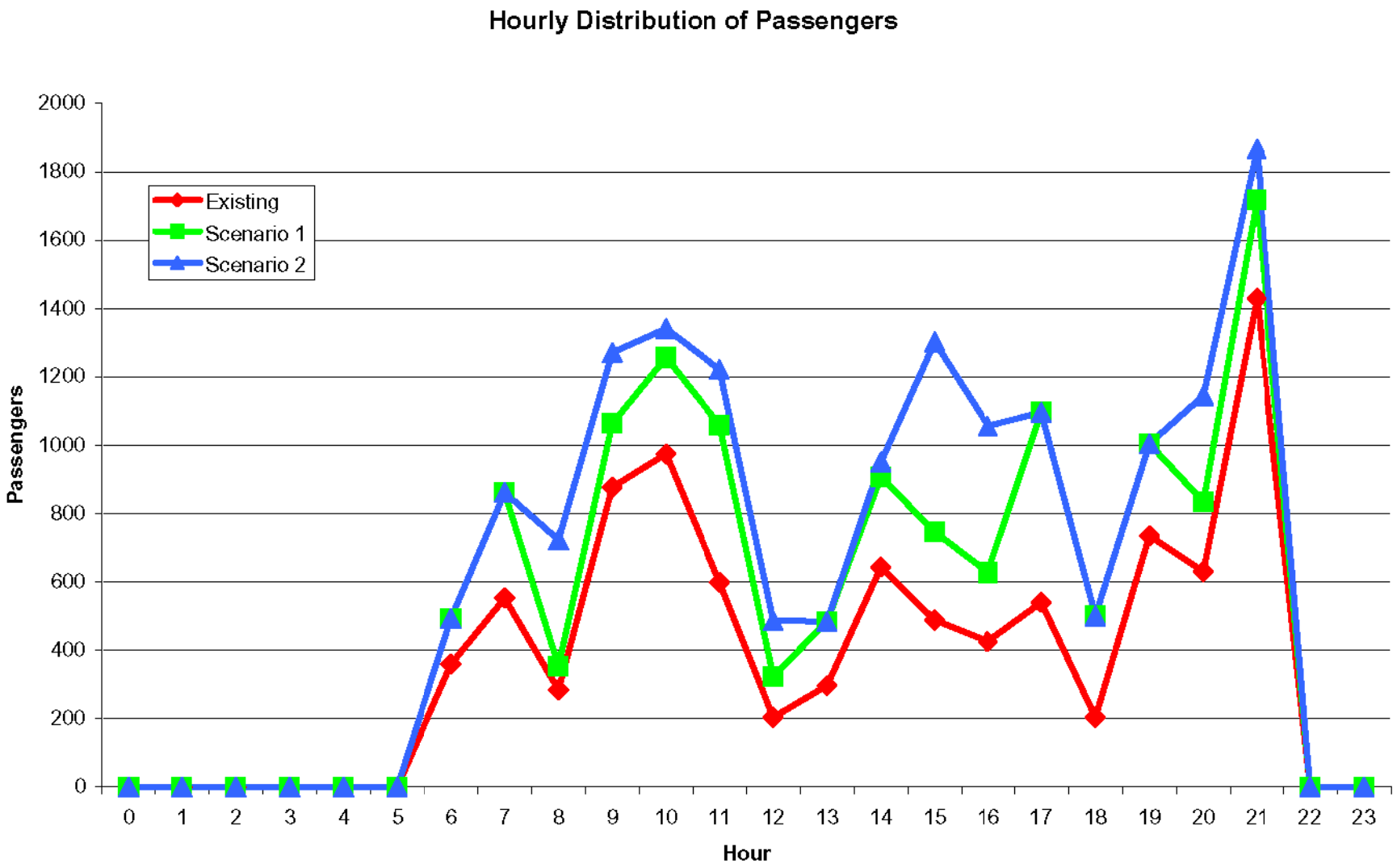


Table 5

LONG BEACH AIRPORT

Comparison of Scheduled Seat Departure Distribution by Time of Day
West Coast Airports (a)

Hour	Long Beach Scenario 1 (b)	Long Beach Scenario 2 (c)	Burbank	Spokane	Oakland	Ontario	Portland	San Diego	San Jose	Orange Cty
Scheduled Seat Arrivals										
Peak Hour Percent	14.6%	14.1%	15.5%	13.3%	11.2%	14.0%	8.3%	11.7%	10.3%	11.8%
Scheduled Seat Departures										
Peak Hour Percent	11.6%	10.4%	15.6%	12.3%	13.3%	14.8%	13.8%	11.6%	14.8%	10.7%
Scheduled Seat Arrivals and Seat Departures										
Peak Hour Percent	12.7%	11.6%	12.3%	9.5%	7.9%	10.8%	8.2%	9.7%	9.8%	9.1%

(a) Schedule for August , 2003. Excludes operations by Southwest Airlines.
(b) Appendix B.
(c) Appendix C.

Sources: Official Airline Guide as compiled by BACK Aviation Solutions and HNTB analysis.

Table 6

LONG BEACH AIRPORT

Summary of Activity Projections
Scenario 1 and 2

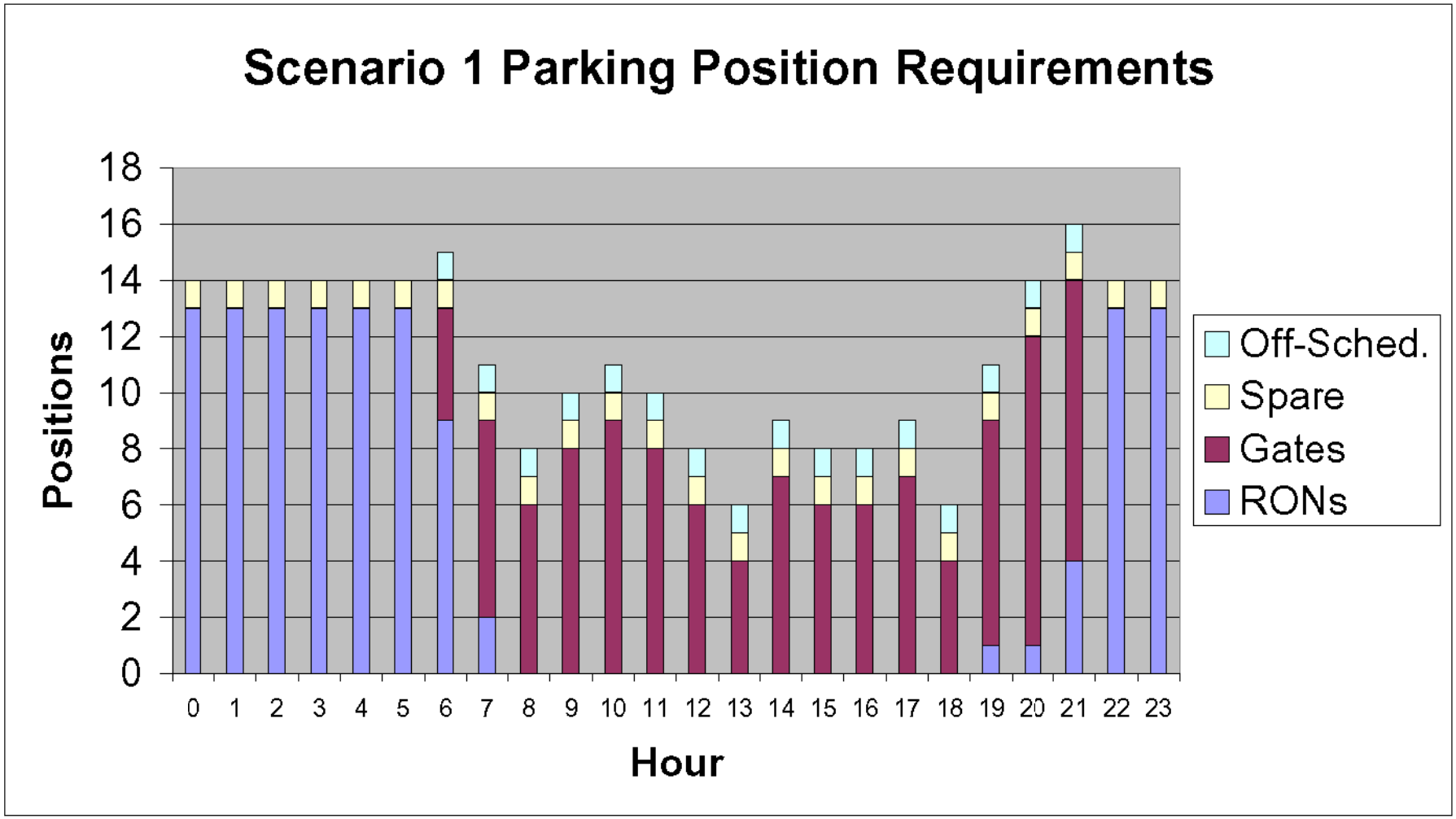
	Existing (a)	Scenario1	Scenario 2
Enplanements			
Peak 20 Minutes	615	802	802
Peak 60 Minutes	769	1,083	1,083
Average Day Peak Month (ADPM)	4,623	6,667	7,903
Peak Month (b)	143,313	206,677	244,993
Annual (c)	1,475,298	2,127,581	2,522,015
Deplanements			
Peak 20 Minutes	452	591	680
Peak 60 Minutes	911	1,074	1,187
Average Day Peak Month (ADPM)	4,623	6,667	7,903
Peak Month (b)	143,313	206,677	244,993
Annual (c)	1,475,298	2,127,581	2,522,015
Total Passengers			
Peak 20 Minutes	833	937	937
Peak 60 Minutes	1,634	1,828	1,867
Average Day Peak Month (ADPM)	9,246	13,333	15,806
Peak Month (b)	286,626	413,354	489,986
Annual (c)	2,950,595	4,255,163	5,044,030
Passenger Aircraft Flights (ADPM)			
Air Carrier	35	36	45
Regional Carrier	-	25	25
Total	35	61	70
Gate Requirements			
757	2	2	2
Other Narrow Body (d)	8	6	8
Regional Jet	-	3	3
Total	10	11	13
Aircraft Parking Requirements (e)			
757	3	4	5
Other Narrow Body (d)	7	8	10
Regional Jet	-	4	4
Total	10	16	19

(a) Based on April 2004 schedule and assuming peak month load factors. Gate and aircraft parking requirements are requirements based on the airline schedules and do not necessarily correspond to existing availability.
(b) Average day peak month multiplied by 31 days.
(c) Peak month passengers multiplied by ratio of annual days to peak month days and ratio of annual load factor to peak month load factor.
(d) Canadair 900s included with narrow body aircraft.
(e) Includes overnight parking positions and allowance for one spare parking position and an additional position to accommodate off-schedule aircraft.

Sources: Appendix B, Appendix C and HNTB analysis.

Figure 2

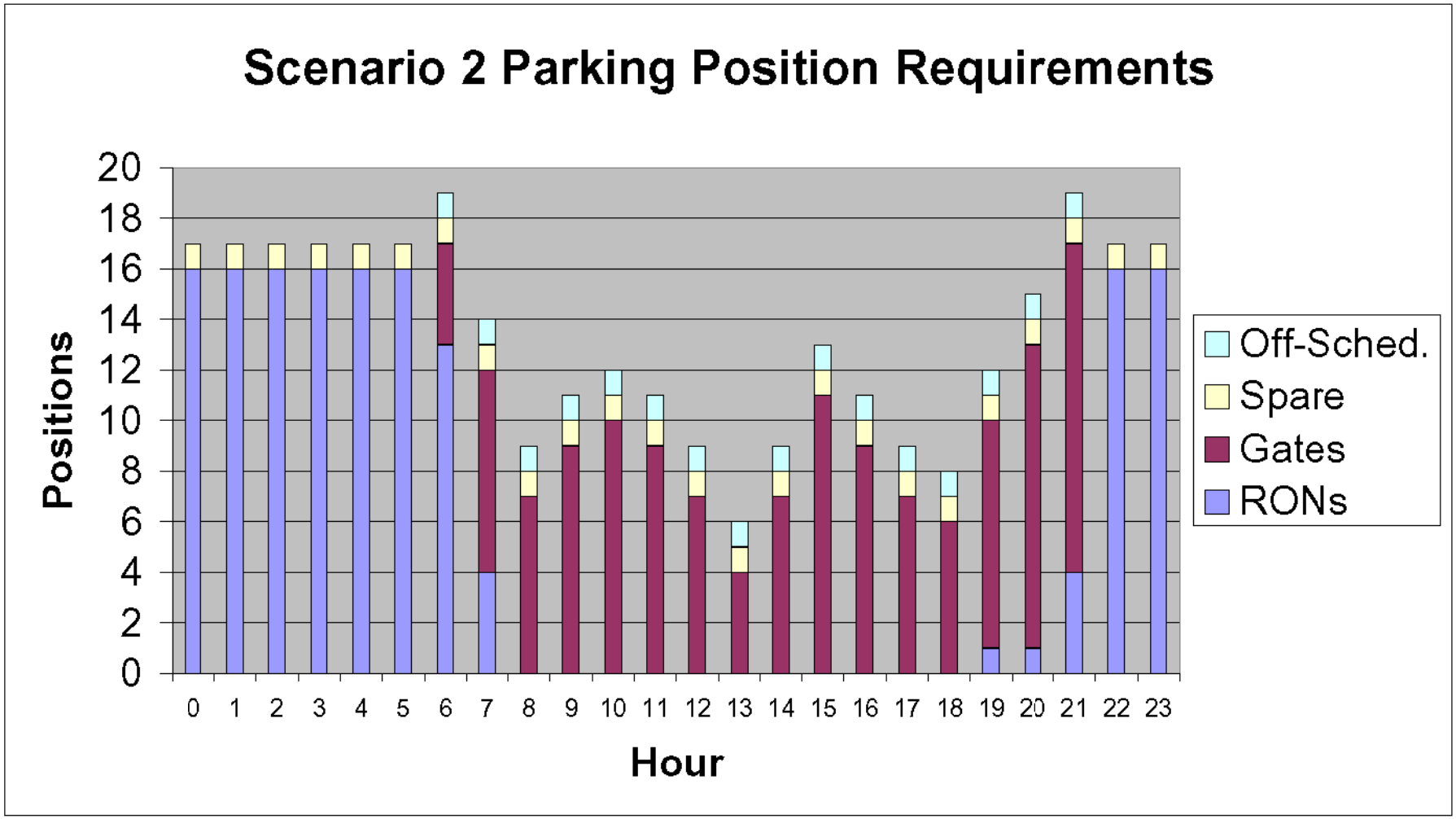
LONG BEACH AIRPORT



Sources: Appendix B and HNTB analysis

Figure 3

LONG BEACH AIRPORT



Sources: Appendix B and HNTB analysis

Appendix B

LONG BEACH AIRPORT

Scenario 1 Schedule

		Arrivals													Departures											
Rec.			Type		Arr.	Arr.	Air-	Flt.	Equip-		Arr.	Arr.				Type		Dept.	Dept.	Air-	Flt.	Equip-		Dept.	Dept.		
No.	Gate	RON	D/I	Origin	Hour	Min.	line	No.	ment	Seats	L.F.	OD %	Depl	Term	RON	D/I	Dest.	Hour	Min.	line	No.	ment	Seats	L.F.	OD %	Enp	Orig
1	G01	Y					B6		320	156						D	OAK	6	50	B6	242	320	156	0.95	1.00	148	148
2	G01		D	SLC	7	15	B6	231	320	156	0.95	1.00	148	148		D	BOS	8	10	B6	482	320	156	0.95	1.00	148	148
3	G01		D	FLL	9	25	B6	244	320	156	0.95	1.00	148	148		D	LAS	10	10	B6	280	320	156	0.95	1.00	148	148
4	G01		D	BOS	11	25	B6	481	320	156	0.95	1.00	148	148		D	OAK	12	55	B6	250	320	156	0.95	1.00	148	148
5	G01		D	OAK	13	25	B6	247	320	156	0.95	1.00	148	148		D	JFK	14	25	B6	222	320	156	0.95	1.00	148	148
6	G01		D	LAS	14	45	B6	281	320	156	0.95	1.00	148	148		D	OAK	15	20	B6	252	320	156	0.95	1.00	148	148
7	G01		D	IAD	16	10	B6	300	320	156	0.95	1.00	148	148		D	LAS	17	10	B6	284	320	156	0.95	1.00	148	148
8	G01		D	OAK	18	45	B6	253	320	156	0.95	1.00	148	148		D	SLC	19	55	B6	92	320	156	0.95	1.00	148	148
9	G01		D	OAK	20	30	B6	243	320	156	0.95	1.00	148	148		D	FLL	21	30	B6	243	320	156	0.95	1.00	148	148
10	G01		D	JFK	21	45	B6	217	320	156	0.95	1.00	148	148	Y					B6		320	156				
11	G02	Y					B6		320	156						D	JFK	7	5	B6	202	320	156	0.95	1.00	148	148
12	G02		D	OAK	8	5	B6	241	320	156	0.95	1.00	148	148		D	JFK	9	0	B6	204	320	156	0.95	1.00	148	148
13	G02		D	IAD	9	35	B6	311	320	156	0.95	1.00	148	148		D	IAD	10	30	B6	307	320	156	0.95	1.00	148	148
14	G02		D	JFK	11	45	B6	221	320	156	0.95	1.00	148	148	Y					B6		320	156				
15	G02		D	JFK	14	30	B6	209	320	156	0.95	1.00	148	148		D	JFK	15	40	B6	210	320	156	0.95	1.00	148	148
16	G02		D	OAK	16	25	B6	251	320	156	0.95	1.00	148	148		D	OAK	17	10	B6	300	320	156	0.95	1.00	148	148
17	G02		D	JFK	19	30	B6	215	320	156	0.95	1.00	148	148		D	OAK	20	25	B6	256	320	156	0.95	1.00	148	148
18	G02		D	IAD	20	40	B6	306	320	156	0.95	1.00	148	148		D	IAD	21	35	B6	255	320	156	0.95	1.00	148	148
19	G03	Y					B6		320	156						D	OAK	10	40	B6	244	320	156	0.95	1.00	148	148
20	G03		D	OAK	15	10	B6	310	320	156	0.95	1.00	148	148		D	IAD	16	10	B6	310	320	156	0.95	1.00	148	148
21	G03		D	JFK	17	0	B6	215	320	156	0.95	1.00	148	148		D	JFK	17	55	B6	210	320	156	0.95	1.00	148	148
22	G03		D	LAS	19	55	B6	285	320	156	0.95	1.00	148	148		D	BOS	21	0	B6	488	320	156	0.95	1.00	148	148
23	G03		D	BOS	21	20	B6	489	320	156	0.95	1.00	148	148	Y					B6		320	156				
24	G04		D	JFK	10	20	B6	205	320	156	0.95	1.00	148	148		D	JFK	11	20	B6	206	320	156	0.95	1.00	148	148
25	G04		D	JFK	20	50	B6	219	320	156	0.95	1.00	148	148		D	JFK	21	45	B6	216	320	156	0.95	1.00	148	148
26	G05	Y					AA		757	176						D	DFW	6	47	AA	1194	757	176	0.92	1.00	162	162
27	G05	Y					AA		757	176						D	DFW	9	5	AA	2414	757	176	0.92	1.00	162	162
28	G05		D	DFW	9	29	AA	2411	757	176	0.92	1.00	162	162		D	DFW	10	35	AA	2460	757	176	0.92	1.00	162	162
29	G05		D	DFW	13	49	AA	1343	757	176	0.92	1.00	162	162		D	DFW	14	41	AA	368	757	176	0.92	1.00	162	162
30	G05		D	DFW	19	50	AA	2405	757	176	0.92	1.00	162	162	Y					AA		757	176				
31	G05		D	DFW	21	48	AA	2164	757	176	0.92	1.00	162	162	Y					AA		757	176				
32	G06	Y					AA		757	176						D	JFK	7	30	AA	242	757	176	0.92	1.00	162	162
33	G06		D	JFK	10	49	AA	291	757	176	0.92	1.00	162	162		D	JFK	11	55	AA	290	757	176	0.92	1.00	162	162
34	G06		D	JFK	19	58	AA	241	757	176	0.92	1.00	162	162		D	JFK	21	15	AA	294	757	176	0.92	1.00	162	162
35	G06		D	JFK	21	58	AA	293	757	176	0.92	1.00	162	162	Y					AA		757	176				
36	G07	Y					AA*		CR7	70						D	SJC	7	5	AA*	NEW	CR7	70	0.85	1.00	60	60
37	G07		D	SJC	9	15	AA*	NEW	CR7	70	0.85	1.00	60	60		D	SJC	9	55	AA*	NEW	CR7	70	0.85	1.00	60	60
38	G07		D	SJC	11	55	AA*	NEW	CR7	70	0.85	1.00	60	60		D	SJC	12	35	AA*	NEW	CR7	70	0.85	1.00	60	60
39	G07		D	SJC	14	15	AA*	NEW	CR7	70	0.85	1.00	60	60		D	SJC	14	55	AA*	NEW	CR7	70	0.85	1.00	60	60
40	G07		D	SJC	17	20	AA*	NEW	CR7	70	0.85	1.00	60	60		D	SJC	18	0	AA*	NEW	CR7	70	0.85	1.00	60	60
41	G07		D	SJC	19	45	AA*	NEW	CR7	70	0.85	1.00	60	60		D	SJC	20	25	AA*	NEW	CR7	70	0.85	1.00	60	60
42	G07		D	SJC	21	25	AA*	NEW	CR7	70	0.85	1.00	60	60	Y					AA*		CR7	70				
43	G08	Y					HP		320	150						D	PHX	6	55	HP	6433	320	150	0.82	1.00	123	123
44	G08	Y					HP		320	150						D	LAS	7	55	HP	NEW	320	150	0.82	1.00	123	123
45	G08		D	PHX	8	47	HP	NEW	CR7	70	0.82	1.00	57	57		D	PHX	9	30	HP	NEW	CR7	70	0.82	1.00	57	57
46	G08		D	LAS	11	0	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	11	40	HP	NEW	CR7	70	0.82	1.00	57	57
47	G08		D	PHX	11	47	HP	6689	CR7	70	0.82	1.00	57	57		D	PHX	12	30	HP	6526	CR7	70	0.82	1.00	57	57
48	G08		D	LAS	13	0	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	13	40	HP	NEW	CR7	70	0.82	1.00	57	57
49	G08		D	PHX	14	43	HP	6094	320	150	0.82	1.00	123	123		D	PHX	15	30	HP	6416	320	150	0.82	1.00	123	123
50	G08		D	LAS	16	55	HP	NEW	320	150	0.82	1.00	123	123		D	LAS	17	35	HP	NEW	320	150	0.82	1.00	123	123
51	G08		D	PHX	17	49	HP	6099	CR7	70	0.82	1.00	57	57		D	PHX	18	25	HP	6092	CR7	70	0.82	1.00	57	57
52	G08		D	LAS	18	55	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	19	35	HP	NEW	CR7	70	0.82	1.00	57	57
53	G08		D	PHX	20	56	HP	6090	320	150	0.82	1.00	123	123	Y					HP		320	150				
54	G08		D	LAS	21	35	HP	NEW	320	150	0.82	1.00	123	123	Y					HP		320	150				
55	G09	Y					AS		73G	120						D	SEA	7	0	AS	349	73G	120	0.85	1.00	102	102
56	G09		D	SEA	10	40	AS	332	73G	120	0.85	1.00	102	102		D	SEA	11	10	AS	311	73G	120	0.85	1.00	102	102
57	G09		D	SEA	17	6	AS	338	73G	120	0.85	1.00	102	102		D	SEA	17	41	AS	335	73G	120	0.85	1.00	102	102
58	G09		D	SEA	21	16	AS	342	73G	120	0.85	1.00	102	102	Y					AS		73G	120				
59	G10	Y					F9*		CR7	70						D	DEN	6	55	F9*	NEW	CR7	70	0.85	1.00	60	60
60	G10	Y					AS*		CR7	70						D	PDX	7	25	AS*	NEW	CR7	70	0.85	1.00	60	60
61	G10		D	SEA	9	30	AS*	NEW	CR7	70	0.85	1.00	60	60		D	SEA	10	10	AS*	NEW	CR7	70	0.85	1.00	60	60
62	G10		D	PDX	10	20	AS*	NEW	CR7	70	0.85	1.00	60	60		D	PDX	10	50	AS*	NEW	CR7	70	0.85	1.00	60	60
63	G10		D	DEN	11	5	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	11	35	F9*	NEW	CR7	70	0.85	1.00	60	60
64	G10		D	SEA	14	30	AS*	NEW	CR7	70	0.85	1.00	60	60		D	SEA	15	0	AS*	NEW	CR7	70	0.85	1.00	60	60
65	G10		D	PDX	15	20	AS*	NEW	CR7	70	0.85	1.00	60	60		D	PDX	15	50	AS*	NEW	CR7	70	0.85	1.00	60	60
66	G10		D	DEN	18	10	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	18	40	F9*	NEW	CR7	70	0.85	1.00	60	60
67	G10		D	SEA	18	56	AS*	NEW	CR7	70	0.85	1.00	60	60		D	SEA	19	25	AS*	NEW	CR7	70	0.85	1.00	60	60
68	G10		D	PDX	20	10	AS*	NEW	CR7	70	0.85	1.00	60	60	Y					AS*		CR7	70				
69	G10		D	DEN	21	45	F9*	NEW	CR7	70	0.85	1.00	60	60	Y					F9*		CR7	70				
70	G11	Y					DL*		CR7	70						D	SLC	7	25	DL*	NEW	CR7	70	0.85	1.00	60	60
71	G11		D	SLC	9	45	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	10	25	DL*	NEW	CR7	70	0.85	1.00	60	60
72	G11		D	SLC	12	20	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	13	0	DL*	NEW	CR7	70	0.85	1.00	60	60
73	G11		D	SLC	16	20	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	17	0	DL*	NEW	CR7	70	0.85	1.00	60	60
74	G11		D	SLC	19	45	DL*	NEW	CR7	70	0.85	1.00	60	60	Y					DL*		CR7	70				
										74	61												74	61			

Sources: Offical Airline Guide as compiled by BACK Aviation Solutions, and HNTB analysis.

Appendix C

LONG BEACH AIRPORT

Scenario 2 Schedule

		Arrivals													Departures												
Rec.			Type		Arr.	Arr.	Air-	Flt.	Equip-		Arr.	Arr.				Type			Dept.	Dept.	Air-	Flt.	Equip-		Dept.	Dept.		
No.	Gate	RON	D/I	Origin	Hour	Min.	line	No.	ment	Seats	L.F.	OD %	Depl	Term	RON	D/I	Dest.	Hour	Min.	line	No.	ment	Seats	L.F.	OD %	Enp	Orig
1	G01	Y					B6		320	156						D	OAK	6	50	B6	242	320	156	0.95	1.00	148	148
2	G01		D	SLC	7	15	B6	231	320	156	0.95	1.00	148	148.2		D	BOS	8	10	B6	482	320	156	0.95	1.00	148	148
3	G01		D	FLL	9	25	B6	244	320	156	0.95	1.00	148	148.2		D	LAS	10	10	B6	280	320	156	0.95	1.00	148	148
4	G01		D	BOS	11	25	B6	481	320	156	0.95	1.00	148	148.2		D	OAK	12	55	B6	250	320	156	0.95	1.00	148	148
5	G01		D	OAK	13	25	B6	247	320	156	0.95	1.00	148	148.2		D	JFK	14	25	B6	222	320	156	0.95	1.00	148	148
6	G01		D	LAS	14	45	B6	281	320	156	0.95	1.00	148	148.2		D	OAK	15	20	B6	252	320	156	0.95	1.00	148	148
7	G01		D	IAD	16	10	B6	300	320	156	0.95	1.00	148	148.2		D	LAS	17	10	B6	284	320	156	0.95	1.00	148	148
8	G01		D	OAK	18	45	B6	253	320	156	0.95	1.00	148	148.2		D	SLC	19	55	B6	92	320	156	0.95	1.00	148	148
9	G01		D	OAK	20	30	B6	243	320	156	0.95	1.00	148	148.2		D	FLL	21	30	B6	243	320	156	0.95	1.00	148	148
10	G01		D	JFK	21	45	B6	217	320	156	0.95	1.00	148	148.2	Y					B6		320	156				
11	G02	Y					B6		320	156						D	JFK	7	5	B6	202	320	156	0.95	1.00	148	148
12	G02		D	OAK	8	5	B6	241	320	156	0.95	1.00	148	148.2		D	JFK	9	0	B6	204	320	156	0.95	1.00	148	148
13	G02		D	IAD	9	35	B6	311	320	156	0.95	1.00	148	148.2		D	IAD	10	30	B6	307	320	156	0.95	1.00	148	148
14	G02		D	JFK	11	45	B6	221	320	156	0.95	1.00	148	148.2	Y					B6		320	156				
15	G02		D	JFK	14	30	B6	209	320	156	0.95	1.00	148	148.2		D	JFK	15	40	B6	210	320	156	0.95	1.00	148	148
16	G02		D	OAK	16	25	B6	251	320	156	0.95	1.00	148	148.2		D	OAK	17	10	B6	300	320	156	0.95	1.00	148	148
17	G02		D	JFK	19	30	B6	215	320	156	0.95	1.00	148	148.2		D	OAK	20	25	B6	256	320	156	0.95	1.00	148	148
18	G02		D	IAD	20	40	B6	306	320	156	0.95	1.00	148	148.2		D	IAD	21	35	B6	255	320	156	0.95	1.00	148	148
19	G02		D	FLL	21	50	B6	NEW	320	156	0.95	1.00	148	148.2	Y					B6		320	156				
20	G03	Y					B6		320	156						D	SLC	8	0	B6	NEW	320	156	0.95	1.00	148	148
21	G03	Y					B6		320	156						D	OAK	10	40	B6	244	320	156	0.95	1.00	148	148
22	G03		D	OAK	15	10	B6	310	320	156	0.95	1.00	148	148.2		D	IAD	16	10	B6	310	320	156	0.95	1.00	148	148
23	G03		D	JFK	17	0	B6	215	320	156	0.95	1.00	148	148.2		D	JFK	17	55	B6	210	320	156	0.95	1.00	148	148
24	G03		D	LAS	19	55	B6	285	320	156	0.95	1.00	148	148.2		D	BOS	21	0	B6	488	320	156	0.95	1.00	148	148
25	G03		D	BOS	21	20	B6	489	320	156	0.95	1.00	148	148.2	Y					B6		320	156				
26	G04	Y					B6		320	156						D	FLL	9	0	B6	NEW	320	156	0.95	1.00	148	148
27	G04		D	JFK	10	20	B6	205	320	156	0.95	1.00	148	148.2		D	JFK	11	20	B6	206	320	156	0.95	1.00	148	148
28	G04		D	BOS	15	55	B6	NEW	320	156	0.95	1.00	148	148.2		D	BOS	16	50	B6	NEW	320	156	0.95	1.00	148	148
29	G04		D	JFK	20	50	B6	219	320	156	0.95	1.00	148	148.2		D	JFK	21	45	B6	216	320	156	0.95	1.00	148	148
30	G05		D	SLC	20	30	B6	NEW	320	156	0.95	1.00	148	148.2	Y					B6		320	156				
31	G06	Y					AA		757	176						D	DFW	6	47	AA	1194	757	176	0.92	1.00	162	162
32	G06	Y					AA		757	176						D	ORD	8	15	AA	NEW	757	176	0.92	1.00	162	162
33	G06	Y					AA		757	176						D	DFW	9	5	AA	2414	757	176	0.92	1.00	162	162
34	G06		D	DFW	9	29	AA	2411	757	176	0.92	1.00	162	161.9		D	DFW	10	35	AA	2460	757	176	0.92	1.00	162	162
35	G06		D	ORD	11	15	AA	NEW	757	176	0.92	1.00	162	161.9		D	ORD	12	15	AA	NEW	757	176	0.92	1.00	162	162
36	G06		D	DFW	13	49	AA	1343	757	176	0.92	1.00	162	161.9		D	DFW	14	41	AA	368	757	176	0.92	1.00	162	162
37	G06		D	DFW	19	50	AA	2405	757	176	0.92	1.00	162	161.9	Y					AA		757	176				
38	G06		D	ORD	20	45	AA	NEW	757	176	0.92	1.00	162	161.9	Y					AA		757	176				
39	G06		D	DFW	21	48	AA	2164	757	176	0.92	1.00	162	161.9	Y					AA		757	176				
40	G07	Y					AA		757	176						D	JFK	7	30	AA	242	757	176	0.92	1.00	162	162
41	G07		D	JFK	10	49	AA	291	757	176	0.92	1.00	162	161.9		D	JFK	11	55	AA	290	757	176	0.92	1.00	162	162
42	G07		D	ORD	15	15	AA	NEW	757	176	0.92	1.00	162	161.9		D	ORD	16	15	AA	NEW	757	176	0.92	1.00	162	162
43	G07		D	JFK	19	58	AA	241	757	176	0.92	1.00	162	161.9		D	JFK	21	15	AA	294	757	176	0.92	1.00	162	162
44	G07		D	JFK	21	58	AA	293	757	176	0.92	1.00	162	161.9	Y					AA		757	176				
45	G08	Y					AA*		CR7	70						D	SJC	7	5	AA*	NEW	CR7	70	0.85	1.00	60	60
46	G08		D	SJC	9	15	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	9	55	AA*	NEW	CR7	70	0.85	1.00	60	60
47	G08		D	SJC	11	55	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	12	35	AA*	NEW	CR7	70	0.85	1.00	60	60
48	G08		D	SJC	14	5	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	14	35	AA*	NEW	CR7	70	0.85	1.00	60	60
49	G08		D	SJC	16	0	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	16	35	AA*	NEW	CR7	70	0.85	1.00	60	60
50	G08		D	SJC	17	55	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	18	35	AA*	NEW	CR7	70	0.85	1.00	60	60
51	G08		D	SJC	19	45	AA*	NEW	CR7	70	0.85	1.00	60	59.5		D	SJC	20	25	AA*	NEW	CR7	70	0.85	1.00	60	60
52	G08		D	SJC	21	25	AA*	NEW	CR7	70	0.85	1.00	60	59.5	Y					AA*		CR7	70				
53	G09	Y					HP		320	150						D	PHX	6	55	HP	6433	320	150	0.82	1.00	123	123
54	G09	Y					HP		320	150						D	LAS	7	55	HP	NEW	320	150	0.82	1.00	123	123
55	G09		D	PHX	8	47	HP	NEW	CR7	70	0.82	1.00	57	57		D	PHX	9	30	HP	NEW	CR7	70	0.82	1.00	57	57
56	G09		D	LAS	11	0	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	11	40	HP	NEW	CR7	70	0.82	1.00	57	57
57	G09		D	PHX	11	47	HP	6693	CR7	70	0.82	1.00	57	57		D	PHX	12	30	HP	6526	CR7	70	0.82	1.00	57	57
58	G09		D	LAS	13	0	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	13	40	HP	NEW	CR7	70	0.82	1.00	57	57
59	G09		D	PHX	14	43	HP	6094	320	150	0.82	1.00	123	123		D	PHX	15	30	HP	6416	320	150	0.82	1.00	123	123
60	G09		D	LAS	16	55	HP	NEW	320	150	0.82	1.00	123	123		D	LAS	17	35	HP	NEW	320	150	0.82	1.00	123	123
61	G09		D	PHX	17	49	HP	6099	CR7	70	0.82	1.00	57	57		D	PHX	18	25	HP	6092	CR7	70	0.82	1.00	57	57
62	G09		D	LAS	18	55	HP	NEW	CR7	70	0.82	1.00	57	57		D	LAS	19	35	HP	NEW	CR7	70	0.82	1.00	57	57
63	G09		D	PHX	20	56	HP	6090	320	150	0.82	1.00	123	123	Y					HP		320	150				
64	G09		D	LAS	21	35	HP	NEW	320	150	0.82	1.00	123	123	Y					HP		320	150				
65	G10	Y					AS		73G	120						D	SEA	7	0	AS	349	73G	120	0.85	1.00	102	102
66	G10		D	SEA	9	30	AS*	NEW	CR7	70	0.85	1.00	60	60		D	SEA	10	10	AS*	NEW	CR7	70	0.85	1.00	60	60
67	G10		D	SEA	10	40	AS	332	73G	120	0.85	1.00	102	102		D	SEA	11	10	AS	311	73G	120	0.85	1.00	102	102
68	G10		D	SEA	14	30	AS	NEW	73G	120	0.85	1.00	102	102		D	SEA	15	0	AS	NEW	73G	120	0.85	1.00	102	102
69	G10		D	SEA	17	6	AS	338	73G	120	0.85	1.00	102	102		D	SEA	17	41	AS	335	73G	120	0.85	1.00	102	102
70	G10		D	SEA	21	16	AS	342	73G	120	0.85	1.00	102	102	Y					AS		73G	120				
71	G11	Y					AS*		CR7	70						D	PDX	7	25	AS*	NEW	CR7	70	0.85	1.00	60	60
72	G11		D	PDX	10	15	AS	NEW	73G	120	0.85	1.00	102	102		D	PDX	10	55	AS	NEW	73G	120	0.85	1.00	102	102
73	G11		D	PDX	15	15	AS	NEW	73G	120	0.85	1.00	102	102		D	PDX	15	55	AS	NEW	73G	120	0.85	1.00	102	102
74	G11		D	SEA	18	56	AS*	NEW	CR7	70	0.85	1.00	60	60		D	SEA	19	25	AS*	NEW	CR7	70	0.85	1.00	60	60
75	G11		D	PDX	20	10	AS*	NEW	CR7	70	0.85	1.00	60	60	Y					AS*		CR7	70				
76	G12	Y					F9*		CR7	70						D	DEN	6	55	F9*	NEW	CR7	70	0.85	1.00	60	60
77	G12		D	DEN	8	30	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	9	0	F9*	NEW	CR7	70	0.85	1.00	60	60
78	G12		D	DEN	11	5	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	11	35	F9*	NEW	CR7	70	0.85	1.00	60	60
79	G12		D	DEN	15	10	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	15	40	F9*	NEW	CR7	70	0.85	1.00	60	60
80	G12		D	DEN	18	10	F9*	NEW	CR7	70	0.85	1.00	60	60		D	DEN	18	40	F9*	NEW	CR7	70	0.85	1.00	60	60
81	G12		D	DEN	21	45	F9*	NEW	CR7	70	0.85	1.00	60	60	Y					F9*		CR7	70				
82	G13	Y					DL*		CR7	70						D	SLC	7	25	DL*	NEW	CR7	70	0.85	1.00	60	60
83	G13		D	SLC	9	45	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	10	25	DL*	NEW	CR7	70	0.85	1.00	60	60
84	G13		D	SLC	12	20	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	13	0	DL*	NEW	CR7	70	0.85	1.00	60	60
85	G13		D	SLC	16	20	DL*	NEW	CR7	70	0.85	1.00	60	60		D	SLC	17	0	DL*	NEW	CR7	70	0.85	1.00	60	60
86	G13		D	SLC	19	45	DL*	NEW	CR7	70	0.85	1.00	60	60	Y					DL*		CR7	70				
Sources: Offical Airline Guide as compiled by BACK Aviation Solutions, and HNTB analysis																											
										86	70												86	70			

Attachment E
Roadway Fleet Mix

Long Beach Airport - Terminal Improvement Project EIR

Roadway Vehicle Fleet Mix

Roadway Segment	Vehicle Type	Vehicles per Hour (in Peak Hour)				
		2005 Baseline	2011 Project	2020 Project	2011 No Project	2020 No Project
DD1	1 LD Auto	1,213	2,028	2,028	2,783	2,783
DD1	2 Other/Shuttles	3	5	5	7	7
DD1	3 Buses	2	3	3	4	4
DD1	4 MD Truck	4	7	7	9	9
DD1	5 HHD Truck	3	4	4	6	6
DD2	1 LD Auto	579	1,205	1,205	1,416	1,416
DD2	2 Other/Shuttles	2	3	3	4	4
DD2	3 Buses	1	2	2	2	2
DD2	4 MD Truck	2	4	4	5	5
DD2	5 HHD Truck	1	3	3	3	3
DD3	1 LD Auto	579	1,205	1,205	1,416	1,416
DD3	2 Other/Shuttles	2	3	3	4	4
DD3	3 Buses	1	2	2	2	2
DD3	4 MD Truck	2	4	4	5	5
DD3	5 HHD Truck	1	3	3	3	3
DD4	1 LD Auto	579	1,205	1,205	1,416	1,416
DD4	2 Other/Shuttles	2	3	3	4	4
DD4	3 Buses	1	2	2	2	2
DD4	4 MD Truck	2	4	4	5	5
DD4	5 HHD Truck	1	3	3	3	3
DD5	1 LD Auto	579	1,205	1,205	1,416	1,416
DD5	2 Other/Shuttles	2	3	3	4	4
DD5	3 Buses	1	2	2	2	2
DD5	4 MD Truck	2	4	4	5	5
DD5	5 HHD Truck	1	3	3	3	3
Cargo1	5 HHD Truck	3	3	3	3	3
Cargo2	5 HHD Truck	3	3	3	3	3

Attachment F
Construction Emissions

LGB Terminal Improvement Project

Construction Emissions - Summary

		Total
Project Emissions (tons)	CO	40.3
	VOC	14.0
	NOx	114.7
	SOx	0.1
	PM2.5	6.9
	PM10	16.0

		2006	2007	2008	2009	2010	2011	Peak Annual (ton/yr)
Annual Emissions (tons/year)	CO	3.8	10.9	8.0	6.3	5.7	5.6	10.9
	ROC	0.9	6.4	1.7	2.9	1.1	1.0	6.4
	NOx	11.8	30.9	20.1	17.9	17.5	16.6	30.9
	SOx	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	PM2.5	0.6	1.9	1.4	1.1	1.0	1.0	1.9
	PM10	1.1	3.8	3.1	2.6	2.7	2.7	3.8

		2006				2007				2008				2009			
Pollutant	CEQA	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
CO	24.75	0.0	0.0	1.3	0.9	1.8	2.8	3.0	3.1	2.0	2.0	2.0	2.0	1.9	1.0	0.8	0.8
VOC	2.5	0.0	0.0	0.3	0.2	0.4	0.7	0.8	4.5	0.4	0.4	0.4	0.4	2.0	0.2	0.1	0.1
NOx	2.5	0.0	0.0	3.7	2.1	5.3	8.0	8.5	8.6	5.0	5.0	5.1	5.1	4.8	2.4	1.9	1.9
SOx	6.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
PM2.5		0.0	0.0	0.2	0.1	0.3	0.5	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.1	0.1	0.1
PM10	6.75	0.0	0.0	0.4	0.2	0.5	1.0	1.1	1.1	0.8	0.8	0.8	0.8	0.7	0.3	0.2	0.2

Quarterly Emissions (tons/quarter)			2010				2011				Peak Quarterly	CEQA
	Pollutant	CEQA	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	(tons/Qtr)	Significance
	CO	24.75	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4	3.1	Not significant
	VOC	2.5	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	4.5	Significant
	NOx	2.5	4.3	4.4	4.4	4.4	4.1	4.1	4.2	4.1	8.6	Significant
	SOx	6.75	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	Not significant
	PM2.5		0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.5	Unknown
	PM10	6.75	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	1.1	Not significant

			Average Day, Peak Month						Peak	CEQA
Pollutant	CEQA		2006	2007	2008	2009	2010	2011	Day	Significance
CO	550	CO	68	93	61	60	43	43	177	Not significant
VOC	75	VOC	17	270	13	161	8	7	513	Significant
NOx	100	NOx	217	260	154	150	134	128	494	Significant
SOx	150	SOx	0	0	0	0	0	0	1	Not significant
PM2.5		PM2.5	12	17	10	10	8	8	31	Unknown
PM10	150	PM10	28	34	24	23	21	21	64	Not significant

Daily Emissions (lbs/day)

Notes:

CEQA = California Environmental Quality Act threshold (a project is considered significant by the SCAQMD if construction-related emissions exceed the CEQA emission thresholds)

Emissions estimates use emission factors from CARB OFFROAD Model, Years 2004-2015

Mitigation Measures:

Off-Road Diesel Equip.: No Mitigation

Diesel Generators: No Mitigation

Fugitive Dust: No Mitigation (Assumes Watering, per Rule 403)

LGB Terminal Improvement Project
Construction Emissions - Summary of Emissions by Activity

TONS PER YEAR							2006 Emissions (tons/year)						2007 Emissions (tons/year)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	0.4	0.1	1.6	0.0	0.1	0.2	0.0	0.0	0.0	0.0	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	1.6	0.4	5.9	0.0	0.3	0.5	3.7	4.6	13.3	0.0	0.6	1.1
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.6	0.0	0.1	0.2
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	0.0	0.0	0.0	0.0	0.0	0.0	3.6	1.0	9.1	0.0	0.8	1.8
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	1.7	0.4	4.3	0.0	0.2	0.4	3.4	0.7	7.9	0.0	0.4	0.7
					Annual Emissions (tons/year)		3.8	0.9	11.8	0.0	0.6	1.1	10.9	6.4	30.9	0.0	1.9	3.8

POUNDS PER DAY							2006 Emissions (lb/day in Peak Month)						2007 Emissions (lb/day in Peak Month)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	41.6	10.7	151.8	0.25	8.9	22.0	0.0	0.0	0.0	0.00	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	0.0	0.0	0.0	0.00	0.0	0.0	28.7	253.5	102.1	0.12	4.9	8.7
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	0.0	0.0	0.0	0.00	0.0	0.0	38.6	11.0	98.0	0.11	8.3	19.2
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	26.7	6.3	65.7	0.07	3.4	5.8	25.9	5.7	60.2	0.07	3.2	5.6
					Daily Emissions in Peak Month (lbs/day)		68.3	16.9	217.5	0.32	12.3	27.8	93.3	270.2	260.2	0.29	16.5	33.5
					Peak Quarterly (tons/qtr)		1.3	0.3	3.7	0.0	0.2	0.4	3.1	4.5	8.6	0.0	0.5	1.1

Notes:

	LGB Terminal Improvement Project (Average lb/day in Peak Month)						**LGB Terminal Improvement Project (Peak lb/day in Peak Month)**					
Maximum Daily emissions (lbs/day) for overlapping tasks only.	CO	ROC	NOx	SOx	PM2.5	PM10	**CO**	**ROC**	**NOx**	**SOx**	**PM2.5**	**PM10**
Mtigation Measures:	0.0	0.0	0.0	0.00	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.00**	**0.0**	**0.0**
Off-Road Diesel Equip.: No Mtigation	28.7	253.5	102.1	0.12	4.9	8.7	**54.5**	**481.7**	**193.9**	**0.22**	**9.4**	**16.6**
Diesel Generators: No Mtigation	0.0	0.0	0.0	0.00	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.00**	**0.0**	**0.0**
Fugitive Dust: No Mtigation (Assumes Watering, per Rule 403)	38.6	11.0	98.0	0.11	8.3	19.2	**73.4**	**20.9**	**186.1**	**0.21**	**15.8**	**36.5**
Peak Day in Peak Month emissions = 1.9 x (Average Day, Peak Month emissions);	0.0	0.0	0.0	0.00	0.0	0.0	**0.0**	**0.0**	**0.0**	**0.00**	**0.0**	**0.0**
based on actual daily construction data for LGB Taxiways F & B work done in 2003 and 2004.	25.9	5.7	60.2	0.07	3.2	5.6	**49.3**	**10.8**	**114.3**	**0.13**	**6.1**	**10.6**
	93.3	270.2	260.2	0.29	16.5	33.5	**177.2**	**513.4**	**494.4**	**0.55**	**31.4**	**63.7**

LGB Terminal Improvement Project
Construction Emissions - Summary of Emissions by Activity

TONS PER YEAR							2008 Emissions (tons/year)						2009 Emissions (tons/year)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	4.8	1.1	12.4	0.0	1.0	2.4	1.4	1.9	3.5	0.0	0.3	0.7
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	0.0	0.0	0.0	0.0	0.0	0.0	1.7	0.4	6.9	0.0	0.4	1.3
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	3.3	0.6	7.7	0.0	0.4	0.7	3.2	0.5	7.4	0.0	0.4	0.7
					Annual Emissions (tons/year)		8.0	1.7	20.1	0.0	1.4	3.1	6.3	2.9	17.9	0.0	1.1	2.6

POUNDS PER DAY							2008 Emissions (lb/day in Peak Month)						2009 Emissions (lb/day in Peak Month)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	36.3	8.3	94.8	0.11	7.5	18.3	35.6	157.2	93.2	0.11	7.3	18.1
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	25.1	4.6	58.9	0.07	2.9	5.2	24.8	4.1	56.9	0.07	2.8	5.1
					Daily Emissions in Peak Month (lbs/day)		61.4	12.9	153.7	0.17	10.4	23.5	60.4	161.3	150.1	0.17	10.0	23.1
					Peak Quarterly (tons/qtr)		2.0	0.4	5.1	0.0	0.3	0.8	1.9	2.0	4.8	0.0	0.3	0.7

Notes:

Maximum Daily emissions (lbs/day) for overlapping tasks only.
Mtigation Measures:
Off-Road Diesel Equip.: No Mtigation
Diesel Generators: No Mtigation
Fugitive Dust: No Mtigation (Assumes Watering, per Rule 403)
Peak Day in Peak Month emissions = 1.9 x (Average Day, Peak Month emissions);
based on actual daily construction data for LGB Taxiways F & B work done in 2003 and 2004.

LGB Terminal Improvement Project (Average lb/day in Peak Month)			**LGB Terminal Improvement Project (Peak lb/day in Peak Month)**		
	PM2.5	PM10		**PM2.5**	**PM10**
	0.0	0.0		**0.0**	**0.0**
Fugitive Dust Only.	0.9	4.3	**Fugitive Dust Only.**	**1.7**	**8.2**
	0.0	0.0		**0.0**	**0.0**
	2.7	13.1		**5.2**	**24.9**
	0.0	0.0		**0.0**	**0.0**
	0.5	2.7		**1.0**	**5.0**
	4.1	20.1		**7.8**	**38.1**

LGB Terminal Improvement Project
Construction Emissions - Summary of Emissions by Activity

TONS PER YEAR							2010 Emissions (tons/year)						2011 Emissions (tons/year)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	2.9	0.7	10.8	0.0	0.7	2.1	2.9	0.6	10.3	0.0	0.7	2.1
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	2.8	0.4	6.7	0.0	0.3	0.6	2.7	0.4	6.2	0.0	0.3	0.6
					Annual Emissions (tons/year)		5.7	1.1	17.5	0.0	1.0	2.7	5.6	1.0	16.6	0.0	1.0	2.7

POUNDS PER DAY							2010 Emissions (lb/day in Peak Month)						2011 Emissions (lb/day in Peak Month)					
Activity	Activity Description	Crew	No. of Crews	Start Date	End Date	Total Work Days	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
New Parking Structure	Parking Lot - Demolition	D01	1	01-Jul-06	31-Jul-06	21	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
New Parking Structure	Parking Lot - Construction	ES1	1	01-Aug-06	31-Dec-07	370	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Terminal Buildings	Terminal Buildings - Demolition	D02	1	15-Mar-07	15-Apr-07	22	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
Terminal Buildings	Terminal Buildings - Construction	ES2	1	16-Apr-07	16-Apr-09	524	0.0	0.0	0.0	0.00	0.0	0.0	0.0	0.0	0.0	0.00	0.0	0.0
New Aircraft Parking	Aircraft Parking - Construction	P01	1	01-Jun-09	31-Dec-11	675	22.1	5.1	83.0	0.08	5.7	16.4	22.1	4.6	79.4	0.08	5.5	16.2
Support	Contractor Shop/Yard Operations	Y01	1	01-Jul-06	31-Dec-11	1435	21.2	3.2	51.0	0.07	2.2	4.5	21.1	2.9	48.1	0.07	2.1	4.3
					Daily Emissions in Peak Month (lbs/day)		43.3	8.3	134.0	0.14	7.9	20.9	43.1	7.5	127.5	0.14	7.6	20.5
					Peak Quarterly (tons/qtr)		1.4	0.3	4.4	0.0	0.3	0.7	1.4	0.2	4.2	0.0	0.2	0.7

Notes:

Maximum Daily emissions (lbs/day) for overlapping tasks only.
Mtigation Measures:
Off-Road Diesel Equip.: No Mtigation
Diesel Generators: No Mtigation
Fugitive Dust: No Mtigation (Assumes Watering, per Rule 403)
Peak Day in Peak Month emissions = 1.9 x (Average Day, Peak Month emissions);
based on actual daily construction data for LGB Taxiways F & B work done in 2003 and 2004.

LGB Terminal Improvement Project
Construction Emissions - Summary of Daily Emissions by Construction Crew

			10	11	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
					2006 CARB OFFROAD Factors						2007 CARB OFFROAD Factors						2008 CARB OFFROAD Factors						2009 CARB OFFROAD Factors					
			Fugitive	Fugitive	Emissions (lb/day)						Emissions (lb/day)						Emissions (lb/day)						Emissions (lb/day)					
Crew	No. Equipment Description	Model No.	Total Pcs	PM2.5 (lb/day)	PM10 (lb/day)	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
DEMOLITION			7	8	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53
D02	TEMPORARY HOLD ROOMS		9	**2.3**	**11.3**	**19.6**	**4.4**	**52.5**	**0.1**	**4.9**	**14.1**	**19.6**	**4.4**	**52.5**	**0.1**	**4.9**	**14.1**	**19.6**	**4.3**	**50.7**	**0.1**	**4.9**	**14.0**	**19.4**	**3.9**	**49.8**	**0.1**	**4.7**	**13.8**
1	Excavator (CAT 320)	320		0.1	0.3	3.0	0.3	5.1	0.0	0.3	0.5	3.0	0.3	5.1	0.0	0.3	0.5	3.0	0.2	4.8	0.0	0.2	0.5	3.0	0.2	4.8	0.0	0.2	0.5
1	Crane - 25 Ton (Grove RT500C)	RT500C		0.0	0.0	2.3	0.2	3.9	0.0	0.2	0.2	2.3	0.2	3.9	0.0	0.2	0.2	2.3	0.2	3.7	0.0	0.1	0.1	2.3	0.2	3.7	0.0	0.1	0.1
1	Flatbed Truck-10 Wheel (Freightliner FLD120SI	FLD120SD		0.0	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
3	Haul Truck-10 Wheel (Freightliner FLD120SD-H	FLD120SD-Haul		0.1	0.5	2.0	0.5	7.4	0.1	0.3	0.7	2.0	0.5	7.4	0.1	0.3	0.7	2.0	0.5	7.4	0.1	0.3	0.7	2.0	0.5	7.4	0.1	0.3	0.7
1	Front End Loader (CAT 966F)	966F		0.4	1.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8
1	Grader (CAT 12H)	12H		1.5	7.4	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0
1	Compactor, Dual Drum (CAT CB434B)	CB434B		0.2	1.2	2.4	0.7	6.0	0.0	0.7	1.7	2.4	0.7	6.0	0.0	0.7	1.7	2.4	0.7	4.7	0.0	0.7	1.7	2.2	0.3	3.8	0.0	0.5	1.5
D01	PARKING LOT		15	**3.2**	**15.8**	**40.9**	**10.6**	**151.8**	**0.3**	**8.9**	**21.9**	**40.5**	**10.1**	**146.7**	**0.3**	**8.8**	**21.8**	**35.4**	**8.6**	**140.4**	**0.3**	**8.0**	**21.0**	**35.3**	**8.1**	**133.5**	**0.3**	**7.9**	**20.9**
1	Excavator (CAT 330L)	330L		0.1	0.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3
1	Crane - 80 Ton (Grove RT880)	RT880		0.0	0.0	1.5	0.3	7.3	0.0	0.2	0.2	1.5	0.3	7.3	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2
2	Flatbed Truck-10 Wheel (Freightliner FLD120SI	FLD120SD		0.1	0.3	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
4	Haul Truck-10 Wheel (Freightliner FLD120SD-H	FLD120SD-Haul		0.1	0.6	2.7	0.7	9.9	0.1	0.4	0.9	2.7	0.7	9.9	0.1	0.4	0.9	2.7	0.7	9.9	0.1	0.4	0.9	2.7	0.7	9.9	0.1	0.4	0.9
1	Front End Loader (CAT 988F)	988F		0.5	2.2	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
1	Grader (CAT 16H)	16H		1.5	7.4	7.3	2.0	21.7	0.0	2.6	8.5	7.3	2.0	21.7	0.0	2.6	8.5	2.5	0.9	16.6	0.0	2.0	7.8	2.5	0.7	13.1	0.0	1.9	7.7
1	Compactor, Dual Drum (CAT CB634C)	CB634C		0.2	1.2	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7
1	Excavator (CAT 325L)	325L		0.1	0.3	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	12.9	0.0	0.8	1.1
1	Reclaimer/Stabilizer (CMI RS650)	RS650		0.5	2.3	5.7	1.4	30.4	0.0	1.2	3.1	5.7	1.2	27.7	0.0	1.2	3.1	5.7	1.2	27.7	0.0	1.2	3.1	5.7	1.1	26.3	0.0	1.2	3.1
1	Dozer (CAT D9R)	D9R		0.2	1.2	3.7	0.9	19.6	0.0	0.7	1.7	3.7	0.8	17.8	0.0	0.7	1.6	3.7	0.8	17.8	0.0	0.7	1.6	3.7	0.7	16.9	0.0	0.7	1.6
1	Welder (Lincoln Classic III D)	Classic III D		0.0	0.0	2.0	0.7	2.5	0.0	0.3	0.3	1.6	0.6	2.0	0.0	0.2	0.2	1.3	0.3	1.9	0.0	0.2	0.2	1.2	0.2	1.8	0.0	0.1	0.1
CONSTRUCTION																												
ES1	EXCAVATION/FDN/STRUCTURE-PARKING LOT		10	**0.9**	**4.2**	**28.4**	**7.4**	**108.2**	**0.1**	**5.1**	**8.8**	**28.0**	**6.8**	**102.0**	**0.1**	**4.9**	**8.6**	**27.5**	**6.0**	**99.9**	**0.1**	**4.6**	**8.3**	**27.3**	**5.6**	**96.3**	**0.1**	**4.5**	**8.2**
1	Excavator (CAT 330L)	330L		0.1	0.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3
1	Crane - 25 Ton (Grove RT750)	RT750		0.0	0.0	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
2	Haul Truck-10 Wheel (Freightliner FLD120SD-H	FLD120SD-Haul		0.1	0.3	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
1	Front End Loader (CAT 988F)	988F		0.5	2.2	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
1	Welder (Lincoln Classic III D)	Classic III D		0.0	0.0	2.0	0.7	2.5	0.0	0.3	0.3	1.6	0.6	2.0	0.0	0.2	0.2	1.3	0.3	1.9	0.0	0.2	0.2	1.2	0.2	1.8	0.0	0.1	0.1
1	Forklift - 50 ton (Manitou M430CP)	M430CP		0.1	0.3	2.6	0.8	6.5	0.0	0.6	0.8	2.6	0.8	5.2	0.0	0.6	0.8	2.4	0.4	4.2	0.0	0.4	0.6	2.4	0.2	3.8	0.0	0.3	0.5
1	Compactor, Padded Drum (CAT CP433C)	CP433C		0.2	1.2	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9
1	Concrete Pump (Putzmeister M52)	M52		0.0	0.0	2.5	0.6	13.4	0.0	0.3	0.3	2.5	0.5	12.2	0.0	0.3	0.3	2.5	0.5	12.2	0.0	0.3	0.3	2.5	0.4	11.6	0.0	0.3	0.3
1	Generator, 500kW (CAT 3412TA)	3412TA		0.0	0.0	6.5	1.5	34.7	0.0	0.8	0.9	6.5	1.2	31.6	0.0	0.8	0.8	6.5	1.2	31.6	0.0	0.8	0.8	6.5	1.1	30.0	0.0	0.8	0.8
ES2	EXCAVATION/FDN/STRUCTURE-TERMINAL BUILDINGS		19	**2.7**	**13.0**	**40.0**	**12.0**	**105.1**	**0.1**	**8.7**	**19.5**	**37.9**	**11.0**	**97.9**	**0.1**	**8.3**	**19.2**	**35.6**	**8.3**	**94.7**	**0.1**	**7.5**	**18.3**	**34.9**	**7.4**	**93.2**	**0.1**	**7.3**	**18.0**
1	Crane - 25 Ton (Grove RT750)	RT750		0.0	0.0	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
1	Crane - Track (Manitwoc 3900)	3900		0.0	0.0	1.7	0.3	7.9	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2
2	Flatbed Truck-10 Wheel (Freightliner FLD120SI	FLD120SD		0.1	0.3	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
2	Front End Loader (CAT 966F)	966F		0.8	3.7	10.9	3.0	32.4	0.0	2.5	5.6	10.9	3.0	32.4	0.0	2.5	5.6	10.9	3.0	32.4	0.0	2.5	5.6	10.9	3.0	32.4	0.0	2.5	5.6
1	Grader (CAT 12H)	12H		1.5	7.4	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0
1	Compactor, Dual Drum (CAT CB224C)	CB224C		0.2	1.2	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4
4	Light Plant (Almond Brothers Maxi Show 1000)	Maxi Show 1000		0.0	0.0	3.4	1.3	4.2	0.0	0.5	0.5	2.8	1.0	3.4	0.0	0.4	0.4	2.2	0.5	3.1	0.0	0.3	0.3	2.0	0.3	3.1	0.0	0.2	0.3
4	Welder (Lincoln Classic III D)	Classic III D		0.0	0.0	8.0	3.0	10.0	0.0	1.1	1.2	6.6	2.4	8.1	0.0	0.9	0.9	5.3	1.1	7.4	0.0	0.6	0.7	4.8	0.7	7.2	0.0	0.5	0.6
2	Forklift - 50 ton (Manitou M430CP)	M430CP		0.1	0.5	5.3	1.6	13.1	0.0	1.2	1.7	5.3	1.6	10.3	0.0	1.2	1.7	4.9	0.8	8.3	0.0	0.7	1.2	4.7	0.5	7.7	0.0	0.6	1.0
1	Concrete Pump (Putzmeister M52)	M52		0.0	0.0	2.5	0.6	13.4	0.0	0.3	0.3	2.5	0.5	12.2	0.0	0.3	0.3	2.5	0.5	12.2	0.0	0.3	0.3	2.5	0.4	11.6	0.0	0.3	0.3

LGB Terminal Improvement Project
Construction Emissions - Summary of Daily Emissions by Construction Crew

Crew	No.	Equipment Description	Model No.	Total Pcs	Fugitive PM2.5 (lb/day)	Fugitive PM10 (lb/day)	2006 CARB OFFROAD Factors Emissions (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10	2007 CARB OFFROAD Factors Emissions (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10	2008 CARB OFFROAD Factors Emissions (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10	2009 CARB OFFROAD Factors Emissions (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10
				10	11	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
P01		PAVING - AIRCRAFT PARKING		9	**2.7**	**13.2**	**42.5**	**11.4**	**128.9**	**0.1**	**9.0**	**20.0**	**42.2**	**11.3**	**128.5**	**0.1**	**8.9**	**19.9**	**21.5**	**6.6**	**105.8**	**0.1**	**6.2**	**16.9**	**21.4**	**5.4**	**89.7**	**0.1**	**5.8**	**16.5**
	1	Flatbed Truck-10 Wheel (Freightliner FLD120SD	FLD120SD		0.0	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
	1	Front End Loader (CAT 988F)	988F		0.5	2.2	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
	1	Grader (CAT 16H)	16H		1.5	7.4	7.3	2.0	21.7	0.0	2.6	8.5	7.3	2.0	21.7	0.0	2.6	8.5	2.5	0.9	16.6	0.0	2.0	7.8	2.5	0.7	13.1	0.0	1.9	7.7
	1	Compactor, Dual Drum (CAT CB634C)	CB634C		0.2	1.2	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7
	2	Light Plant (Almond Brothers Maxi Show 1000)	Maxi Show 1000		0.0	0.0	1.7	0.6	2.1	0.0	0.2	0.3	1.4	0.5	1.7	0.0	0.2	0.2	1.1	0.2	1.6	0.0	0.1	0.1	1.0	0.1	1.5	0.0	0.1	0.1
	1	Reclaimer/Stabilizer (CAT RR250)	RR250		0.5	2.3	11.4	3.0	34.2	0.0	2.2	4.1	11.4	3.0	34.2	0.0	2.2	4.1	3.9	1.4	26.2	0.0	1.1	3.0	3.9	1.1	20.6	0.0	1.0	2.9
	1	Slipform Paver (CMI SF-7004)	SF-7004		0.0	0.0	12.2	3.3	36.6	0.0	1.8	1.9	12.2	3.3	36.6	0.0	1.8	1.9	4.2	1.5	28.0	0.0	0.7	0.8	4.2	1.1	22.0	0.0	0.6	0.6
	1	Texturing/Curing (CMI TC2502T)	TC2502T		0.0	0.0	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6
SUPPORT																															
Y01		YARD / MAINTENANCE / SHOP		10	**0.5**	**2.6**	**26.0**	**6.2**	**65.6**	**0.1**	**3.4**	**5.7**	**25.2**	**5.6**	**60.1**	**0.1**	**3.2**	**5.5**	**24.4**	**4.6**	**58.8**	**0.1**	**2.9**	**5.1**	**24.1**	**4.1**	**56.8**	**0.1**	**2.7**	**5.0**
	1	Flatbed Truck-10 Wheel (Freightliner FLD120SD	FLD120SD		0.0	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
	1	Forklift - 50 ton (Manitou M430CP)	M430CP		0.1	0.3	2.6	0.8	6.5	0.0	0.6	0.8	2.6	0.8	5.2	0.0	0.6	0.8	2.4	0.4	4.2	0.0	0.4	0.6	2.4	0.2	3.8	0.0	0.3	0.5
	4	Pickup Truck (Ford F250)	F250		0.1	0.3	6.7	0.7	0.7	0.0	0.1	0.4	6.7	0.7	0.7	0.0	0.1	0.4	6.7	0.7	0.7	0.0	0.1	0.4	6.7	0.7	0.7	0.0	0.1	0.4
	1	Front End Loader (CAT 966F)	966F		0.4	1.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8
	2	Welder (Lincoln Classic III D)	Classic III D		0.0	0.0	4.0	1.5	5.0	0.0	0.5	0.6	3.3	1.2	4.0	0.0	0.4	0.5	2.6	0.5	3.7	0.0	0.3	0.3	2.4	0.3	3.6	0.0	0.3	0.3
	1	Generator, 500kW (CAT 3412TA)	3412TA		0.0	0.0	6.5	1.5	34.7	0.0	0.8	0.9	6.5	1.2	31.6	0.0	0.8	0.8	6.5	1.2	31.6	0.0	0.8	0.8	6.5	1.1	30.0	0.0	0.8	0.8
	2	Water Wagon (CAT 769C)	769C		0.3	0.3	7.6	2.1	39.9	0.0	1.4	1.5	7.6	1.8	36.2	0.0	1.3	1.4	7.6	1.8	36.2	0.0	1.3	1.4	7.6	1.7	34.4	0.0	1.3	1.4
	2	Aerial Personnel Lift (GMC GMC)	GMC		0.1	0.5	6.8	1.8	20.3	0.0	1.1	1.6	6.8	1.8	17.1	0.0	1.1	1.6	6.8	1.0	12.9	0.0	0.7	1.2	6.8	0.7	11.4	0.0	0.6	1.1
	1	Chipper (Veneer 1800)	1800		0.2	1.2	4.0	1.2	10.0	0.0	1.0	2.0	4.0	1.2	10.0	0.0	1.0	2.0	4.0	1.2	7.9	0.0	1.0	2.0	3.7	0.6	6.4	0.0	0.7	1.6

LGB Terminal Improvement Project
Construction Emissions - Summary of Daily Emissions by C

		52	53	54	55	56	57	58	59	60	61	62	63
		2010 CARB OFFROAD Factors						2011 CARB OFFROAD Factors					
		Emissions (lb/day)						Emissions (lb/day)					
Crew	No. Equipment Description	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
DEMOLITION		54	55	56	57	58	59	60	61	62	63	64	65
D02	TEMPORARY HOLD ROOMS	**15.8**	**3.0**	**43.9**	**0.1**	**4.0**	**13.1**	**15.8**	**2.4**	**38.8**	**0.1**	**3.8**	**12.8**
1	Excavator (CAT 320)	3.0	0.2	4.8	0.0	0.2	0.5	3.0	0.2	4.8	0.0	0.2	0.5
1	Crane - 25 Ton (Grove RT500C)	2.3	0.2	3.7	0.0	0.1	0.1	2.3	0.2	3.7	0.0	0.1	0.1
1	Flatbed Truck-10 Wheel (Freightliner FLD120SD	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
3	Haul Truck-10 Wheel (Freightliner FLD120SD-H	2.0	0.5	7.4	0.1	0.3	0.7	2.0	0.5	7.4	0.1	0.3	0.7
1	Front End Loader (CAT 966F)	1.9	0.7	12.4	0.0	0.7	2.2	1.9	0.5	9.7	0.0	0.6	2.1
1	Grader (CAT 12H)	3.8	1.0	9.6	0.0	2.1	8.0	3.8	0.6	7.2	0.0	1.9	7.8
1	Compactor, Dual Drum (CAT CB434B)	2.2	0.2	3.5	0.0	0.4	1.4	2.2	0.2	3.5	0.0	0.4	1.4
D01	PARKING LOT	**31.5**	**7.0**	**121.7**	**0.3**	**7.3**	**20.2**	**31.5**	**5.8**	**113.9**	**0.3**	**6.8**	**19.6**
1	Excavator (CAT 330L)	2.0	0.7	13.1	0.0	0.4	0.7	2.0	0.6	10.2	0.0	0.3	0.6
1	Crane - 80 Ton (Grove RT880)	1.5	0.2	7.0	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2
2	Flatbed Truck-10 Wheel (Freightliner FLD120SD	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
4	Haul Truck-10 Wheel (Freightliner FLD120SD-H	2.7	0.7	9.9	0.1	0.4	0.9	2.7	0.7	9.9	0.1	0.4	0.9
1	Front End Loader (CAT 988F)	3.1	0.5	13.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
1	Grader (CAT 16H)	2.5	0.6	11.9	0.0	1.8	7.7	2.5	0.6	11.9	0.0	1.8	7.7
1	Compactor, Dual Drum (CAT CB634C)	3.5	0.9	8.9	0.0	0.8	1.7	3.5	0.5	6.7	0.0	0.6	1.5
1	Excavator (CAT 325L)	4.3	1.2	10.9	0.0	0.8	1.1	4.3	0.7	8.1	0.0	0.5	0.8
1	Reclaimer/Stabilizer (CMI RS650)	5.7	1.0	24.5	0.0	1.2	3.1	5.7	1.0	24.5	0.0	1.2	3.1
1	Dozer (CAT D9R)	3.7	0.6	15.8	0.0	0.7	1.6	3.7	0.6	15.8	0.0	0.7	1.6
1	Welder (Lincoln Classic III D)	1.2	0.2	1.8	0.0	0.1	0.1	1.1	0.1	1.8	0.0	0.1	0.1
CONSTRUCTION													
ES1	EXCAVATION/FDN/STRUCTURE-PARKING LOT	**23.5**	**4.6**	**89.5**	**0.1**	**4.0**	**7.6**	**23.4**	**4.3**	**84.7**	**0.1**	**3.8**	**7.5**
1	Excavator (CAT 330L)	2.0	0.7	13.1	0.0	0.4	0.7	2.0	0.6	10.2	0.0	0.3	0.6
1	Crane - 25 Ton (Grove RT750)	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
2	Haul Truck-10 Wheel (Freightliner FLD120SD-H	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
1	Front End Loader (CAT 988F)	3.1	0.5	13.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
1	Welder (Lincoln Classic III D)	1.2	0.2	1.8	0.0	0.1	0.1	1.1	0.1	1.8	0.0	0.1	0.1
1	Forklift - 50 ton (Manitou M430CP)	2.4	0.2	3.8	0.0	0.3	0.5	2.3	0.2	3.7	0.0	0.2	0.5
1	Compactor, Padded Drum (CAT CP433C)	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	6.5	0.0	0.9	1.9
1	Concrete Pump (Putzmeister M52)	2.5	0.4	10.8	0.0	0.3	0.3	2.5	0.4	10.8	0.0	0.3	0.3
1	Generator, 500kW (CAT 3412TA)	6.5	1.0	28.0	0.0	0.8	0.8	6.5	1.0	28.0	0.0	0.8	0.8
ES2	EXCAVATION/FDN/STRUCTURE-TERMINAL BUIL	**27.7**	**5.7**	**83.0**	**0.1**	**6.2**	**16.8**	**27.0**	**4.4**	**74.3**	**0.1**	**5.6**	**16.2**
1	Crane - 25 Ton (Grove RT750)	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
1	Crane - Track (Manitwoc 3900)	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2
2	Flatbed Truck-10 Wheel (Freightliner FLD120SD	1.4	0.3	4.9	0.1	0.2	0.5	1.4	0.3	4.9	0.1	0.2	0.5
2	Front End Loader (CAT 966F)	3.7	1.4	24.8	0.0	1.4	4.3	3.7	1.1	19.3	0.0	1.3	4.2
1	Grader (CAT 12H)	3.8	1.0	9.6	0.0	2.1	8.0	3.8	0.6	7.2	0.0	1.9	7.8
1	Compactor, Dual Drum (CAT CB224C)	1.8	0.7	2.0	0.0	0.5	1.4	1.5	0.6	1.6	0.0	0.4	1.4
4	Light Plant (Almond Brothers Maxi Show 1000)	2.0	0.3	3.1	0.0	0.2	0.3	1.9	0.2	3.0	0.0	0.2	0.2
4	Welder (Lincoln Classic III D)	4.8	0.7	7.2	0.0	0.5	0.6	4.6	0.4	7.1	0.0	0.5	0.5
2	Forklift - 50 ton (Manitou M430CP)	4.7	0.5	7.7	0.0	0.6	1.0	4.7	0.4	7.3	0.0	0.5	0.9
1	Concrete Pump (Putzmeister M52)	2.5	0.4	10.8	0.0	0.3	0.3	2.5	0.4	10.8	0.0	0.3	0.3

LGB Terminal Improvement Project
Construction Emissions - Summary of Daily Emissions by C

	52	53	54	55	56	57	58	59	60	61	62	63
	2010 CARB OFFROAD Factors						2011 CARB OFFROAD Factors					
	Emissions (lb/day)						Emissions (lb/day)					
Crew No. Equipment Description	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
P01 PAVING - AIRCRAFT PARKING	**21.4**	**5.0**	**83.0**	**0.1**	**5.7**	**16.4**	**21.4**	**4.5**	**79.4**	**0.1**	**5.5**	**16.1**
1 Flatbed Truck-10 Wheel (Freightliner FLD120SD	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
1 Front End Loader (CAT 988F)	3.1	0.5	13.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
1 Grader (CAT 16H)	2.5	0.6	11.9	0.0	1.8	7.7	2.5	0.6	11.9	0.0	1.8	7.7
1 Compactor, Dual Drum (CAT CB634C)	3.5	0.9	8.9	0.0	0.8	1.7	3.5	0.5	6.7	0.0	0.6	1.5
2 Light Plant (Almond Brothers Maxi Show 1000)	1.0	0.1	1.5	0.0	0.1	0.1	1.0	0.1	1.5	0.0	0.1	0.1
1 Reclaimer/Stabilizer (CAT RR250)	3.9	0.9	18.7	0.0	1.0	2.8	3.9	0.9	18.7	0.0	1.0	2.8
1 Slipform Paver (CMI SF-7004)	4.2	1.0	20.0	0.0	0.5	0.6	4.2	1.0	20.0	0.0	0.5	0.6
1 Texturing/Curing (CMI TC2502T)	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	5.1	0.0	0.5	0.6
SUPPORT												
Y01 YARD / MAINTENANCE / SHOP	**20.5**	**3.2**	**51.0**	**0.1**	**2.2**	**4.4**	**20.4**	**2.9**	**48.0**	**0.1**	**2.1**	**4.3**
1 Flatbed Truck-10 Wheel (Freightliner FLD120SD	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
1 Forklift - 50 ton (Manitou M430CP)	2.4	0.2	3.8	0.0	0.3	0.5	2.3	0.2	3.7	0.0	0.2	0.5
4 Pickup Truck (Ford F250)	6.7	0.7	0.7	0.0	0.1	0.4	6.7	0.7	0.7	0.0	0.1	0.4
1 Front End Loader (CAT 966F)	1.9	0.7	12.4	0.0	0.7	2.2	1.9	0.5	9.7	0.0	0.6	2.1
2 Welder (Lincoln Classic III D)	2.4	0.3	3.6	0.0	0.3	0.3	2.3	0.2	3.6	0.0	0.3	0.3
1 Generator, 500 kW (CAT 3412TA)	6.5	1.0	28.0	0.0	0.8	0.8	6.5	1.0	28.0	0.0	0.8	0.8
2 Water Wagon (CAT 769C)	7.6	1.6	32.0	0.0	1.3	1.4	7.6	1.6	32.0	0.0	1.3	1.4
2 Aerial Personnel Lift (GMC GMC)	6.8	0.7	11.4	0.0	0.6	1.1	6.8	0.6	10.7	0.0	0.5	1.0
1 Chipper (Veneer 1800)	3.6	0.4	5.9	0.0	0.6	1.5	3.6	0.4	5.9	0.0	0.6	1.5

LGB Terminal Improvement Project
Construction Emissions - Summary of Equipment Emission Factors and Emission Rates

	Type	Description	Make	Model	Full Description (Make/Model/Type)	Size (hp)	Load Factor	Usage Factor	Fugitive PM2.5 (lb/day)	Fugitive PM10 (lb/day)	2006 CARB Offroad EF (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10	2007 CARB Offroad EF (lb/day) CO	ROC	NOx	SOx	PM2.5	PM10
1	Crane	Crane - 25 Ton	Grove	RT500C	Crane - 25 Ton (Grove RT500C)	130	0.43	0.83	0.00	0.00	2.3	0.2	3.9	0.0	0.2	0.2	2.3	0.2	3.9	0.0	0.2	0.2
2	Crane	Crane - 25 Ton	Grove	RT750	Crane - 25 Ton (Grove RT750)	200	0.43	0.83	0.00	0.00	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.9	0.0	0.1	0.1
3	Crane	Crane - 55 Ton	Grove	RT635C	Crane - 55 Ton (Grove RT635C)	152	0.43	0.83	0.00	0.00	2.7	0.2	4.6	0.0	0.2	0.2	2.7	0.2	4.6	0.0	0.2	0.2
4	Crane	Crane - 60 Ton	Grove	RT760	Crane - 60 Ton (Grove RT760)	200	0.43	0.83	0.00	0.00	1.2	0.2	5.9	0.0	0.1	0.1	1.2	0.2	5.9	0.0	0.1	0.1
5	Crane	Crane - 80 Ton	Grove	RT880	Crane - 80 Ton (Grove RT880)	250	0.43	0.83	0.00	0.00	1.5	0.3	7.3	0.0	0.2	0.2	1.5	0.3	7.3	0.0	0.2	0.2
6	Crane	Crane - Track	Mantiwoc	3900	Crane - Track (Mantiwoc 3900)	287	0.43	0.83	0.00	0.00	1.7	0.3	7.9	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2
7	Excavator	Excavator	CAT	320	Excavator (CAT 320)	128	0.57	0.83	0.07	0.32	3.0	0.3	5.1	0.0	0.3	0.5	3.0	0.3	5.1	0.0	0.3	0.5
8	Excavator	Excavator	CAT	325L	Excavator (CAT 325L)	168	0.57	0.83	0.07	0.33	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	12.9	0.0	0.8	1.1
9	Excavator	Excavator	CAT	330L	Excavator (CAT 330L)	222	0.57	0.83	0.07	0.35	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3
10	Excavator	Excavator	CAT	375	Excavator (CAT 375)	428	0.57	0.83	0.08	0.41	10.7	2.9	31.9	0.0	1.7	2.2	10.7	2.9	31.9	0.0	1.7	2.2
11	Excavator	Excavator w/Breaker/Shear	CAT	325L-BS	Excavator w/Breaker/Shear (CAT 325L-BS)	168	0.57	0.83	0.06	0.31	4.1	1.1	12.3	0.0	0.7	1.0	4.1	1.1	10.4	0.0	0.7	1.0
12	Dozer	Dozer	CAT	D8R	Dozer (CAT D8R)	305	0.64	0.83	0.24	1.16	2.8	0.7	14.8	0.0	0.6	1.6	2.8	0.6	13.4	0.0	0.6	1.5
13	Dozer	Dozer	CAT	D9R	Dozer (CAT D9R)	405	0.64	0.83	0.24	1.16	3.7	0.9	19.6	0.0	0.7	1.7	3.7	0.8	17.8	0.0	0.7	1.6
14	Dozer	Dozer	CAT	D10R	Dozer (CAT D10R)	570	0.64	0.83	0.24	1.16	5.2	1.9	35.0	0.0	1.1	2.1	5.2	1.3	27.6	0.0	0.9	1.9
15	Compactor	Compactor, Dual Drum	CAT	CB434B	Compactor, Dual Drum (CAT CB434B)	80	0.56	0.83	0.24	1.16	2.4	0.7	6.0	0.0	0.7	1.7	2.4	0.7	6.0	0.0	0.7	1.7
16	Compactor	Compactor, Padded Drum	CAT	CP563C	Compactor, Padded Drum (CAT CP563C)	145	0.56	0.83	0.24	1.16	3.4	0.9	10.2	0.0	0.7	1.7	3.4	0.9	8.6	0.0	0.7	1.7
17	Compactor	Compactor, Dual Drum	CAT	CB634C	Compactor, Dual Drum (CAT CB634C)	145	0.56	0.83	0.24	1.16	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7
18	Compactor	Compactor, Padded Drum	CAT	CP433C	Compactor, Padded Drum (CAT CP433C)	107	0.56	0.83	0.24	1.16	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9
19	Compactor	Compactor, Dual Tamping	CAT	825G	Compactor, Dual Tamping (CAT 825G)	315	0.56	0.83	0.24	1.16	7.5	2.0	22.4	0.0	1.3	2.3	7.5	2.0	22.4	0.0	1.3	2.3
20	Compactor	Compactor, Dual Drum	CAT	CB224C	Compactor, Dual Drum (CAT CB224C)	33	0.56	0.83	0.24	1.16	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4
21	Paving	Reclaimer/Stabilizer	CAT	RR250	Reclaimer/Stabilizer (CAT RR250)	430	0.62	0.83	0.48	2.32	11.4	3.0	34.2	0.0	2.2	4.1	11.4	3.0	34.2	0.0	2.2	4.1
22	Paving	Slipform Paver	CMI	SF-7004	Slipform Paver (CMI SF-7004)	460	0.62	0.83	0.00	0.00	12.2	3.3	36.6	0.0	1.8	1.9	12.2	3.3	36.6	0.0	1.8	1.9
23	Paving	Paver	Barber-Greene	BG270B	Paver (Barber-Greene BG270B)	200	0.62	0.83	0.00	0.00	5.5	1.5	16.3	0.0	0.8	0.9	5.5	1.5	16.3	0.0	0.8	0.9
24	Paving	Texturing/Curing	CMI	TC2502T	Texturing/Curing (CMI TC2502T)	87	0.53	0.83	0.00	0.00	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6
25	Grader	Grader	CAT	12H	Grader (CAT 12H)	140	0.61	0.83	1.53	7.38	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0
26	Grader	Grader	CAT	14H	Grader (CAT 14H)	215	0.61	0.83	1.53	7.38	5.9	1.6	17.5	0.0	2.4	8.4	5.9	1.6	17.5	0.0	2.4	8.4
27	Grader	Grader	CAT	16H	Grader (CAT 16H)	275	0.61	0.83	1.53	7.38	7.3	2.0	21.7	0.0	2.6	8.5	7.3	2.0	21.7	0.0	2.6	8.5
28	Grader	Grader	CAT	143H	Grader (CAT 143H)	150	0.61	0.83	1.53	7.38	4.1	1.1	12.2	0.0	2.2	8.1	4.1	1.1	12.2	0.0	2.2	8.1
29	Front End Loader	Front End Loader	CAT	966F	Front End Loader (CAT 966F)	220	0.54	0.83	0.38	1.83	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8
30	Front End Loader	Front End Loader	CAT	980G	Front End Loader (CAT 980G)	300	0.54	0.83	0.43	2.05	7.2	1.9	21.3	0.0	1.5	3.2	7.2	1.9	21.3	0.0	1.5	3.2
31	Front End Loader	Front End Loader	CAT	988F	Front End Loader (CAT 988F)	400	0.54	0.83	0.45	2.17	3.1	0.6	14.8	0.0	0.8	2.6	3.1	0.6	14.8	0.0	0.8	2.6
32	Front End Loader	Front End Loader	CAT	992D	Front End Loader (CAT 992D)	710	0.54	0.83	0.55	2.63	5.4	1.4	29.0	0.0	1.3	3.4	5.4	1.1	26.3	0.0	1.2	3.3
33	Scraper	Scraper	CAT	631E	Scraper (CAT 631E)	450	0.72	0.83	2.80	13.47	4.6	1.0	22.3	0.0	3.4	14.1	4.6	1.0	22.3	0.0	3.4	14.1
34	Forklift	Forklift - 50 ton	Manitou	M430CP	Forklift - 50 ton (Manitou M430CP)	80	0.6	0.83	0.06	0.27	2.6	0.8	6.5	0.0	0.6	0.8	2.6	0.8	5.2	0.0	0.6	0.8
35	Misc	Welder	Lincoln	Classic III D	Welder (Lincoln Classic III D)	38.9	0.62	0.83	0.00	0.00	2.0	0.7	2.5	0.0	0.3	0.3	1.6	0.6	2.0	0.0	0.2	0.2
36	Misc	Light Plant	Almond Brothers	Maxi Show 1000	Light Plant (Almond Brothers Maxi Show 1000)	16.5	0.62	0.83	0.00	0.00	0.9	0.3	1.1	0.0	0.1	0.1	0.7	0.3	0.9	0.0	0.1	0.1
37	Misc	Concrete Pump	Putzmeister	M52	Concrete Pump (Putzmeister M52)	290	0.62	0.83	0.00	0.00	2.5	0.6	13.4	0.0	0.3	0.3	2.5	0.5	12.2	0.0	0.3	0.3
38	Misc	Generator, 500kW	CAT	3412TA	Generator, 500kW (CAT 3412TA)	749	0.62	0.83	0.00	0.00	6.5	1.5	34.7	0.0	0.8	0.9	6.5	1.2	31.6	0.0	0.8	0.8
39	Paving	Reclaimer/Stabilizer	CMI	RS650	Reclaimer/Stabilizer (CMI RS650)	650	0.62	0.83	0.48	2.32	5.7	1.4	30.4	0.0	1.2	3.1	5.7	1.2	27.7	0.0	1.2	3.1
40	Forklift	Aerial Personnel Lift	GMC	GMC	Aerial Personnel Lift (GMC GMC)	130	0.6	0.83	0.06	0.27	3.4	0.9	10.1	0.0	0.6	0.8	3.4	0.9	8.6	0.0	0.6	0.8
41	Chipper	Chipper	Veneer	1800	Chipper (Veneer 1800)	120	0.62	0.83	0.24	1.16	4.0	1.2	10.0	0.0	1.0	2.0	4.0	1.2	10.0	0.0	1.0	2.0
42	Water Wagon	Water Wagon	CAT	769C	Water Wagon (CAT 769C)	450	0.57	0.83	0.17	0.17	3.8	1.1	20.0	0.0	0.7	0.7	3.8	0.9	18.1	0.0	0.7	0.7
43	On-Road	Flatbed Truck-10 Wheel	Freightliner	FLD120SD	Flatbed Truck-10 Wheel (Freightliner FLD120SI	360	0.57	0.30	0.03	0.15	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
44	On-Road	Haul Truck-10 Wheel	Freightliner	FLD120SD-Haul	Haul Truck-10 Wheel (Freightliner FLD120SD-H	360	0.57	0.50	0.03	0.15	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
45	On-Road	Oil Tank Truck	Freightliner	FLD120SD-Oil	Oil Tank Truck (Freightliner FLD120SD-Oil)	360	0.57	0.30	0.03	0.17	0.3	0.0	0.7	0.0	0.1	0.2	0.3	0.0	0.7	0.0	0.1	0.2
46	On-Road	Ambulance	Ford	F350	Ambulance (Ford F350)	200	0.57	0.05	0.01	0.08	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1
47	On-Road	Pickup Truck	Ford	F250	Pickup Truck (Ford F250)	200	0.57	0.40	0.01	0.08	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1

LGB Terminal Improvement Project
Construction Emissions - Summary of Equipment Emission Factors and Emission Rates

				2008 CARB Offroad EF (lb/day)						2009 CARB Offroad EF (lb/day)						2010 CARB Offroad EF (lb/day)						2011 CARB Offroad EF (lb/day)					
Type	Description	Make	Model	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
1 Crane	Crane - 25 Ton	Grove	RT500C	2.3	0.2	3.7	0.0	0.1	0.1	2.3	0.2	3.7	0.0	0.1	0.1	2.3	0.2	3.7	0.0	0.1	0.1	2.3	0.2	3.7	0.0	0.1	0.1
2 Crane	Crane - 25 Ton	Grove	RT750	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
3 Crane	Crane - 55 Ton	Grove	RT635C	2.7	0.2	4.3	0.0	0.2	0.2	2.7	0.2	4.3	0.0	0.2	0.2	2.7	0.2	4.3	0.0	0.2	0.2	2.7	0.2	4.3	0.0	0.2	0.2
4 Crane	Crane - 60 Ton	Grove	RT760	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1	1.2	0.2	5.6	0.0	0.1	0.1
5 Crane	Crane - 80 Ton	Grove	RT880	1.5	0.2	7.0	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2	1.5	0.2	7.0	0.0	0.2	0.2
6 Crane	Crane - Track	Mantiwoc	3900	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2	1.7	0.2	7.3	0.0	0.2	0.2
7 Excavator	Excavator	CAT	320	3.0	0.2	4.8	0.0	0.2	0.5	3.0	0.2	4.8	0.0	0.2	0.5	3.0	0.2	4.8	0.0	0.2	0.5	3.0	0.2	4.8	0.0	0.2	0.5
8 Excavator	Excavator	CAT	325L	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	12.9	0.0	0.8	1.1	4.3	1.2	10.9	0.0	0.8	1.1	4.3	0.7	8.1	0.0	0.5	0.8
9 Excavator	Excavator	CAT	330L	5.7	1.6	17.1	0.0	1.0	1.3	5.7	1.6	17.1	0.0	1.0	1.3	2.0	0.7	13.1	0.0	0.4	0.7	2.0	0.6	10.2	0.0	0.3	0.6
10 Excavator	Excavator	CAT	375	3.6	1.4	24.4	0.0	0.7	1.1	3.6	1.1	19.1	0.0	0.6	1.0	3.6	0.9	17.4	0.0	0.6	0.9	3.6	0.9	17.4	0.0	0.6	0.9
11 Excavator	Excavator w/Breaker/Shear	CAT	325L-BS	4.1	0.6	7.8	0.0	0.4	0.7	4.1	0.4	7.0	0.0	0.4	0.6	4.1	0.4	7.0	0.0	0.4	0.6	4.1	0.4	7.0	0.0	0.4	0.6
12 Dozer	Dozer	CAT	D8R	2.8	0.6	13.4	0.0	0.6	1.5	2.8	0.5	12.8	0.0	0.6	1.5	2.8	0.5	11.9	0.0	0.6	1.5	2.8	0.5	11.9	0.0	0.6	1.5
13 Dozer	Dozer	CAT	D9R	3.7	0.8	17.8	0.0	0.7	1.6	3.7	0.7	16.9	0.0	0.7	1.6	3.7	0.6	15.8	0.0	0.7	1.6	3.7	0.6	15.8	0.0	0.7	1.6
14 Dozer	Dozer	CAT	D10R	5.2	1.1	25.1	0.0	0.9	1.8	5.2	1.1	25.1	0.0	0.9	1.8	5.2	1.0	23.8	0.0	0.9	1.8	5.2	1.0	23.8	0.0	0.9	1.8
15 Compactor	Compactor, Dual Drum	CAT	CB434B	2.4	0.7	4.7	0.0	0.7	1.7	2.2	0.3	3.8	0.0	0.5	1.5	2.2	0.2	3.5	0.0	0.4	1.4	2.2	0.2	3.5	0.0	0.4	1.4
16 Compactor	Compactor, Padded Drum	CAT	CP563C	3.4	0.5	6.5	0.0	0.5	1.5	3.4	0.3	5.8	0.0	0.5	1.4	3.4	0.3	5.8	0.0	0.5	1.4	3.4	0.2	5.4	0.0	0.4	1.4
17 Compactor	Compactor, Dual Drum	CAT	CB634C	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	10.5	0.0	0.8	1.7	3.5	0.9	8.9	0.0	0.8	1.7	3.5	0.5	6.7	0.0	0.6	1.5
18 Compactor	Compactor, Padded Drum	CAT	CP433C	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	8.3	0.0	0.9	1.9	3.3	1.0	6.5	0.0	0.9	1.9
19 Compactor	Compactor, Dual Tamping	CAT	825G	2.5	0.9	17.1	0.0	0.7	1.6	2.5	0.7	13.5	0.0	0.6	1.5	2.5	0.6	12.2	0.0	0.6	1.5	2.5	0.6	12.2	0.0	0.6	1.5
20 Compactor	Compactor, Dual Drum	CAT	CB224C	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4	1.8	0.7	2.0	0.0	0.5	1.4	1.5	0.6	1.6	0.0	0.4	1.4
21 Paving	Reclaimer/Stabilizer	CAT	RR250	3.9	1.4	26.2	0.0	1.1	3.0	3.9	1.1	20.6	0.0	1.0	2.9	3.9	0.9	18.7	0.0	1.0	2.8	3.9	0.9	18.7	0.0	1.0	2.8
22 Paving	Slipform Paver	CMI	SF-7004	4.2	1.5	28.0	0.0	0.7	0.8	4.2	1.1	22.0	0.0	0.6	0.6	4.2	1.0	20.0	0.0	0.5	0.6	4.2	1.0	20.0	0.0	0.5	0.6
23 Paving	Paver	Barber-Greene	BG270B	5.5	1.5	16.3	0.0	0.8	0.9	5.5	1.5	16.3	0.0	0.8	0.9	1.9	0.7	12.5	0.0	0.3	0.3	1.9	0.5	9.8	0.0	0.2	0.3
24 Paving	Texturing/Curing	CMI	TC2502T	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	6.4	0.0	0.5	0.6	2.6	0.8	5.1	0.0	0.5	0.6
25 Grader	Grader	CAT	12H	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	11.4	0.0	2.1	8.0	3.8	1.0	9.6	0.0	2.1	8.0	3.8	0.6	7.2	0.0	1.9	7.8
26 Grader	Grader	CAT	14H	5.9	1.6	17.5	0.0	2.4	8.4	5.9	1.6	17.5	0.0	2.4	8.4	2.0	0.8	13.4	0.0	1.9	7.7	2.0	0.6	10.5	0.0	1.8	7.7
27 Grader	Grader	CAT	16H	2.5	0.9	16.6	0.0	2.0	7.8	2.5	0.7	13.1	0.0	1.9	7.7	2.5	0.6	11.9	0.0	1.8	7.7	2.5	0.6	11.9	0.0	1.8	7.7
28 Grader	Grader	CAT	143H	4.1	1.1	12.2	0.0	2.2	8.1	4.1	1.1	12.2	0.0	2.2	8.1	4.1	1.1	10.3	0.0	2.2	8.1	4.1	0.6	7.7	0.0	1.9	7.8
29 Front End Loader	Front End Loader	CAT	966F	5.4	1.5	16.2	0.0	1.2	2.8	5.4	1.5	16.2	0.0	1.2	2.8	1.9	0.7	12.4	0.0	0.7	2.2	1.9	0.5	9.7	0.0	0.6	2.1
30 Front End Loader	Front End Loader	CAT	980G	2.4	0.9	16.3	0.0	0.9	2.5	2.4	0.7	12.8	0.0	0.8	2.4	2.4	0.6	11.6	0.0	0.7	2.4	2.4	0.6	11.6	0.0	0.7	2.4
31 Front End Loader	Front End Loader	CAT	988F	3.1	0.6	14.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6	3.1	0.5	13.1	0.0	0.8	2.6
32 Front End Loader	Front End Loader	CAT	992D	5.4	1.1	26.3	0.0	1.2	3.3	5.4	1.0	25.0	0.0	1.2	3.3	5.4	1.0	25.0	0.0	1.2	3.3	5.4	1.0	25.0	0.0	1.2	3.3
33 Scraper	Scraper	CAT	631E	4.6	0.9	21.2	0.0	3.4	14.1	4.6	0.8	19.7	0.0	3.3	14.1	4.6	0.8	19.7	0.0	3.3	14.1	4.6	0.8	19.7	0.0	3.3	14.1
34 Forklift	Forklift - 50 ton	Manitou	M430CP	2.4	0.4	4.2	0.0	0.4	0.6	2.4	0.2	3.8	0.0	0.3	0.5	2.4	0.2	3.8	0.0	0.3	0.5	2.3	0.2	3.7	0.0	0.2	0.5
35 Misc	Welder	Lincoln	Classic III D	1.3	0.3	1.9	0.0	0.2	0.2	1.2	0.2	1.8	0.0	0.1	0.1	1.2	0.2	1.8	0.0	0.1	0.1	1.1	0.1	1.8	0.0	0.1	0.1
36 Misc	Light Plant	Almond Brothers	Maxi Show 1000	0.6	0.1	0.8	0.0	0.1	0.1	0.5	0.1	0.8	0.0	0.1	0.1	0.5	0.1	0.8	0.0	0.1	0.1	0.5	0.0	0.8	0.0	0.1	0.1
37 Misc	Concrete Pump	Putzmeister	M52	2.5	0.5	12.2	0.0	0.3	0.3	2.5	0.4	11.6	0.0	0.3	0.3	2.5	0.4	10.8	0.0	0.3	0.3	2.5	0.4	10.8	0.0	0.3	0.3
38 Misc	Generator, 500kW	CAT	3412TA	6.5	1.2	31.6	0.0	0.8	0.8	6.5	1.1	30.0	0.0	0.8	0.8	6.5	1.0	28.0	0.0	0.8	0.8	6.5	1.0	28.0	0.0	0.8	0.8
39 Paving	Reclaimer/Stabilizer	CMI	RS650	5.7	1.2	27.7	0.0	1.2	3.1	5.7	1.1	26.3	0.0	1.2	3.1	5.7	1.0	24.5	0.0	1.2	3.1	5.7	1.0	24.5	0.0	1.2	3.1
40 Forklift	Aerial Personnel Lift	GMC	GMC	3.4	0.5	6.4	0.0	0.4	0.6	3.4	0.4	5.7	0.0	0.3	0.5	3.4	0.4	5.7	0.0	0.3	0.5	3.4	0.3	5.4	0.0	0.3	0.5
41 Chipper	Chipper	Veneer	1800	4.0	1.2	7.9	0.0	1.0	2.0	3.7	0.6	6.4	0.0	0.7	1.6	3.6	0.4	5.9	0.0	0.6	1.5	3.6	0.4	5.9	0.0	0.6	1.5
42 Water Wagon	Water Wagon	CAT	769C	3.8	0.9	18.1	0.0	0.7	0.7	3.8	0.9	17.2	0.0	0.6	0.7	3.8	0.8	16.0	0.0	0.6	0.7	3.8	0.8	16.0	0.0	0.6	0.7
43 On-Road	Flatbed Truck-10 Wheel	Freightliner	FLD120SD	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
44 On-Road	Haul Truck-10 Wheel	Freightliner	FLD120SD-Haul	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2	0.7	0.2	2.5	0.0	0.1	0.2
45 On-Road	Oil Tank Truck	Freightliner	FLD120SD-Oil	0.3	0.0	0.7	0.0	0.1	0.2	0.3	0.0	0.7	0.0	0.1	0.2	0.3	0.0	0.7	0.0	0.1	0.2	0.3	0.0	0.7	0.0	0.1	0.2
46 On-Road	Ambulance	Ford	F350	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1
47 On-Road	Pickup Truck	Ford	F250	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1	1.7	0.2	0.2	0.0	0.0	0.1

LGB Terminal Improvement Project
Construction Emissions - Summary of Equipment Emission Factors and Emission Rates

				2.77	0.24	4.79	0.00		0.20												
				2006 CARB Offroad EF (lb/hp-hr)						2007 CARB Offroad EF (lb/hp-hr)						2008 CARB Offroad EF (lb/hp-hr)					
	Type	Description	Make	Model	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
1	Crane	Crane - 25 Ton	Grove	RT500C	0.0061	0.0005	0.0106	0.000	0.000	0.0004	0.0061	0.0005	0.0106	0.0000	0.0004	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
2	Crane	Crane - 25 Ton	Grove	RT750	0.0021	0.0004	0.0102	0.000	0.000	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
3	Crane	Crane - 55 Ton	Grove	RT635C	0.0061	0.0005	0.0106	0.000	0.000	0.0004	0.0061	0.0005	0.0106	0.0000	0.0004	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
4	Crane	Crane - 60 Ton	Grove	RT760	0.0021	0.0004	0.0102	0.000	0.000	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
5	Crane	Crane - 80 Ton	Grove	RT880	0.0021	0.0004	0.0102	0.000	0.000	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
6	Crane	Crane - Track	Mantiwoc	3900	0.0021	0.0003	0.0096	0.000	0.000	0.0003	0.0021	0.0003	0.0089	0.0000	0.0002	0.0003	0.0021	0.0003	0.0089	0.0000	0.0002	0.0003
7	Excavator	Excavator	CAT	320	0.0061	0.0005	0.0106	0.000	0.000	0.0004	0.0061	0.0005	0.0106	0.0000	0.0004	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
8	Excavator	Excavator	CAT	325L	0.0068	0.0019	0.0202	0.000	0.001	0.0012	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012
9	Excavator	Excavator	CAT	330L	0.0068	0.0019	0.0202	0.000	0.001	0.0012	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012
10	Excavator	Excavator	CAT	375	0.0066	0.0018	0.0196	0.000	0.001	0.0011	0.0066	0.0018	0.0196	0.0000	0.0010	0.0011	0.0022	0.0008	0.015	0.0000	0.0004	0.0004
11	Excavator	Excavator w/Breaker/Shear	CAT	325L-BS	0.0064	0.0017	0.0193	0.000	0.001	0.001	0.0064	0.0017	0.0163	0.0000	0.0009	0.001	0.0064	0.0009	0.0122	0.0000	0.0006	0.0006
12	Dozer	Dozer	CAT	D8R	0.0021	0.0005	0.0114	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003
13	Dozer	Dozer	CAT	D9R	0.0021	0.0005	0.0114	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003
14	Dozer	Dozer	CAT	D10R	0.0021	0.0008	0.0144	0.000	0.000	0.0004	0.0021	0.0005	0.0114	0.0000	0.0003	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003
15	Compactor	Compactor, Dual Drum	CAT	CB434B	0.0081	0.0024	0.0201	0.000	0.002	0.0017	0.0081	0.0024	0.0201	0.0000	0.0016	0.0017	0.0081	0.0024	0.0159	0.0000	0.0016	0.0017
16	Compactor	Compactor, Padded Drum	CAT	CP563C	0.0063	0.0016	0.0188	0.000	0.001	0.001	0.0063	0.0016	0.0159	0.0000	0.0009	0.001	0.0063	0.0008	0.012	0.0000	0.0006	0.0006
17	Compactor	Compactor, Dual Drum	CAT	CB634C	0.0065	0.0017	0.0194	0.000	0.001	0.001	0.0065	0.0017	0.0194	0.0000	0.0010	0.001	0.0065	0.0017	0.0194	0.0000	0.0010	0.001
18	Compactor	Compactor, Padded Drum	CAT	CP433C	0.0084	0.0025	0.0208	0.000	0.002	0.0019	0.0084	0.0025	0.0208	0.0000	0.0017	0.0019	0.0084	0.0025	0.0208	0.0000	0.0017	0.0019
19	Compactor	Compactor, Dual Tamping	CAT	825G	0.0063	0.0017	0.019	0.000	0.001	0.001	0.0063	0.0017	0.019	0.0000	0.0009	0.001	0.0022	0.0008	0.0145	0.0000	0.0004	0.0004
20	Compactor	Compactor, Dual Drum	CAT	CB224C	0.0148	0.0057	0.016	0.000	0.002	0.0021	0.0148	0.0057	0.016	0.0000	0.0019	0.0021	0.0148	0.0057	0.016	0.0000	0.0019	0.0021
21	Paving	Reclaimer/Stabilizer	CAT	RR250	0.0064	0.0017	0.0192	0.000	0.001	0.001	0.0064	0.0017	0.0192	0.0000	0.0009	0.001	0.0022	0.0008	0.0147	0.0000	0.0004	0.0004
22	Paving	Slipform Paver	CMI	SF-7004	0.0064	0.0017	0.0192	0.000	0.001	0.001	0.0064	0.0017	0.0192	0.0000	0.0009	0.001	0.0022	0.0008	0.0147	0.0000	0.0004	0.0004
23	Paving	Paver	Barber-Greene	BG270B	0.0066	0.0018	0.0197	0.000	0.001	0.0011	0.0066	0.0018	0.0197	0.0000	0.0010	0.0011	0.0066	0.0018	0.0197	0.0000	0.0010	0.0011
24	Paving	Texturing/Curing	CMI	TC2502T	0.0084	0.0025	0.0209	0.000	0.002	0.0019	0.0084	0.0025	0.0209	0.0000	0.0018	0.0019	0.0084	0.0025	0.0209	0.0000	0.0018	0.0019
25	Grader	Grader	CAT	12H	0.0067	0.0018	0.02	0.000	0.001	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011
26	Grader	Grader	CAT	14H	0.0067	0.0018	0.02	0.000	0.001	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011
27	Grader	Grader	CAT	16H	0.0065	0.0017	0.0194	0.000	0.001	0.001	0.0065	0.0017	0.0194	0.0000	0.0010	0.001	0.0022	0.0008	0.0149	0.0000	0.0004	0.0004
28	Grader	Grader	CAT	143H	0.0067	0.0018	0.02	0.000	0.001	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0067	0.0018	0.02	0.0000	0.0010	0.0011
29	Front End Loader	Front End Loader	CAT	966F	0.0069	0.0019	0.0204	0.000	0.001	0.0012	0.0069	0.0019	0.0204	0.0000	0.0011	0.0012	0.0069	0.0019	0.0204	0.0000	0.0011	0.0012
30	Front End Loader	Front End Loader	CAT	980G	0.0066	0.0018	0.0198	0.000	0.001	0.0011	0.0066	0.0018	0.0198	0.0000	0.0010	0.0011	0.0023	0.0008	0.0151	0.0000	0.0004	0.0004
31	Front End Loader	Front End Loader	CAT	988F	0.0021	0.0004	0.0103	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003
32	Front End Loader	Front End Loader	CAT	992D	0.0021	0.0005	0.0113	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003
33	Scraper	Scraper	CAT	631E	0.0021	0.0004	0.0103	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003
34	Forklift	Forklift - 50 ton	Manitou	M430CP	0.0082	0.0024	0.0204	0.000	0.002	0.0018	0.0082	0.0024	0.0161	0.0000	0.0017	0.0018	0.0076	0.0012	0.013	0.0000	0.0009	0.001
35	Misc	Welder	Lincoln	Classic III D	0.0125	0.0046	0.0155	0.000	0.002	0.0018	0.0103	0.0037	0.0125	0.0000	0.0013	0.0015	0.0082	0.0017	0.0115	0.0000	0.0010	0.001
36	Misc	Light Plant	Almond Brothers	Maxi Show 1000	0.0125	0.0046	0.0155	0.000	0.002	0.0018	0.0103	0.0037	0.0125	0.0000	0.0013	0.0015	0.0082	0.0017	0.0115	0.0000	0.0010	0.001
37	Misc	Concrete Pump	Putzmeister	M52	0.0021	0.0005	0.0112	0.000	0.000	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003
38	Misc	Generator, 500kW	CAT	3412TA	0.0021	0.0005	0.0112	0.000	0.000	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003	0.0021	0.0004	0.0102	0.0000	0.0002	0.0003
39	Paving	Reclaimer/Stabilizer	CMI	RS650	0.0021	0.0005	0.0113	0.000	0.000	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003
40	Forklift	Aerial Personnel Lift	GMC	GMC	0.0065	0.0017	0.0195	0.000	0.001	0.0011	0.0065	0.0017	0.0165	0.0000	0.0010	0.0011	0.0065	0.0009	0.0124	0.0000	0.0006	0.0007
41	Chipper	Chipper	Veneer	1800	0.0081	0.0024	0.0201	0.000	0.002	0.0017	0.0081	0.0024	0.0201	0.0000	0.0016	0.0017	0.0081	0.0024	0.0159	0.0000	0.0016	0.0017
42	Water Wagon	Water Wagon	CAT	769C	0.0022	0.0006	0.0117	0.000	0.000	0.0003	0.0022	0.0005	0.0106	0.0000	0.0003	0.0003	0.0022	0.0005	0.0106	0.0000	0.0003	0.0003
43	On-Road	Flatbed Truck-10 Wheel	Freightliner	FLD120SD	0.0068	0.0019	0.0203	0.000	0.001	0.0012	0.0068	0.0019	0.0203	0.0000	0.0011	0.0012	0.0023	0.0009	0.0155	0.0000	0.0004	0.0005
44	On-Road	Haul Truck-10 Wheel	Freightliner	FLD120SD-Haul	0.0068	0.0019	0.0203	0.000	0.001	0.0012	0.0068	0.0019	0.0203	0.0000	0.0011	0.0012	0.0023	0.0009	0.0155	0.0000	0.0004	0.0005
45	On-Road	Oil Tank Truck	Freightliner	FLD120SD-Oil	0.0068	0.0019	0.0203	0.000	0.001	0.0012	0.0068	0.0019	0.0203	0.0000	0.0011	0.0012	0.0023	0.0009	0.0155	0.0000	0.0004	0.0005
46	On-Road	Ambulance	Ford	F350	0.0071	0.002	0.0211	0.000	0.001	0.0013	0.0071	0.002	0.0211	0.0000	0.0012	0.0013	0.0071	0.002	0.0211	0.0000	0.0012	0.0013
47	On-Road	Pickup Truck	Ford	F250	0.0071	0.002	0.0211	0.000	0.001	0.0013	0.0071	0.002	0.0211	0.0000	0.0012	0.0013	0.0071	0.002	0.0211	0.0000	0.0012	0.0013

LGB Terminal Improvement Project
Construction Emissions - Summary of Equipment Emission Factors and Emission Rates

				2009 CARB Offroad EF (lb/hp-hr)						2010 CARB Offroad EF (lb/hp-hr)						2011 CARB Offroad EF (lb/hp-hr)					
Type	Description	Make	Model	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10	CO	ROC	NOx	SOx	PM2.5	PM10
1 Crane	Crane - 25 Ton	Grove	RT500C	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
2 Crane	Crane - 25 Ton	Grove	RT750	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
3 Crane	Crane - 55 Ton	Grove	RT635C	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
4 Crane	Crane - 60 Ton	Grove	RT760	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
5 Crane	Crane - 80 Ton	Grove	RT880	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003	0.0021	0.0003	0.0098	0.0000	0.0002	0.0003
6 Crane	Crane - Track	Mantiwoc	3900	0.0021	0.0003	0.0089	0.0000	0.0002	0.0003	0.0021	0.0003	0.0089	0.0000	0.0002	0.0003	0.0021	0.0003	0.0089	0.0000	0.0002	0.0003
7 Excavator	Excavator	CAT	320	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004	0.0061	0.0004	0.0099	0.0000	0.0003	0.0004
8 Excavator	Excavator	CAT	325L	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012	0.0068	0.0019	0.0171	0.0000	0.0011	0.0012	0.0068	0.0011	0.0127	0.0000	0.0007	0.0007
9 Excavator	Excavator	CAT	330L	0.0068	0.0019	0.0202	0.0000	0.0011	0.0012	0.0023	0.0009	0.0155	0.0000	0.0004	0.0004	0.0023	0.0007	0.0121	0.0000	0.0003	0.0003
10 Excavator	Excavator	CAT	375	0.0022	0.0006	0.0118	0.0000	0.0003	0.0003	0.0022	0.0006	0.0107	0.0000	0.0003	0.0003	0.0022	0.0006	0.0107	0.0000	0.0003	0.0003
11 Excavator	Excavator w/Breaker/Shear	CAT	325L-BS	0.0064	0.0007	0.0109	0.0000	0.0005	0.0005	0.0064	0.0007	0.0109	0.0000	0.0005	0.0005	0.0064	0.0007	0.0109	0.0000	0.0005	0.0005
12 Dozer	Dozer	CAT	D8R	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003
13 Dozer	Dozer	CAT	D9R	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003
14 Dozer	Dozer	CAT	D10R	0.0021	0.0004	0.0103	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003
15 Compactor	Compactor, Dual Drum	CAT	CB434B	0.0075	0.0012	0.0129	0.0000	0.0009	0.001	0.0073	0.0007	0.0119	0.0000	0.0007	0.0007	0.0073	0.0007	0.0119	0.0000	0.0007	0.0007
16 Compactor	Compactor, Padded Drum	CAT	CP563C	0.0063	0.0006	0.0107	0.0000	0.0004	0.0005	0.0063	0.0006	0.0107	0.0000	0.0004	0.0005	0.0063	0.0005	0.0101	0.0000	0.0004	0.0004
17 Compactor	Compactor, Dual Drum	CAT	CB634C	0.0065	0.0017	0.0194	0.0000	0.0010	0.001	0.0065	0.0017	0.0164	0.0000	0.0010	0.001	0.0065	0.0009	0.0123	0.0000	0.0006	0.0007
18 Compactor	Compactor, Padded Drum	CAT	CP433C	0.0084	0.0025	0.0208	0.0000	0.0017	0.0019	0.0084	0.0025	0.0208	0.0000	0.0017	0.0019	0.0084	0.0025	0.0164	0.0000	0.0017	0.0019
19 Compactor	Compactor, Dual Tamping	CAT	825G	0.0022	0.0006	0.0115	0.0000	0.0003	0.0003	0.0022	0.0005	0.0104	0.0000	0.0003	0.0003	0.0022	0.0005	0.0104	0.0000	0.0003	0.0003
20 Compactor	Compactor, Dual Drum	CAT	CB224C	0.0148	0.0057	0.016	0.0000	0.0019	0.0021	0.0148	0.0057	0.016	0.0000	0.0019	0.0021	0.0121	0.0046	0.013	0.0000	0.0015	0.0017
21 Paving	Reclaimer/Stabilizer	CAT	RR250	0.0022	0.0006	0.0116	0.0000	0.0003	0.0003	0.0022	0.0005	0.0105	0.0000	0.0003	0.0003	0.0022	0.0005	0.0105	0.0000	0.0003	0.0003
22 Paving	Slipform Paver	CMI	SF-7004	0.0022	0.0006	0.0116	0.0000	0.0003	0.0003	0.0022	0.0005	0.0105	0.0000	0.0003	0.0003	0.0022	0.0005	0.0105	0.0000	0.0003	0.0003
23 Paving	Paver	Barber-Greene	BG270B	0.0066	0.0018	0.0197	0.0000	0.0010	0.0011	0.0022	0.0008	0.0151	0.0000	0.0004	0.0004	0.0022	0.0006	0.0118	0.0000	0.0003	0.0003
24 Paving	Texturing/Curing	CMI	TC2502T	0.0084	0.0025	0.0209	0.0000	0.0018	0.0019	0.0084	0.0025	0.0209	0.0000	0.0018	0.0019	0.0084	0.0025	0.0165	0.0000	0.0018	0.0019
25 Grader	Grader	CAT	12H	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0067	0.0018	0.0169	0.0000	0.0010	0.0011	0.0067	0.001	0.0126	0.0000	0.0006	0.0007
26 Grader	Grader	CAT	14H	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0023	0.0009	0.0153	0.0000	0.0004	0.0004	0.0023	0.0006	0.012	0.0000	0.0003	0.0003
27 Grader	Grader	CAT	16H	0.0022	0.0006	0.0117	0.0000	0.0003	0.0003	0.0022	0.0005	0.0106	0.0000	0.0003	0.0003	0.0022	0.0005	0.0106	0.0000	0.0003	0.0003
28 Grader	Grader	CAT	143H	0.0067	0.0018	0.02	0.0000	0.0010	0.0011	0.0067	0.0018	0.0169	0.0000	0.0010	0.0011	0.0067	0.001	0.0126	0.0000	0.0006	0.0007
29 Front End Loader	Front End Loader	CAT	966F	0.0069	0.0019	0.0204	0.0000	0.0011	0.0012	0.0023	0.0009	0.0156	0.0000	0.0004	0.0004	0.0023	0.0007	0.0122	0.0000	0.0003	0.0003
30 Front End Loader	Front End Loader	CAT	980G	0.0023	0.0007	0.0119	0.0000	0.0003	0.0003	0.0023	0.0006	0.0108	0.0000	0.0003	0.0003	0.0023	0.0006	0.0108	0.0000	0.0003	0.0003
31 Front End Loader	Front End Loader	CAT	988F	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003
32 Front End Loader	Front End Loader	CAT	992D	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003
33 Scraper	Scraper	CAT	631E	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003
34 Forklift	Forklift - 50 ton	Manitou	M430CP	0.0074	0.0008	0.012	0.0000	0.0007	0.0008	0.0074	0.0008	0.012	0.0000	0.0007	0.0008	0.0073	0.0006	0.0115	0.0000	0.0006	0.0006
35 Misc	Welder	Lincoln	Classic III D	0.0075	0.001	0.0112	0.0000	0.0008	0.0009	0.0075	0.001	0.0112	0.0000	0.0008	0.0009	0.0071	0.0007	0.011	0.0000	0.0008	0.0009
36 Misc	Light Plant	Almond Brothers	Maxi Show 1000	0.0075	0.001	0.0112	0.0000	0.0008	0.0009	0.0075	0.001	0.0112	0.0000	0.0008	0.0009	0.0071	0.0007	0.011	0.0000	0.0008	0.0009
37 Misc	Concrete Pump	Putzmeister	M52	0.0021	0.0004	0.0097	0.0000	0.0002	0.0003	0.0021	0.0003	0.009	0.0000	0.0002	0.0003	0.0021	0.0003	0.009	0.0000	0.0002	0.0003
38 Misc	Generator, 500kW	CAT	3412TA	0.0021	0.0004	0.0097	0.0000	0.0002	0.0003	0.0021	0.0003	0.009	0.0000	0.0002	0.0003	0.0021	0.0003	0.009	0.0000	0.0002	0.0003
39 Paving	Reclaimer/Stabilizer	CMI	RS650	0.0021	0.0004	0.0098	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003	0.0021	0.0004	0.0091	0.0000	0.0003	0.0003
40 Forklift	Aerial Personnel Lift	GMC	GMC	0.0065	0.0007	0.011	0.0000	0.0005	0.0005	0.0065	0.0007	0.011	0.0000	0.0005	0.0005	0.0065	0.0006	0.0103	0.0000	0.0004	0.0004
41 Chipper	Chipper	Veneer	1800	0.0075	0.0012	0.0129	0.0000	0.0009	0.001	0.0073	0.0007	0.0119	0.0000	0.0007	0.0007	0.0073	0.0007	0.0119	0.0000	0.0007	0.0007
42 Water Wagon	Water Wagon	CAT	769C	0.0022	0.0005	0.0101	0.0000	0.0003	0.0003	0.0022	0.0005	0.0094	0.0000	0.0003	0.0003	0.0022	0.0005	0.0094	0.0000	0.0003	0.0003
43 On-Road	Flatbed Truck-10 Wheel	Freightliner	FLD120SD	0.0023	0.0007	0.0121	0.0000	0.0003	0.0004	0.0023	0.0007	0.011	0.0000	0.0003	0.0003	0.0023	0.0007	0.011	6E-06	0.0003	0.0003
44 On-Road	Haul Truck-10 Wheel	Freightliner	FLD120SD-Haul	0.0023	0.0007	0.0121	0.0000	0.0003	0.0004	0.0023	0.0007	0.011	0.0000	0.0003	0.0003	0.0023	0.0007	0.011	6E-06	0.0003	0.0003
45 On-Road	Oil Tank Truck	Freightliner	FLD120SD-Oil	0.0023	0.0007	0.0121	0.0000	0.0003	0.0004	0.0023	0.0007	0.011	0.0000	0.0003	0.0003	0.0023	0.0007	0.011	6E-06	0.0003	0.0003
46 On-Road	Ambulance	Ford	F350	0.0071	0.002	0.0211	0.0000	0.0012	0.0013	0.0024	0.0009	0.0162	0.0000	0.0004	0.0005	0.0024	0.0008	0.0125	7E-06	0.0003	0.0004
47 On-Road	Pickup Truck	Ford	F250	0.0071	0.002	0.0211	0.0000	0.0012	0.0013	0.0024	0.0009	0.0162	0.0000	0.0004	0.0005	0.0024	0.0008	0.0125	7E-06	0.0003	0.0004

LGB Terminal Improvement Project
Construction Emissions - Fugitive PM Emissions from Roads and Soil Handling

	Excavators					Loaders				Scraper	Grader	Bulldozer	Compactor	Forklift	Flatbed/Oil trucks	Haul Truck	Water Wagon	Pickup	Automobile
	CAT 320	CAT 325L	CAT 330L	CAT 375	CAT 325L-BS	CAT 966F	CAT 980G	CAT 988F	CAT 992D	CAT 631E				M430CP					
Equipment Details/Performance																			
Job Efficiency/Usage Factor	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	30%	50%	83%	40%	30%
Vehicle weight, empty (lb)	42,770	59,690	74,380	167,070	59,690	47,333	65,765	100,492	201,982	101,370	-	-	-	15,000	17,400	17,400	68,000	6,000	3,500
Soil Capacity (yd3)	0.75	1	1.5	3.0	0	4.75	16	7.8	14	21	-	-	-	-	-	16	-	-	-
Vehicle Speed (mi/hr)	-	-	-	-	-	-	-	-	-	-	5	-	-	5	15	19	5	15	15
Cycle Time (min)	0.7	0.8	0.8	1.0	0.8	2.0	2.2	2.2	2.4	25	-	-	-	-	-	20	-	-	-
Number of Cycles/50 min-hr	72	66	61	49	66	25	22	22	20	2.0	-	-	-	-	-	1.5	-	-	-
Bucket Fill Factor	90%	90%	90%	90%	0	90%	90%	90%	90%	-	-	-	-	-	-	-	-	-	-
Volume Moved (yd3/hour)	49	59	82	132	0	107	317	154	252	42.0	-	-	-	-	-	24	-	-	-
Total Vol During Project (million yd3)	0.0	0.0	0.3	0.0	0	2.1	0.0	1.3	0.0	0	-	-	-	-	-	#######	-	-	-
Travel Distance (ft/cycle)	5	5	5	5	5	80	80	80	80	3500	-	-	-	-	-	-	-	-	-
Travel Distance (ft/hr)	360	330	305	245	330	2000	1760	1760	1600	7000	-	-	-	-	-	-	-	-	-
VMT/hr	0.07	0.06	0.06	0.05	0.06	0.38	0.33	0.33	0.30	1.33	4.17	-	-	-	4.50	9.50	4.17	6.00	4.50
VMT/day	0.5	0.5	0.5	0.4	0.5	3.0	2.7	2.7	2.4	10.6	33.3	-	-	-	36.0	76.0	33.3	48.0	36.0
Transportation on Roads			Unpaved					Unpaved			-	-	-	Paved	Paved	Paved	Unpaved	Paved	Paved
Mean Vehicle Weight (tons)	21.4	29.8	37.2	83.5	29.8	26.9	43.7	55.5	110.4	64.9	-	-	-	7.5	8.7	19.5	52.0	3.0	1.8
PM10 Emissions (lb/VMT)	1.07	1.23	1.34	1.85	1.23	1.17	1.43	1.57	2.07	1.67	0.53	-	-	0.016	0.020	0.067	2.068	0.004	0.002
Rule 403 Reduction	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	0%	0%	0%	0%	0%
PM10 Emissions (lb/hr)	0.04	0.04	0.04	0.04	0.04	0.22	0.24	0.26	0.31	1.11	0.92	0.14	0.14	0.03	0.09	0.63	8.62	0.02	0.01
PM10 Emissions (lb/day)	0.29	0.31	0.31	0.34	0.31	1.78	1.90	2.09	2.51	8.86	7.38	1.16	1.16	0.27	0.15	0.15	0.17	0.08	0.07
Material Handling/Drop Operations:																			
PM10 Emissions (lb/ton)	9E-05	9E-05	9E-05	9E-05	-	9E-05	9E-05	9E-05	9E-05	-	-	-	-	-	-	9E-05	-	-	-
Material Handling Rate (ton/hr)	66	80	111	179	-	144	428	208	340	-	-	-	-	-	-	32.4	-	-	-
Rule 403 Reduction	50%	50%	50%	50%	-	50%	50%	50%	50%	-	-	-	-	-	-	50%	-	-	-
PM10 Emissions (lb/hr)	0.003	0.004	0.005	0.008	-	0.006	0.019	0.009	0.015	-	-	-	-	-	-	0.001	-	-	-
PM10 Emissions (lb/day)	0.023	0.028	0.039	0.063	-	0.051	0.151	0.073	0.120	-	-	-	-	-	-	0.011	-	-	-
Scraper Scraping Emissions:																			
TSP Emissions (lb /ton top soil)	-	-	-	-	-	-	-	-	-	0.058	-	-	-	-	-	-	-	-	-
PM10 fraction	-	-	-	-	-	-	-	-	-	0.35	-	-	-	-	-	-	-	-	-
Excavation rate (ton/hr)	-	-	-	-	-	-	-	-	-	56.7	-	-	-	-	-	-	-	-	-
Rule 403 Reduction	-	-	-	-	-	-	-	-	-	50%	-	-	-	-	-	-	-	-	-
Scraping PM10 Emissions (lb/hr)	-	-	-	-	-	-	-	-	-	0.58	-	-	-	-	-	-	-	-	-
Scraping PM10 Emissions (lb/day)	-	-	-	-	-	-	-	-	-	4.6	-	-	-	-	-	-	-	-	-
Total PM10 Emissions (lb/day)	**0.32**	**0.33**	**0.35**	**0.41**	**0.31**	**1.83**	**2.05**	**2.17**	**2.63**	**13.47**	**7.38**	**1.16**	**1.16**	**0.27**	**0.15**	**0.16**	**0.17**	**0.08**	**0.07**

LGB Terminal Improvement Project
Construction Emissions - Fugitive PM Emissions from Roads and Soil Handling

Notes: (Fugitive PM Emissions from Roads and Soil Handling)

General
lb/VMT = pounds per vehicle mile traveled.
Job efficiency assumes a 50 minute work hour (50/60 = 0.83) because real-world operations are not 100% efficient (accounts for breaks, downtime, lunch, etc.)
Haul truck capacity estimated based on Freightliner 120SD (Chassis weight: 17,400 lb, Gross Vehicle Weight Rating = 66,000 lb)
Soil weight = 2,700 lb/yd3 (Assumption: Loose, wet excavated earth. Weight varies with moisture content, compaction, etc.)
Source: Caterpillar Performance Handbook (Edition 30, October 1999)

Unpaved Roads
Empirical formula from AP-42, Section 13.2.2 (Unpaved Roads ,9/98):
PM10 Emissions (lbs/VMT) = (k * (s / 12)^a * (w / 3)^b) / (M / 0.2)^c, where:
k = 2.6 lb/VMT (empirical constant for PM10 from Table 13.2.2-2)
s = 7.5 % (surface material silt content)
a = 0.8 (empirical constant for PM10 from Table 13.2.2-2)
b = 0.4 (empirical constant for PM10 from Table 13.2.2-2)
c = 0.3 (empirical constant for PM10 from Table 13.2.2-2)
W = [Varies] tons (mean vehicle weight)
M = 15 % (surface material moisture content)
Assumption: Moist soil (Dry = 2.0%, Moist = 15.0%, Wet = 50.0%)

Paved Roads
Assumption: All roads at construction site will be paved to mitigate fugitive PM10 emissions; all haul trucks, flatbed trucks, and autos are assumed to travel on paved roads
Empirical formula from AP42, Section 13.2.1 (Paved Roads, 9/98):
PM10 Emissions (lb/VMT) = k * [(sL / 2)^(0.65)] * [(W / 3)^(1.5)]
k = 0.016 lb/VMT (particle size multiplier for PM10)
Source: AP42, Table 13.2-1.1 (Particle Size Multipliers for Paved Road Equation)
sL = 0.24 grams/m2 (road surface silt loading)
Source: CARB, Section 7.9, Table 3 (Silt Loadings and Emission Factors for California Entrained Paved Road Dust Estimates), Los Angeles County: Local Road = 0.24 g/m2, Freeway = 0.02 g/m2)
W = Varies tons (average weight of the vehicle)

Alternate source not used: CEQA Handbook (1993), Table A9-9-B (Estimating Emissions From Passenger Vehicle Travel on Paved Roads):
PM10 emissions = VMT x 0.33 lb/VMT (Default emission factor of 0.33 lb/VMT assumes no street cleaning)

Material Handling/Drop Operations.
AP42, Section 13.2.4 (Aggregate Handling and Storage Piles, 1/95):
PM10 Emissions (lb/ton) = k * (0.0032) * ((u /5)^(1.3) / (M / 2)^(1.4)) -- Note: equation is the same as that provided in Table 9-9-G of the 1993 CEQA Handbook--, where:
k = 0.35 unitless (particle size multiplier for PM10)
u = 6.2 mi/hr (mean wind speed)
Source: EPA Tanks v4.0 (Average wind speed for Los Angeles County = 6.2 mi/hr)
M = 15 % (material moisture content)
Source: Assumption based on Table 9-9-G-1, 1993 CEQA Handbook (Dry = 2.0%, Moist = 15.0%, Wet = 50.0%)

Excavators and Loaders:
Performance data based on Caterpillar Performance Handbook (Edition 30, October 1999), field experience input from MARRS Services, and professional judgment.
Cycle times are calculated estimates based on construction experience and estimated hourly excavation rates.

LGB Terminal Improvement Project
Construction Emissions - Fugitive PM Emissions from Roads and Soil Handling

Notes: (Fugitive PM Emissions from Roads and Soil Handling, continued)
Scraper:
Scraper emissions based on AP42, Section 13.2.3 (Heavy Construction Operations, 1/95), Table 13.2.3-1 (Recommended Emission Factors for Construction Operations)
Scrapers removing topsoil: Emission factor is 0.058 lb TSP/ton (Table 11.9-4 - Uncontrolled Particulate Emission Factors for Open Dust Sources at Western Surface Coal Mines)
Assumptions: PM10 fraction based on PM10 particle size multiplier of 0.35, per AP42, based on Section 13.2.4-3 (Aggregate Handling and Storage Piles)
Cycle time = load time (5 minutes) +maneuver and dump time (5 minutes) +travel time (10 minutes), per MARRS Services, 30 Jul 2002.

Grader:
AP42, Section 11.9 (Western Surface Coal Mining), Table 11.9-1 (Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines, 7/98), Grading Operations:
PM10 Emissions (lbs/VMT) = 0.60 * 0.051 * (S)^(2.0), where S = mean vehicle speed in miles per hour

Bulldozer and Compactor:
AP42, Section 13.2.3 (Heavy Construction Operations), Table 13.2.3-1 (Recommended Emission Factors for Construction Operations, 1/95) and
Table 11.9-1 (Emission Factor Equations for Uncontrolled Open Dust Sources at Western Surface Coal Mines, 7/98, Bulldozing Operations):
PM10 emissions (lb/hr) = 0.75 * 1.0 * ([s]^1.5) / ([M]^1.4)
s = 7.5 % (surface material silt content)
Source: Table A9-9-F-1, 1993 CEQA Handbook. Assumes dirt type is "Overburden".
M = 15 % (surface material moisture content)
Source: Table 9-9-F-2, 1993 CEQA Handbook (Dry = 2.0%, Moist = 15.0%, Wet = 50.0%)
(Note: PM10 emission equation from 1993 CEQA Handbook, Table A9-9-F (Estimating Emissions from Dirt Pushing or Bulldozing Operations) is incorrect)

Water Wagon:
Calculations assume water wagon's time is split evenly between paved and unpaved surfaces
Water tank capacity = 9,000 gallons
Mean vehicle weight accounts for weight of water carried by water wagon.

PM10 Emissions from Wind Erosion of Storage Piles

Storage piles are assumed to be generated by each activity, and each pile is assumed to be the same size.

PM10 Emissions (lb/day) = (0.85 x (s/1.5) x ((365-p)/235) x (UW/15) x A)

Silt Content (% wt) (s)	6.9	ASTM Test Method default
Days of Rain per Year (>0.01 in) (p)	34	SCAQMD Meteorological Records
nd Speed (% of Time > 12 MPH) (UW)	95%	SCAQMD Assumption
Storage Pile Size (acres) (A)	2	Assumption
Mtigation:	50%	No Mitigation (Assumes Watering, per Rule 403)
PM10 Emissions (lb/day/pile)	**0.35**	

Notes:
Source: EPA's Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures (September 1992)
Appendix F, Construction and Operational Emission Calculation Methodologies, Equation F-4 and Table F-4.
1993 CEQA Handbook, Table A9-9-E

LGB Terminal Improvement Project
Construction Emissions - Summary of Equipment Emission Factor Assumptions

Equipment daily emission rate [lb/day] = (Emission Factor [lb/hp-hr]) x (Size [hp]) x (Load Factor) x (Usage Factor) x (Daily usage [hr/day]);

Brake horsepower ratings based on information provided by Bechtel Infrastructure Corporation (1998) and Caterpillar (http://www.cat.com);
Load factors from SCAQMD CEQA Air Quality Handbook, 1993, Table A9-8-D
Usage factor assumes equipment works at rated horsepower and load factor for an average of 50 minutes per hour (50/60 = 0.83);

Default emission factors (except SOx) from SCAQMD CEQA Air Quality Handbook, 1993, Table A9-8-B (Cranes, Dozers, Compactors, Graders, Loaders, Misc.)
Table A9-8-A (Forklifts), and EPA AP-42.

CARB OFFROAD emission factors derived from "Emission Inventory of Off-Road Large Compression-Ignited Engines (>25 HP)
Using the New Offroad Emissions Model (Mailout MSC #99-32)" [http://www.arb.ca.gov/msei/msei.htm

"Onroad" equipment (eg., haul trucks, automobiles, pickup truck) emissions obtained from California Air Resources Board's EMFAC2002 (Version 2.2, September 2003)
an emission inventory model that calculates emissions for motor vehicles operating on roads in California.

All emission factors assume combustion of diesel fuel, except Pickup Trucks and Automobiles, which are assumed to combust gasoline.

Construction operations: **8 hours/day, excluding weekends.**

SCAQMD Rule 431.2 (Sulfur Content of Liquid Fuels):
Effective 1 Jan 2005, a refiner or importer shall not produce or supply any diesel fuel for any stationary or mobile source applicatior
in the District, unless the diesel fuel is low sulfur diesel for which the sulfur content shall not exceed 15 ppm by weight.

Diesel fuel sulfur content:	15	ppmw (as S)
Diesel fuel fuel density:	7	lb/gal
Higher Heating Value (HHV) of diesel fuel:	138000	Btu/gal
Brake Specific Fuel Consumption (BSFC):	7300	Btu/hp-hr (Default for Naturally Aspirated Engine, Santa Barbara APCD

SOx as SO2 (lb/hp-hr) = (ppmw as S/1000000) x (Fuel Density [lb/gal]) x (1 gal/138000 Btu) x (1 lb-mol S/32 lb S) x (1 lb-mole SO2/1 lb-mole S) x (64 lb SO2/1 lb-mole SO2) x (BSFC [Btu/hp-hr]

SOx EF:	1.11E-05	lb/hp-hr (15 ppmw) BEGINNING 1 JANUARY 2005
	0.0050	g/hp-hr (15 ppmw) BEGINNING 1 JANUARY 2005
	0.0004	lb/hp-hr (500 ppmw) BEFORE 1 JANUARY 2005
	0.1680	g/hp-hr (500 ppmw) BEFORE 1 JANUARY 2005

Fuel consumption estimates based on Table A9-3-E, SCAQMD CEQA Handbook:

Diesel fuel consumption:	0.05	gallons per brake horsepower-hour
Gasoline fuel consumption:	0.12	gallons per brake horsepower-hour

LGB Terminal Improvement Project
Construction Emissions - Architectural Coatings

Unless noted, equations and parameters come from:
"Software User's Guide: URBEMIS2002 for Windows with Enhanced Construction Module," Version 8.7
South Coast Air Quality Management District, Diamond Bar, CA. April 2005.

Non-residential architectural coating emissions estimate equation:

VOC (lb/day) = { [(0.0185 lbs VOC / ft^2) * (ΣBFA * FTSR)] * thickness } / (Coat Days)

where:

0.0185 = coating emission factor in lbs of VOC emitted per square foot of surface coated (lb/ft^2).
Assumes:
- waterborne coating
- 47.67 wt %solids
- 10.54 lbs/gal density
- 250 grams/liter VOC content
- coating thickness of one mil (0.001 inch)

ΣBFA = sum of individual building floor area (ft^2).
FTSR = floor-to-surface ratio, converts building floor area to total coated surface area.
thickness = coating thickness (mils).
Coat Days = Number of days of coating application.

	Coating EF (lb/ft^2)	ΣBFA (ft^2)	FTSR (unitless)	thickness (mils)	Coat Days (days)	Coating Emissions (lbs VOC/day)
Parking Structure [a,b,d]	0.0185	1600000	0.25	1	30	**247**
Terminal Buildings [c,e]	0.0185	44530	2.0	2	22	**150**

Source: CDM 2005.

[a] Building floor area of parking structure based on 4,000 parking spaces (from NOP April 14, 2005), and 200 ft^2 per space (assumed) + 200 ft^2 per space for driveways.

[b] Floor-to-surface ratio for parking structure assumed to be 0.25.

[c] Terminal buildings floor area based on difference between Project and No Project areas (from NOP April 14, 2005).

[d] Coating of parking structure is assumed to occur in December 2007.

[e] Coating of terminal buildings is assumed to occur in February 2009.

LGB Terminal Improvement Project
Construction Emissions - Onroad Equipment

Onroad Vehicle Emissions (lb/day)

Description		CO (lb/day)	VOC (lb/day)	NOx (lb/day)	SOx (lb/day)	Comb.+Fug. PM2.5 (lb/day)	Comb.+Fug. PM10 (lb/day)	Fugitive PM2.5 (lb/day)	Fugitive PM10 (lb/day)
Passenger car	LDA	0.6315	0.0627	0.0515	0.0005	0.0148	0.0755	0.0127	0.0733
Light-duty truck	LDT2	0.6911	0.0341	0.0615	0.0004	0.0142	0.0749	0.0127	0.0733
Onsite pickup truck	MDV	1.6726	0.1833	0.1707	0.0011	0.0195	0.0881	0.0143	0.0824
Watering truck	MHDT	0.3325	0.0393	0.7300	0.0079	0.0664	0.2132	0.0294	0.1731
Haul truck, onsite	HHDT	0.1968	0.0382	0.4369	0.0040	0.0205	0.0376	0.0033	0.0189
Flatbed truck, onsite	HHDT	0.1968	0.0382	0.4369	0.0040	0.0205	0.0376	0.0033	0.0189
Haul truck, offsite	HHDT	0.6780	0.1688	2.4697	0.0317	0.1025	0.2339	0.0267	0.1515
Flatbed truck, offsite	HHDT	0.6780	0.1688	2.4697	0.0317	0.1025	0.2339	0.0267	0.1515

Notes:

Onsite daily motor vehicle construction emissions include emissions from material delivery and haul trucks, watering trucks, and pickup trucks while onsite.

Offsite daily construction motor vehicle emissions entail all emissions generated outside the project sites' boundaries from worker and material transport trips.
Off-site emissions during construction include exhaust emissions and entrained paved road dust (PM10)
from worker commute trips and haul truck material removal/delivery trips to and from the construction site
Off-site emissions are NOT included in the construction emissions estimates.
Fugitive PM10 means PM10 from tire and brake wear only.
PM2.5 factors corrected from PM10 factors using CARB PM Profiles (400-Cat Gas.; 425-Diesel; 471-Paved Road; 472-Tire Wear; and 473-Brake Wear.
The following equations were used to calculate emissions from motor vehicles:
CO, NOX and SOX
Emissions (lb/hr) = [(EFRun [g/mile]) x (VMT [mi/day]) + (EFStart x Start/day)] / 453.6, for Passenger and Light-duty Truck
Emissions (lb/hr) = [(EFRun [g/mile]) x (VMT [mi/day]) + (EFStart x Start/hr x Work Hours/day)] / 453.6, for Onsite pickup truck
Emissions (lb/hr) = [(EFRun [g/mile]) x (VMT [mi/day])] / 453.6, for all others
VOC
Emissions (lb/day) = [(EFRun x VMT) + (EFStart x Start) + (EFSoak x Trip) + (EFRest) + (EFRunEvap x VMT/Speed)], for Pass., LDT, & Onsite pickup truck
Emissions (lb/day) = [(EFRun x VMT)], for all others

PM10
Emissions (lb/day) = [(EFRun + EFTire + EFBrake [g/mi]) x (VMT [mi/day] + (EFStart [g/start] x Starts)] / 453.6 [g/lb]

where:

EFRun = Running exhaust emission factor (g/mi)
EFStart = Start-up emission factor (g/start)
VMT = Distance traveled (mi/vehicle-day)
Start = Number of starts/vehicle-day
EFSoak = Hot-soak emission factor (g/trip) -> Evaporation from the fuel delivery system when a hot engine is turned off and the vehicle is stationary
Trip = One-way trips/vehicle-day
EFRest = Resting loss evaporative emission factor (g/hr)
Rest = Resting time with constant or decreasing ambient temperature (hours/vehicle-day)
EFRunevap = Running evaporative emission factor (g/mi) - Evaporative emissions while vehicle is running
EFDiurnal = Diurnal evaporative emission factor -> Emissions from the increase in the volatility of the fuel and expansion of the vapour in the fuel tank due to the diurnal rise in ambient temperature. Evaporation through "tank breathing" will occur each day for all vehicles with gasoline fuel in the tank
Diurnal = Time with increasing ambient temperature (hours/vehicle-day)
EFTire = Tire wear emission factor (g/mi)
EFBrake = Break wear emission factor (g/mi)

The motor vehicle emission factors generally depend on the vehicle class, and the running exhaust emission factors depend on vehicle speed.

LGB Terminal Improvement Project
Construction Emissions - Onroad Equipment

Motor Vehicle Classes, Speeds and Daily VMT During Construction

Vehicle Type	Vehicle Class	Speed(mph)	VMT (mi/day)	Weight Class		Starts	
Passenger car	Passenger	15	40	ALL	LDA	Starts/day->	2
Construction commuter	Light-duty truck, catalyst	35	40	3751-5750	LDT2	Starts/day->	2
Pickup truck, onsite	Medium duty truck, catalyst	15	45	5751-8500	MDV	Starts/hour->	2
Watering truck, onsite	Medium heavy-duty truck, d	5	20	14001-33000	MHDT		-
Haul truck, onsite	Heavy heavy-duty truck, die	10	10	33001-60000	HHDT		-
Flatbed truck, onsite	Heavy heavy-duty truck, die	10	10	33001-60000	HHDT		-
Haul truck, off-site	Heavy heavy-duty truck, die	25	80	33001-60000	HHDT		-
Flatbed truck, off-site	Heavy heavy-duty truck, die	25	80	33001-60000	HHDT		-

CO, NOx, SOx Emission Factors

Vehicle Type	CO EFRun (g/mi)	CO EFStart (g/start)a	NOx EFRun (g/mi)	NOx EFStart (g/start)a	SOx EFRun (g/mi)	SOx EFStart (g/start)a
Passenger car	6.339	16.444	0.552	0.651	0.006	0.002
Construction commuter	6.978	17.178	0.65	0.953	0.004	0.003
Onsite pickup truck, cat	8.746	22.82	1.291	1.207	0.01	0.004
Watering truck (MHDV, onsite)	7.542	-	16.557	-	0.18	-
Haul truck, onsite	8.925	-	19.817	-	0.18	-
Flatbed truck, onsite	8.925	-	19.817	-	0.18	-
Haul truck, off-site	3.844	-	14.003	-	0.18	-
Flatbed truck, off-site	3.844	-	14.003	-	0.18	-

a After 720 minutes with engine off.
Source: ARB EMFAC2002 motor vehicle emission factor model (version 2.2), for calendar year 2004, annual, Los Angeles County (70 F, 60% RH

VOC Emission Factors

Vehicle Type	EFRun (g/mi)	EFStart (g/start)a	EFSoak (g/trip)	EFRest (g/hr)	EFEvap (g/min)	EFDiurnal (g/hr)
Passenger, catalyst	0.349	1.744	0.256	0.061	0.065	0.022
Light-duty truck, catalyst	0.18	1.678	0.2	0.048	0.065	0.023
Medium duty truck, catalyst	0.549	2.448	0.279	0.064	0.082	0.022
Medium heavy-duty truck, diesel (onsite)	0.892	-	-	-	-	-
Haul truck, onsite	1.734	-	-	-	-	-
Flatbed truck, onsite	1.734	-	-	-	-	-
Haul truck, off-site	0.957	-	-	-	-	-
Flatbed truck, off-site	0.957	-	-	-	-	-

a After 720 minutes with engine off.
Source: ARB EMFAC2002 motor vehicle emission factor model (version 2.2), for calendar year 2004, annual, Los Angeles County (70 F, 60% RH

LGB Terminal Improvement Project
Construction Emissions - Onroad Equipment

PM10 Emission Factors

Vehicle Type	EFRun (g/mi)	EFTire (g/mi)	EFBrake (g/mi)	EFStart (g/start)a	EFFugPaved (g/mi)
Passenger	0.024	0.008	0.013	0.015	0.81
Light-duty truck, catalyst	0.017	0.008	0.013	0.023	0.81
Medium duty truck, catalyst	0.047	0.008	0.013	0.027	0.81
Medium heavy-duty truck, diesel	0.911	0.012	0.013	-	3.9
Haul truck, onsite	0.847	0.036	0.013	-	0.81
Flatbed truck, onsite	0.847	0.036	0.013	-	0.81
Haul truck, off-site	0.467	0.036	0.013	-	0.81
Flatbed truck, off-site	0.467	0.036	0.013	-	0.81

a After 720 minutes with engine off.
Source: ARB EMFAC2002 motor vehicle emission factor model (version 2.2), for calendar year 2004, annual, Los Angeles County (70 F, 60% RH
Fug dust from paved roads from "Improvement of Specific Emission Factors (BACM Project No. 1) - Final Report," by MRI for SCAQMD, Mar. 29, 1996
value is for average conditions, and for 65% travel on high daily trip roads and 35% travel on low daily trip roads, except water truck (MHDT)-worst case, low ADT
Start-up emissions assume that each gasoline-fueled vehicle is started twice each day, once at the beginning of the day and once at the end of the day.

URBEMIS 2002 For Windows 8.7.0

File Name: C:\Program Files\URBEMIS 2002 Version 8.7\Projects2k2\LGB Parcel O Grading.urb
Project Name: Parcel C Grading
Project Location: South Coast Air Basin (Los Angeles area)
On-Road Motor Vehicle Emissions Based on EMFAC2002 version 2.2

DETAIL REPORT
(Pounds/Day - Summer)

Construction Start Month and Year: March, 2006
Construction Duration: 3
Total Land Use Area to be Developed: 5.1 acres
Maximum Acreage Disturbed Per Day: 1.3 acres
Single Family Units: 0 Multi-Family Units: 0
Retail/Office/Institutional/Industrial Square Footage: 110000

CONSTRUCTION EMISSION ESTIMATES UNMITIGATED (lbs/day)

Source *** 2006***	ROG	NOx	CO	SO2	PM10 TOTAL	PM10 EXHAUST	PM10 DUST
Phase 1 - Demolition Emissions							
Fugitive Dust	-	-	-	-	0.00	-	0.00
Off-Road Diesel	0.00	0.00	0.00	-	0.00	0.00	0.00
On-Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maximum lbs/day	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phase 2 - Site Grading Emissions							
Fugitive Dust	-	-	-	-	13.00	-	13.00
Off-Road Diesel	5.40	35.57	44.58	-	1.55	1.55	0.00
On-Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker Trips	0.02	0.06	0.59	0.00	0.00	0.00	0.00
Maximum lbs/day	5.42	35.63	45.17	0.00	14.55	1.55	13.00
Phase 3 - Building Construction							
Bldg Const Off-Road Diesel	0.00	0.00	0.00	-	0.00	0.00	0.00
Bldg Const Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arch Coatings Off-Gas	0.00	-	-	-	-	-	-
Arch Coatings Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Off-Gas	0.22	-	-	-	-	-	-
Asphalt Off-Road Diesel	2.24	13.60	19.01	-	0.49	0.49	0.00
Asphalt On-Road Diesel	0.05	0.98	0.18	0.01	0.02	0.02	0.00
Asphalt Worker Trips	0.04	0.07	0.73	0.00	0.00	0.00	0.00
Maximum lbs/day	2.54	14.63	19.93	0.01	0.51	0.51	0.00
Max lbs/day all phases	5.42	35.63	45.17	0.01	14.55	1.55	13.00

Phase 1 - Demolition Assumptions: Phase Turned OFF

Phase 2 - Site Grading Assumptions
Start Month/Year for Phase 2: Mar '06
Phase 2 Duration: 0.3 months
On-Road Truck Travel (VMT): 0
Off-Road Equipment

No.	Type	Horsepower	Load Factor	Hours/Day
1	Graders	174	0.575	8.0
1	Scrapers	313	0.660	8.0

Phase 3 - Building Construction Assumptions
Start Month/Year for Phase 3: Mar '06
Phase 3 Duration: 2.7 months
SubPhase Building Turned OFF
SubPhase Architectural Coatings Turned OFF
Start Month/Year for SubPhase Asphalt: Mar '06
SubPhase Asphalt Duration: 2.7 months
Acres to be Paved: 5
Off-Road Equipment

No.	Type	Horsepower	Load Factor	Hours/Day
1	Pavers	132	0.590	8.0
1	Rollers	114	0.430	8.0

Changes made to the default values for Land Use Trip Percentages

Changes made to the default values for Construction

URBEMIS 2002 For Windows 8.7.0

File Name: C:\Program Files\URBEMIS 2002 Version 8.7\Projects2k2\LGB Parcel O Grading.urb
Project Name: Parcel O Grading
Project Location: South Coast Air Basin (Las Angeles Area)
On-Road Motor Vehicle Emissions Based on EMFAC2002 version 2.2

DETAIL REPORT
(Tons/Year)

Construction Start Month and Year: March, 2006
Construction Duration: 3
Total Land Use Area to be Developed: 5.1 acres
Maximum Acreage Disturbed Per Day: 1.3 acres
Single Family Units: 0 Multi-Family Units: 0
Retail/Office/Institutional/Industrial Square Footage: 110000

CONSTRUCTION EMISSION ESTIMATES UNMITIGATED (tons/year)

Source *** 2006***	ROG	NOx	CO	SO2	PM10 TOTAL	PM10 EXHAUST	PM10 DUST
Phase 1 - Demolition Emissions							
Fugitive Dust	-	-	-	-	0.00	-	0.00
Off-Road Diesel	0.00	0.00	0.00	-	0.00	0.00	0.00
On-Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons/year	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Phase 2 - Site Grading Emissions							
Fugitive Dust	-	-	-	-	0.04	-	0.04
Off-Road Diesel	0.02	0.12	0.15	-	0.01	0.01	0.00
On-Road Diesel	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total tons/year	0.02	0.12	0.15	0.00	0.05	0.01	0.04
Phase 3 - Building Construction							
Bldg Const Off-Road Diesel	0.00	0.00	0.00	-	0.00	0.00	0.00
Bldg Const Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arch Coatings Off-Gas	0.00	-	-	-	-	-	-
Arch Coatings Worker Trips	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Asphalt Off-Gas	0.01	-	-	-	-	-	-
Asphalt Off-Road Diesel	0.07	0.40	0.56	-	0.01	0.01	0.00
Asphalt On-Road Diesel	0.00	0.02	0.01	0.00	0.00	0.00	0.00
Asphalt Worker Trips	0.00	0.00	0.02	0.00	0.00	0.00	0.00
Total tons/year	0.08	0.42	0.59	0.00	0.01	0.01	0.00
Total all phases tons/yr	0.10	0.54	0.74	0.00	0.06	0.02	0.04

Phase 1 - Demolition Assumptions: Phase Turned OFF

Phase 2 - Site Grading Assumptions
Start Month/Year for Phase 2: Mar '06
Phase 2 Duration: 0.3 months
On-Road Truck Travel (VMT): 0
Off-Road Equipment

No.	Type	Horsepower	Load Factor	Hours/Day
1	Graders	174	0.575	8.0
1	Scrapers	313	0.660	8.0

Phase 3 - Building Construction Assumptions
Start Month/Year for Phase 3: Mar '06
Phase 3 Duration: 2.7 months
SubPhase Building Turned OFF
SubPhase Architectural Coatings Turned OFF
Start Month/Year for SubPhase Asphalt: Mar '06
SubPhase Asphalt Duration: 2.7 months
Acres to be Paved: 5
Off-Road Equipment

No.	Type	Horsepower	Load Factor	Hours/Day
1	Pavers	132	0.590	8.0
1	Rollers	114	0.430	8.0

Changes made to the default values for Land Use Trip Percentages

Changes made to the default values for Construction

Attachment G
Meteorological Data Selection Report

Selection of Meteorological Data for the Long Beach Airport Terminal Improvement Project

CDM reviewed available meteorological data for the Long Beach Airport Terminal Improvement Project Draft Environmental Impact Report (DEIR), and compared the dispersion results that were obtained from preliminary model runs for different years used in the model. Based on these results, CDM completed the EIR air quality impact analysis and health risk assessment using one year (1985) of meteorological data, the year that produced the highest impacts for the preliminary model runs. A detailed discussion of the meteorological data review, analysis and final selection is presented. This approach used for selection of the meteorological data was reviewed and approved by SCAQMD[1,2] prior to completion of the DEIR modeling analysis.

I. Available Meteorological Data for Long Beach Airport

CDM completed its review of the available surface meteorological data for the Long Beach Airport Terminal Improvement Project Environmental Impact Report (EIR) in August 2005. The findings of this review are summarized below:

1. The South Coast Air Quality Management District (SCAQMD) has developed a one year (1981) meteorological data set from data collected in Long Beach for use with the U.S. EPA Industrial Source Complex – Short Term (ISCST3) air dispersion model. ISCST3 is the standard model used in air quality permitting and stationary source modeling in the South Coast Air Basin, and the SCAQMD data sets[3] are the standard data used in the model. This data set is not useable in the U.S. EPA AERMOD model that is part of the FAA Emission and Dispersion Modeling System (EDMS) - the required model for use on airport projects.[4,5] Therefore, another hourly surface meteorological data set from the Long Beach area, in a format useable by the AERMOD meteorological preprocessor (AERMET), is required to complete the analysis.

2. A summary of available meteorological data sets available from the National Climatic Data Center (NCDC) for the Long Beach area was reviewed. This summary indicated that hourly meteorological data was available from the Long Beach Airport (LGB).

3. An automated surface observation system (ASOS) began operating at Long Beach Airport (LGB) in late 1996. Prior to the ASOS installation, meteorological data was recorded manually. With the operation of the ASOS, total sky cover and opaque sky cover readings are no longer recorded – these parameters are necessary in processing the meteorological data to obtain atmospheric stability parameters. Therefore, the

[1] Teleconference with SCAQMD (S. Smith and T. Chico) on August 30, 2005.
[2] Email from SCAQMD (T. Chico) on September 2, 2005.
[3] SCAQMD maintains 1981 meteorological data sets for 35 stations in the basin.
[4] 63 FR 18068 (April 13, 1998).
[5] FAA Order 1050.1E, *Environmental Impacts: Policies and Procedures*, June 8, 2004.

selection of meteorological data sets was limited to the years prior to operation of the ASOS (i.e., prior to 1997).

4. Raw hourly meteorological data for LGB was obtained for each year from 1981 through 1996[6] with the intent of identifying a year with at least 90 percent complete data[7] to use in the air dispersion analysis. Each year of surface meteorological data from LGB were reviewed for completeness and for number of calm hours[8] The most complete data set found was for 1982, which was 99.93 percent complete. However, the number of calm hours exceeded 1600, or about 19 percent. **Figure 1** presents a summary of the percent of data missing and percent of calm hours reported by the AERMET preprocessor. The 1981 data only reported wind speed, wind direction and ceiling height data for every third hour for the first half of the year, thus was missing a substantial amount of critical data. After 1985, the met station was not operated 24 hours per day, typically reporting only 20 to 21 hours. Therefore, the only years with raw hourly data which meet the on-site data 90 percent completeness criterion are 1982, 1983, 1984, and 1985.

5. The U.S. EPA *Guideline on Air Quality Models*[9] requires that at least 1 year of site specific data be used, and that if more site specific data is available, these data are preferred for use in air quality analyses (Section 9.3.1.2.b). Based on the findings above, only four (4) years meet the completeness criterion, 1982, 1983, 1984, and 1985.

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[6] Raw hourly data for 1981 through 1990 was obtained in Solar and Meteorological Surface Observational Network (SAMSON) format, and for 1991 through 1996 was obtained in TD3505 format from NCDC. NCDC staff converted the 1991 through 1996 data into TD3280 format for use in AERMET.

[7] The U.S. EPA *Meteorological Monitoring Guidance for Regulatory Modeling Applications*, EPA-454/R-99-005, February 2000, indicates that on-site meteorological data collection efficiency (before substitutions to fill in missing data) must be 90 percent or greater if the data is to be used in regulatory modeling applications.

[8] Calm hours are typically defined as consecutive hours where the wind speed is less than 1 meter per second (m/s) or less than the wind speed detectable by the monitoring instrumentation. The U.S. EPA *Guideline on Air Quality Models* (40 CFR 51, Appendix W) recommends that calm periods be treated as missing data and the those hours are not to be included in the calculation of ambient concentrations from dispersion models (Section 9.3.4.2).

[9] 40 CFR 51, Appendix W.

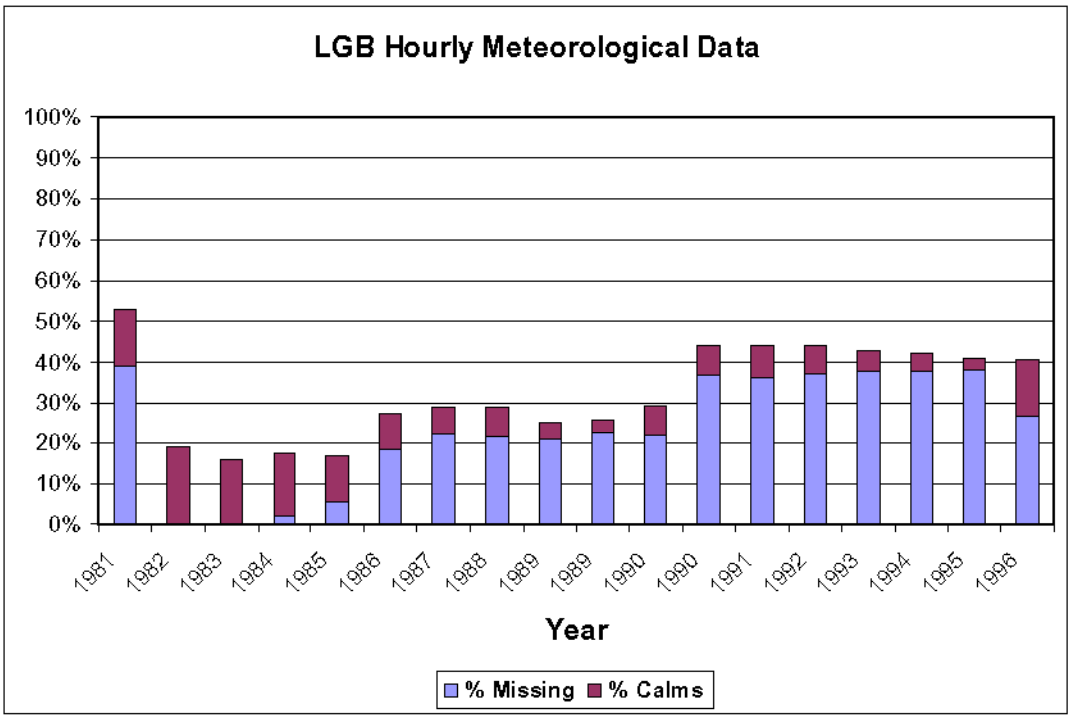

Figure 1. Percent Missing and Calm Hours for LGB (1981 – 1996).

II. Comparison of Results for 1982, 1983, 1984 and 1985 Meteorological Data Sets

A model run for one scenario or alternative with 348 receptors, one pollutant, the AERMOD sources generated by EDMS 4.3 (over 600 area sources, 10 to 13 volume sources and 15 point sources), and appropriate source groups to allow estimation of toxic air contaminant (TAC) concentrations from modeled VOC results, required approximately 32 hours to complete. One model run could address multiple averaging periods for one pollutant, but individual model runs would need to be completed for five criteria air pollutants (CO, NOx, SO_2, PM10, and PM2.5), for VOC (to be used in determining chronic TAC concentrations), and for several TACs with acute reference exposure levels, for each scenario AND for each were of meteorological data used as input. With a minimum of five (5) scenarios, and possibly nine (9) to complete, considerable effort was focused on looking for options to reduce the modeling demand. The most obvious option was to determine if one year of the meteorological data consistently produced the highest impacts.

II.A Scenarios Selected for Comparison

Three (3) preliminary EDMS/AERMOD model sets were conducted to analyze the variation in ground level concentrations between each year of meteorological data:

- Preliminary Baseline (2005), annual average VOC
- Preliminary Baseline (2005), annual average NOx
- Preliminary Scenario 2 with Project (2025), annual and 1-hour average VOC

Each set consisted of four runs, one for each year of meteorological data. With the selection of these model sets, several comparisons can be made, including comparisons between pollutants in a given scenario, between averaging periods in a given scenario, and between two different scenarios.

NOx and VOC are both produced by combustion processes. VOC emissions are also produced from fueling operations (AvGas and Jet A), as well as maintenance operations that require the use of VOC-containing solvents and coatings. NOx and VOC, though both produced in combustion processes, behave quite differently. The NOx emissions tend to increase with increasing temperature, therefore, aircraft NOx emission rates at high thrust settings (takeoff and climbout) are higher than at low setting (taxi/idle and approach). The VOC emissions behave in the opposite manner, highest VOC emissions from aircraft occur at the low thrust settings, and are much lower at the high thrust settings. Due to the difference in behavior of NOx and VOC in combustion processes, and the additional VOC sources from non-combustion processes (e.g., fuel storage and handling) on the airport, these pollutants were selected for comparison.

The selection of 1-hour and annual averaging periods in a given model run represents the widest variation achievable in a one-year analysis. Therefore, these averaging periods were selected for comparison.

The 2005 Baseline had 41 daily commercial flights and no commuter flights. The 2025 Scenario 2 with Project was assumed to have 52 daily commercial flights and 25 commuter flights. The same number of general aviation, military and industrial flights were assumed for each scenario. These two scenarios have the greatest difference in aircraft operations, as well as in size of the terminal buildings, number of aircraft parking positions, and aircraft fueling requirements. Therefore, these scenarios were selected for comparison.

II.B Modeling Results

The modeling results are presented in the following tables:

- Table 1 provides the annual NOx concentrations for the Preliminary 2005 Baseline scenario,
- Table 2 provides the annual VOC concentrations for the Preliminary 2005 Baseline scenario,
- Table 3 provides the annual VOC concentrations for the Preliminary 2025 Scenario 2 with Project, and
- Table 4 provides the peak 1-hour VOC concentrations for the Preliminary 2025 Scenario 2 with Project.

The results from all four tables clearly indicate that the 1985 meteorological data set produced the highest concentrations. Therefore, conducting an analysis with the 1985 meteorological data will provide reasonably conservative impacts. Use of one full year of on-site meteorological data also satisfies the U.S. EPA requirement that at least one year of on-site data be used in regulatory model applications.

Note: Results in these tables are preliminary. Do not cite for comparison to ambient air quality standards.

Table 1. 2005 Baseline – Annual NOx Concentration ($\mu g/m^3$)

	Meteorological Data Set				
Receptor Type	**1982**	**1983**	**1984**	**1985**	**Maximum**
Max. School ->	5.2385	5.8179	5.6861	5.9643	**5.9643**
Max. Resident ->	7.7770	7.2244	7.4416	8.9809	**8.9809**
Max. Commercial ->	15.3377	14.1610	16.9889	18.8149	**18.8149**
Max. Property Line ->	38.3254	36.2534	37.5668	42.3260	**42.3260**
Max. Security Fenceline ->	46.8529	43.3199	42.4169	50.6647	**50.6647**
Max. On-Site Worker ->	67.5384	65.5366	64.3297	72.3043	**72.3043**
Max. Hospital ->	60.5986	57.9251	56.9374	65.2136	**65.2136**
Max. Recreational ->	12.5121	11.5848	11.7010	13.9194	**13.9194**

Source: CDM 2005.

Table 2. 2005 Baseline – Annual VOC Concentration (µg/m³)

	Meteorological Data Set				
Receptor Type	**1982**	**1983**	**1984**	**1985**	**Maximum**
Max. School ->	0.4828	0.4677	0.4655	0.5791	**0.5791**
Max. Resident ->	0.9258	0.8776	0.9103	1.1688	**1.1688**
Max. Commercial ->	1.5397	1.4385	1.4854	1.6441	**1.6441**
Max. Property Line ->	7.5104	7.2463	7.1090	7.8202	**7.8202**
Max. Security Fenceline ->	6.8865	6.6800	7.0722	7.7195	**7.7195**
Max. On-Site Worker ->	7.4181	7.3565	7.6375	8.0974	**8.0974**
Max. Hospital ->	6.1310	6.2292	6.0617	6.6008	**6.6008**
Max. Recreational ->	1.5057	1.3660	1.3745	1.6219	**1.6219**

Source: CDM 2005.

Table 3. 2025 w/Project Scenario 2
Annual VOC Concentration (µg/m³)

	Meteorological Data Set				
Receptor Type	**1982**	**1983**	**1984**	**1985**	**Maximum**
Max. School ->	0.2590	0.2622	0.2624	0.2926	**0.2926**
Max. Resident ->	0.5146	0.4823	0.5032	0.5620	**0.5620**
Max. Commercial ->	1.1297	1.0702	1.1245	1.2541	**1.2541**
Max. Property Line ->	2.0759	1.9908	2.0700	2.3046	**2.3046**
Max. Security Fenceline ->	6.2191	6.1107	6.2161	6.9314	**6.9314**
Max. On-Site Worker ->	5.5939	5.3449	5.4256	5.9780	**5.9780**
Max. Hospital ->	0.2139	0.2175	0.2131	0.2372	**0.2372**
Max. Recreational ->	0.7103	0.6512	0.6653	0.7704	**0.7704**

Source: CDM 2005.

Table 4. 2025 w/Project Scenario 2
1-Hour VOC Concentration (µg/m³)

	Meteorological Data Set				
Receptor Type	**1982**	**1983**	**1984**	**1985**	**Maximum**
Maximum Impact Location ->	38.5499	37.3158	38.0062	39.3811	**39.3811**

Source: CDM 2005.

Attachment H
Receptor Locations

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
Commercial_1	393864.5	743139.9	12	12	1.8
Commercial_2	394176.8	743127.9	11	11	1.8
Commercial_3	394068.7	741326.2	9	9	1.8
Commercial_4	393275.9	741470.3	13	13	1.8
Commercial_5	392242.9	743200.0	19	19	1.8
Commercial_6	392837.5	742629.4	14	14	1.8
Commercial_7	392405.1	742623.4	16	18	1.8
Commercial_8	392321.0	742281.1	16	16	1.8
Commercial_9	393684.3	741446.3	10	11	1.8
Commercial_10	394417.0	743566.3	12	12	1.8
Hospital_1	394000.6	739153.0	20.15	51	1.8
Hospital_2	390179.5	741593.8	17	17	1.8
Hospital_3	393877.1	740905.4	11	13	1.8
Hospital_4	391983.3	740811.3	45.29	108	1.8
Hospital_5	393794.8	739152.8	33.22	51	1.8
Hospital_6	394324.1	746186.9	15	15	1.8
Hospital_7	390477.7	741328.9	14.37	14.37	1.8
Hospital_8	390385.2	743295.3	27	29	1.8
Hospital_9	390407.1	741505.5	15.71	15.71	1.8
Hospital_10	393993.6	738471.9	6.72	6.72	1.8
Hospital_11	390374.6	741370.8	15.19	15.19	1.8
Hospital_12	393487.2	741315.1	12	12	1.8
Hospital_13	393975.0	739108.4	26.99	36	1.8
Hospital_14	389594.6	741274.9	6	6	1.8
Hospital_15	393822.7	740884.5	11.87	14	1.8
Hospital_16	392191.2	739467.1	10.91	109	1.8
Hospital_17	394940.4	738458.7	15	15	1.8
Hospital_18	390404.1	744475.8	27	27	1.8
Hospital_19	390006.7	741880.6	13.86	13.86	1.8
Hospital_20	389573.6	741304.7	6	6	1.8
Hospital_21	389444.5	742559.2	14	17	1.8
Hospital_22	389439.8	742668.1	15.62	19	1.8
Hospital_23	389406.7	742474.0	14	14	1.8
Other_1	394182.0	742409.0	9	9	1.8
Other_2	394109.0	742443.0	9.5	9.5	1.8
Other_3	394429.0	741726.0	6.41	8	1.8
PROP_INT_1	395094.5	741035.7	6	7	1.8
PROP_INT_2	395097.4	741225.9	5.45	5.45	1.8
PROP_INT_3	395100.3	741416.1	5	5	1.8
PROP_INT_4	395103.1	741606.4	6.33	6.33	1.8
PROP_INT_5	395106.0	741796.6	8	8	1.8
PROP_INT_6	395108.9	741986.8	8	8	1.8
PROP_INT_7	395111.8	742177.1	8.22	8.22	1.8
PROP_INT_8	395114.7	742367.3	8.62	10	1.8
PROP_INT_9	395117.6	742557.5	9	9	1.8
PROP_INT_10	395120.4	742747.8	9.51	9.51	1.8
PROP_INT_11	395123.3	742938.0	9	9	1.8
PROP_INT_12	394888.4	742948.5	9	9	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
PROP_INT_13	394731.5	742951.2	9	9	1.8
PROP_INT_14	394574.6	742953.9	9	9	1.8
PROP_INT_15	394208.6	742975.6	10.79	10.79	1.8
PROP_INT_16	394011.1	742975.8	11	12	1.8
PROP_INT_17	393813.7	742975.9	12	12	1.8
PROP_INT_18	393616.2	742976.1	12	13	1.8
PROP_INT_19	393418.8	742976.3	13	14	1.8
PROP_INT_20	393060.5	743163.9	15	16	1.8
PROP_INT_21	392770.0	743315.6	16	16	1.8
PROP_INT_22	392376.8	743302.5	19	19	1.8
PROP_INT_23	392373.8	743138.7	18	18	1.8
PROP_INT_24	392534.2	742743.3	15.17	17	1.8
PROP_INT_25	392733.3	742580.6	14	14	1.8
PROP_INT_26	392732.9	742417.6	14	14	1.8
PROP_INT_27	392732.5	742254.7	14	15	1.8
PROP_INT_28	392587.3	742091.8	15	15	1.8
PROP_INT_29	392442.5	742091.8	16	16	1.8
PROP_INT_30	392347.2	741847.7	16.87	16.87	1.8
PROP_INT_31	392493.7	741790.5	16	16	1.8
PROP_INT_32	392938.8	741685.4	14	15	1.8
PROP_INT_33	393318.5	741597.2	12	13	1.8
PROP_INT_34	393469.1	741597.4	11	12	1.8
PROP_INT_35	393619.7	741597.6	10	11	1.8
PROP_INT_36	393963.3	741483.2	8.85	8.85	1.8
PROP_INT_37	393782.3	741289.7	10	10	1.8
PROP_INT_38	393855.3	741177.3	10	11	1.8
PROP_INT_39	393987.0	741155.9	9	10	1.8
PROP_INT_40	394228.1	741193.9	6.14	9	1.8
PROP_INT_41	394636.2	740937.5	7	13	1.8
PROP_INT_42	394923.7	740829.7	7	7	1.8
PROP_PRI_1	395046.4	740794.8	6	6	1.8
PROP_PRI_2	395046.6	740846.0	6	6	1.8
PROP_PRI_3	395091.6	740845.4	6	7	1.8
PROP_PRI_4	395126.2	743128.2	10.29	10.29	1.8
PROP_PRI_5	395045.8	743129.4	10.08	10.08	1.8
PROP_PRI_6	395045.3	742945.8	9	9	1.8
PROP_PRI_7	394417.6	742956.5	9.15	9.15	1.8
PROP_PRI_8	394406.0	742975.5	9	10	1.8
PROP_PRI_9	393221.4	742976.4	14	14	1.8
PROP_PRI_10	393222.3	743163.1	14	14	1.8
PROP_PRI_11	392898.8	743164.7	15.56	15.56	1.8
PROP_PRI_12	392641.2	743466.4	17.14	19	1.8
PROP_PRI_13	392641.2	743551.1	17.25	19	1.8
PROP_PRI_14	392521.4	743551.1	19	20	1.8
PROP_PRI_15	392521.4	743613.5	19	19	1.8
PROP_PRI_16	392378.6	743613.0	20	20	1.8
PROP_PRI_17	392378.6	743580.1	20	20	1.8
PROP_PRI_18	392223.8	743580.1	20	20	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
PROP_PRI_19	392220.4	743467.6	20	20	1.8
PROP_PRI_20	392379.8	743466.4	19.84	19.84	1.8
PROP_PRI_21	392370.8	742974.8	17.16	19	1.8
PROP_PRI_22	392248.7	742974.8	18	19	1.8
PROP_PRI_23	392244.9	742869.4	18	18	1.8
PROP_PRI_24	392371.3	742869.4	17	17	1.8
PROP_PRI_25	392334.8	742743.0	16.82	16.82	1.8
PROP_PRI_26	392733.7	742743.5	15	15	1.8
PROP_PRI_27	392732.2	742091.7	14	14	1.8
PROP_PRI_28	392297.7	742091.9	16	16	1.8
PROP_PRI_29	392297.8	742028.6	16.34	16.34	1.8
PROP_PRI_30	392145.1	742027.6	17	17	1.8
PROP_PRI_31	392146.5	742073.0	17	17	1.8
PROP_PRI_32	392138.6	742072.7	17	17	1.8
PROP_PRI_33	392139.4	742061.4	17	17	1.8
PROP_PRI_34	392102.6	742061.3	17	17	1.8
PROP_PRI_35	392101.8	742084.8	17	17	1.8
PROP_PRI_36	392072.3	742084.4	17	17	1.8
PROP_PRI_37	392097.5	742056.3	17	17	1.8
PROP_PRI_38	392116.2	742046.2	17	17	1.8
PROP_PRI_39	392137.6	742028.8	17	17	1.8
PROP_PRI_40	392163.6	741937.5	17	17	1.8
PROP_PRI_41	392200.8	741905.0	17	17	1.8
PROP_PRI_42	392640.1	741733.3	15	15	1.8
PROP_PRI_43	392837.7	741727.7	14	14	1.8
PROP_PRI_44	393040.0	741643.1	13.33	13.33	1.8
PROP_PRI_45	393043.3	741592.5	14	14	1.8
PROP_PRI_46	393023.3	741538.9	14	15	1.8
PROP_PRI_47	393031.5	741501.5	14.48	16	1.8
PROP_PRI_48	393047.3	741478.4	14.45	16	1.8
PROP_PRI_49	393152.0	741428.7	14	14	1.8
PROP_PRI_50	393167.7	741471.5	13.75	15	1.8
PROP_PRI_51	393167.8	741597.1	13	14	1.8
PROP_PRI_52	393770.4	741597.8	9	10	1.8
PROP_PRI_53	393868.9	741565.2	8.44	10	1.8
PROP_PRI_54	393998.5	741578.9	8.3	8.3	1.8
PROP_PRI_55	394068.3	741606.0	9	9	1.8
PROP_PRI_56	394085.4	741585.5	9	9	1.8
PROP_PRI_57	393841.1	741380.8	9.31	9.31	1.8
PROP_PRI_58	393723.6	741198.6	11	18	1.8
PROP_PRI_59	394118.7	741134.5	9	9	1.8
PROP_PRI_60	394337.5	741253.3	6.02	8	1.8
PROP_PRI_61	394372.4	741311.0	8	8	1.8
PROP_PRI_62	394439.1	741278.7	7.61	7.61	1.8
PROP_PRI_63	394395.4	741184.0	7.18	7.18	1.8
PROP_PRI_64	394412.8	741153.9	7	7	1.8
PROP_PRI_65	394516.2	741119.3	7	7	1.8
PROP_PRI_66	394552.4	741083.9	7	7	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
PROP_PRI_67	394555.3	741007.3	7	12	1.8
PROP_PRI_68	394717.2	740867.7	7	12	1.8
PROP_PRI_69	394801.0	740864.5	7	7	1.8
Recreation_1	393333.0	743701.4	14.91	16	1.8
Recreation_2	393689.3	744318.0	15	15	1.8
Recreation_3	394850.4	742736.5	10	10	1.8
Recreation_4	394870.4	742059.9	9	9	1.8
Resident_1	394026.6	744040.8	15	15	1.8
Resident_2	392999.7	744070.8	18	18	1.8
Resident_3	392543.2	744082.8	20	20	1.8
Resident_4	391984.7	743896.6	21	23	1.8
Resident_5	391984.7	743506.3	21	21	1.8
Resident_6	391984.7	743272.0	20	20	1.8
Resident_7	391978.7	742791.6	17	18	1.8
Resident_8	395203.8	743692.4	9	9	1.8
Resident_9	395203.8	743464.2	9	9	1.8
Resident_10	395191.7	743224.0	10.71	10.71	1.8
Resident_11	395197.8	743007.8	9.97	9.97	1.8
Resident_12	395197.8	742755.5	9	9	1.8
Resident_13	395191.7	742539.3	9	9	1.8
Resident_14	395191.7	742329.1	8	8	1.8
Resident_15	395191.7	742106.9	7.09	9	1.8
Resident_16	395185.7	741908.7	7.19	9	1.8
Resident_17	395179.7	741698.5	8	8	1.8
Resident_18	395191.7	741476.3	5	5	1.8
Resident_19	395185.7	741296.2	5	5	1.8
Resident_20	395191.7	741092.0	6	6	1.8
Resident_21	395191.7	740845.7	6	6	1.8
Resident_22	392771.4	744088.8	19	19	1.8
Resident_23	394236.8	744040.8	14	14	1.8
Resident_24	391990.7	743734.5	21	23	1.8
Resident_25	391966.7	742605.4	17	17	1.8
Resident_26	391978.7	743025.8	18	20	1.8
Resident_27	393888.5	743806.5	14.55	14.55	1.8
Resident_28	393888.5	743476.2	14	14	1.8
Resident_29	394194.8	743812.5	14	14	1.8
Resident_30	394212.8	743416.2	12	12	1.8
School_1	391319.4	742188.2	24.39	26	1.8
School_2	392927.7	744746.5	18.6	18.6	1.8
School_3	397684.2	740838.2	5	5	1.8
School_4	394858.8	743846.6	12	12	1.8
School_5	393365.2	741511.4	12	12	1.8
School_6	391609.4	742152.0	21	23	1.8
School_7	395173.4	740226.7	5	5	1.8
School_8	394593.0	740446.2	7	7	1.8
School_9	393449.4	739091.5	29.47	29.47	1.8
School_10	394581.3	739985.4	9	10	1.8
School_11	395414.9	740010.2	5	5	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
School_12	394471.0	740547.6	7.1	9	1.8
School_13	391547.8	743966.2	24.31	26	1.8
School_14	391209.9	743282.3	24	24	1.8
School_15	395686.5	741722.9	6.33	6.33	1.8
School_16	397835.3	739893.4	3	9	1.8
School_17	395804.4	739122.7	3	3	1.8
School_18	395462.6	739167.5	3	3	1.8
School_19	397467.4	739382.4	3.17	4	1.8
School_20	390878.5	743490.9	27.09	27.09	1.8
School_21	390694.7	743423.9	26	26	1.8
School_22	391208.2	743854.5	27	27	1.8
School_23	390416.2	744345.7	27	27	1.8
School_24	390417.9	743687.1	27	27	1.8
School_25	390223.7	742933.3	26	26	1.8
School_26	393397.3	741291.8	12.16	15	1.8
School_27	393287.8	741126.0	15.83	18	1.8
School_28	393099.5	741215.9	16.68	19	1.8
School_29	393739.0	740955.6	12	14	1.8
School_30	396512.2	739235.5	3.49	3.49	1.8
School_31	396210.9	739089.7	3	3	1.8
School_32	395448.1	740367.5	5	5	1.8
School_33	395398.7	740165.6	5	5	1.8
School_34	395204.3	739978.0	5	5	1.8
School_35	394843.5	740030.2	6	8	1.8
School_36	396810.4	740705.4	6	6	1.8
School_37	396744.7	740458.7	5.16	5.16	1.8
School_38	396500.3	740394.0	5	5	1.8
School_39	397298.7	741232.0	5	5	1.8
School_40	397255.8	740821.4	3.23	5	1.8
School_41	397400.3	740664.5	2.17	6	1.8
SEC_INT_1	395089.0	740964.0	6	7	1.8
SEC_INT_2	394965.1	741195.5	6	6	1.8
SEC_INT_3	394842.3	741311.8	6.35	6.35	1.8
SEC_INT_4	394719.6	741428.2	7.69	7.69	1.8
SEC_INT_5	394564.7	741960.1	8	8	1.8
SEC_INT_6	394309.8	742294.5	9	9	1.8
SEC_INT_7	394443.1	742851.0	10	10	1.8
SEC_INT_8	394175.0	742975.8	11	11	1.8
SEC_INT_9	393984.3	742975.8	11.43	12	1.8
SEC_INT_10	393793.6	742975.8	12	12	1.8
SEC_INT_11	393602.9	742975.8	12.12	12.12	1.8
SEC_INT_12	393412.2	742975.8	13	14	1.8
SEC_INT_13	393060.7	743164.9	15	15	1.8
SEC_INT_14	392786.5	743320.1	16	16	1.8
SEC_INT_15	392374.9	743157.0	18	18	1.8
SEC_INT_16	392369.4	742973.0	17.19	19	1.8
SEC_INT_17	392549.9	742759.8	15.19	15.19	1.8
SEC_INT_18	392708.0	742759.5	15	15	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
SEC_INT_19	392941.8	742595.4	13.49	13.49	1.8
SEC_INT_20	392800.8	742222.8	14	14	1.8
SEC_INT_21	392737.1	742223.7	14	14	1.8
SEC_INT_22	392538.7	742093.1	15	15	1.8
SEC_INT_23	392348.4	741849.2	16.86	16.86	1.8
SEC_INT_24	392494.4	741791.1	16	16	1.8
SEC_INT_25	392987.1	741663.5	13.84	15	1.8
SEC_INT_26	393294.4	741600.0	12	13	1.8
SEC_INT_27	393452.5	741599.5	11	12	1.8
SEC_INT_28	393610.6	741599.0	10	10	1.8
SEC_INT_29	394169.9	741507.0	8.41	8.41	1.8
SEC_INT_30	394271.5	741406.9	8	8	1.8
SEC_INT_31	394636.9	740938.0	7	13	1.8
SEC_INT_32	394905.5	740834.9	7	7	1.8
SEC_PRI_1	395009.5	740804.8	6	6	1.8
SEC_PRI_2	395042.2	740800.9	6	6	1.8
SEC_PRI_3	395041.4	740849.6	6	7	1.8
SEC_PRI_4	395090.1	740848.9	6	7	1.8
SEC_PRI_5	395087.9	741079.1	6	6	1.8
SEC_PRI_6	394596.8	741544.6	4.83	8	1.8
SEC_PRI_7	394557.3	741568.1	2.52	8	1.8
SEC_PRI_8	394609.2	741728.0	6	6	1.8
SEC_PRI_9	394556.2	741728.3	4.99	7	1.8
SEC_PRI_10	394559.3	741801.8	6	6	1.8
SEC_PRI_11	394438.9	741802.9	3.99	8	1.8
SEC_PRI_12	394359.1	741774.9	3.19	9	1.8
SEC_PRI_13	394328.3	741812.2	7	9	1.8
SEC_PRI_14	394396.6	741852.5	7.49	7.49	1.8
SEC_PRI_15	394564.7	741852.5	7.32	7.32	1.8
SEC_PRI_16	394564.7	742067.6	8.86	8.86	1.8
SEC_PRI_17	394621.3	742067.1	9	9	1.8
SEC_PRI_18	394626.8	742242.7	9	9	1.8
SEC_PRI_19	394568.2	742241.2	9	9	1.8
SEC_PRI_20	394568.2	742147.9	9	9	1.8
SEC_PRI_21	394452.4	742148.1	9	9	1.8
SEC_PRI_22	394459.0	742292.5	9	9	1.8
SEC_PRI_23	394160.5	742296.4	9	10	1.8
SEC_PRI_24	394161.1	742480.6	9	9	1.8
SEC_PRI_25	394303.3	742480.6	9	9	1.8
SEC_PRI_26	394303.3	742629.9	9	9	1.8
SEC_PRI_27	394336.8	742630.6	9.2	9.2	1.8
SEC_PRI_28	394336.3	742612.2	9	9	1.8
SEC_PRI_29	394394.7	742611.8	9.54	9.54	1.8
SEC_PRI_30	394398.0	742580.5	9.62	9.62	1.8
SEC_PRI_31	394561.7	742577.4	9.6	9.6	1.8
SEC_PRI_32	394579.8	742598.9	9.74	9.74	1.8
SEC_PRI_33	394546.9	742687.5	10.22	10.22	1.8
SEC_PRI_34	394525.5	742692.4	10.49	10.49	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
SEC_PRI_35	394520.5	742726.3	11	11	1.8
SEC_PRI_36	394365.7	742975.8	9	11	1.8
SEC_PRI_37	393221.4	742975.8	14	14	1.8
SEC_PRI_38	393221.4	743163.6	14	14	1.8
SEC_PRI_39	392899.9	743166.2	15.53	15.53	1.8
SEC_PRI_40	392900.0	743206.4	15.79	15.79	1.8
SEC_PRI_41	392673.0	743433.8	16.84	19	1.8
SEC_PRI_42	392490.4	743433.3	19	20	1.8
SEC_PRI_43	392422.2	743396.5	19	20	1.8
SEC_PRI_44	392380.3	743341.0	19	19	1.8
SEC_PRI_45	392364.0	742789.0	16.26	16.26	1.8
SEC_PRI_46	392373.2	742770.5	16.08	16.08	1.8
SEC_PRI_47	392391.8	742760.2	16.19	18	1.8
SEC_PRI_48	392866.1	742759.2	14	14	1.8
SEC_PRI_49	392941.1	742708.7	14	14	1.8
SEC_PRI_50	392942.6	742482.2	13	13	1.8
SEC_PRI_51	392819.4	742482.3	14	14	1.8
SEC_PRI_52	392820.6	742408.2	14	14	1.8
SEC_PRI_53	392842.8	742408.2	13.47	14	1.8
SEC_PRI_54	392843.0	742429.3	13.47	13.47	1.8
SEC_PRI_55	392885.1	742429.9	13	13	1.8
SEC_PRI_56	392883.0	742337.0	13	13	1.8
SEC_PRI_57	392827.5	742338.2	13.71	13.71	1.8
SEC_PRI_58	392826.1	742279.3	14	14	1.8
SEC_PRI_59	392832.4	742239.9	13.65	13.65	1.8
SEC_PRI_60	392863.5	742223.4	13	13	1.8
SEC_PRI_61	392883.5	742221.9	13	13	1.8
SEC_PRI_62	392874.6	742195.7	13	14	1.8
SEC_PRI_63	392877.0	742156.4	13	13	1.8
SEC_PRI_64	392818.4	742156.7	14	14	1.8
SEC_PRI_65	392816.1	742089.1	14	14	1.8
SEC_PRI_66	392797.9	742092.2	14	14	1.8
SEC_PRI_67	392803.7	742353.4	14	14	1.8
SEC_PRI_68	392738.0	742353.5	14	14	1.8
SEC_PRI_69	392736.2	742093.9	14	14	1.8
SEC_PRI_70	392341.2	742092.3	16	16	1.8
SEC_PRI_71	392341.2	742027.0	16	16	1.8
SEC_PRI_72	392145.2	742026.4	17	17	1.8
SEC_PRI_73	392163.5	741938.6	17	17	1.8
SEC_PRI_74	392202.4	741907.3	17	17	1.8
SEC_PRI_75	392640.4	741733.0	15	15	1.8
SEC_PRI_76	392837.8	741726.5	14	14	1.8
SEC_PRI_77	393136.4	741600.6	13	14	1.8
SEC_PRI_78	393768.6	741598.4	9	10	1.8
SEC_PRI_79	393871.3	741568.2	9	10	1.8
SEC_PRI_80	393997.5	741576.4	8.27	8.27	1.8
SEC_PRI_81	394068.4	741607.1	9	9	1.8
SEC_PRI_82	394373.0	741306.8	8	8	1.8

RECEPTOR LOCATIONS AND GROUND ELELVATIONS

Receptor ID	X (m)[1]	Y (m)[2]	Z (m)	Hill (m)	Flagpole (m)
SEC_PRI_83	394439.6	741278.5	7.6	7.6	1.8
SEC_PRI_84	394394.0	741185.7	7.2	7.2	1.8
SEC_PRI_85	394410.0	741154.3	7	7	1.8
SEC_PRI_86	394513.9	741123.5	7	7	1.8
SEC_PRI_87	394551.6	741085.7	7	7	1.8
SEC_PRI_88	394555.4	741007.5	7	12	1.8
SEC_PRI_89	394718.3	740868.5	7	12	1.8
SEC_PRI_90	394716.5	740887.9	7	12	1.8
SEC_PRI_91	394755.9	740893.4	7	7	1.8
SEC_PRI_92	394755.6	740866.6	7	11	1.8
SEC_PRI_93	394801.6	740865.0	7	7	1.8
Signal_Hill	392375.3	740504.6	96	96	1.8

Source: CDM 2005.

Notes:

[1] X locations are UTM Easting (NAD 27), in meters.

[2] Y locations are UTM Northing (NAD 27) minus 3,000,000 in meters.

Schools Within Vicinity of Airport

BonTerra ID	Receptor Number	Name	Address	City	UTM Coordinates, m Easting	Northing	Comment
1	School_1	Burroughs Elementary School	1260 E 33rd St	Signal Hill	391319.40	3742188.24	
2	School_2	James Madison Elementary Schl	2801 Bomberry St	Lakewood	392927.70	3744746.46	
3	School_3	Ralph Waldo Emerson Elementary	2625 Josie Ave	Long Beach	397684.19	3740838.16	
4	School_4	Long Beach City College Liberal Arts Campus	4901 E. Carson St.	Long Beach	394858.79	3743846.63	Not K-12
5	School_5	Unknown School Site	Unknown	Long Beach	393365.18	3741511.41	Does not exist
6	School_6	Webster Daniel Elementary School	1755 West 32nd Way	Long Beach	391609.38	3742152.03	
7	School_7	First Church of the Nazarene	2280 Clark Ave.	Long Beach	395173.40	3740226.71	
8	School_8	Marina Montessori School	2301 Ximeno Ave	Long Beach	394592.95	3740446.16	
9	School_9	Oak Tree Preschool and Kindgergarten	1710 Redondo Ave	Long Beach	393449.36	3739091.46	
10	School_10	Association for Retarded Citizens	4519 E. Stearns St.	Long Beach	394581.26	3739985.40	
11	School_11	Florence Bixby Elementary Schl	5251 E Stearns St	Long Beach	395414.94	3740010.20	
12	School_12	Charles A Buffum Elem School	2350 Ximeno Ave	Long Beach	394470.96	3740547.55	
13	School_13	California Heights Parent Participation Nursery School	1500 E. Carson St.	Long Beach	391547.76	3743966.22	
14	School_14	California Heights United Methodist Children's Center	3759 Orange Ave.	Long Beach	391209.90	3743282.30	
15	School_15	George Washington Carver Schl	5335 E Pavo St	Long Beach	395686.54	3741722.89	
16	School_16	Christ Lutheran Preschool	6500 E. Stearns St.	Long Beach	397835.25	3739893.35	
17	School_17	Long Beach Montessori School	5454 Atherton St.	Long Beach	395804.39	3739122.68	
18	School_18	Edgewater Preschool	5270 E. Atherton St.	Long Beach	395462.58	3739167.52	
19	School_19	Educare	1901 Palo Verde Ave.	Long Beach	397467.41	3739382.40	
24	School_20	Charles Evans Hughes Jr High	3846 California Ave	Long Beach	390878.52	3743490.85	
35	School_21	Longfellow Elementary School	3800 Olive Ave	Long Beach	390694.67	3743423.86	
47	School_22	St Barnabas School	3980 Marron Ave	Long Beach	391208.21	3743854.50	
26	School_23	LBUSD - Special Programs-Services, High Schools	4344 Atlantic Ave	Long Beach	390416.16	3744345.68	
42	School_24	Opportunities for Learning	3939 Atlantic Ave.	Long Beach	390417.90	3743687.14	
23	School_25	Long Beach Brethren Elem Schl	3601 Linden Ave	Long Beach	390223.69	3742933.28	
33	School_26	LBUSD - Support Functions, Food Services	3333 East Airport Way	Long Beach	393397.32	3741291.77	Not K-12
34	School_27	LBUSD - Truancy Center	3090 E. 29th St.	Long Beach	393287.78	3741125.97	
50	School_28	Westerly School Of Long Beach	2950 E 29th St	Long Beach	393099.51	3741215.87	
29	School_29	Long Beach Regional Occupational Program Center	3701 E. Willow St.	Long Beach	393739.04	3740955.61	
--	School_29	Alpert Jewish Community Center	3801 E. Willow St.	Long Beach	393739.04	3740955.61	
22	School_30	Minnie Gant Elementary School	1854 N Britton Dr	Long Beach	396512.23	3739235.53	
37	School_31	Montessori Children's House	5550 E Atherton St	Long Beach	396210.87	3739089.66	
40	School_32	Nazarene Christian School	5253 E Los Coyotes Diagonal	Long Beach	395448.05	3740367.46	
44	School_33	Our Lady of Refuge - Rectory	5195 E. Stearns St.	Long Beach	395398.71	3740165.63	
43	School_34	Our Lady Of Refuge School	5210 E Los Coyotes Diagonal	Long Beach	395204.27	3739978.03	

Schools Within Vicinity of Airport (continued)

BonTerra ID	Receptor Name	Name	Address	City	UTM Coordinates, m Easting	Northing	Comment
49	School_35	Benjamin F Tucker Elementary	2221 Argonne Ave	Long Beach	394843.47	3740030.23	
38	School_36	Los Altos United Methodist Preschool and Daycare	5950 E. Willow St.	Long Beach	396810.43	3740705.41	
46	School_37	Prisk Elementary School	2375 Fanwood Ave	Long Beach	396744.72	3740458.73	
32	School_38	Stanford Middle School	5871 E Los Arcos St	Long Beach	396500.30	3740394.00	
39	School_39	Robert A Millikan High School	2800 Snowden Ave	Long Beach	397298.67	3741232.01	
48	School_40	St Joseph Elementary School	6200 E Willow St	Long Beach	397255.81	3740821.36	
45	School_41	Palo Verde Avenue Christian Nursery School	2501 Palo Verde Ave.	Long Beach	397400.25	3740664.49	
--	School_42	St Cornelius School	3330 N Bellflower Blvd	Long Beach	396023.37	3742301.53	
--	School_43	Burcham Elementary School	5610 E Monlaco Rd	Long Beach	396246.79	3742808.79	
--	School_43	Laurelcrest School for Girls	3435 San Anseline	Long Beach	396246.79	3742808.79	
--	School_44	Mark Twain Elementary School	5021 E Centralia St	Long Beach	395132.19	3744787.10	
--	School_45	Bethany Pre-School	2244 Clark Ave	Long Beach	395146.66	3740154.96	
--	School_46	Bethany Lutheran School	5100 E Arbor Rd	Long Beach	395281.76	3745168.29	
--	School_47	St Cyprian's School	5133 E Arbor Rd	Long Beach	395368.62	3745158.63	
--	School_48	Henry Elementary School	3720 Canehill Ave	Long Beach	397342.10	3743199.63	
--	School_49	First Baptist Elementary Schl	5336 E Arbor Rd	Long Beach	395711.44	3745123.60	
--	School_49	Montessori School – Eureka	5306 E. Arbor Rd.	Long Beach	395711.44	3745123.60	
--	School_50	James Whitcomb Riley Elem Schl	3319 Sandwood St	Lakewood	393445.66	3745276.64	
--	School_51	St Maria Goretti	3954 Palo Verde Ave	Long Beach	397600.51	3743628.53	
--	School_52	Mac Arthur Elementary School	6011 Centralia St	Lakewood	396930.12	3744757.88	
--	School_53	St Timothy Lutheran School	4645 Woodruff Ave	Lakewood	396730.09	3745046.82	
--	School_54	Holmes Elementary School	5020 Barlin Ave	Lakewood	393803.73	3745854.35	
--	School_55	Signal Hill Elementary School	2285 Walnut Ave	Signal Hill	391551.54	3740260.91	
--	School_56	Alvarado Elementary School	1900 E 21st St	Signal Hill	391921.96	3739875.67	
--	School_57	Robert E Lee Elementary School	1620 Temple Ave	Long Beach	392810.99	3739001.47	
--	School_58	William Cullen Bryant Elem	4101 E Fountain St	Long Beach	394100.54	3738595.09	
--	School_59	Huntington Academy	2935 E Spaulding St	Long Beach	392934.28	3738798.60	
--	School_60	Gompers Elementary School	5206 Briercrest Ave	Lakewood	396206.07	3746195.36	
--	School_61	Mary Butler School	1400 E 20th St	Long Beach	391431.44	3739730.04	
--	School_62	Lakewood Elementary School	3701 Michelson St	Lakewood	393842.24	3746696.66	
--	School_63	Whittier Elementary School	1761 Walnut Ave	Long Beach	391556.63	3739254.44	

Schools Within Vicinity of Airport (continued)

BonTerra ID	Receptor Name	Name	Address	City	UTM Coordinates, m Easting	Northing	Comment
--	School_64	Parkridge Private School	3605 Long Beach Blvd #304	Long Beach	389975.57	3742915.74	
--	School_65	Oakwood Elementary School	2951 Long Beach Blvd	Long Beach	389967.74	3741694.69	
--	School_66	Barton Elementary School	1100 E Del Amo Blvd	Long Beach	390969.63	3745600.49	
--	School_67	Creative Arts School	1423 Walnut Ave	Long Beach	391547.52	3738751.14	
--	School_68	Burnett Elementary School	566 E Hill St	Long Beach	390339.81	3740078.16	
--	School_69	Jackie Robinson Academy	2750 Pine Ave	Long Beach	389711.11	3741246.80	
--	School_69	Oakwood Academy	2650 Pacific Ave.	Long Beach	389711.11	3741246.80	
--	School_70	Holy Innocents School	2500 Pacific Ave	Long Beach	389625.41	3740753.69	
--	School_70	Pacific Christian School	2474 Pacific Ave.	Long Beach	389625.41	3740753.69	
--	School_71	Roosevelt Elementary School	1574 Linden Ave	Long Beach	390235.64	3738979.53	
--	School_72	John Marshall Middle School	5870 E Wardlow Rd	Long Beach	396696.59	3742419.03	
--	School_73	Herbert Hoover Middle School	3501 County Club Dr	Lakewood	393488.42	3744815.09	
--	School_74	Hubert Howe Bancroft Jr High	5301 E Centralia St	Long Beach	395589.17	3744774.82	
--	School_75	Charles A Lindbergh School	1022 E Market St	Long Beach	390880.59	3746416.65	
--	School_76	Lakewood High School	4400 Briercrest Ave	Lakewood	396187.21	3744544.19	
--	School_77	St Anthony High School	4832 Clark Ave	Long Beach	395200.69	3745435.86	
--	School_78	Educational Partnership Hs	3722 Atlantic Ave	Long Beach	390432.57	3743212.22	
--	School_79	Long Beach Educational High	3411 E Anaheim St	Long Beach	393384.70	3738476.96	
--	School_80	Paramount Academy High School	3717 Michelson St	Lakewood	393871.24	3746697.23	
--	School_81	Educational Partnership Hs	4344 Atlantic Ave	Long Beach	390455.31	3744378.62	
--	School_82	Long Beach Polytechnic High	1600 Atlantic Ave	Long Beach	390383.57	3739064.57	
--	School_83	Paal Academy	1545 Long Beach Blvd	Long Beach	389942.47	3738982.23	

Hospitals, Medical Clinics, and Urgent Care Centers Within Vicinity of Airport

Receptor Number	Name	Address	City	UTM Coordinates, m Easting	Northing
Hospital_1	Long Beach Community Hospital	1720 Termino Ave	Long Beach	394000.60	3739153.00
Hospital_2	Memorial Urgent Care	450 E Spring St #9	Long Beach	390179.48	3741593.81
Hospital_3	Intercommunity Care Ctr	2626 Grand Ave	Long Beach	393877.11	3740905.44
Hospital_4	Health Net	2525 Cherry Ave #160	Signal Hill	391983.31	3740811.34
Hospital_5	Grand Avenue Convalescent Hosp	1730 Grand Ave	Long Beach	393794.78	3739152.79
Hospital_6	Immediate Medical Care Ctr	5203 Lakewood Blvd	Lakewood	394324.10	3746186.93
Hospital_7	Breast Center Long Beach Meml	701 E 28th St #200	Long Beach	390477.67	3741328.90
Hospital_8	Bixby Knolls Towers	3747 Atlantic Ave	Long Beach	390385.16	3743295.31
Hospital_9	Surgery Center of Long Beach	2880 Atlantic Ave #160	Long Beach	390407.12	3741505.54
Hospital_10	Shoreline Healthcare Ctr	4029 E Anaheim St	Long Beach	393993.58	3738471.92
Hospital_11	Miller Children's Hospital	2801 Atlantic Ave	Long Beach	390374.60	3741370.81
Hospital_12	Pediatric Medical Ctr	2921 Redondo Ave	Long Beach	393487.20	3741315.07
Hospital_13	St John Patrick Medical Clinic	1703 Termino Ave #206	Long Beach	393974.99	3739108.37
Hospital_14	Pacific Hospital of Long Beach	2776 Pacific Ave	Long Beach	389594.59	3741274.88
Hospital_15	Willow Lake Nursing Care Ctr	2615 Grand Ave	Long Beach	393822.67	3740884.48
Hospital_16	Courtyard Care Ctr	1880 Dawson Ave	Signal Hill	392191.21	3739467.07
Hospital_17	Bel Vista Convalescent Hosp	5001 E Anaheim St	Long Beach	394940.43	3738458.70
Hospital_18	Child Guidance Ctr	4335 Atlantic Ave	Long Beach	390404.07	3744475.77
Hospital_19	Saddle Group	3060 Long Beach Blvd	Long Beach	390006.73	3741880.57
Hospital_20	Universal Psychiatric	2777 Pacific Ave	Long Beach	389573.60	3741304.67
Hospital_21	Hillcrest Convalescent Hospital	3401 Cedar Ave	Long Beach	389444.54	3742559.23
Hospital_22	Palmcrest North	3501 Cedar Ave	Long Beach	389439.81	3742668.10
Hospital_23	Pacific Care Nursing Center	3355 Pacific Pl	Long Beach	389406.68	3742474.03

Attachment I
Airport Contributions to Criteria Pollutant Concentrations

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

One-Hour NO_2 Concentrations, from One-Hour NOx Concentration and SCAQMD LST Methodology

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
Commercial	35	68	76	63	54
Hospital	30	70	43	46	46
On-Site Worker	9	48	40	36	34
Property Line/Offsite Worker	48	75	45	82	65
Recreational	21	45	41	39	41
Resident	73	92	92	95	117
School	52	45	71	47	86

Incremental One-Hour NO_2 Concentrations, Above 2005 Baseline

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$	$\mu g/m^3$
Commercial	N/A	33	41	28	19
Hospital	N/A	40	13	17	16
On-Site Worker	N/A	39	31	27	25
Property Line/Offsite Worker	N/A	27	-4	33	16
Recreational	N/A	25	21	19	21
Resident	N/A	19	19	22	44
School	N/A	-6	19	-4	34

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

Annual NO_2 Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	2.1	1.9	1.5	2.2	1.8
Hospital	0.7	0.7	0.6	0.7	0.7
On-Site Worker	9.6	22.2	15.2	18.8	14.0
Property Line/Offsite Worker	4.7	3.2	2.8	3.7	3.1
Recreational	1.7	2.2	1.7	2.2	1.8
Resident	1.6	1.9	1.9	2.0	2.0
School	0.8	0.9	0.7	0.9	0.8

Incremental Annual NO_2 Concentrations (above 2005 Baseline)

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	-0.2	-0.6	0.1	-0.3
Hospital	N/A	0.1	0.0	0.1	0.0
On-Site Worker	N/A	12.5	5.5	9.1	4.3
Property Line/Offsite Worker	N/A	-1.5	-1.9	-1.0	-1.6
Recreational	N/A	0.5	0.0	0.5	0.1
Resident	N/A	0.4	0.3	0.5	0.4
School	N/A	0.1	-0.1	0.1	0.0

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

One-Hour CO Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	6277	5522	3032	5293	2920
Hospital	6124	5344	2673	5115	2547
On-Site Worker	6397	6911	4218	6682	3191
Property Line/Offsite Worker	6433	5706	3378	5477	3316
Recreational	6173	5490	2792	5261	2672
Resident	6202	5459	2793	5230	2679
School	6115	5342	2691	5113	2569

Calculated by summing on-airport operations with peak intersection CO concentrations for each alternative.

Incremental One-Hour CO Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	-755	-3245	-984	-3357
Hospital	N/A	-780	-3451	-1009	-3576
On-Site Worker	N/A	514	-2179	285	-3206
Property Line/Offsite Worker	N/A	-727	-3055	-956	-3117
Recreational	N/A	-683	-3381	-912	-3501
Resident	N/A	-743	-3408	-972	-3523
School	N/A	-772	-3423	-1001	-3546

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

8-Hour CO Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	4217	3767	1838	3538	1726
Hospital	4162	3716	1764	3487	1649
On-Site Worker	4340	4097	2183	3868	1821
Property Line/Offsite Worker	4257	3794	1867	3565	1764
Recreational	4202	3773	1819	3544	1673
Resident	4194	3745	1790	3516	1672
School	4176	3738	1785	3509	1669

Calculated by summing on-airport operations with peak intersection CO concentrations for each alternative.

Incremental 8-Hour CO Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	-450	-2380	-679	-2491
Hospital	N/A	-446	-2398	-675	-2513
On-Site Worker	N/A	-243	-2156	-472	-2518
Property Line/Offsite Worker	N/A	-463	-2390	-692	-2493
Recreational	N/A	-429	-2384	-659	-2529
Resident	N/A	-449	-2404	-678	-2522
School	N/A	-438	-2391	-667	-2508

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

24-Hour PM10 Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	1.2	2.3	2.4	2.1	2.1
Hospital	0.6	1.1	1.1	1.0	0.9
On-Site Worker	11.9	21.9	26.2	22.3	22.3
Property Line/Offsite Worker	2.3	4.8	4.9	4.0	3.9
Recreational	2.1	4.0	4.3	3.7	3.6
Resident	2.0	4.1	4.1	3.4	3.4
School	0.9	1.7	1.8	1.5	1.5

Incremental 24-Hour PM10 Concentrations above Baseline

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	1.0	1.2	0.8	0.8
Hospital	N/A	0.5	0.5	0.4	0.4
On-Site Worker	N/A	10.1	14.3	10.4	10.4
Property Line/Offsite Worker	N/A	2.5	2.6	1.6	1.6
Recreational	N/A	1.9	2.2	1.6	1.6
Resident	N/A	2.1	2.2	1.4	1.4
School	N/A	0.8	0.9	0.6	0.6

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

Annual PM10 Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	0.4	0.7	0.7	0.6	0.6
Hospital	0.1	0.2	0.2	0.2	0.2
On-Site Worker	7.9	17.1	17.2	14.8	14.7
Property Line/Offsite Worker	0.7	1.2	1.2	1.0	1.0
Recreational	0.6	1.2	1.2	1.0	1.0
Resident	0.5	1.0	1.0	0.8	0.8
School	0.2	0.4	0.4	0.4	0.4

Incremental Annual PM10 Concentrations above Baseline

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	0.2	0.2	0.2	0.2
Hospital	N/A	0.1	0.1	0.0	0.0
On-Site Worker	N/A	9.2	9.4	7.0	6.8
Property Line/Offsite Worker	N/A	0.5	0.5	0.3	0.3
Recreational	N/A	0.6	0.6	0.4	0.4
Resident	N/A	0.5	0.5	0.3	0.3
School	N/A	0.2	0.2	0.1	0.1

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

24-Hour PM2.5 Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	0.8	1.0	1.0	1.0	1.0
Hospital	0.4	0.5	0.5	0.5	0.5
On-Site Worker	4.0	5.6	6.6	5.9	5.7
Property Line/Offsite Worker	1.2	1.7	1.7	1.5	1.5
Recreational	0.9	1.3	1.3	1.2	1.2
Resident	0.9	1.4	1.4	1.2	1.2
School	0.6	0.7	0.7	0.6	0.6

Incremental 24-Hour PM2.5 Concentrations above Baseline

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	0.2	0.1	0.2	0.2
Hospital	N/A	0.1	0.1	0.1	0.1
On-Site Worker	N/A	1.6	2.6	1.9	1.7
Property Line/Offsite Worker	N/A	0.5	0.5	0.3	0.2
Recreational	N/A	0.4	0.5	0.4	0.3
Resident	N/A	0.5	0.5	0.4	0.4
School	N/A	0.1	0.1	0.1	0.1

LGB Terminal Improvement Project
Optimized Flight Scenarios and 2005 Baseline

Annual PM2.5 Concentrations

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	0.3	0.3	0.3	0.3	0.3
Hospital	0.1	0.1	0.1	0.1	0.1
On-Site Worker	2.5	4.4	4.2	3.8	3.6
Property Line/Offsite Worker	0.5	0.5	0.5	0.5	0.5
Recreational	0.2	0.4	0.3	0.3	0.3
Resident	0.2	0.3	0.3	0.3	0.3
School	0.1	0.1	0.1	0.1	0.1

Incremental Annual PM2.5 Concentrations above Baseline

	Baseline	No Project (with Opt. Flights)		Project (with Opt. Flights)	
	2005	2011	2020	2011	2020
Receptor Type	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
Commercial	N/A	0.0	0.0	0.0	0.0
Hospital	N/A	0.0	0.0	0.0	0.0
On-Site Worker	N/A	1.9	1.7	1.2	1.1
Property Line/Offsite Worker	N/A	0.0	0.0	0.1	0.0
Recreational	N/A	0.1	0.1	0.1	0.1
Resident	N/A	0.1	0.1	0.1	0.1
School	N/A	0.0	0.0	0.0	0.0

Attachment J
Incremental Risk and Hazard Calculations for Peak Receptors

Table J-1
Incremental Risk and Hazard Calculation for 2011 No Project, 2005 Baseline
(Based on Location where Cancer Risks are Greatest)

Exposure Parameters	Residential Child	School Child	Residential Adult	Off-Airport Worker
Inhalation rate	10.5 (m^3/day)	3.5 (m^3/day)	19 (m^3/day)	10.4 (m^3/day)
Daily Breathing Rate	581 (L/kg BW-day)	112 (L/kg BW-day)	302 (L/kg BW-day)	149 (L/kg BW-day)
Exposure Duration	9 (years)	7 (years)	70 (years)	40 (years)
Exposure Frequency	350 (days/year)	200 (days/year)	350 (days/year)	350 (days/year)
Body Weight	18 (kg)	31 (kg)	63 (kg)	70 (kg)
Averaging Time	3285 (d)	2555 (d)	25550 (d)	25550 (d)
Conversion Factor	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)

	Location Specific Concentrations						Toxicity Criteria used in Calculation		Cancer Risks					Hazard Quotients			
TAC	Concentration at Residence Cancer-Peak Resident_30 (ug/m^3)	Concentration at Residence Non-cancer-Peak Resident_14 (ug/m^3)	Concentration at School Location Cancer-Peak School_80 (ug/m^3)	Concentration at School Location Non-cancer-Peak School_42 (ug/m^3)	Concentration at Worker Location Cancer-Peak Prop_Int_16 (ug/m^3)	Concentration at Worker Location Non-cancer-Peak Other_1 (ug/m^3)	EPA/CalEPA Inhalation Slope Factor ($mg/kg-d)^{-1}$	EPA/CalEPA EPA RfDi or REL (mg/kg-d)	Cancer Risk to Child Resident	Cancer Risk to School Child	Cancer Risk to Adult+Child Resident	Cancer Risk to Adult Resident	Cancer Risk to Off-Airport Worker	Hazard Quotient Child Resident	Hazard Quotient School Child	Hazard Quotient Adult Resident	Hazard Quotient Off-Airport Worker
Acetaldehyde	1.60E-04	2.31E-04	3.53E-05	1.67E-04	8.56E-04	5.24E-03	1.00E-02	2.57E-03	1.14E-10	2.17E-12	4.80E-10	4.63E-10	4.89E-10	5.01E-05	3.98E-06	2.60E-05	2.04E-04
Acrolein	7.61E-05	1.56E-04	1.37E-05	7.55E-05	3.12E-04	3.78E-03	NA	1.71E-05	NC	NC	NC	NC	NC	5.08E-03	2.70E-04	2.64E-03	2.21E-02
Benzene	-2.55E-04	1.25E-03	-3.50E-05	8.77E-05	1.56E-03	2.33E-02	1.00E-01	1.71E-02	-1.83E-09	-2.15E-11	-7.66E-09	-7.38E-09	8.89E-09	4.07E-05	3.14E-07	2.12E-05	1.36E-04
1,3-Butadiene	4.10E-05	3.62E-04	7.47E-06	8.92E-05	5.48E-04	7.43E-03	6.00E-01	5.71E-04	1.76E-09	2.75E-11	7.39E-09	7.12E-09	1.88E-08	3.53E-04	9.59E-06	1.84E-04	1.30E-03
Formaldehyde	1.95E-03	2.95E-03	3.52E-04	1.75E-03	6.58E-03	7.63E-02	2.10E-02	8.57E-04	2.93E-09	4.54E-11	1.23E-08	1.19E-08	7.90E-09	1.92E-03	1.25E-04	9.97E-04	8.90E-03
Toluene	-9.03E-04	2.63E-03	-1.37E-04	-6.36E-05	2.05E-03	5.13E-02	NA	8.57E-02	NC	NC	NC	NC	NC	1.71E-05	-4.55E-08	8.88E-06	5.98E-05
Xylene (total)	0.00E+00	1.82E-03	-1.52E-04	-2.25E-04	1.73E-03	2.76E-02	NA	2.00E-01	NC	NC	NC	NC	NC	5.07E-06	-6.92E-08	2.64E-06	1.38E-05
Naphthalene	1.36E-05	3.26E-05	3.54E-06	1.85E-05	1.18E-04	6.31E-04	1.20E-01	2.57E-03	1.17E-10	2.60E-12	4.91E-10	4.73E-10	8.08E-10	7.07E-06	4.42E-07	3.68E-06	2.45E-05
Barium	2.40E-04	7.30E-04	1.99E-05	1.85E-04	5.35E-04	1.58E-02	NA	2.00E-01	NC	NC	NC	NC	NC	2.03E-06	5.66E-08	1.06E-06	7.92E-06
Calcium	4.86E-03	1.39E-02	4.18E-04	3.48E-03	1.10E-02	3.03E-01	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cobalt	4.76E-06	1.47E-05	4.00E-07	3.68E-06	1.08E-05	3.23E-04	9.80E+00	5.70E-06	3.34E-09	2.40E-11	1.40E-08	1.35E-08	6.05E-09	1.44E-03	3.96E-05	7.49E-04	5.68E-03
Chromium (VI)	1.03E-06	2.87E-06	9.99E-08	8.02E-07	2.48E-06	6.14E-05	5.10E+02	2.86E-05	3.77E-08	3.13E-10	1.59E-07	1.53E-07	7.23E-08	5.59E-05	1.72E-06	2.91E-05	2.15E-04
Copper	4.23E-05	1.31E-04	3.48E-06	3.33E-05	9.40E-05	2.84E-03	NA	4.00E-02	NC	NC	NC	NC	NC	1.82E-06	5.10E-08	9.48E-07	7.09E-06
Manganese	1.22E-04	3.52E-04	1.05E-05	8.81E-05	2.77E-04	7.70E-03	NA	5.71E-05	NC	NC	NC	NC	NC	3.43E-03	9.47E-05	1.78E-03	1.35E-02
Nickel	4.25E-06	1.38E-05	3.47E-07	3.48E-06	9.51E-06	3.02E-04	9.10E-01	2.00E-02	2.77E-10	1.94E-12	1.16E-09	1.12E-09	4.95E-10	3.85E-07	1.07E-08	2.00E-07	1.51E-06
Zinc	1.54E-04	4.45E-04	1.31E-05	1.11E-04	3.48E-04	9.73E-03	NA	3.00E-01	NC	NC	NC	NC	NC	8.27E-07	2.28E-08	4.30E-07	3.24E-06
PAHs	1.54E-08	1.31E-08	3.00E-09	1.29E-08	4.90E-08	3.77E-07	3.90E+00	NA	4.32E-12	7.18E-14	1.81E-11	1.74E-11	1.09E-11	NC	NC	NC	NC
Dibenzo(a,h)anthracene	9.82E-09	8.30E-09	1.91E-09	8.21E-09	3.12E-08	2.40E-07	4.10E+00	NA	2.68E-12	4.80E-14	1.21E-11	1.17E-11	7.30E-12	NC	NC	NC	NC
Ethylbenzene	-1.50E-04	4.90E-04	-2.55E-05	-7.51E-06	4.31E-04	8.72E-03	NA	5.71E-01	NC	NC	NC	NC	NC	4.78E-07	-8.06E-10	2.48E-07	1.53E-06
Styrene	-9.67E-06	3.51E-05	3.81E-07	8.22E-06	1.44E-04	3.21E-04	NA	2.57E-01	NC	NC	NC	NC	NC	7.61E-08	1.96E-09	3.95E-08	1.25E-07
Phenol	3.92E-05	3.31E-05	7.62E-06	3.26E-05	1.24E-04	9.58E-04	NA	5.71E-02	NC	NC	NC	NC	NC	3.23E-07	3.52E-08	1.68E-07	1.68E-06
Iron	8.48E-03	2.45E-02	7.23E-04	6.13E-03	1.92E-02	5.35E-01	NA	3.00E-01	NC	NC	NC	NC	NC	4.55E-05	1.25E-06	2.36E-05	1.78E-04
Lead	-3.96E-05	1.92E-05	4.37E-06	-3.74E-06	-5.77E-05	1.04E-03	4.20E-02	NA	-1.19E-10	1.13E-12	-5.00E-10	-4.82E-10	-1.39E-10	NC	NC	NC	NC
Scandium	5.95E-07	5.75E-07	9.47E-08	3.77E-07	1.85E-06	9.20E-06	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Strontium	5.20E-05	1.48E-04	4.49E-06	3.73E-05	1.18E-04	3.24E-03	NA	6.00E-01	NC	NC	NC	NC	NC	1.38E-07	3.82E-09	7.15E-08	5.40E-07
Sulfur	5.70E-04	1.53E-03	5.33E-05	4.09E-04	1.34E-03	3.30E-02	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tin	1.89E-05	5.81E-05	1.57E-06	1.50E-05	4.20E-05	1.25E-03	NA	6.00E-01	NC	NC	NC	NC	NC	5.39E-08	1.53E-09	2.80E-08	2.09E-07
Titanium	7.28E-04	2.08E-03	6.27E-05	5.21E-04	1.66E-03	4.54E-02	NA	8.60E-03	NC	NC	NC	NC	NC	1.35E-04	3.72E-06	7.00E-05	5.28E-04
Zirconium	1.97E-05	5.48E-05	1.75E-06	1.40E-05	4.54E-05	1.19E-03	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diesel PM	1.04E-03	-1.33E-03	-1.66E-04	-1.10E-03	1.59E-02	-8.45E-02	1.10E+00	1.43E-03	8.17E-08	-1.12E-09	3.43E-07	3.30E-07	1.00E-06	-5.21E-04	-4.74E-05	-2.71E-04	-5.92E-03
									1.3E-07	-7.2E-10	5.3E-07	5.1E-07	1.1E-06	0.01	0.0005	0.006	0.05
								per million	0.1	-0.0007	0.5	0.5	1.1				

NA = Not Available

Source: Camp Dresser & McKee Inc., 2005

Table J-2
Incremental Risk and Hazard Calculation for 2011 Project, 2005 Baseline
(Based on Location where Cancer Risks are Greatest)

Exposure Parameters	Residential Child	School Child	Residential Adult	Off-Airport Worker
Inhalation rate	10.5 (m^3/day)	3.5 (m^3/day)	19 (m^3/day)	10.4 (m^3/day)
Daily Breathing Rate	581 (L/kg BW-day)	112 (L/kg BW-day)	302 (L/kg BW-day)	149 (L/kg BW-day)
Exposure Duration	9 (years)	7 (years)	70 (years)	40 (years)
Exposure Frequency	350 (days/year)	200 (days/year)	350 (days/year)	350 (days/year)
Body Weight	18 (kg)	31 (kg)	63 (kg)	70 (kg)
Averaging Time	3285 (d)	2555 (d)	25550 (d)	25550 (d)
Conversion Factor	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)

	Location Specific Concentrations						Toxicity Criteria used in Calculation		Cancer Risks					Hazard Quotients			
TAC	Concentration at Residence Cancer-Peak Resident_30 (ug/m^3)	Concentration at Residence Non-cancer-Peak Resident_14 (ug/m^3)	Concentration at School Location Cancer-Peak School_43 (ug/m3)	Concentration at School Location Non-cancer-Peak School_15 (ug/m3)	Concentration at Worker Location Cancer-Peak Prop_Int_15 (ug/m^3)	Concentration at Worker Location Non-cancer-Peak Other_1 (ug/m^3)	EPA/CalEPA Inhalation Slope Factor $(mg/kg\text{-}d)^{-1}$	EPA/CalEPA EPA RfDi or REL (mg/kg-d)	Cancer Risk to Child Resident	Cancer Risk to School Child	Cancer Risk to Adult+Child Resident	Cancer Risk to Adult Resident	Cancer Risk to Off-Airport Worker	Hazard Quotient Child Resident	Hazard Quotient School Child	Hazard Quotient Adult Resident	Hazard Quotient Off-Airport Worker
Acetaldehyde	5.85E-04	3.95E-04	1.19E-04	1.77E-04	2.97E-03	-2.62E-03	1.00E-02	2.57E-03	4.19E-10	7.33E-12	1.76E-09	1.69E-09	1.70E-09	8.56E-05	4.22E-06	4.45E-05	-1.02E-04
Acrolein	1.82E-04	1.52E-04	4.06E-05	7.50E-05	8.86E-04	8.83E-04	NA	1.71E-05	NC	NC	NC	NC	NC	4.96E-03	2.68E-04	2.58E-03	5.15E-03
Benzene	8.07E-05	-3.19E-04	-2.14E-04	-5.36E-04	6.14E-03	-3.84E-02	1.00E-01	1.71E-02	5.78E-10	-1.31E-10	2.43E-09	2.34E-09	3.51E-08	-1.04E-05	-1.92E-06	-5.39E-06	-2.24E-04
1,3-Butadiene	1.93E-04	9.97E-05	6.29E-06	-1.05E-05	1.80E-03	-5.09E-03	6.00E-01	5.71E-04	8.31E-09	2.32E-11	3.49E-08	3.36E-08	6.18E-08	9.73E-05	-1.12E-06	5.06E-05	-8.92E-04
Formaldehyde	4.33E-03	3.85E-03	1.10E-03	2.11E-03	1.78E-02	4.29E-02	2.10E-02	8.57E-04	6.51E-09	1.42E-10	2.73E-08	2.63E-08	2.14E-08	2.50E-03	1.51E-04	1.30E-03	5.01E-03
Toluene	-1.06E-03	-1.45E-03	-7.35E-04	-1.54E-03	8.32E-03	-7.81E-02	NA	8.57E-02	NC	NC	NC	NC	NC	-9.45E-06	-1.10E-06	-4.91E-06	-9.11E-05
Xylene (total)	-7.14E-04	-1.50E-03	-6.71E-04	-1.57E-03	8.91E-03	-9.08E-02	NA	2.00E-01	NC	NC	NC	NC	NC	-4.19E-06	-4.82E-07	-2.18E-06	-4.54E-05
Naphthalene	7.35E-05	4.11E-05	1.18E-05	1.28E-05	4.44E-04	-1.01E-03	1.20E-01	2.57E-03	6.32E-10	8.69E-12	2.65E-09	2.55E-09	3.05E-09	8.90E-06	3.06E-07	4.63E-06	-3.91E-05
Barium	3.25E-04	9.67E-04	4.59E-05	4.38E-04	8.53E-04	2.22E-02	NA	2.00E-01	NC	NC	NC	NC	NC	2.69E-06	1.34E-07	1.40E-06	1.11E-05
Calcium	6.71E-03	1.88E-02	8.90E-04	8.83E-03	1.75E-02	4.34E-01	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cobalt	4.18E-06	1.38E-05	7.75E-07	6.49E-06	1.21E-05	3.29E-04	9.80E+00	5.70E-06	2.93E-09	4.66E-11	1.23E-08	1.19E-08	6.76E-09	1.35E-03	6.98E-05	7.00E-04	5.77E-03
Chromium (VI)	1.06E-06	2.91E-06	2.32E-07	1.38E-06	3.13E-06	6.48E-05	5.10E+02	2.86E-05	3.68E-08	7.26E-10	1.63E-07	1.57E-07	9.13E-08	5.67E-05	2.96E-06	2.95E-05	2.27E-04
Copper	5.45E-05	1.66E-04	8.15E-06	7.46E-05	1.45E-04	3.82E-03	NA	4.00E-02	NC	NC	NC	NC	NC	2.31E-06	1.14E-07	1.20E-06	9.54E-06
Manganese	1.67E-04	4.72E-04	2.23E-05	2.21E-04	4.36E-04	1.09E-02	NA	5.71E-05	NC	NC	NC	NC	NC	4.60E-03	2.37E-04	2.39E-03	1.91E-02
Nickel	3.37E-06	1.22E-05	7.11E-07	5.54E-06	1.01E-05	2.90E-04	9.10E-01	2.00E-02	2.20E-10	3.97E-12	9.22E-10	8.89E-10	5.23E-10	3.39E-07	1.70E-08	1.76E-07	1.45E-06
Zinc	2.10E-04	5.97E-04	2.81E-05	2.79E-04	5.48E-04	1.38E-02	NA	3.00E-01	NC	NC	NC	NC	NC	1.11E-06	5.70E-08	5.76E-07	4.60E-06
PAHs	3.85E-08	3.25E-08	1.03E-08	1.87E-08	1.44E-07	3.38E-07	3.90E+00	NA	1.08E-11	2.46E-13	4.51E-11	4.35E-11	3.20E-11	NC	NC	NC	NC
Dibenzo(a,h)anthracene	2.45E-08	2.07E-08	6.52E-09	1.19E-08	9.14E-08	2.14E-07	4.10E+00	NA	7.19E-12	1.64E-13	3.01E-11	2.91E-11	2.14E-11	NC	NC	NC	NC
Ethylbenzene	-1.29E-04	-2.49E-04	-1.26E-04	-2.82E-04	1.79E-03	-1.58E-02	NA	5.71E-01	NC	NC	NC	NC	NC	-2.43E-07	-3.03E-08	-1.26E-07	-2.76E-06
Styrene	7.27E-05	1.06E-05	1.17E-06	-1.90E-05	6.66E-04	-3.31E-03	NA	2.57E-01	NC	NC	NC	NC	NC	2.30E-08	-4.54E-09	1.20E-08	-1.29E-06
Phenol	9.77E-05	8.24E-05	2.60E-05	4.74E-05	3.65E-04	8.55E-04	NA	5.71E-02	NC	NC	NC	NC	NC	8.04E-07	5.09E-08	4.18E-07	1.50E-06
Iron	1.17E-02	3.32E-02	1.56E-03	1.55E-02	3.05E-02	7.65E-01	NA	3.00E-01	NC	NC	NC	NC	NC	6.16E-05	3.17E-06	3.20E-05	2.55E-04
Lead	-3.23E-05	3.84E-05	-1.28E-05	1.04E-05	-4.75E-04	1.54E-03	4.20E-02	NA	-9.71E-11	-3.30E-12	-4.07E-10	-3.93E-10	-1.14E-09	NC	NC	NC	NC
Scandium	8.25E-07	7.45E-07	2.56E-07	5.24E-07	2.68E-06	6.85E-06	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Strontium	7.19E-05	2.01E-04	9.64E-06	9.43E-05	1.88E-04	4.63E-03	NA	6.00E-01	NC	NC	NC	NC	NC	1.87E-07	9.65E-09	9.71E-08	7.73E-07
Sulfur	7.87E-04	2.06E-03	1.21E-04	9.79E-04	2.11E-03	4.64E-02	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tin	2.52E-05	7.58E-05	3.83E-06	3.38E-05	6.69E-05	1.73E-03	NA	6.00E-01	NC	NC	NC	NC	NC	7.04E-08	3.46E-09	3.66E-08	2.88E-07
Titanium	1.01E-03	2.83E-03	1.34E-04	1.33E-03	2.63E-03	6.51E-02	NA	8.60E-03	NC	NC	NC	NC	NC	1.83E-04	9.46E-06	9.51E-05	7.57E-04
Zirconium	2.73E-05	7.45E-05	3.80E-06	3.52E-05	7.18E-05	1.71E-03	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diesel PM	4.78E-03	-2.36E-04	-8.11E-05	-2.03E-03	3.72E-02	-2.36E-01	1.10E+00	1.43E-03	3.77E-07	-5.47E-10	1.58E-06	1.52E-06	2.34E-06	-9.21E-05	-8.74E-05	-4.78E-05	-1.66E-02
									4.4E-07	2.8E-10	1.8E-06	1.8E-06	2.6E-06	0.01	0.0007	0.007	0.02
NA = Not Available								per million	0.4	0.0003	1.8	1.8	2.6				

Source: Camp Dresser & McKee Inc., 2005

Table J-3
Incremental Risk and Hazard Calculation for 2020 No Project, 2005 Baseline
(Based on Location where Cancer Risks are Greatest)

Exposure Parameters	Residential Child	School Child	Residential Adult	Off-Airport Worker
Inhalation rate	10.5 (m^3/day)	3.5 (m^3/day)	19 (m^3/day)	10.4 (m^3/day)
Daily Breathing Rate	581 (L/kg BW-day)	112 (L/kg BW-day)	302 (L/kg BW-day)	149 (L/kg BW-day)
Exposure Duration	9 (years)	7 (years)	70 (years)	40 (years)
Exposure Frequency	350 (days/year)	200 (days/year)	350 (days/year)	350 (days/year)
Body Weight	18 (kg)	31 (kg)	63 (kg)	70 (kg)
Averaging Time	3285 (d)	2555 (d)	25550 (d)	25550 (d)
Conversion Factor	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)

	Location Specific Concentrations							Toxicity Criteria used in Calculation		Cancer Risks					Hazard Quotients			
TAC	Concentration at Residence Cancer-Peak Resident_20 (ug/m^3)	Concentration at Adult Residence Non-cancer-Peak School_25 (ug/m^3)	Concentration at Child Residence Non-cancer-Peak Signal_Hill (ug/m^3)	Concentration at School Location Cancer-Peak School_38 (ug/m^3)	Concentration at School Location Non-cancer-Peak School_25 (ug/m^3)	Concentration at Worker Location Cancer-Peak Hospital_23 (ug/m^3)	Concentration at Worker Location Non-cancer-Peak Other_3 (ug/m^3)	EPA/CalEPA Inhalation Slope Factor $(mg/kg\text{-}d)^{-1}$	EPA/CalEPA RfDi or REL (mg/kg-d)	Cancer Risk to Child Resident	Cancer Risk to School Child	Cancer Risk to Adult+Child Resident	Cancer Risk to Adult Resident	Cancer Risk to Off-Airport Worker	Hazard Quotient Child Resident	Hazard Quotient School Chid	Hazard Quotient Adult Resident	Hazard Quotient Off-Airport Worker
Acetaldehyde	-2.55E-04	-4.01E-05	-5.01E-05	-1.03E-04	-4.01E-05	-9.03E-04	-3.18E-05	1.00E-02	2.57E-03	-1.90E-10	-5.33E-12	-7.97E-10	-7.58E-10	-5.16E-10	-1.09E-05	-9.58E-07	-4.52E-06	-1.24E-06
Acrolein	-5.95E-05	-9.90E-06	-1.26E-05	-2.74E-05	-9.90E-06	-2.27E-04	-7.67E-06	NA	1.71E-05	NC	NC	NC	NC	NC	-4.10E-04	-3.54E-05	-1.67E-04	-4.47E-05
Benzene	-1.78E-03	-3.38E-04	-4.43E-04	-8.09E-04	-3.38E-04	-5.81E-03	-2.78E-04	1.00E-01	1.71E-02	-1.27E-08	-4.97E-10	-5.33E-08	-5.14E-08	-3.89E-08	-1.44E-05	-1.21E-06	-5.71E-06	-1.62E-06
1,3-Butadiene	-3.43E-04	-5.23E-05	-8.14E-05	-1.52E-04	-5.23E-05	-1.28E-03	-5.09E-05	6.00E-01	5.71E-04	-1.48E-08	-5.60E-10	-6.19E-08	-5.97E-08	-4.41E-08	-7.95E-05	-6.70E-06	-3.16E-05	-8.92E-06
Formaldehyde	-5.44E-04	-4.11E-05	-4.44E-05	-1.89E-04	-4.11E-05	-1.50E-03	-2.20E-05	2.10E-02	8.57E-04	-9.69E-10	-2.43E-11	-4.06E-09	-3.92E-09	-1.79E-09	-2.89E-05	-2.95E-06	-1.39E-05	-2.57E-06
Toluene	-3.57E-03	-6.98E-04	-9.22E-04	-1.67E-03	-6.98E-04	-1.39E-02	-5.74E-04	NA	8.57E-02	NC	NC	NC	NC	NC	-5.00E-06	-5.00E-07	-2.35E-06	-5.70E-07
Xylene (total)	-3.52E-03	-6.87E-04	-9.03E-04	-1.62E-03	-6.87E-04	-1.37E-02	-5.63E-04	NA	2.00E-01	NC	NC	NC	NC	NC	-2.52E-06	-2.11E-07	-9.95E-07	-2.84E-07
Naphthalene	-5.53E-05	-9.29E-06	-1.18E-05	-2.29E-05	-9.29E-06	-1.99E-04	-7.51E-06	1.20E-01	2.57E-03	-4.76E-10	-1.68E-11	-2.00E-09	-1.92E-09	-1.37E-09	-2.56E-06	-2.22E-07	-1.05E-06	-2.92E-07
Barium	8.00E-05	1.31E-05	2.09E-05	4.28E-05	1.31E-05	2.95E-04	9.81E-06	NA	2.00E-01	NC	NC	NC	NC	NC	5.82E-08	4.02E-09	1.90E-08	4.91E-09
Calcium	4.42E-03	3.52E-04	5.24E-04	1.34E-03	3.52E-04	1.49E-02	2.48E-04	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cobalt	1.79E-06	3.50E-07	5.81E-07	1.14E-06	3.50E-07	6.84E-06	2.70E-07	9.80E+00	5.70E-06	1.25E-09	6.87E-11	5.25E-09	5.07E-09	3.83E-09	5.68E-05	3.77E-06	1.78E-05	4.74E-06
Chromium (VI)	2.15E-05	5.83E-07	1.04E-06	4.00E-06	5.83E-07	6.85E-05	4.37E-07	5.10E+02	2.85E-05	7.85E-07	1.25E-08	3.30E-06	3.18E-06	2.00E-06	2.02E-05	1.25E-06	5.90E-06	1.53E-06
Copper	4.02E-05	2.98E-06	5.04E-06	1.25E-05	2.98E-06	1.35E-04	2.28E-06	NA	4.00E-02	NC	NC	NC	NC	NC	7.02E-08	4.57E-09	2.16E-08	5.70E-09
Manganese	6.53E-05	7.77E-06	1.14E-05	2.59E-05	7.77E-06	2.32E-04	5.49E-06	NA	5.71E-05	NC	NC	NC	NC	NC	1.11E-04	8.35E-06	3.94E-05	9.60E-06
Nickel	1.57E-06	3.11E-07	5.55E-07	1.08E-06	3.11E-07	6.37E-06	2.52E-07	9.10E-01	2.00E-02	1.09E-10	6.05E-12	4.55E-10	4.40E-10	3.31E-10	1.55E-08	9.53E-10	4.50E-09	1.25E-09
Zinc	4.02E-05	8.68E-06	1.24E-05	2.48E-05	8.68E-06	1.55E-04	6.10E-06	NA	3.00E-01	NC	NC	NC	NC	NC	2.31E-08	1.78E-09	8.38E-09	2.03E-09
PAHs	-1.18E-09	5.00E-10	7.85E-10	5.20E-10	5.00E-10	3.99E-09	5.11E-10	3.90E+00	NA	-3.29E-13	1.24E-14	-1.38E-12	-1.33E-12	8.89E-13	NC	NC	NC	NC
Dibenzo(a,h)anthracene	-7.48E-10	3.18E-10	5.00E-10	3.31E-10	3.18E-10	2.54E-09	3.25E-10	4.10E+00	NA	-2.20E-13	8.32E-15	-9.21E-13	-8.88E-13	5.95E-13	NC	NC	NC	NC
Ethylbenzene	-5.90E-04	-1.35E-04	-1.77E-04	-3.20E-04	-1.35E-04	-2.59E-03	-1.11E-04	NA	5.71E-01	NC	NC	NC	NC	NC	-1.73E-07	-1.44E-08	-6.82E-08	-1.94E-08
Styrene	-1.25E-04	-2.28E-05	-2.94E-05	-5.43E-05	-2.28E-05	-4.73E-04	-1.88E-05	NA	2.57E-01	NC	NC	NC	NC	NC	-5.37E-08	-5.45E-09	-2.57E-08	-7.30E-09
Phenol	-2.99E-06	1.27E-06	1.99E-06	1.32E-06	1.27E-06	1.01E-05	1.30E-06	NA	5.71E-02	NC	NC	NC	NC	NC	1.94E-08	1.35E-09	6.43E-09	2.27E-09
Iron	3.38E-03	5.02E-04	7.28E-04	1.55E-03	5.02E-04	1.22E-02	3.54E-04	NA	3.00E-01	NC	NC	NC	NC	NC	1.35E-06	1.03E-07	4.85E-07	1.18E-07
Lead	1.43E-02	2.48E-03	3.05E-03	7.55E-03	2.48E-03	6.05E-02	1.75E-03	4.20E-02	NA	4.31E-08	1.97E-09	1.81E-07	1.74E-07	1.45E-07	NC	NC	NC	NC
Scandium	5.28E-05	1.55E-05	2.78E-05	1.13E-05	1.55E-05	1.99E-04	1.16E-05	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Strontium	8.18E-05	4.58E-06	7.10E-06	2.04E-05	4.58E-06	2.69E-04	3.27E-06	NA	6.00E-01	NC	NC	NC	NC	NC	6.60E-09	4.68E-10	2.21E-09	5.46E-10
Sulfur	7.10E-03	2.01E-04	3.49E-04	1.33E-03	2.01E-04	2.25E-02	1.49E-04	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tin	5.20E-05	2.35E-06	4.12E-06	1.34E-05	2.35E-06	2.00E-04	1.79E-06	NA	6.00E-01	NC	NC	NC	NC	NC	3.82E-09	2.40E-10	1.13E-09	2.98E-10
Titanium	7.57E-04	5.48E-05	8.24E-05	2.17E-04	5.48E-05	2.53E-03	3.88E-05	NA	8.60E-03	NC	NC	NC	NC	NC	5.34E-06	3.91E-07	1.85E-06	4.51E-07
Zirconium	9.52E-05	3.33E-06	5.54E-06	1.94E-05	3.33E-06	3.09E-04	2.43E-06	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diesel PM	-3.77E-03	-6.94E-04	-7.81E-04	-1.62E-03	-6.94E-04	-5.81E-03	-5.72E-04	1.10E+00	1.43E-03	-2.97E-07	-1.09E-08	-1.25E-06	-1.20E-06	-3.65E-07	-3.05E-04	-2.98E-05	-1.41E-04	-4.01E-05
										5.0E-07	2.5E-09	2.1E-06	2.0E-06	1.7E-06	-0.0007	-0.00006	-0.00030	-0.00008
NA = Not Available									per million	0.5	0.003	2.1	2.0	1.7				

Source: Camp Dresser & McKee Inc., 2005

Table J-4
Incremental Risk and Hazard Calculation for 2020 Project, 2005 Baseline
(Based on Location where Cancer Risks are Greatest)

Exposure Parameters	Residential Child	School Child	Residential Adult	Off-Airport Worker
Inhalation rate	10.5 (m^3/day)	3.5 (m^3/day)	19 (m^3/day)	10.4 (m^3/day)
Daily Breathing Rate	581 (L/kg BW-day)	112 (L/kg BW-day)	302 (L/kg BW-day)	149 (L/kg BW-day)
Exposure Duration	9 (years)	7 (years)	70 (years)	40 (years)
Exposure Frequency	350 (days/year)	200 (days/year)	350 (days/year)	350 (days/year)
Body Weight	18 (kg)	31 (kg)	63 (kg)	70 (kg)
Averaging Time	3285 (d)	2555 (d)	25550 (d)	25550 (d)
Conversion Factor	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)	1.00E-03 (mg/ug)

	Location Specific Concentrations						Toxicity Criteria used in Calculation		Cancer Risks					Hazard Quotients			
TAC	Concentration at Adult Residence Cancer-Peak School_80 (ug/m^3)	Concentration at Child Residence Cancer-Peak Signal_Hill (ug/m^3)	Concentration at Residence Non-cancer-Peak Resident_20 (ug/m^3)	Concentration at School Location Cancer-Peak School_83 (ug/m^3)	Concentration at School Location Non-cancer-Peak School_80 (ug/m^3)	Concentration at Worker Location Prop_Int_15 (ug/m^3)	EPA/CalEPA Inhalation Slope Factor (mg/kg-d)$^{-1}$	EPA/CalEPA EPA RfDi or REL (mg/kg-d)	Cancer Risk to Child Resident	Cancer Risk to School Child	Cancer Risk to Adult+Child Resicent	Cancer Risk to Adult Resident	Cancer Risk to Off-Airport Worker	Hazard Quotient Child Resident	Hazard Quotient School Child	Hazard Quotient Adult Resident	Hazard Quotient Off-Airport Worker
Acetaldehyde	-1.25E-05	-2.39E-05	4.13E-05	-1.25E-05	-1.18E-05	7.74E-04	1.00E-02	2.57E-03	-1.71E-11	-7.69E-13	-7.17E-11	-3.63E-11	4.42E-10	8.94E-06	-2.81E-07	4.65E-06	3.01E-05
Acrolein	-2.67E-06	-5.03E-06	2.39E-05	-2.67E-06	-1.77E-06	2.43E-04	NA	1.71E-05	NC	NC	NC	NC	NC	7.78E-04	-6.35E-06	4.04E-04	1.42E-03
Benzene	-2.86E-04	-4.45E-04	-1.55E-03	-2.86E-04	-4.10E-04	-7.89E-03	1.00E-01	1.71E-02	-3.19E-09	-1.76E-10	-1.34E-08	-8.28E-09	-4.51E-08	-5.03E-05	-1.47E-06	-2.61E-05	-4.60E-05
1,3-Butadiene	-4.76E-05	-7.50E-05	-2.24E-04	-4.76E-05	-6.63E-05	-1.02E-03	6.00E-01	5.71E-04	-3.22E-09	-1.75E-10	-1.35E-08	-8.27E-09	-3.46E-08	-2.19E-04	-7.13E-06	-1.14E-04	-1.78E-04
Formaldehyde	1.04E-04	1.42E-04	1.50E-03	1.04E-04	2.00E-04	1.06E-02	2.10E-02	8.57E-04	2.13E-10	1.34E-11	8.94E-10	6.33E-10	1.27E-08	9.75E-04	1.43E-05	5.07E-04	1.23E-03
Toluene	-6.34E-04	-9.73E-04	-3.58E-03	-6.34E-04	-9.21E-04	-1.98E-02	NA	8.57E-02	NC	NC	NC	NC	NC	-2.33E-05	-6.60E-07	-1.21E-05	-2.31E-05
Xylene (total)	-6.09E-04	-9.46E-04	-3.51E-03	-6.09E-04	-8.86E-04	-1.84E-02	NA	2.00E-01	NC	NC	NC	NC	NC	-9.79E-06	-2.72E-07	-5.09E-06	-9.18E-06
Naphthalene	-5.10E-06	-8.56E-06	-1.50E-05	-5.10E-06	-6.58E-06	1.36E-06	1.20E-01	2.57E-03	-7.36E-11	-3.76E-12	-3.09E-10	-1.77E-10	9.34E-12	-3.26E-06	-1.57E-07	-1.69E-06	5.30E-08
Barium	1.07E-05	1.37E-05	4.33E-05	1.07E-05	1.40E-05	4.48E-04	NA	2.00E-01	NC	NC	NC	NC	NC	1.21E-07	4.31E-09	6.27E-08	2.24E-07
Calcium	2.14E-04	2.60E-04	9.01E-04	2.14E-04	2.62E-04	8.54E-03	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Cobalt	3.19E-07	4.22E-07	1.34E-06	3.19E-07	4.06E-07	1.30E-05	9.80E+00	5.70E-06	2.96E-10	1.92E-11	1.24E-09	9.05E-10	7.30E-09	1.31E-04	4.37E-06	6.80E-05	2.29E-04
Chromium (VI)	7.31E-08	1.00E-07	6.18E-07	7.31E-08	9.96E-08	3.11E-06	5.10E+02	2.86E-05	3.67E-09	2.29E-10	1.54E-08	1.08E-08	9.05E-08	1.20E-05	2.14E-07	6.25E-06	1.09E-05
Copper	2.03E-06	2.65E-06	8.63E-06	2.03E-06	2.64E-06	8.56E-05	NA	4.00E-02	NC	NC	NC	NC	NC	1.20E-07	4.06E-09	6.25E-08	2.14E-07
Manganese	5.46E-06	6.66E-06	2.23E-05	5.46E-06	7.16E-06	2.18E-04	NA	5.71E-05	NC	NC	NC	NC	NC	2.18E-04	7.69E-06	1.13E-04	3.82E-04
Nickel	3.00E-07	4.09E-07	1.27E-06	3.00E-07	3.81E-07	1.26E-05	9.10E-01	2.00E-02	2.67E-11	1.68E-12	1.12E-10	7.92E-11	6.53E-10	3.53E-08	1.17E-09	1.84E-08	6.28E-08
Zinc	6.82E-06	8.33E-06	2.73E-05	6.82E-06	8.94E-06	2.73E-04	NA	3.00E-01	NC	NC	NC	NC	NC	5.06E-08	1.83E-09	2.63E-08	9.11E-08
PAHs	1.78E-09	2.54E-09	1.77E-08	1.78E-09	2.99E-09	1.22E-07	3.90E+00	NA	7.10E-13	4.27E-14	2.98E-12	2.02E-12	2.71E-11	NC	NC	NC	NC
Dibenzo(a,h)anthracene	1.13E-09	1.62E-09	1.13E-08	1.13E-09	1.90E-09	7.74E-08	4.10E+00	NA	4.75E-13	2.85E-14	1.99E-12	1.35E-12	1.81E-11	NC	NC	NC	NC
Ethylbenzene	-1.20E-04	-1.86E-04	-6.85E-04	-1.20E-04	-1.75E-04	-3.65E-03	NA	5.71E-01	NC	NC	NC	NC	NC	-6.68E-07	-1.87E-08	-3.47E-07	-6.39E-07
Styrene	-1.63E-05	-2.63E-05	-7.99E-05	-1.63E-05	-2.28E-05	-3.02E-04	NA	2.57E-01	NC	NC	NC	NC	NC	-1.73E-07	-5.44E-09	-9.00E-08	-1.17E-07
Phenol	4.52E-06	6.45E-06	4.49E-05	4.52E-06	7.60E-06	3.09E-04	NA	5.71E-02	NC	NC	NC	NC	NC	4.38E-07	8.16E-09	2.28E-07	5.41E-07
Iron	3.71E-04	4.52E-04	1.50E-03	3.71E-04	4.87E-04	1.49E-02	NA	3.00E-01	NC	NC	NC	NC	NC	2.78E-06	9.96E-08	1.44E-06	4.96E-06
Lead	-4.39E-07	-5.38E-07	-7.62E-06	-4.39E-07	3.85E-06	-5.09E-04	4.20E-02	NA	-1.62E-12	-1.13E-13	-6.79E-12	-5.33E-12	-1.22E-09	NC	NC	NC	NC
Scandium	5.94E-08	8.49E-08	1.17E-06	5.94E-08	9.47E-08	2.60E-06	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Strontium	2.30E-06	2.80E-06	1.02E-05	2.30E-06	3.04E-06	9.21E-05	NA	6.00E-01	NC	NC	NC	NC	NC	9.46E-09	3.11E-10	4.92E-09	1.53E-08
Sulfur	2.87E-05	3.64E-05	2.16E-04	2.87E-05	3.94E-05	1.18E-03	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Tin	8.85E-07	1.17E-06	4.41E-06	8.85E-07	1.17E-06	3.79E-05	NA	6.00E-01	NC	NC	NC	NC	NC	4.10E-09	1.20E-10	2.13E-09	6.32E-09
Titanium	3.20E-05	3.88E-05	1.36E-04	3.20E-05	4.21E-05	1.28E-03	NA	8.60E-03	NC	NC	NC	NC	NC	8.80E-06	3.00E-07	4.57E-06	1.48E-05
Zirconium	9.06E-07	1.11E-06	4.97E-06	9.06E-07	1.21E-06	3.64E-05	NA	NA	NC	NC	NC	NC	NC	NC	NC	NC	NC
Diesel PM	-5.74E-04	-8.15E-04	-3.62E-03	-5.74E-04	-7.39E-04	1.25E-02	1.10E+00	1.43E-03	-6.42E-08	-3.87E-09	-2.69E-07	-1.83E-07	7.85E-07	-1.49E-03	-3.18E-05	-7.74E-04	8.74E-04
									-6.6E-08	-4.0E-09	-2.8E-07	-1.9E-07	8.2E-07	0.0003	-0.00002	0.0002	0.004
NA = Not Available								per million	-0.07	-0.004	-0.3	-0.2	0.8				

Source: Camp Dresser & McKee Inc., 2006