4.7 Hazards/Hazardous Materials

4.7.1 Human Health Risk Assessment

4.7.1.1 Introduction

Although the SPAS alternatives would not result in any change to future activity levels projected for LAX (i.e., 78.9 million annual passengers [MAP] in 2025), changes to the LAX airfield, terminals, and ground access facilities associated with the SPAS alternatives would cause changes to airport operations. Such changes would result in alterations to the amounts of toxic air contaminants (TAC)[327] released by aircraft, ground support equipment (GSE), vehicles, and other sources. During construction of any of SPAS alternatives, additional TAC would be released during the construction phase. Differences in TAC releases from construction activities and operations could have an impact on people living in the vicinity of the airport. The objective of this Human Health Risk Assessment (HHRA) is to assess incremental changes to health impacts for people exposed to TAC resulting from construction and operations associated with each SPAS alternative. The results of the HHRA will identify whether the SPAS alternatives would increase health risks for people living, working, recreating, or attending school near LAX.

As with all activities at facilities that accommodate vehicles and equipment that consume fuel, activities at LAX release TAC to the air. These TAC may come from aircraft; GSE; other motor vehicles; combustion of fossil fuels to produce hot water, steam, and power; aircraft maintenance; and other sources. Impacts to human health associated with releases of TAC may include increased cancer risks, increased chronic (long-term) non-cancer health hazards, and increased acute (short-term) non-cancer health hazards from inhalation of TAC. As demonstrated in the analysis that follows, implementation of the SPAS alternatives would, in many instances, decrease these risks and hazards by improving the efficiency of aircraft operations, improving traffic flow, and implementing mitigation measures.

Incremental impacts to human health were assessed by comparing health risks and hazards associated with the SPAS alternatives with baseline conditions. For purposes of this analysis, baseline conditions were established for calendar year 2009, which provides a full years' worth of aircraft-related activity data prior to the publication of the SPAS Draft EIR Notice of Preparation (NOP) in October 2010, and is representative of 2010 baseline conditions.

327 In the LAX Master Plan Final EIR, these were referred to as toxic air pollutants (TAPs). In this EIR, the term "toxic air contaminants," or TAC, is used to reflect California regulatory terminology.

4.7.1 Human Health Risk Assessment

This HHRA was developed as required under State of California statutes and regulations.[328] The HHRA was conducted in four steps as defined in South Coast Air Quality Management District (SCAQMD), California Environmental Protection Agency (CalEPA), and U.S. Environmental Protection Agency (USEPA) guidance[329,330,331] consisting of:

- Identification of chemicals (in this case, TAC) 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 chemicals (TACs) (Exposure Assessment);
- Evaluation of the toxicity of chemicals (TAC) that may present public health risks (Toxicity Assessment); and
- Characterization of the magnitude of health risks for the exposed community, and of locations in the community where the greatest risks or hazards may be realized (Risk Characterization).

The HHRA analyses for the SPAS alternatives address the following issues, and provide additional information on the potential for human health impacts:

- Quantitative assessment of cancer risks and chronic non-cancer health hazards due to release of TAC associated with construction and operational activities for the SPAS alternatives.
- Quantitative evaluation of possible acute non-cancer health hazards due to release of TAC during operations associated with the SPAS alternatives.

Construction of any SPAS alternative is projected to take about 11 years. A detailed evaluation of TAC emissions during the construction phase cannot be accomplished until project-level information on construction staging is available. For purposes of the program-level evaluation in this EIR, possible construction emissions are estimated generically based on projected costs for the various alternatives. This approach provides sufficient information on the relative impact of construction emissions to analyze how important these emissions might be to incremental impacts of the SPAS alternatives. Detailed evaluation of construction impacts at the project level will be completed to help judge how construction impacts might vary from year-to-year as construction starts and moves through different phases across the airport.

Risk assessment is an evolving and uncertain process. Important uncertainties exist in the estimation of emissions of TAC from mobile sources, the dispersion of such TAC in the air, actual human exposure to such TAC, and health effects associated with such exposure. Also, combined effects of chronic exposure to multiple chemicals are difficult to assess, as are interactions among pollutants, such as acrolein and

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328 California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Information and Assessment Act of 1987, Section 44300; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003.

329 South Coast Air Quality Management District, Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics Hot Spots Information and Assessment Act (AB2588), July 2005.

330 California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part I: Technical Support Document for the Determination of Acute Reference Exposure Levels for Airborne Toxicants, March 1999; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxic Hot Spots Program Risk Assessment Guidelines, Part IV: Technical Support Document for Exposure Assessment and Stochastic Analysis, September 2000; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part III: The Determination of Chronic Reference Exposure Levels for Airborne Toxicants, February 23, 2000; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II: Technical Support Document for Describing Available Cancer Potency Factors, updated August 2003; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003.

331 U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December, 1989.

criteria pollutants[332] that cause short-term (acute) health impacts. These uncertainties were discussed in detail in LAX Master Plan Final EIR Technical Report 14a and Technical Report S-9a.[333] This HHRA relied upon the best data and methodologies available; however, the nature and types of uncertainties described in the LAX Master Plan Final EIR technical reports also apply to this HHRA, as further described in Section 4.7.1.2.3 and Appendix G1, *Human Health Risk Assessment*, of this EIR.

To help address uncertainties, this analysis uses protective[334] methods (i.e., methods that are likely to overestimate rather than underestimate possible health risks, to estimate cancer risks and chronic non-cancer health hazards). For example, incremental risks and hazards associated with the SPAS alternatives were calculated for individuals assumed to live, work, recreate, or attend school at locations where TAC concentrations are predicted to be highest. These individuals were assumed to be exposed to TAC for almost all days of the year and for many years to maximize estimates of possible exposure. These "maximally exposed individuals," or MEI, are hypothetical individuals used to help ensure that the HHRA is protective.

Risk estimates for MEI are, therefore, upper-bound predictions associated with working or living near LAX, who would breathe TAC released during operational activities associated with the SPAS alternatives. By protecting hypothetical individuals that receive the highest exposures, the risk assessment is also protective for actual members of the population near LAX that would not be as highly exposed. Additional technical details of the analysis are provided in Appendix G1, *Human Health Risk Assessment*.

The HHRA for the SPAS alternatives also evaluates the potential for short-term (1-hour) exposures to cause immediate, or acute, non-cancer health impacts. These estimates are also intentionally protective; they use, for example, the highest 1-hour concentrations for assessing acute impacts regardless of whether individuals might have access to locations where maximum concentrations occur. This approach helps ensure that actual exposure concentrations in off-airport areas are not underestimated.

4.7.1.2 Methodology

The objective of this HHRA is to estimate incremental health risks and hazards associated with construction and operational activities for the SPAS alternatives. People working at the airport, and people living, working, recreating, or attending school in communities near the airport, are the populations of primary interest in the assessment. Methodologies used in this analysis are summarized below. Details of these methodologies are provided in Appendix G1, *Human Health Risk Assessment*.

Cancer risk and chronic and acute non-cancer health hazard assessments all depend on estimating TAC concentrations in air in two steps: (1) estimation of emissions of TAC associated with construction and operations (discussed in Section 4.7.1.2.1), and subsequent modeling of dispersion of those TAC to downwind receptor locations (discussed in Section 4.7.1.2.2); and (2) estimation of health risks associated with those emissions (discussed in Section 4.7.1.2.3). Estimated emission rates were used, along with meteorological and geographic information, as inputs to an air dispersion model. The dispersion model predicted possible concentrations of TAC released during construction and airport operations within the study area around the airport. Modeled concentrations were used to estimate human health risks and hazards, which serve as the basis of the significance determinations for the SPAS alternatives.

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332 Criteria pollutants include sulfur dioxide (SO_2), carbon monoxide (CO), particulate matter with an aerodynamic diameter less than or equal to 10 micrometers (PM10), particulate matter with an aerodynamic diameter less than or equal to 2.5 micrometers (PM2.5), nitrogen dioxide (NO_2), and ozone (O_3) using as surrogates volatile organic compounds (VOC) and oxides of nitrogen (NO_x) -- see Section 4.2.1.1 for further description of criteria pollutants.

333 City of Los Angeles, Final Environmental Impact Report for Los Angeles International Airport (LAX) Proposed Master Plan Improvements, April 2004.

334 The terms "protective" and "conservative" are often used interchangeably to indicate that risk assessment methods were designed to err on the side of over-estimating risk. "Protective is used in this HHRA to avoid confusion over what "conservative" means in different situations. For example, a "conservative" estimate of the time that someone might live in a given residence could imply to some readers that a minimum time was identified.

Incremental cancer risks and chronic non-cancer health hazards were then estimated as the difference between risks and hazards associated with a given SPAS alternative and risks and hazards associated with 2009 baseline conditions. Results of the analysis were then interpreted by comparing incremental cancer risks and chronic non-cancer health hazards to regulatory thresholds. For purposes of assessing the significance of any health impacts, these comparisons were made for MEI at locations where maximum concentrations of TAC were predicted by the air dispersion modeling. An impact was considered significant[335] if cancer risks and/or chronic non-cancer health hazards for MEI exceeded regulatory thresholds. In addition, the range of possible risks and hazards was addressed by evaluating risks for all modeled locations within the defined study area.

Possible acute non-cancer health hazards were estimated by comparing modeled maximum 1-hour concentrations with acute Reference Exposure Levels (RELs). As discussed in the LAX Master Plan Final EIR, acrolein is the TAC of concern responsible for the majority of predicted acute non-cancer health hazards associated with LAX operations. This TAC is released in relatively large amounts in aircraft exhaust, although smaller amounts are also found in emissions from internal combustion (i.e., diesel) engines. Acrolein is also the only TAC of concern in emissions from LAX that might be present at concentrations approaching a threshold for acute effects and was, therefore, the only TAC evaluated for potential acute non-cancer health hazard impacts in the LAX Master Plan Final EIR. However, in the HHRA analyses for the SPAS alternatives, all TAC with RELs, not just acrolein, were evaluated for potential acute non-cancer health hazard impacts.

Methods for estimating cumulative impacts followed the approach used for the LAX Master Plan Final EIR, including using data collected for and analyzed in the Multiple Air Toxics Exposure Study in the South Coast Air Basin (MATES-III)[336] completed by the SCAQMD to evaluate cumulative cancer risks. Data presented in USEPA's National Air Toxics Assessment to evaluate cumulative chronic non-cancer health hazards were also used. For cumulative acute non-cancer health hazards, conservative (likely to overestimate) approximations of short-term concentrations were made using generic conversion factors and the annual average estimates of TAC in air from USEPA. These estimates can be used to provide a semi-quantitative evaluation of the possible range of cumulative impacts. The analysis of cumulative impacts is provided in Section 5.5.7.1.

4.7.1.2.1 Emissions of Toxic Air Contaminants (TAC)

As noted above, the first step in the process of establishing concentrations of TAC in air was estimation of emissions of TAC during project construction and operations. During the construction phase, emissions of diesel particulate matter (DPM) are expected to contribute the majority to total incremental cancer risks. Based on previous evaluation of construction impacts, other TAC make minimal contributions.[337,338] For this reason, the generic evaluation of TAC releases during the construction phase focused exclusively on release of DPM from construction vehicles.

During operations, large quantities of non-DPM TAC are released from aircraft, auxiliary power units (APUs), and gasoline GSE and on-road motor vehicles. All of these TAC were assessed, along with DPM, to assess the operational phase of the SPAS alternatives. Overall, TAC emissions used in the HHRA include the DPM component from construction sources and a range of TAC, including DPM, from operational sources.

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335 The term "significant" is used as defined under CEQA regulations and does not imply an independent judgment of the acceptability of risks or hazards.

336 The HHRA for the LAX Master Plan EIR was completed prior to publication of MATES III results. Thus, cumulative risk assessment for the LAX Master Plan HHRA used results from a previous and very similar study, MATES II.

337 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Bradley West Project, September 2009.

338 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Central Utility Plant Replacement Project, October 2009.

Construction DPM emissions were assumed to be equal to the engine exhaust component of particles less than 10 microns in diameter (PM10) emissions.[339] For operational sources, both vapor phase and particulate-bound TAC were analyzed. TAC exist in air as either vapor or gases, or as particulate matter (PM). Emission rates of TAC likely to remain in the vapor phase were developed from volatile organic compounds (VOC) emission inventories for the operational sources analyzed in Section 4.2, *Air Quality*. Emission rates for TAC likely to be associated with small particles were developed from emission inventories of PM10 also included in Section 4.2, *Air Quality*. PM10 is the focus for particulate emissions because this size fraction can deposit in the deep lung and is therefore responsible for most inhalation exposure. Speciation profiles[340] for VOC and PM10 emissions from individual source types, developed primarily by the California Air Resources Board (CARB), were used to calculate TAC emissions. These emissions form the basis for modeling concentrations of TAC in air on and around LAX.

Operational emissions for the SPAS alternatives were analyzed for 2025 following buildout and for 2009 baseline conditions. 2009 baseline estimated concentrations were subtracted from the 2025 buildout estimated concentrations in order to determine the incremental impact. Sources considered include aircraft, on-board APUs, GSE, heavy construction vehicles that operate in the non-public access areas of LAX, and on-road motor vehicles, such as privately-owned vehicles, government-owned vehicles, and commercially-owned vehicles such as rental cars, shuttles, buses, taxicabs, and trucks.

TAC inventories for operational source VOC emissions were developed from Organic Profile No. 2110 for gasoline motor vehicles, Organic Profile No. 816 for gasoline off-road equipment, Organic Profile No. 818 for diesel-fueled motor vehicles and off-road equipment, and the FAA/USEPA developed hazardous air pollutant (HAP) profile for aircraft engine exhaust that is available in the FAA Emissions and Dispersion Modeling System (EDMS) Version 5.1 model. TAC inventories for operational source PM emissions were developed from PM Profile No. 400 for gasoline motor vehicles (with catalyst), PM Profile No. 425 for diesel motor vehicles and off-road equipment, and an elemental analysis of Jet A fuel[341] for aircraft engine and APU exhaust. Detailed calculations for the SPAS alternatives operational VOC and PM10 pollutant emissions inventory are provided in Appendix C, *Air Quality*.

4.7.1.2.2 Exposure Concentrations (Dispersion)

Air dispersion modeling was used to estimate TAC concentrations for the SPAS alternatives. Dispersion modeling analysis of TAC was conducted for emissions from construction and operational sources (Section 4.7.1.2.1). Details of the dispersion model analysis for the SPAS alternatives operations emissions are provided in Section 4.2, *Air Quality*. A summary is provided below.

TAC concentrations were estimated in two steps: first, dispersion modeling was used to estimate total VOC and PM10 concentrations, and then individual organic or particulate TAC concentrations were calculated using emissions profiles to speciate total VOC and PM10 estimates. For example, if total VOC at a given location was 0.1 microgram per cubic meter ($\mu g/m^3$) and a given volatile TAC was expected to make up 1 percent of this total, the concentration of that TAC at that location would be 0.001 $\mu g/m^3$.

Program-related concentrations for TAC from operational sources were estimated using the air dispersion model (AERMOD, Version 12060) with model options for 1-hour maximum and annual average concentrations selected. The SPAS alternatives were modeled for anticipated conditions in 2025 after buildout; baseline (2009) conditions were modeled using available emissions data and assumptions for that year. Short-term 1-hour concentrations and annual average concentrations for baseline conditions

[339] Construction DPM emissions were based on PM10, rather than PM2.5 because CARB speciation profiles are based on PM10, not PM2.5. In addition, the use of PM10 emissions results in higher concentrations (i.e., more conservative values) because the particles are larger.

[340] Speciation profiles provide estimates of the chemical composition of emissions, and are used in the emission inventory and air quality models.

[341] Shumway, L.A., Technical Report 1845: Trace Element and Polycyclic Aromatic Hydrocarbon Analyses of Jet Engine Fuels: Jet A, JP5, and JP8, United States Department of the Navy, Space and Naval Warfare Systems Command (SPAWAR) Systems Center San Diego, December 2000.

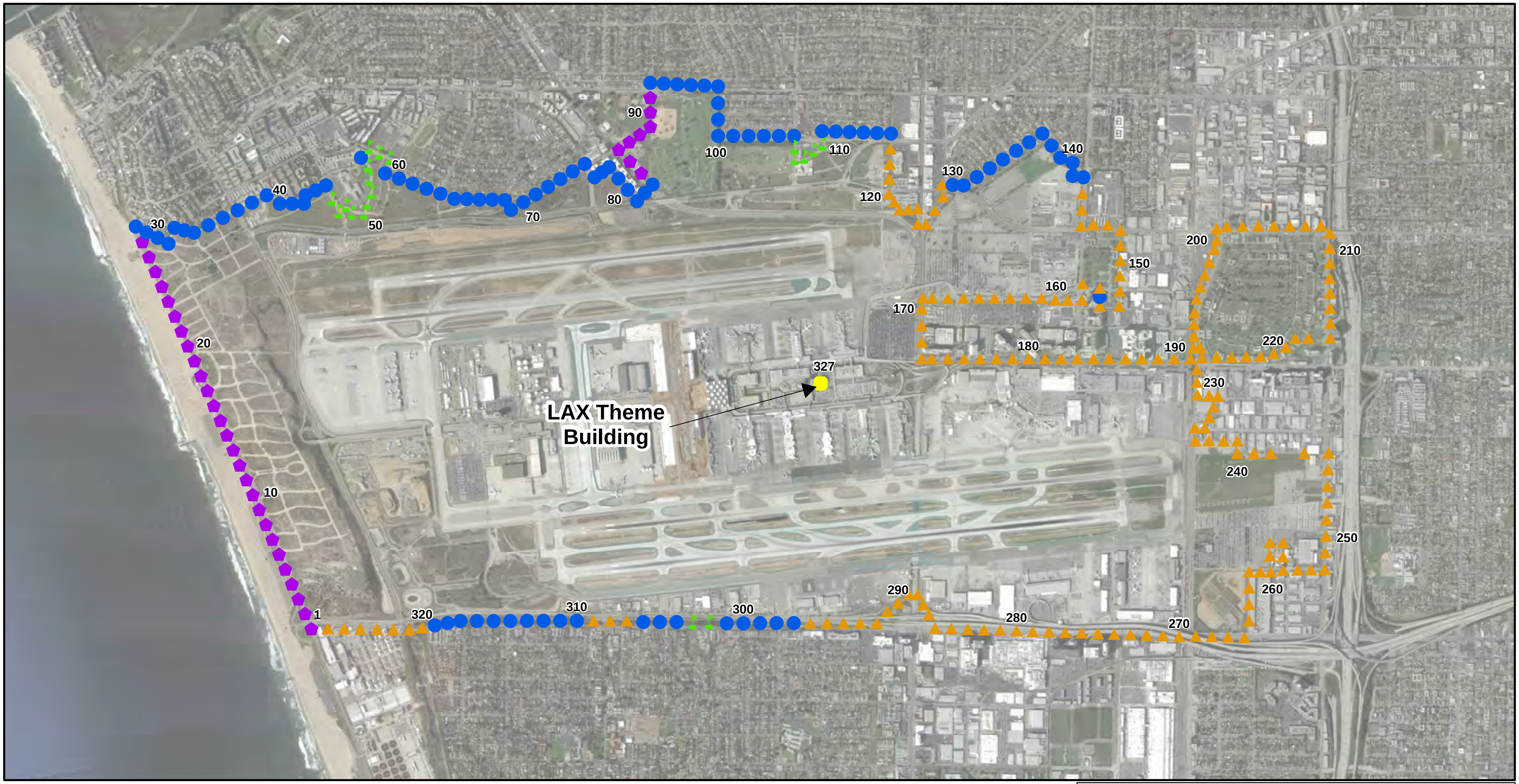
were subtracted from short-term 1-hour concentrations and annual average concentrations for the SPAS alternatives, respectively, to estimate the incremental impact of each alternative. Incremental short-term 1-hour concentrations were then used to estimate acute non-cancer health hazard impacts, and incremental annual average concentrations were used to estimate cancer risk and chronic non-cancer health hazards using methods described in Appendix G1, *Human Health Risk Assessment*.

TAC concentrations were also estimated at 326 grid nodes at or near the LAX property line (fence-line) and at one grid node at the LAX Theme Building (see **Figure 4.7.1-1**). Receptor type (i.e., recreational, residential, commercial, or school) for each grid node was dictated by land use at or near the grid node location. Although the fence-line is the closest location with unrestricted access to LAX emission sources, actual off-airport receptors do not now, and would not in the future, work or reside at the fence-line. Modeled concentrations at the fence-line will therefore be higher than concentrations modeled farther out from the airport where people currently reside, work, recreate, and go to school. Concentrations at these fence-line locations reasonably represent concentrations of TAC for use in evaluating MEI. As discussed above, risk and hazards for MEI provide a ceiling for off-airport residential, commercial, and student receptors.

Although the grid nodes between LAX and the Pacific Ocean have been identified as recreational uses in **Figure 4.7.1-1**, to maintain consistency with previous LAX risk assessments and to provide a protective analysis, these grid nodes were evaluated as residential receptor locations for the cancer risk and chronic non-cancer health hazards analyses. In the acute non-cancer health hazards analyses, these receptor locations were described as recreational. Although land use distinctions and different exposure scenarios are irrelevant for assessment of acute non-cancer health hazards, this designation may provide some reflection of populations more likely to be exposed in certain locations.

Nineteen of the 327 grid node locations are located close to school sites nearest to the LAX fence-line (i.e., Saint Bernard High School at 9100 Falmouth Avenue in Playa Del Rey, and Visitation Catholic Elementary School located north of LAX at 8740 Emerson Avenue in Westchester, and Imperial Avenue School located south of LAX at 540 East Imperial Avenue in El Segundo). These grid nodes were selected to assess risks and hazards for sensitive receptors attending or working at schools near the fence-line. The analysis for these 19 grid nodes provides direct information on potential impacts on students, faculty, and staff at these schools.

The one grid node near the center of LAX (LAX Theme Building) was evaluated to represent where on-airport workers might receive the greatest exposure to TAC. TAC concentrations at the LAX Theme Building were compared to the California Occupational Safety and Health Administration (CalOSHA) 8-hour Time-Weighted Average Permissible Exposure Levels (PEL-TWAs).



0 3,000 ft

Scale

north

Legend

- Off-Site Worker
- On-Site Occupational
- Residential
- Recreational
- School
- 170 Grid Node ID

Note:
Selected grid node numbers are provided for locational purposes.

Source: CDM Smith, 2012.

LAX Specific Plan Amendment Study Draft EIR	Fenceline Receptor Locations	Figure 4.7.1-1

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4.7.1.2.3 Overview of Risk Assessment

The HHRA was conducted based on DPM emissions associated with SPAS construction and on total TAC emissions associated with operational activities. SPAS construction and operational changes were evaluated for cancer risk and acute and chronic non-cancer health hazard incremental impacts above or below the 2009 environmental baseline. The HHRA followed state and federal guidance for performance of risk assessments and was conducted in four steps described above as defined in SCAQMD, CalEPA, and USEPA guidance[342,343,344] consisting of selection of TAC of concern, exposure assessment, toxicity assessment, and risk characterization. These steps are summarized below. Details of the risk assessment methodology are provided in Appendix G1, *Human Health Risk Assessment*.

Selection of TAC of Concern

The list of TAC of concern used in this HHRA was selected using regulatory lists, emissions estimates, human toxicity information, results of the LAX Master Plan HHRA, and a review of health risk assessments included in the Long Beach Airport Terminal Area Improvement Project EIR,[345] LAX South Airfield Improvement Project (SAIP) Final EIR,[346] LAX Crossfield Taxiway Project (CFTP) Final EIR,[347] LAX Bradley West Project Final EIR,[348] LAX Central Utility Plant Replacement Project (CUP-RP) Final EIR,[349] LAX Master Plan Final EIR,[350] Oakland International Airport - Airport Development Program (ADP) Final Supplemental EIR,[351] and the Civilian Reuse of MCAS El Toro Final EIR, Draft Supplemental Analysis.[352] This list of TAC was further refined to include only TAC with chronic RELs, acute RELs, and cancer potency values identified by the California Office of Environmental Health Hazard Assessment (OEHHA). The resulting list of TAC of concern evaluated in this HHRA is provided in **Table 4.7.1-1**. A discussion of TAC not included in this list is provided in Appendix G1, *Human Health Risk Assessment*.

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342 South Coast Air Quality Management District, Supplemental Guidelines for Preparing Risk Assessments for the Air Toxics Hot Spots Information and Assessment Act (AB2588), July 2005.

343 California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part I: Technical Support Document for the Determination of Acute Reference Exposure Levels for Airborne Toxicants, March 1999; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxic Hot Spots Program Risk Assessment Guidelines, Part IV: Technical Support Document for Exposure Assessment and Stochastic Analysis, September 2000; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part III: The Determination of Chronic Reference Exposure Levels for Airborne Toxicants, February 23, 2000; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Risk Assessment Guidelines, Part II: Technical Support Document for Describing Available Cancer Potency Factors, updated August 2003; California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003.

344 U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December, 1989.

345 City of Long Beach, Long Beach Airport Terminal Area Improvement Project Draft EIR, September 2005.

346 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) South Airfield Improvement Project, August 2005.

347 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Crossfield Taxiway Project, January 2009.

348 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Bradley West Project, September 2009.

349 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Central Utility Plant Replacement Project, October 2009.

350 City of Los Angeles, Final Environmental Impact Report for Los Angeles International Airport (LAX) Proposed Master Plan Improvements, April 2004.

351 Port of Oakland, Draft Oakland International Airport - Airport Development Program (ADP) Supplemental Environmental Impact Report, September 2003.

352 County of Orange, Draft Environmental Impact Report No. 573 for the Civilian Reuse of MCAS El Toro and the Airport System Master Plan for John Wayne Airport and Proposed Orange County International Airport, Draft Supplemental Analysis, April 2001.

Table 4.7.1-1

Toxic Air Contaminants of Concern for the SPAS Alternatives

Toxic Air Contaminant	Type
Acetaldehyde	VOC
Acrolein	VOC
Benzene	VOC
1,3-Butadiene	VOC
Ethylbenzene	VOC
Formaldehyde	VOC
n-Hexane	VOC
Methyl alcohol	VOC
Methyl ethyl ketone	VOC
Phenol	VOC
Propylene	VOC
Styrene	VOC
Toluene	VOC
Xylene (total)	VOC
Naphthalene	PAH
Arsenic	PM-Metal
Chromium VI	PM-Metal
Copper	PM-Metal
Lead	PM-Metal
Manganese	PM-Metal
Mercury	PM-Metal
Nickel	PM-Metal
Vanadium	PM-Metal
Diesel PM	Diesel Exhaust
Chlorine	PM-Inorganics
Sulfates	PM-Inorganics

Notes:

VOC = volatile organic compounds
PM = particulate matter
PAH = polycyclic aromatic hydrocarbon

Source: CDM Smith, 2012.

Exposure Assessment

For the HHRA analysis of the SPAS alternatives, receptors selected for quantitative evaluation were: off-airport workers, off-airport adult residents, off-airport child residents, and off-airport school children. Each receptor represents a unique population and set of exposure conditions. As a whole, they cover a range of exposure scenarios for people who may be affected by LAX emissions to the greatest extent. Receptors for which exposure scenarios are prepared were selected to provide protective risks and hazards estimated for MEI and to demonstrate the range of risks and hazards in the vicinity of the airport. As previously noted, by providing estimates for the most exposed individuals for determination of significance, the general population is protected.

Different receptors (e.g., off-site workers, school children) could be exposed to TAC in several ways, deemed exposure pathways. An exposure scenario was developed for each receptor that considered various pathways by which they might be exposed to TAC.

An exposure pathway consists of four parts:

- A TAC source (e.g., aircraft engines)
- A release mechanism (e.g., engine exhaust)
- A means of transport from point of release to point of exposure (e.g., local winds)
- A route of exposure (e.g., inhalation)

If any of these elements of an exposure pathway is absent, no exposure can take place and the pathway is considered incomplete and was not evaluated in this HHRA. In addition, some exposure pathways that may be complete, may result in little or negligible exposure. Thus, numerous possibly complete exposure pathways exist for receptors at or near LAX, but most are anticipated to make minimal to negligible contribution to total risks and hazards. For this HHRA, the inhalation pathway is the most important complete exposure pathway, contributing the majority of risk associated with the SPAS alternatives, and was therefore quantitatively evaluated for all receptors. Other exposure pathways -- including deposition of TAC onto soils and subsequent exposure via incidental ingestion of this soil, uptake from soil into homegrown vegetables, and other indirect pathways -- were addressed quantitatively in the programmatic HHRA developed for the LAX Master Plan EIR[353] (see LAX Master Plan Final EIR Technical Report 14a and Technical Report S-9a). No pathway other than inhalation was found to be an important contributor to exposure and thus to risk/hazard. Based on this previous analysis, pathways other than inhalation were not assessed in this HHRA.

Modeled concentrations were used for estimating human health risks and hazards, which serve as the basis for significance determinations for the SPAS alternatives. Measured concentrations of TAC cannot, of course, be obtained for future conditions. For the 2009 baseline conditions, measured concentrations are problematic due to releases of TAC from multiple non-airport sources in the Los Angeles basin. Methods are not currently available to separate contributions of TAC from airport operations to air quality. Thus, modeled concentrations were used for evaluation of both 2009 baseline conditions and future (2025) conditions for the SPAS alternatives.

Construction and operational phases were combined to obtain single estimated concentrations of DPM at each location used in the air dispersion modeling. Average construction impacts across the 11-year construction time-frame were amortized over a 70-year lifetime to estimate cancer risks.[354] That is, 11-year average concentrations of DPM in air were multiplied by 11 and divided by 70 to estimate long-term average yearly exposure. These DPM concentrations were added to incremental DPM concentrations modeled for operational emissions after buildout in 2025. Construction-related emissions were not assessed against baseline conditions, since no construction-related emissions are included in the baseline conditions. This approach assumes that full operational emissions for year 2025 also occur during the preceding construction phase.

To estimate cancer risks and the potential for adverse acute and chronic non-cancer health hazards, TAC intakes via inhalation for each receptor were estimated. For cancer risks and acute and chronic non-cancer health hazard assessment, average long-term daily intakes are used to estimate risk and hazards. Cancer risk is evaluated as the lifetime average daily dose (LADD) according to CalEPA and USEPA guidance. Non-cancer health hazards are evaluated as average daily dose (ADD) over the period of exposure, again, following CalEPA and USEPA guidance. Exposure assumptions and risk calculation equations are discussed further in Appendix G1, *Human Health Risk Assessment*.

Assessment of chronic non-cancer health hazard impacts due to release of TAC associated with the SPAS alternatives assumes that exposure concentrations of TAC are constant over a 70-year period for

[353] City of Los Angeles, Final Environmental Impact Report for Los Angeles International Airport (LAX) Proposed Master Plan Improvements, April 2004.

[354] 70 years is the lifetime expectancy typically assumed in USEPA risk assessments for an adult. In some cases, USEPA published toxicity values use 70 year lifetime assumption in the derivation of cancer slope factors or unit risks for the dose-response relationship. If a different lifetime expectancy was used, the toxicity value would require adjustment.

residential receptors. Exposure parameters used to calculate LADD and ADD for all receptors for the inhalation pathway are summarized in Appendix G1, *Human Health Risk Assessment*. Exposure parameters are based on the CalEPA *Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities*,[355] USEPA *Exposure Factors Handbook*,[356] and CalEPA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments*.[357] These exposure parameters were selected to maintain consistency with the health risk analyses conducted for the LAX Master Plan Final EIR, the SAIP EIR,[358] the Bradley West Project EIR,[359] and the CFTP EIR.[360] However, the CalEPA *Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments* recommends that a range of exposure durations be evaluated. Additional analyses on exposure durations are presented in Section 5, Uncertainties, of Appendix G1, *Human Health Risk Assessment*.

Toxicity Assessment

Risks from exposure to TAC were calculated by combining estimates of exposure with appropriate toxicity criteria. A toxicity assessment for TAC of concern was conducted for the LAX Master Plan Final EIR, as described in Technical Report 14a of that EIR. Conclusions of that assessment have not changed materially. Both the CalEPA OEHHA and USEPA continually update toxicity values as new studies are completed, all toxicity information provided in Technical Report 14a was reviewed and updated as appropriate by researching recent information available from USEPA, CalEPA OEHHA, World Health Organization (WHO), and Agency for Toxic Substance and Disease Registry (ATSDR). Revised toxicity profiles are provided as Attachment 1 to Appendix G1, *Human Health Risk Assessment*. Cancer slope factors and chronic RELs developed by the State of California were used to characterize cancer risks and chronic non-cancer health hazards associated with longer term exposure to construction and operational emissions.

Acute RELs developed by the State of California were used in the characterization of potential acute non-cancer health hazards associated with the SPAS alternatives. Other sources of acute toxicity criteria (e.g., ATSDR) were evaluated as a source of acute criteria as part of this re-assessment of toxicity information. Toxicity values for all TAC assessed in the HHRA are provided in tables in Appendix G1, *Human Health Risk Assessment*.

Risk Characterization

Methodology for Evaluating Cancer Risks and Chronic Non-Cancer Health Hazards

Cancer risks were 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. Cancer risks were based on an exposure duration of 70 years.

Chronic non-cancer health hazard estimates were calculated by dividing exposure estimates by reference doses. Reference doses are estimates of the highest exposure levels that would not cause adverse health effects even if exposures continue over a lifetime. A ratio that is less than one indicates that

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355 California Environmental Protection Agency, Supplemental Guidance for Human Health Multimedia Risk Assessments of Hazardous Waste Sites and Permitted Facilities, 1993.

356 U.S. Environmental Protection Agency, Exposure Factors Handbook, EPA/600/R-09/052F, September 2011.

357 California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003.

358 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) South Airfield Improvement Project, August 2005.

359 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Bradley West Project, September 2009.

360 City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Crossfield Taxiway Project, January 2009.

SPAS-related (incremental) exposure was less than the highest exposure level that would not cause adverse health effects and, hence, no impact to human health would be expected.

As noted in Section 4.7.1.2.2, 327 grid points were analyzed along the airport fence-line and within the study area (**Figure 4.7.1-1**) for each of the SPAS alternatives. Concentrations of each TAC at these grid nodes were used in the cancer risk and chronic and acute non-cancer health hazard estimates. These calculations were used to identify locations with maximum cancer risks and maximum non-cancer health hazards. These locations represent MEI as defined in Section 4.7.1.1 and were used in the significance determinations. In many instances, incremental cancer risk estimates are negative. That is, estimates for implementing a SPAS alternative are less than risk estimates for baseline conditions. When this situation occurs, incremental cancer risks are also reported for fence-line locations where the impact of construction emissions is anticipated to be greatest. This approach helps to illustrate the range of possible beneficial impacts. Note that the magnitude of beneficial impacts would decrease with distance from the fence-line because total impacts from airport emissions decrease with distance from the fence-line. In general, the percent beneficial impact would be similar in areas surrounding the airport.

Results from air dispersion modeling indicate that concentrations of TAC at fence-line grid nodes are the highest or near-highest concentrations that could be considered "off-airport." Concentrations in areas where people actually work, live, or attend school are predicted to be lower. Estimated impacts for residents, workers, and school children using TAC concentrations at fence-line grid nodes overestimates risks and hazards at off-airport locations where people actually live, work, or attend school. These locations were thus used to define MEI and therefore to provide protective estimates for risks and hazards. Note that the analysis used maximum predicted impacts even if these impacts occurred at locations where no receptors (people) currently work, live, recreate, or go to school (i.e., the LAX fence-line). This approach provides an additional level of protection in the estimates for health impacts.

MEI estimates were also land use specific. Land use designations (commercial, residential, etc.) were used to identify receptor type at each grid node used in the air dispersion analysis. For off-airport locations, surrounding land use was used to identify appropriate receptors. For fence-line grid points, land use designations in nearest off-airport areas were used to identify the receptor type. Risk and hazard calculations were based on receptors appropriate for the land use designations. For example, if a grid node was identified as commercial land use, exposure parameters appropriate for adult commercial workers were used to estimate exposures, cancer risks, and non-cancer health hazards at that grid point location. For grid nodes identified as residential or school, exposure parameters for both residential receptors and school children were used to estimate exposures, cancer risks, and chronic non-cancer health hazards at that grid point location. This approach was used for the residential and school grid points because, over the long term, schools could be constructed in residential areas and current school locations could become residential areas.

Off-airport grid nodes were evaluated to provide perspective on the range of incremental cancer risks and chronic non-cancer health hazards that might be realized in the communities surrounding LAX. Risk and hazard estimates at each grid node used both modeled TAC concentrations at that node as well as land use appropriate for the location. The analysis of off-airport TAC concentrations thus provides an illustration of the distribution of health impacts, which reflect both TAC releases and land use.

Methodology for Evaluating Acute Non-Cancer Health Hazard Impacts

As with cancer risks and chronic non-cancer health hazards, acute non-cancer health hazards were analyzed at 327 grid points within the study area. Land use distinctions and different exposure scenarios are irrelevant for assessment of acute non-cancer health hazards. For example, someone visiting a commercial establishment would be subject to the same acute non-cancer health hazards as someone working at the establishment. However, likely receptors (residential, school, and occupational) for each grid point were designated through inspection of aerial photos, since these designations may provide some reflection of populations more likely to be exposed in certain locations. Residential land use was, for example, assumed for grid points that are adjacent to residential areas. Acute non-cancer health hazards at these locations may reflect the relative magnitude of acute non-cancer health hazards in residential areas nearest to emission sources. Likewise, off-airport workers were assumed at receptor locations that are adjacent to commercial land uses. Three schools, Saint Bernard High School, Visitation Catholic Elementary School, and Imperial Avenue School, were identified as school sites in the study area closest to the fence-line; potential acute non-cancer health hazards for school children were estimated at the grid points closest to these locations.

Negative hazards (beneficial impacts) were suggested for some fence-line locations, but incremental increases in non-cancer hazard were projected for most fence-line locations. Thus, locations for MEI generally correspond to locations where construction impacts are likely to be highest.

Acute non-cancer health hazards were estimated at each grid point by comparison of the modeled TAC concentration at each grid point with the acute REL. Short-term concentrations for TAC associated with implementation of SPAS alternatives were used to assess acute non-cancer health hazards. These concentrations were estimated using the same AERMOD used to estimate annual average concentrations, but with the model option for 1-hour maximum concentrations selected. These concentrations represent the highest predicted concentrations of TAC. Acute non-cancer health hazards were then estimated at each grid point by dividing estimated maximum 1-hour TAC concentrations in air by acute RELs. A hazard index equal to or greater than 1, the threshold of significance for acute non-cancer health impacts, indicates some potential for adverse acute non-cancer health impacts. A hazard index less than 1 suggests that adverse acute non-cancer health impacts are not expected.

Toxicity criteria (i.e., RELs) for acute non-cancer health hazards do not distinguish between adults and children, but are established at levels that are considered protective of sensitive populations. An acute REL is a concentration in air below which adverse effects are unlikely, including in sensitive subgroups. In most cases, RELs were estimated on the basis of a 1-hour exposure duration. CalEPA's OEHHA has developed acute RELs for several of the TAC of concern identified in emissions from the airport.

As noted in the LAX Master Plan Final EIR, acrolein is a TAC of concern and is responsible for the majority of all predicted chronic non-cancer health hazards associated with LAX operations. Acrolein release is primarily due to aircraft emissions (i.e., operation emission estimates). Although other TAC of concern associated with LAX operations are unlikely to be present in concentrations that would represent an acute non-cancer health hazard, adverse acute non-cancer health hazard impacts for all TAC for which CalEPA has developed acute RELs, not just acrolein, were evaluated for potential acute non-cancer health impacts.

Finally, acute non-cancer health hazards apply to all human receptors and do not change with land use. However, most likely receptors (residential, school, and occupational) were identified at each grid node for the acute non-cancer health hazards analysis. For fence-line locations, land use closest to the airport at each grid node was used to identify the most likely receptor for the fence-line location. These land use designations provide some indication of likely receptors for different locations around the airport. For example, young children are likely receptors at fence-line locations nearest to schools. An exceedance of an acute REL at such locations might be considered differently, not because of higher risk, but because school children might be primary receptors.

Evaluation of Health Effects for On-Airport Construction Workers

Impacts to construction workers were evaluated by comparing estimated acute 1-hour air concentrations of TAC at the LAX Theme Building associated with operation of the SPAS alternatives to 8-hour standards, referred to as PEL-TWAs, established by CalOSHA.

Uncertainties

Uncertainties are present in all facets of HHRA. For this analysis, uncertainties identified included uncertainties associated with emission estimates and dispersion modeling, evaluation of sensitive receptor populations, exposure parameter assumptions, toxicity assessment, use of Risk Assessment

Guidance for Superfund (RAGS) F methodology instead of RAGS A methodology,[361] background estimates, and interactions among acrolein and criteria pollutants. Detailed discussions of these uncertainties associated with the HHRA are presented in Appendix G1, *Human Health Risk Assessment*. Although the impact of some of these uncertainties on the analysis cannot be predicted, overall, the approach used in this analysis is believed to be protective and most appropriate for assessing the health risks associated with the SPAS alternatives.

4.7.1.3 Existing Conditions

Evaluation of health impacts associated with the SPAS alternatives focuses on exposure to air pollutants released by construction activities and changes in operational activity associated with implementation of these alternatives. TAC releases subsequent to buildout of the SPAS improvements are addressed in this HHRA as incremental increases (or decreases) over 2009 baseline conditions.

Baseline conditions discussed herein refer to calendar year 2009, the last full calendar year for which air quality data were available from the SCAQMD prior to the release of the SPAS NOP. As operational activity in 2009 was lower than (2012) current conditions,[362] use of this baseline year is considered to provide a conservative (i.e., protective) analysis.

4.7.1.4 Thresholds of Significance

Significance determinations for health impacts are assessed as incremental increases or decreases in cancer risks and non-cancer health hazards. A significant[363] incremental impact to human health would occur if changes in airport operations following implementation of the particular SPAS alternative would result in one or more of the following future conditions:

- An increased incremental cancer risk[364] greater than, or equal to, 10 in one million (10×10^{-6}) for potentially exposed off-site workers, residents, or school children.
- A total incremental chronic hazard index[365] greater than, or equal to, one for any target organ system[366] at any receptor location.
- A total incremental acute hazard index greater than, or equal to, one for any target organ system at any receptor location.
- Exceedance of Permissible Exposure Limits - Time Weighted Average or Threshold Limit Values for workers.

The thresholds listed above are based on SCAQMD guidance. The SCAQMD is in the process of developing an "Air Quality Analysis Guidance Handbook" (Handbook) to replace the 1993 SCAQMD

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361 RAGS (Risk Assessment Guidance for Superfund) establishes methods used for estimating human health risks associated with chemical exposure. RAGS Part A established general methods for such assessment for exposure via inhalation of chemicals in air, but these methods were superseded by new methods published in RAGS Part F. This change in guidance occurred during the life of the LAX Master Plan environmental analysis, such that older risk assessments used RAGS Part A methods, but more recent assessments have used, and are using, updated RAGS Part F methods.

362 Passenger activity levels at LAX have been gradually increasing over the past few years, with 2009 having approximately 56.5 MAP, 2010 having 59.1 MAP, and 2011 having 61.9 MAP.

363 The term "significant" is used as defined in CEQA regulations and does not imply an independent judgment of the acceptability of risk or hazard.

364 Incremental cancer risk is defined as the difference in potential cancer risks between the alternatives and baseline conditions (2009).

365 For purposes of this analysis, a health hazard is any non-cancer adverse impact on health. (Cancer-related risks are addressed separately in this analysis.) A chronic health hazard is a hazard caused by repeated exposure to small amounts of a TAC. An acute health hazard is a hazard caused by a single or a few exposures to relatively large amounts of a chemical. A hazard index is the sum of ratios of estimated exposures to TAC and recognized safe exposures developed by regulatory agencies.

366 A target organ or organ system is an organ or tissue in the human body (e.g., liver, skin, lungs) that is harmed by exposure to a chemical at the lowest levels of exposure (chronic exposure), or is the first to be harmed by high levels of exposure (acute exposure).

CEQA Air Quality Handbook. Although not yet fully published, SCAQMD has made certain sections of the Handbook available, including their air quality significance thresholds, which provide thresholds for TAC.[367] Thresholds for workers are based on standards developed by CalOSHA.[368]

4.7.1.5 Applicable LAX Master Plan Commitments and Mitigation Measures

As part of the LAX Master Plan and as described in Section 4.2, *Air Quality*, LAWA adopted commitments and mitigation measures pertaining to air quality (denoted with "AQ") in the Alternative D Mitigation Monitoring and Reporting Program (MMRP). These commitments and measures would reduce emissions of TAC bound to PM (e.g., DPM and metals) during operations. The calculation of TAC emissions and dispersion for the SPAS alternatives assumed implementation of these measures pertaining to ongoing airport operations.

Of the three LAX Master Plan commitments and four mitigation measures that were designed to address air quality impacts related to implementation of the LAX Master Plan, none of the commitments and all of the mitigation measures are applicable to the SPAS alternatives and were considered in the HHRA. As discussed in Section 4.2, *Air Quality*, these measures are technologically/legally feasible and economically reasonable methods to reduce emissions both on and off the airport. The following provides a summary of LAX Master Mitigation Measures MM-AQ-1, MM-AQ-2, MM-AQ-3, and MM-AQ-4, as related to the HHRA analysis herein; the full text of these mitigation measures is included in the LAX Master Plan MMRP available at www.ourlax.org.

- **LAX Master Plan - Mitigation Plan for Air Quality; MM-AQ-1, Framework.**

  This measure provides the basic organizational structure for the full LAX MP-MPAQ. It is also intended to furnish LAWA with a clear, consistent, and convenient foundation for the implementation of the plan. With the Framework's "overarching" configuration, the individual components of the LAX MP-MPAQ (i.e., MM-AQ-2, Construction-Related Mitigation Measures; MM-AQ-3, Transportation-Related Mitigation Measures; and MM-AQ-4, Operations-Related Mitigation Measures) will be better coordinated and completed. The Framework contains the basis and background information for the LAX MP-MPAQ; it identifies the roles and responsibilities of the lead agency, its consultants and contractors; and outlines the approach for monitoring the progress of the plan. Other relevant information in the Framework includes the overall LAX Master Plan and LAX MP-MPAQ schedules, contact information and other supporting materials.

  MM-AQ-1 is complete and was adopted by the Board of Airport Commissioners in December 2005,[369] and its policies and procedures would apply to all SPAS alternatives.

- **LAX Master Plan - Mitigation Plan for Air Quality; MM-AQ-2, Construction-Related Mitigation Measures.**

  This measure describes numerous specific actions to reduce fugitive dust emissions and exhaust emissions from on-road and off-road mobile and stationary sources used in construction. As discussed in the MMRP and Section 4.6.8 of the LAX Master Plan Final EIR, the LAX Master Plan did not quantify potential emission reductions associated with all of the mitigation measures that fall under MM-AQ-2. Emission reduction measures that were quantified and included in the mitigated emissions inventory presented in Section 4.6.8.5 of the LAX Master Plan Final EIR are described in

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367 South Coast Air Quality Management District, CEQA Air Quality Handbook, 1993, as updated by "SCAQMD Air Quality Significance Thresholds," March 2011, Available: http://www.aqmd.gov/ceqa/handbook/signthres.pdf, accessed June 21, 2012.

368 California Occupational Safety and Health Administration, Permissible Exposure Limits for Chemical Contaminants, Table AC-1, Available: http://www.dir.ca.gov/Title8/5155table_ac1.html, accessed June 21, 2012.

369 City of Los Angeles, Los Angeles World Airports, LAX Master Plan Mitigation Plan for Air Quality (MPAQ), MM-AQ-1: Framework, prepared by URS Corp. and KB Environmental Sciences, Inc., October 2005.

Table 4.7.1-2. For the LAX SPAS air quality analysis, it was assumed that these mitigation measures would be in place for all LAX SPAS-related construction. Some components of MM-AQ-2 are not readily quantifiable, but would be implemented as part of LAX SPAS. These mitigation strategies, presented in **Table 4.7.1-3**, are expected to further reduce construction-related emissions associated with LAX SPAS.

MM-AQ-2 is complete and was adopted by the Board of Airport Commissioners in December 2005,[370] and the mitigation elements presented in these tables would apply to all SPAS alternatives where construction is required. Other feasible mitigation measures may be adopted.

Table 4.7.1-2

Construction-Related Mitigation Measures Incorporated into Construction Emissions Inventories

Mitigation Measure	Potential Emissions Reduction by Equipment
Heavy Duty Diesel (Off-road)	
Particulate Traps (where technologically feasible)	85% PM10 and 85% PM2.5, adjusted for compatibility
Fugitive dust caused by on- and off-site vehicle trips	
Watering (per SCAQMD Rule 403)	50% PM10 and 50% PM2.5

Source: CDM Smith, 2012.

Table 4.7.1-3

Construction-Related Air Quality Mitigation Measures Not Quantified in the Construction Emissions Inventories

Measure	Type of Measure
Post a publicly visible sign with the telephone number and person to contact regarding dust complaints; this person shall respond and take corrective action within 24 hours.	Fugitive Dust
Prior to final occupancy, the applicant demonstrates that all ground surfaces are covered or treated sufficiently to minimize fugitive dust emissions.	Fugitive Dust
All roadways, driveways, sidewalks, etc., being installed as part of the project should be completed as soon as possible; in addition, building pads should be laid as soon as possible after grading.	Fugitive Dust
Pave all construction access roads at least 100 feet on to the site from the main road.	Fugitive Dust
To the extent feasible, have construction employees' work/commute during off-peak hours.	On-Road Mobile
Make available on-site lunch trucks during construction to minimize off-site worker vehicle trips.	On-Road Mobile
Prohibit staging and parking of construction vehicles (including workers' vehicles) on streets adjacent to sensitive receptors such as schools, daycare centers, and hospitals.	Nonroad Mobile
Prohibit construction vehicle idling in excess of ten minutes.	Nonroad Mobile

370 City of Los Angeles, Los Angeles World Airports, LAX Master Plan Mitigation Plan for Air Quality (MPAQ), MM-AQ-2: Construction-Related Mitigation Measures, prepared by URS Corp. and KB Environmental Sciences, Inc., October 2005.

Table 4.7.1-3

Construction-Related Air Quality Mitigation Measures Not Quantified in the Construction Emissions Inventories

Measure	Type of Measure
Utilize on-site rock crushing facility, when feasible, during construction to reuse rock/concrete and minimize off-site truck haul trips.	Nonroad Mobile
Specify combination of electricity from power poles and portable diesel- or gasoline-fueled generators using "clean burning diesel" fuel and exhaust emission controls.	Stationary Point Source Controls
Suspend use of all construction equipment during a second-stage smog alert in the immediate vicinity of LAX.	Mobile and Stationary
Utilize construction equipment having the minimum practical engine size (i.e., lowest appropriate horsepower rating for intended job).	Mobile and Stationary
Require that all construction equipment working on-site is properly maintained (including engine tuning) at all times in accordance with manufacturers' specifications and schedules.	Mobile and Stationary
Prohibit tampering with construction equipment to increase horsepower or to defeat emission control devices.	Mobile and Stationary
The contractor or builder shall designate a person or persons to ensure the implementation of all components of the construction-related measure through direct inspections, record reviews, and investigations of complaints.	Administrative

Source: CDM Smith, 2012.

- **LAX Master Plan - Mitigation Plan for Air Quality; MM-AQ-3, Transportation-Related Mitigation Measures.**

  This measure applies to mass transit, surface traffic, and on-site parking facilities. The principal feature of MM-AQ-3 is to replicate and expand the current LAX FlyAway service to other communities within regions of Los Angeles County. This initiative also includes a public outreach program to encourage the use of both the existing and new facilities. For the mitigated emissions inventory presented in Section 4.6.8.5 of the LAX Master Plan Final EIR, only emissions reductions associated with the new FlyAway capacity were quantified to account for the ensuing decrease in vehicle miles traveled (VMT) region-wide combined with less traffic congestion in the vicinity of the airport and the use of clean-fueled buses used in FlyAway service. The remaining, secondary, transportation-related air quality mitigation measures contained in MM-AQ-3 may also be implemented to help ensure the emission reduction goals of the LAX Master Plan Final EIR and MMRP are achieved. It should be noted that no estimate of the air quality benefit (i.e., emission reductions) was made in the LAX Master Plan Final EIR for these remaining, secondary transportation-related measures. These mitigation strategies, presented in **Table 4.7.1-4**, are expected to reduce further the transportation-related emissions associated with the LAX SPAS alternatives. Other transportation-related air quality mitigation measures that are found to be equally feasible and practical, but that were not specifically identified in the MMRP, may also be considered.

  The elements of MM-AQ-3 would apply to all SPAS alternatives that include ground access components, and LAWA would complete preparation of MM-AQ-3 prior to the commencement of implementing any SPAS alternative.

Table 4.7.1-4

Transportation-Related Air Quality Mitigation Measures

Measure	Type of Measure
Construct on-site or off-site bus turnouts, passenger benches, or shelters to encourage transit system use	Transit Ridership
Construct on-site or off-site pedestrian improvements, including showers for pedestrian employees to encourage walking/bicycling to work by LAX employees	Transit Ridership
Link Intelligent Transportation Systems (ITS) with off-airport parking facilities with ability to divert/direct trips to these facilities to reduce traffic/parking congestion and the associated air emissions in the immediate vicinity of the airport	Highway/Roadway Improvements
Expand ITS and Adaptive Traffic Control Systems (ATCS), concentrating on I-405 and I-105 corridors, extending into South Bay and Westside surface street corridors to reduce traffic/parking congestion and associated air emissions in the immediate vicinity of the airport	Highway/Roadway Improvements
Link LAX traffic management system with airport cargo facilities, with ability to re-route cargo trips to/from these facilities to reduce traffic/parking congestion and associated air emissions in the immediate vicinity of the airport	Highway/Roadway Improvements
Develop a program to minimize use of conventional-fueled fleet vehicles during smog alerts to reduce air emissions from vehicles at the airport	Highway/Roadway Improvements
Provide free parking and preferential parking locations for ultra low emission vehicles/super low emission vehicles/zero emission vehicles (ULEV/SULEV/ZEV) in all (including employee) LAX lots; provide free charging stations for ZEV; include public outreach to reduce air emissions from automobiles accessing airport parking	Parking
Develop measures to reduce air emissions of vehicles in line to exit parking lots such as pay-on-foot (before getting into car) to minimizing idle time at parking check out, including public outreach	Parking
Implement on-site circulation plan in parking lots to reduce time and associated air emissions from vehicles circulating through lots looking for parking	Parking
Encourage video conferencing capabilities at various locations on the airport to reduce off-site local business travel and associated VMT and air emissions in the vicinity of the airport	Parking
Expand LAWA's rideshare program to include all airport tenants	Additional Ridership
Promote commercial vehicles/trucks/vans using terminal areas (LAX and regional intermodal) to install SULEV/ZEV engines to reduce vehicle air emissions	Clean Vehicle Fleets
Promote "best-engine" technology for rental cars using on-airport rent-a-car facilities to reduce vehicle air emissions	Clean Vehicle Fleets
Consolidate non-rental car shuttles using SULEV/ZEV engines to reduce vehicle air emissions	Clean Vehicle Fleets
Cover, if feasible, any parking structures that receive direct sunlight, to reduce volatile emissions from vehicle gasoline tanks; and install solar panels on these roofs where feasible to supply electricity or hot water to reduce power production demand and associated air emissions at utility plants	Energy Conservation

Source: CDM Smith, 2012.

- **LAX Master Plan - Mitigation Plan for Air Quality; MM-AQ-4, Operations-Related Mitigation Measures.**

  Consistent with the LAX Master Plan Final EIR and the MMRP, the principle feature of this measure is the conversion of LAX GSE to low and ultra-low emission technology (e.g., electric, fuel cell, and other future low-emission technologies), and emissions reductions associated with this measure were quantified in the LAX Master Plan Final EIR to account for emissions that would otherwise be generated from the combustion of fossil fuels in GSE. Both LAWA- and tenant-owned equipment would be included in this conversion program which would be implemented in phases and completed at the build-out of the LAX Master Plan projects. LAWA would assign a GSE coordinator whose responsibilities it would be to ensure the successful conversion of GSE in a timely manner. This coordinator must have adequate authority to negotiate on behalf of the City and have sufficient technical support to evaluate technical issues that arise during the implementation of this measure. Other operations-related air quality mitigation measures that are found to be equally feasible and practical, but that were not specifically identified in the MMRP, may also be considered.

  MM-AQ-4 would apply to all SPAS alternatives that include airport operations components, and LAWA would complete preparation of MM-AQ-4 prior to the commencement of implementing any SPAS alternative.

Additionally, the LAX Master Plan Community Benefits Agreement (CBA) and Settlement Agreement include several air quality mitigation measures applicable to LAX Master Plan projects that would address impacts to human health. These measures (described in detail in Section 4.2, *Air Quality*) would apply to some or all SPAS alternatives.

- **LAX Master Plan Community Benefits Agreement; X.A., Electrification of Passenger Gates.**

  This provision requires that all passenger gates newly constructed by LAWA shall be equipped with and able to provide grid electricity to parked aircraft (for lighting and ventilation) from and after the date of initial operation and that LAWA will ensure that all aircraft (unless exempt) use the gate-provided grid electricity in lieu of electricity provided by operation of an auxiliary or ground power unit.

  This provision would apply in conjunction with construction or modification of passenger gates that occurs as a result of implementing any of the SPAS alternatives, specifically Alternatives 1, 2, 3, 5, 6, and 7.

- **LAX Master Plan Community Benefits Agreement; X.F., Construction Equipment.**

  LAWA shall require that all diesel-fueled equipment used for construction related to the LAX Master Plan Program be outfitted with the best available emission control devices primarily to reduce emissions of diesel particulate matter (PM), including fine PM (PM2.5), and secondarily, to reduce emissions of NO_x. This requirement shall apply to diesel-fueled off-road equipment (such as construction machinery), diesel-fueled on-road vehicles (such as trucks), and stationary diesel-fueled engines (such as electric generators). The emission control devices utilized in construction equipment in the LAX Master Plan Program shall be verified or certified by CARB or USEPA for use in on-road or off-road vehicles or engines. This provision also requires the use of ultra-low sulfur diesel (ULSD) fuel in construction equipment, places limitations on the amount of idling of diesel-fueled engines, requires following manufacturer's engine maintenance recommendations, and an annual reassessment of determinations of what constitutes best available emission control devices.

  This provision would apply in conjunction with construction that occurs as a result of implementing any of the SPAS alternatives.

- **LAX Master Plan Community Benefits Agreement; X.K., PM2.5.**

  This provision requires LAWA to assess the impacts from the emissions of fine particulate matter (PM2.5) within the context of a CEQA analysis and to mitigate such emissions that exceed applicable thresholds of significance.

Since SCAQMD established thresholds of significance for PM2.5 in October 2006, this provision would apply in conjunction with construction and operations that occur as a result of implementing any of the SPAS alternatives.

- **LAX Master Plan Community Benefits Agreement; X.L., Rock-Crushing Operations and Construction Materials Stockpiles.**

  This provision requires LAWA to locate rock-crushing operations and construction material stockpiles for all construction-related to the LAX Master Plan Program in areas away from LAX-adjacent residents to reduce impacts from emissions of fugitive dust.

  This requirement would be included in specifications for any SPAS alternative requiring on-site construction.

- **LAX Master Plan Community Benefits Agreement; X.M., Limits on Diesel Idling.**

  This provision requires LAWA to prohibit idling or queuing of diesel-fueled vehicles and equipment for more than ten consecutive minutes on-site.

  This requirement would be included in specifications for any SPAS alternative requiring on-site construction.

- **LAX Master Plan Community Benefits Agreement; X.N., Provision of Alternative Fuel.**

  This provision requires LAWA to make sure that there is available and sufficient infrastructure on-site, where not operationally or technically infeasible, to provide fuel to alternative-fueled vehicles to meet all requests for alternative fuels from contractors and other users of LAX. This would apply not only to construction equipment but to operations-related vehicles on-site.

  This provision would apply in conjunction with construction or modification of passenger gates that occurs as a result of implementing any of the SPAS alternatives to provide appropriate infrastructure for electric GSE.

4.7.1.6 Impacts Analysis

This section describes incremental health impacts associated with inhalation of TAC released during construction and during airport operations following implementation of the SPAS alternatives. Environmental consequences considered in this analysis include cancer risks, chronic (long-term) non-cancer health hazards, and acute (short-term) non-cancer health hazards. Health impacts for on-airport workers from inhalation of TAC are also considered.

The discussion of TAC concentrations in air and associated health impacts focuses on MEI. A review of previous health risk assessments conducted for LAX projects[371,372] indicate that maximum TAC concentrations associated with LAX activities occur at the airport fence-line, and the concentrations decrease as one moves away from the airport. For this analysis, MEI were conservatively identified as individuals that work, reside, or attend school at the LAX fence-line. Since no such individuals currently work, reside, or attend school at the LAX fence-line, estimates of risk and hazard overestimate health risk that may actually accrue as a result of implementation of the SPAS alternatives. No exposures or risks within the community would be higher than those calculated for MEI, and the HHRA is protective for all people within the study area. Risks and hazard estimates evaluate incremental risk associated with releases of TAC from construction and operational activities (aircraft operations, on-site mobile sources, and off-site regional traffic). As indicated in Section 4.7.1.1, the baseline year for evaluating incremental impacts is 2009, which is representative of 2010 conditions. The horizon year for buildout of the SPAS alternatives for purposes of analysis is 2025.

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[371] City of Los Angeles, Final Environmental Impact Report Los Angeles International Airport (LAX) Proposed Master Plan Improvements, April 2004.

[372] City of Los Angeles, Los Angeles World Airports, Final Environmental Impact Report for Los Angeles International Airport (LAX) Bradley West Project, September 2009.

Cancer risk and non-cancer health hazards are based on combined emission rates estimated for construction and airport operations after buildout of the SPAS alternatives, and on basic exposure assumptions used in the HHRA for the LAX Master Plan EIR, as revised to be consistent with recent USEPA and CalEPA guidance.[373,374] Cancer risks and non-cancer health hazards for MEI were calculated for adult residents, child residents 0 to 6 years of age, adult workers, and elementary-aged school children near or at fence-line locations where air concentrations for TAC were predicted. The discussion of human health risk emphasizes results for adult residents for cancer risks and for child residents for chronic non-cancer health hazards because these populations are expected to incur the greatest exposures to LAX-related emissions and would hence be subject to the greatest risks and hazards. For the acute non-cancer health hazard impact analysis, receptors were assumed to be located at grid points near or at the fence-line.

Methods used in the HHRA are protective and are more likely to overestimate than underestimate possible health risks. For example, as noted above, risks were calculated for residents and school children for locations near or at the LAX fence-line where TAC concentrations are predicted to be highest. Individuals are assumed to be exposed for almost all days of the year and for many years (e.g., 70 years for adult residents) to maximize estimates of exposure. Resulting incremental risk estimates are therefore upper-bound or ceiling predictions for people living, working, or attending school in the study area. If these upper-bound estimates do not exceed significance thresholds, then actual members of the population near LAX would also not experience risks or hazards that exceed these thresholds.

Calculations supporting the results presented in the following sections are provided in Attachment 2 of Appendix G1, *Human Health Risk Assessment*.

4.7.1.6.1 Cancer Risks

Peak SPAS-related cancer risks are summarized in **Table 4.7.1-5** and shown in **Figures 4.7.1-2** and **4.7.1-3**. Peak incremental cancer risk locations are the locations with the smallest negative increments (i.e., where beneficial impacts would be smallest). These locations are used to determine the significance of project impacts. However, these locations are not necessarily the locations where cancer risks are highest (i.e., MEI) under either baseline conditions or conditions with implementation of the SPAS alternatives. Rather, MEI are identified as being at locations where DPM concentrations and, consequently, cancer risks are highest. At MEI locations, beneficial impacts are substantial - that is, incremental cancer risks are more negative than they are at most other locations along the LAX fence-line. Both peak incremental cancer risk locations and MEI locations are identified in **Figures 4.7.1-2** and **4.7.1-3**.

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373 U.S. Environmental Protection Agency, Office of Emergency and Remedial Response, Risk Assessment Guidance for Superfund, Vol. I, Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment), Final, EPA-540-R-070-002, OSWER 9285.7-82, January 2009.http://www.epa.gov/oswer/riskassessment/ragsf/pdf/partf_200901_final.pdf

374 California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Guidance Manual for Preparation of Health Risk Assessments, August 2003. http://oehha.ca.gov/air/hot_spots/pdf/HRAguidefinal.pdf

Table 4.7.1-5

Peak Incremental Cancer Risks for the SPAS Alternatives

	Incremental Cancer Risks[1,2,3,4] (per million people)							
Receptor Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5[5]**	**Alt. 6[5]**	**Alt. 7[5]**	**Alts. 8 and 9[6,7]**
Child Resident	-0.70	-0.77	-0.74	-0.75	-0.60	-0.72 to-0.71	-0.72 to -0.71	-0.77 to -0.60
School Child	-0.13	-0.15	-0.14	-0.14	-0.12 to -0.11	-0.14	-0.14	-0.15 to -0.11
Adult Resident	-8.2	-9.0	-8.6	-8.7	-7.0	-8.4 to -8.3	-8.4 to -8.3	-9.0 to -7.0
Adult Worker	-4.8	-4.9	1.6	-4.3	-4.8	-4.8	-4.8	-4.9 to -4.8

Notes:

Peak incremental cancer risk locations are the locations with the smallest negative increments (i.e., where beneficial impacts would be smallest). These locations are used to determine the significance of project impacts.

1 Values provided are calculated using RAGS F methodology. See Appendix G1 for results calculated using RAGS A methodology.

2 Incremental values indicate changes in the number of cancer cases per million people exposed as compared to baseline conditions. Estimates are rounded to two significant figures.

3 Negative values indicate a beneficial impact.

4 Maximum values indicated are not all located at the same grid location.

5 Alternatives 5 through 7 focus primarily on airfield improvements and related terminal and roadway improvements. Those improvements are compatible with the ground access improvements proposed under Alternatives 1, 2, 8, and 9. Cancer risks presented in this table for Alternatives 1, 2, 5, 6, and 7 are based on TAC concentrations that are specific to the airfield and terminal characteristics of each of these alternatives; however, TAC concentrations associated with non-airfield sources (i.e., roadways, parking, stationary, and off-airport) included in the analysis of Alternatives 5 through 7 reflect the range predicted for Alternatives 1, 2, 8, and 9. Ranges are shown where combined TAC concentrations associated with airfield and related terminal and roadway improvements, and improvements associated with non-airfield sources, results in a range of cancer risk estimates. When only a single value is shown, it means that small differences among alternatives resulted in no changes in risk estimates when rounded to two significant figures. The emissions presented relative to both airfield and non-airfield operations for Alternatives 3 and 4 are specific to the characteristics of each of these alternatives, which still provide a basis for comparison with the other alternatives.

6 Alternatives 8 and 9 focus primarily on ground access improvements; however, those improvements are compatible with airfield improvements, and related terminal and roadway improvements, proposed under Alternatives 1, 2, 5, 6, and 7. The cancer risks presented in this table for Alternatives 1 and 2 are based on TAC concentrations that are specific to the non-airfield (i.e., roadways, parking, stationary, and off-airport) characteristics of each of these alternatives; however, cancer risks associated with Alternatives 8 and 9 reflect the range of risks for Alternatives 1, 2, 5, 6, and 7.

7 Although the improvements associated with Alternatives 8 and 9 are not identical (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover), cancer risks are predominantly driven by exposure to diesel particulate matter and emissions of diesel particulate matter from GSE would be the same for Alternatives 8 and 9. Therefore, only one range is shown for both alternatives.

Source: CDM Smith, 2012.

Alternative 1

As indicated in **Table 4.7.1-5**, emissions from construction and operational activities for Alternative 1 would result in peak incremental cancer risks of -8 in one million for adult residents and -0.7 in one million for child residents. Peak incremental cancer risks for school children at the peak residential location and for adult workers are estimated to be -0.1 in one million and -5 in one million, respectively. These risk estimates are based on modeling that incorporates select quantifiable mitigation measures from the LAX Master Plan MMRP (see Section 4.7.1.5), but otherwise assumes no additional mitigation. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -444 in one million and -162 in one million, respectively.

The negative values indicate that, relative to baseline conditions in 2009, some TAC concentrations at the LAX fence-line and in the study area would decrease after implementing Alternative 1. In most cases, these negative values are due primarily to reductions in emissions from on-road motor vehicles (cars and trucks carrying passengers and cargo to and from the airport). As emission standards for motor vehicles continue to become more stringent over time, and the motor vehicle fleet is replaced with newer, less-polluting cars and trucks, the daily emissions from these sources decrease substantially when compared to baseline (2009) conditions. The reduction in motor vehicle emissions occurs even though the total VMT for airport-related trips increases between the baseline (2009) period and 2025. This emissions reduction more than compensates for the growth in emissions from aircraft and APUs. Concentrations of DPM in air are anticipated to decrease, even considering releases of DPM during the construction phase, i.e., the increase in DPM emissions during construction would be less than the decrease in DPM emissions during operations. Since DPM is responsible for most of the cancer risk associated with emissions from LAX, a reduction in DPM results in an overall reduction in cancer risk. Since all risks are reported as incremental with respect to 2009 baseline conditions, cancer risks are reported as negative values to indicated reduced cancer risk as compared to 2009 baseline conditions.[375]

For example, if a population of adult residents was exposed to TAC concentrations at the peak location for 70 years after complete buildout of Alternative 1, approximately 8 fewer cancer cases per million people exposed might occur as a result of changes to airport operations. Thus, for this receptor under Alternative 1, a beneficial impact is predicted. Note that incremental risks reported in this HHRA do not consider the background cancer incidence in the United States, which is reported to be in the range of 1 in 3 to 1 in 2. Cancer risk reduction would therefore be realized against a very high background incidence.

Adult residents, for whom it is assumed exposure starts at birth and continues for 70 years, would have a greater change in incremental cancer risk than would children because of the long exposure. Emphasis is therefore placed on adults for purposes of determining significance. Changes in incremental cancer risks for children are not used since predicted cancer risks at a given location are less overall for children than are risks for adults. Information on childhood risks is provided to demonstrate the range of risk reduction for this alternative.

Exposure to DPM released during construction and airport operations contributed 85 percent of cancer risks for residents (adults and children) and school children, and 95 percent of cancer risks for adult workers. DPM concentrations in air in the study area are anticipated to be less for Alternative 1 than for 2009 baseline conditions. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC also increased. However, relatively small increases in risks from exposure to these TAC were more than offset by substantial decreases in DPM-related risks anticipated in 2025.

These estimates show that program-related cancer risks for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 10 in one million for Alternative 1 and are expected to result in decreases in cancer risks due to anticipated decreases in DPM emissions. Therefore, cancer risk impacts to human health under Alternative 1 would be less than significant and would be beneficial. As noted above, these beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE.

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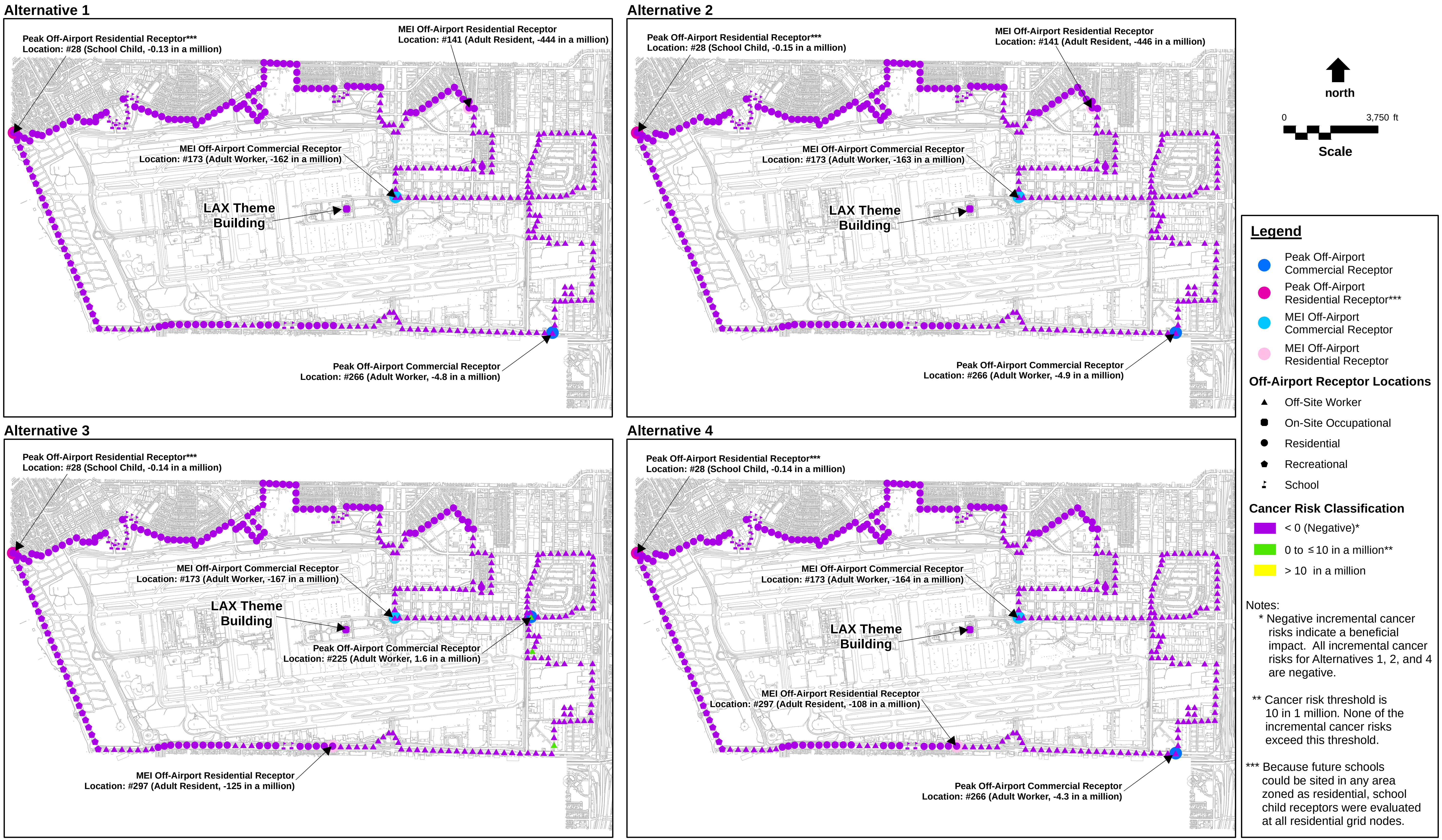
375 Incremental cancer risk estimates in most of the study area suggest smaller absolute decreases as compared to MEI estimates. In these locations, TAC concentrations are lower than they are at locations for MEI and risk reductions are generally similar on a percent of total (as opposed to incremental) cancer risk. As a hypothetical example, if total cancer risks at two locations were 8 and 4 x 10^{-6}, incremental cancer risks might be -2 and -1 x 10^{-6}. Note, however, that the decrease in DPM at all grid nodes in the study area is not uniform because differences in source locations and source strength between 2009 baseline conditions and Alternative 1 result in somewhat different distribution of TAC in dispersion model output. Thus, the best illustration of possible beneficial impacts comes from the analysis of incremental cancer risks on a grid node-by-grid node basis.



Source: CDM Smith, 2012.

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Geographic Representation of Construction and Operational Incremental Cancer Risks by Receptor Type – Alternatives 1, 2, 3, and 4

Figure
4.7.1-2

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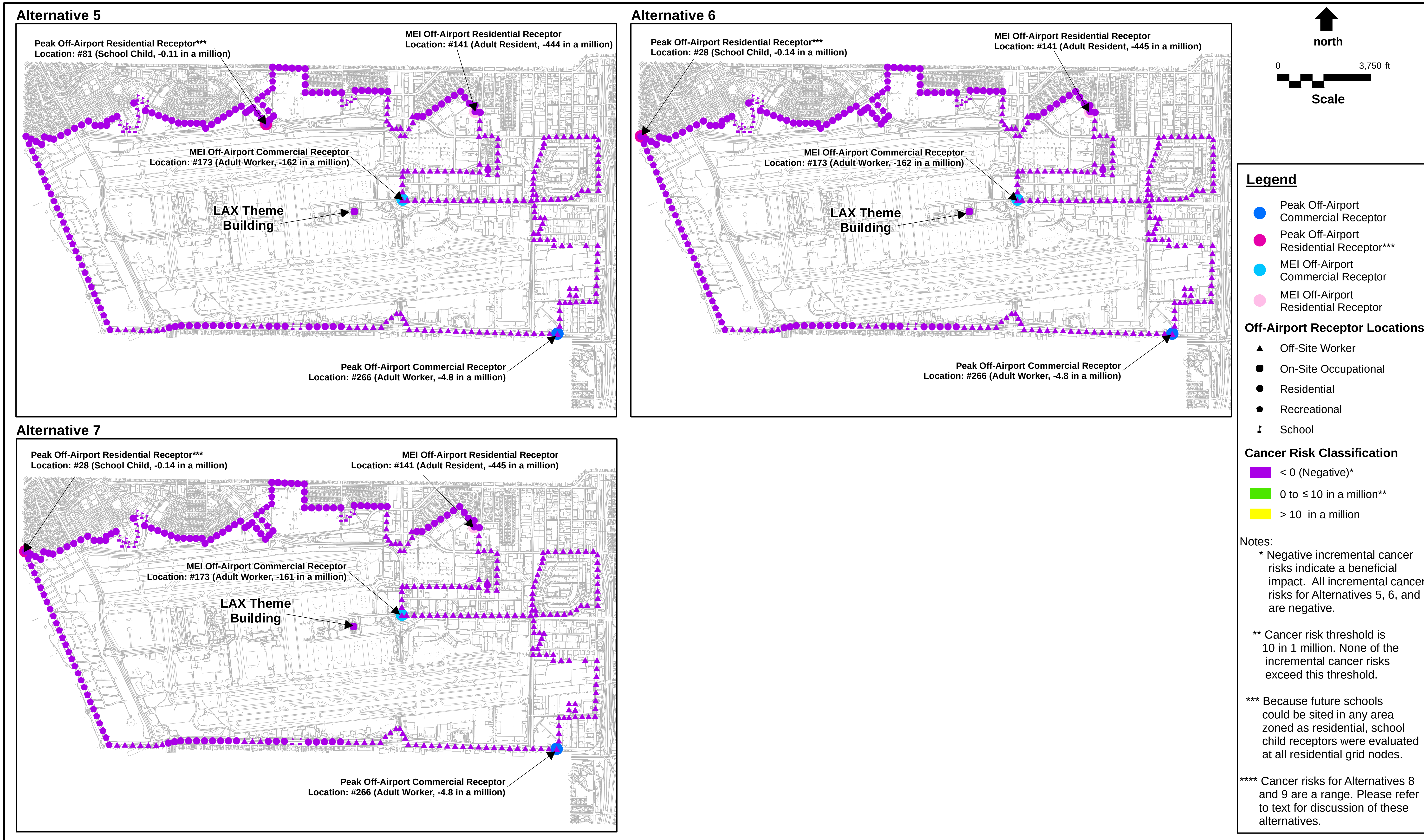

Source: CDM Smith, 2012.

LAX Specific Plan Amendment Study Draft EIR

Geographic Representation of Construction and Operational Incremental Cancer Risks by Receptor Type – Alternatives 5, 6 and 7

Figure 4.7.1-3

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Alternative 2

Negative incremental cancer risks are predicted for implementation of Alternative 2. As described under Alternative 1, these beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. In addition, Alterative 2 would have lower aircraft emissions than Alternatives 1, 3, 4, 5, 6, and 7.

When incremental cancer risks for Alternative 2 are rounded to one significant figure, risks are similar to incremental cancer risks for Alternative 1. (Rounding to a single significant figure is appropriate for the degree of uncertainty in the risk estimates.) Cancer risks are -9 in one million for adult residents and -0.8 in one million for child residents, and -0.2 in one million for the school child at the peak residential location, and -5 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -446 in one million and -163 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 88 percent of cancer risks for residents (adults and children) and school children, and 96 percent of cancer risks for adult workers. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by substantial decreases in DPM anticipated in 2025. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 2 would be less than significant and would be beneficial.

Alternative 3

Negative incremental cancer risks are predicted for implementation of Alternative 3. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE.

Cancer risks under Alternative 3 are estimated to be -9 in one million for adult residents, -0.7 in one million for child residents, and -0.1 in one million for the school child at the residential location with the maximum incremental cancer risk, and 2 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI is -125 in one million and -167 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 85 percent of cancer risks for residents (adults and children) and school children. Incremental cancer risks for adult workers are positive (higher than baseline) and DPM contributes 42 percent to these risks. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by substantial decreases in DPM anticipated in 2025. Overall, negative incremental cancer risks (beneficial impacts) are estimated for all receptors except adult workers. For these workers, incremental risks are estimated to be less than the threshold of significance.

Cancer risk impacts under Alternative 3 would be less than significant for all receptors and would be beneficial for all receptors except adult workers.

Alternative 4

Negative incremental cancer risks are predicted for implementation of Alternative 4. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE.

Cancer risks under Alternative 4 are estimated to be -9 in one million for adult residents, -0.8 in one million for child residents, and -0.1 in one million for the school child at the peak residential location, and -4 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -108 in one million and -164 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 87 percent of cancer risks for residents (adults and children) and school children, and 94 percent of cancer risks for adult workers. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 4 would be less than significant and would be beneficial. Roadway- and parking-related emissions associated with Alternative 4 would be less than the other alternatives because Alternative 4 includes a Consolidated Rental Car Facility (CONRAC), which would consolidate and reduce the number of individual rental car company shuttle trips. In addition, Alternative 4, with its minimal improvements, would have the lowest construction emissions of all the alternatives.

Alternative 5

Alternative 5 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 5 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 5 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental cancer risks was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for cancer are diesel construction equipment and GSE. Therefore, in some cases, the variance is so minor that it does not register in the results when risks are rounded to one or two significant figures.[376]

Negative incremental cancer risks are predicted for implementation of Alternative 5. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. In addition, Alternative 5 would have a reduction in airside emissions primarily due to increased efficiency in aircraft ground movement, as afforded through the proposed airfield improvements.

Cancer risks under Alternative 5 are estimated to be -7 in one million for adult residents, -0.6 in one million for child residents, -0.1 in one million for the school child at the residential location with the maximum cancer risk, and -5 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -444 in one million and -162 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 56 percent of cancer risks for residents (adults and children) and school children, and 95 percent of cancer risks for adult workers. Unlike DPM, formaldehyde and

[376] Results in the text are rounded to one significant figure as is appropriate for the uncertainty in calculations. However, results in tables are rounded to two significant figures to make minor differences among alternatives more evident.

1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 5 would be less than significant and would be beneficial.

Alternative 6

Alternative 6 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 6 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 6 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental cancer risks was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for cancer are diesel construction equipment and GSE. Therefore, in some cases, the variance is so minor that it does not register in the results when the risk values are rounded to one or two significant figures.

Negative incremental cancer risks are predicted for implementation of Alternative 6. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. In addition, Alternative 6 would have a reduction in airside emissions primarily due to increased efficiency in aircraft ground movement, as afforded through the proposed airfield improvements.

When incremental cancer risks for Alternative 6 are rounded to one significant figure, the incremental cancer risks are the same as incremental cancer risks for Alternative 1. Cancer risks are estimated to be -8 in one million for adult residents, -0.7 in one million for child residents, and -0.1 in one million for the school child at the residential location with the maximum cancer risk, and -5 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -445 in one million and -162 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 86 percent of cancer risks for residents (adults and children) and school children, and 96 percent of cancer risks for adult workers. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM and, overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 6 would be less than significant and would be beneficial.

Alternative 7

Alternative 7 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 7 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 7 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental cancer risks was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for cancer are diesel construction equipment and GSE. Therefore, in some cases, the variance is so minor that it does not register in the results when the risk values are rounded to one or two significant figures.

Negative incremental cancer risks are predicted for implementation of Alternative 7. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. In addition, Alternative 7 would have a reduction in airside emissions primarily due to increased efficiency in aircraft ground movement, as afforded through the proposed airfield improvements.

When incremental cancer risks for Alternative 7 are rounded to one significant figure, risks are the same as the incremental cancer risks for Alternative 1. Cancer risks are estimated to be -8 in one million for adult residents, -0.7 in one million for child residents, and -0.1 in one million for the school child at the residential location with the maximum cancer risk, and -5 in one million for the adult worker at the peak commercial location. The incremental cancer risks for the adult resident and adult worker at the location for MEI are -445 in one million and -161 in one million, respectively. Exposure to concentrations of DPM released during construction and operations contributed to 85 percent of cancer risks for residents (adults and children) and school children, and 95 percent of cancer risks for adult workers. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 7 would be less than significant and would be beneficial.

Alternative 8

Alternative 8 focuses on ground access improvements. The ground access configuration under Alternative 8 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental cancer risks was estimated. Alternative-specific concentrations were not modeled for Alternative 8, as these values would fall between the high and low ends of the range. Instead, the cancer risks for Alternative 8 were estimated to be the maximum and minimum risks for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental cancer risks. (As explained previously, the cancer risks for Alternatives 5, 6, and 7 were based on TAC concentrations associated with both airfield and non-airfield sources.) The minimum and maximum of the ranges of the peak locations are presented in **Table 4.7.1-5**.

Negative incremental cancer risks are predicted for implementation of Alternative 8. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. Alternative 8 (and Alternative 9) would also have the second-lowest amount of off-airport traffic emissions, with only Alternative 3 having lower off-airport traffic emissions.

Cancer risks under Alternative 8 are estimated to range from -9 to -7 in one million for adult residents, -0.8 to -0.6 in one million for child residents, and to be -0.2 to -0.1 in one million for the school child at the residential location with the maximum cancer risk, and -5 in one million for the adult worker at the peak commercial location. Exposure to concentrations of DPM released during construction and operations contributed to the majority of cancer risks. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased.

However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 8 would be less than significant and would be beneficial.

Alternative 9

Alternative 9 focuses on ground access improvements. The ground access configuration under Alternative 9 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental cancer risks was estimated. The annual average TAC concentrations for the ground access component of Alternative 9 were modeled and added to the airfield components of Alternatives 5, 6, and 7 to provide the low end of the range of impacts for those alternatives discussed above, since Alternative 9 has the lowest emissions for the ground access component. However, the range of impacts due to different ground access options did not alter the peak risk values when rounded to one or two significant figures. Therefore, the cancer risks for Alternative 9 were estimated to be the maximum and minimum hazards for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental cancer risks. The minimum and maximum of the ranges of the peak locations are presented in **Table 4.7.1-5**.

Although the improvements associated with Alternatives 8 and 9 are not the same (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover [APM]), the incremental cancer risks for these alternatives are estimated to be the same. This is because cancer risks at LAX are driven by concentrations of DPM, whose sources (e.g., construction equipment and GSE) would not vary between these two alternatives.

Negative incremental cancer risks are predicted for implementation of Alternative 9. For all alternatives, the beneficial impacts are primarily due to ongoing implementation of more stringent motor vehicle emissions standards, cleaner future fleet mixes, and the decrease in stationary source emissions attributable to the replacement CUP, currently under construction. These reductions in future emissions, particularly those associated with future motor vehicle emissions, are anticipated to more than offset the estimated increases in other types of emissions, such as from aircraft, APU, and GSE. Alternative 9 (and Alternative 8) would also have the second-lowest amount of off-airport traffic emissions, with only Alternative 3 having lower off-airport traffic emissions.

Cancer risks under Alternative 9 are estimated to range from -9 to -7 in one million for adult residents, -0.8 to -0.6 in one million for child residents, and to be -0.2 to -0.1 in one million for the school child at the residential location with the maximum cancer risk, and -5 in one million for the adult worker at the peak commercial location. Exposure to concentrations of DPM released during construction and operations contributed to the majority of cancer risks. Unlike DPM, formaldehyde and 1,3-butadiene concentrations increased and incremental cancer risks considered individually for these TAC increased. However, relatively small increases in risks from exposure to these TAC were more than offset by the decreases in DPM. Overall, negative incremental cancer risks (beneficial impacts) are estimated.

Cancer risk impacts under Alternative 9 would be less than significant and would be beneficial.

4.7.1.6.2 Chronic Non-Cancer Health Hazards

Acrolein and formaldehyde are the primary TAC of concern in emissions from LAX with respect to chronic non-cancer health hazards. Acrolein is responsible for the majority of predicted chronic non-cancer health hazards associated with LAX SPAS operations and is primarily associated with aircraft emissions. (For a detailed discussion of uncertainties regarding the presence of acrolein in aircraft emissions, see Section 7.3 of Technical Report S-9a of the LAX Master Plan Final EIR.) Primary sources of formaldehyde are emissions from gasoline and diesel powered equipment.

SPAS-related chronic non-cancer hazard indices for MEI for operational impacts are summarized in **Table 4.7.1-6** and shown in **Figures 4.7.1-4** and **4.7.1-5**. Chronic non-cancer hazard indices for adult residents and child residents are the same because RAGS, Part F methodology does not normalize hazard indices to body weight. For this reason, an adult+child resident receptor was not evaluated. An incremental hazard index equal to or greater than 1, the threshold of significance for chronic non-cancer effects, indicates some potential for adverse chronic non-cancer health effects. A hazard index less than 1 suggests that adverse chronic non-cancer health effects are not expected.

Table 4.7.1-6

Peak Incremental Chronic Non-Cancer Health Hazards for Maximally Exposed Individuals for the SPAS Alternatives

	Incremental Chronic Non-Cancer Hazards[1,2,3]							
Receptor Type	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5[4]**	**Alt. 6[4]**	**Alt. 7[4]**	**Alts. 8 and 9[5,6]**
Child Resident	0.47	0.32	0.41	0.27	0.49	0.41	0.40	0.32 to 0.49
School Child	0.09	0.06	0.08	0.05	0.09	0.08	0.08	0.06 to 0.09
Adult Resident	0.47	0.32	0.41	0.27	0.49	0.41	0.40	0.32 to 0.49
Adult Worker	0.13	0.11	0.20	0.16	0.13	0.12	0.12	0.11 to 0.13

Notes:

Peak incremental chronic non-cancer health hazard locations are the locations with the greatest increment (i.e., where hazard impacts would be highest). These locations are used to determine the significance of project impacts.

1 Values provided are calculated using RAGS Part F methodology. See Appendix G1 for results calculated using RAGS Part A methodology.

2 Incremental values indicate change as compared to baseline conditions. Estimates are rounded to two significant figures.

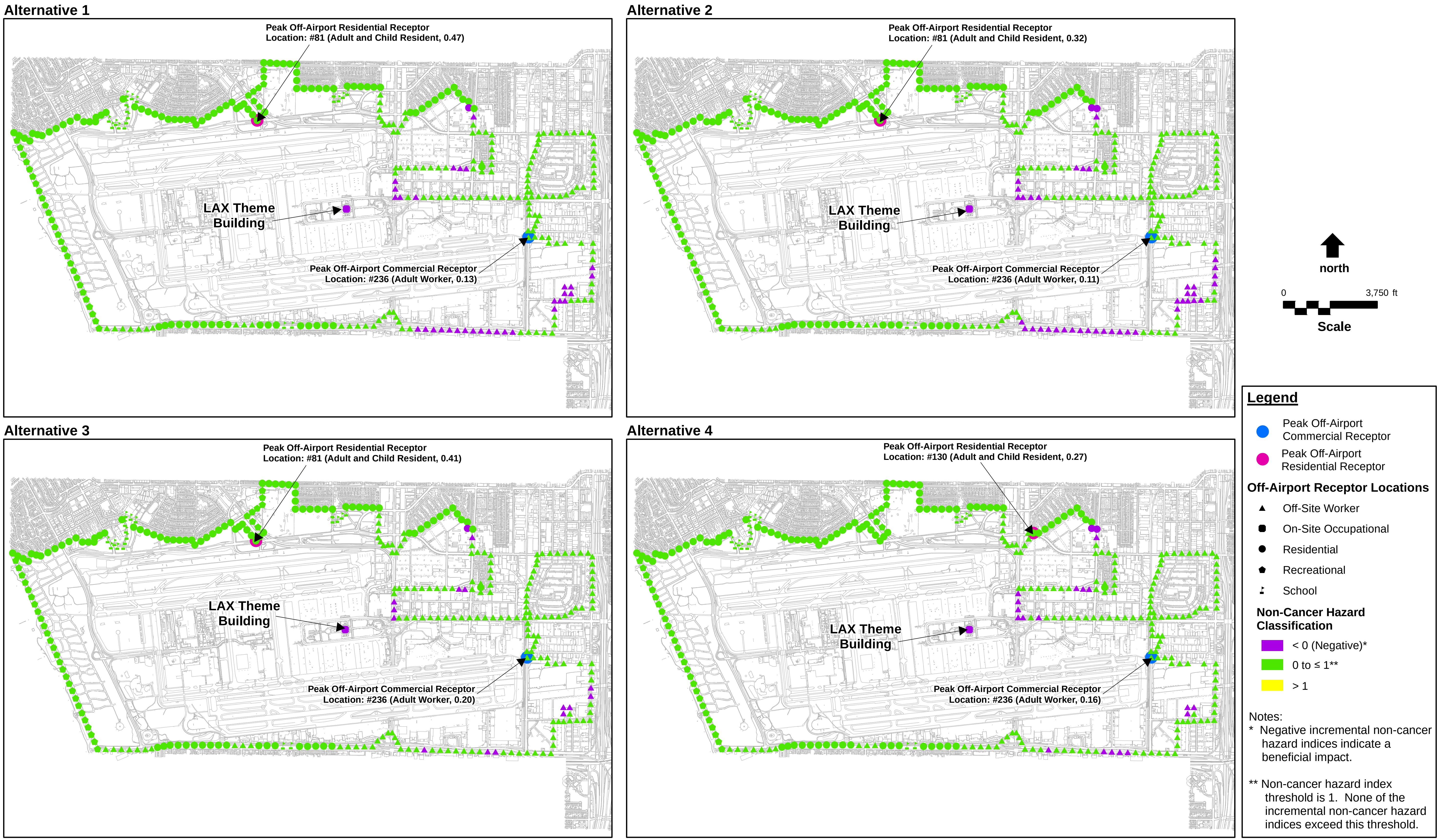
3 Maximum values indicated are not all located at the same grid location.

4 Alternatives 5 through 7 focus primarily on airfield improvements and related terminal and roadway improvements. Those improvements are compatible with the ground access improvements proposed under Alternatives 1, 2, 8, and 9. Chronic non-cancer health hazards presented in this table for Alternatives 1, 2, 5, 6, and 7 are based on TAC concentrations that are specific to the airfield and terminal characteristics of each of these alternatives; however, TAC concentrations associated with non-airfield sources (i.e., roadways, parking, stationary, and off-airport) included in the analysis of Alternatives 5 through 7 reflect the range predicted for Alternatives 1, 2, 8, and 9. Ranges are shown where combined TAC concentrations associated with airfield and related terminal and roadway improvements, and improvements associated with non-airfield sources, results in a range of chronic non-cancer health hazards. When only a single value is shown, it means that small differences among alternatives resulted in no changes in hazard estimates when rounded to two significant figures. The emissions presented relative to both airfield and non-airfield operations for Alternatives 3 and 4 are specific to the characteristics of each of these alternatives, which still provide a basis for comparison with the other alternatives.

5 Alternatives 8 and 9 focus primarily on ground access improvements; however, those improvements are compatible with airfield improvements, and related terminal and roadway improvements, proposed under Alternatives 1, 2, 5, 6, and 7. The chronic non-cancer health hazards presented in this table for Alternatives 1 and 2 are based on TAC concentrations that are specific to the non-airfield (i.e., roadways, parking, stationary, and off-airport) characteristics of each of these alternatives; however, chronic non-cancer health hazards associated with Alternatives 8 and 9 reflect the range of hazards for Alternatives 1, 2, 5, 6, and 7.

6 Although the improvements associated with Alternatives 8 and 9 are not identical (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover), chronic non-cancer health hazards are predominantly driven by exposure to acrolein. Acrolein is only emitted from aircraft emissions, not from the ground access improvements represented in Alternatives 8 and 9. Therefore, the ranges represent chronic non-cancer health hazards associated with the airfield and terminal improvements associated with Alternatives 1, 2, 5, 6, and 7. As these ranges would apply equally to Alternatives 8 and 9, only one range is shown for both Alternatives 8 and 9.

Source: CDM Smith, 2012.



Source: CDM Smith, 2012.

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Geographic Representation of Construction and Operational Incremental Chronic Non-Cancer Hazards by Receptor Type – Alternatives 1, 2, 3, and 4

Figure 4.7.1-4

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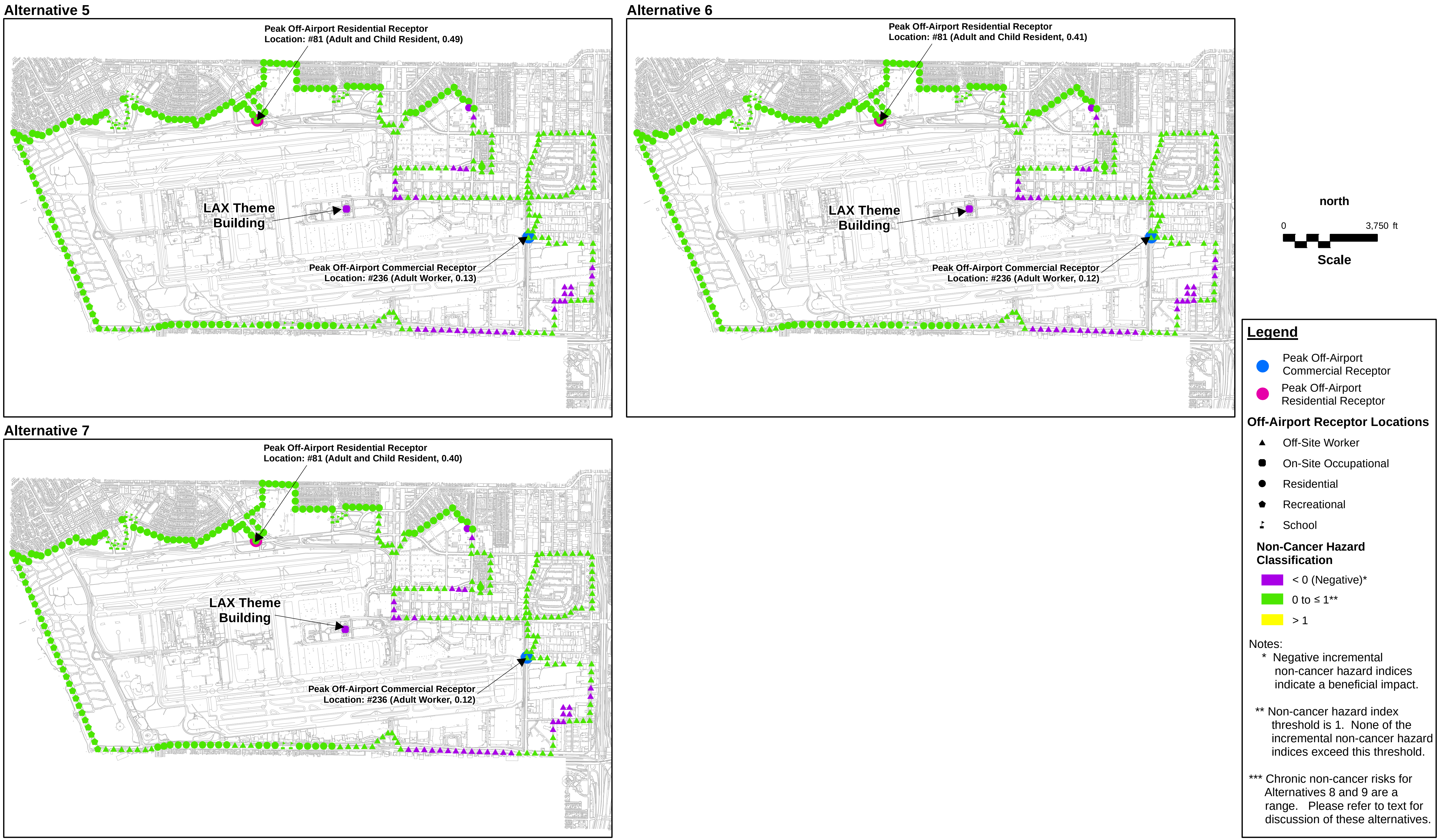

Source: CDM Smith, 2012.

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Geographic Representation of Construction and Operational Incremental Chronic Non-Cancer Hazards by Receptor Type – Alternatives 5, 6 and 7

Figure
4.7.1-5

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Alternative 1

SPAS-related chronic non-cancer health hazard indices for chemicals affecting the same target (i.e., the respiratory system) for Alternative 1 after full buildout are below the threshold of significance (HI of 1) for all receptor types. Incremental hazard indices are estimated to be 0.5 for both adult and child residents living at the peak hazard residential location, 0.09 for school children, and 0.1 for adult workers working at the peak hazard commercial location. These risk estimates are based on modeling that incorporates select quantifiable mitigation measures from the LAX Master Plan MMRP (see Section 4.7.1.5), but otherwise assumes no additional mitigation.

Hazard indices are primarily driven by release of acrolein in aircraft emissions. Acrolein at the peak hazard location contributes 78 percent to total hazard indices for residential receptors and school child receptors and formaldehyde contributes 15 percent. For the adult worker, the contributions are slightly less, 74 percent from acrolein and 14 percent from formaldehyde. Similar to incremental cancer risks, decreases in modeled concentrations of some TAC, in this case DPM and chlorine, result in negative hazard indices that reduce the overall hazard index. However, although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset the impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive (unlike cancer risks, where overall impact is negative (beneficial)). DPM contributes 5 percent to the total hazard indices for residential and school receptors, and 10 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 1. Therefore, chronic non-cancer health hazard impacts under Alternative 1 would be less than significant.

Alternative 2

SPAS-related chronic non-cancer health hazard indices for Alternative 2 are estimated to be 0.3 for both adult and child residents living at the peak hazard residential location, 0.06 for school children, and 0.1 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 76 percent to the total hazard indices for residential receptors and the school child receptor and formaldehyde contributes 15 percent. For the adult worker, contributions are slightly less, 73 percent from acrolein and 14 percent from formaldehyde. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive. DPM contributes 7 percent to total hazard indices for residential and school receptors, and 11 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 2. Therefore, chronic non-cancer health hazard impacts under Alternative 2 would be less than significant.

Alternative 3

SPAS-related chronic non-cancer health hazard indices for Alternative 3 are estimated to be 0.4 for both adult and child residents living at the peak hazard residential location, 0.08 for school children, and 0.2 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 77 percent to the total hazard indices for residential receptors, the school child receptor, and the adult worker and formaldehyde contributes 15 percent. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine. offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive. DPM contributes 5 percent to total hazard indices for residential and school receptors, and 4 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 3. Therefore, chronic non-cancer health hazard impacts under Alternative 3 would be less than significant.

Alternative 4

SPAS-related chronic non-cancer health hazard indices for the operation of Alternative 4 are estimated to be 0.3 for both adult and child residents living at the peak hazard residential location, 0.05 for school children, and 0.2 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 65 percent to total hazard indices for residential receptors and the school child receptor and formaldehyde contributes 12 percent. For the adult worker, contributions are slightly more, 75 percent from acrolein and 15 percent from formaldehyde. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive. DPM contributes 21 percent to total hazard indices for residential and school receptors, and 8 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 4. Therefore, chronic non-cancer health hazard impacts under Alternative 4 would be less than significant.

Alternative 5

Alternative 5 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 5 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 5 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental chronic non-cancer health hazards was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for chronic non-cancer health hazards are aircraft engine exhaust, diesel construction equipment, and GSE. Therefore, the changes to the peak risks from the ground access components do not show up in the results when the hazard indices are rounded.

Maximum SPAS-related chronic non-cancer health hazard indices for Alternative 5 are estimated to be 0.5 for both adult and child residents living at the peak hazard residential location, 0.09 for school children, and 0.1 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 78 percent to total hazard indices for residential receptors and the school child receptor and formaldehyde contributes 15 percent. For the adult worker, contributions are slightly less, 74 percent from acrolein and 14 percent from formaldehyde. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, the overall total hazard indices are still positive. DPM contributes 4 percent to total hazard indices for residential and school receptors, and 10 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 5. Therefore, chronic non-cancer health hazard impacts under Alternative 5 would be less than significant.

Alternative 6

Alternative 6 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 6 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 6 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental chronic non-cancer health hazards was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for chronic non-cancer health hazards are the aircraft engine exhaust, diesel construction equipment, and GSE. Therefore, the changes to the peak risks from the ground access components do not show up in the results when the hazard indices are rounded.

Maximum SPAS-related chronic non-cancer health hazard indices for Alternative 6 are estimated to be 0.4 for adult residents and child residents living at the peak hazard residential location, 0.08 for school children, and 0.1 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 77 percent to total hazard indices for residential receptors and the school child receptor and formaldehyde contributes 15 percent. For the adult worker, contributions are slightly less, 73 percent from acrolein and 14 percent from formaldehyde. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive. DPM contributes 5 percent to the total hazard indices for residential and school receptors, and 11 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 6. Therefore, chronic non-cancer health hazard impacts under Alternative 6 would be less than significant.

Alternative 7

Alternative 7 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 7 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 7 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental chronic non-cancer health hazards was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. However, the risk drivers for chronic non-cancer health hazards are the aircraft engine exhaust, diesel construction equipment, and GSE. Therefore, the changes to the peak risks from the ground access components do not show up in the results when the hazard indices are rounded.

When the incremental hazard indices for Alternative 7 are rounded to two significant figures, incremental hazards are the same as the incremental hazards for Alternative 6. Maximum SPAS-related chronic non-cancer health hazard indices for the operation of Alternative 7 are estimated to be 0.4 for adult residents and child residents living at the peak hazard residential location, 0.08 for school children, and 0.1 for adult workers working at the peak hazard commercial location. Acrolein at the peak hazard location contributes 77 percent to the total hazard indices for residential receptors and the school child receptor and formaldehyde contributes 15 percent. For the adult worker, contributions are slightly less, 73 percent from acrolein and 14 percent from formaldehyde. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive. DPM contributes 5 percent to total hazard indices for residential and school receptors, and 10 percent to the hazard index for the adult worker.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 7. Therefore, chronic non-cancer health hazard impacts under Alternative 7 would be less than significant.

Alternative 8

Alternative 8 focuses on ground access improvements. The ground access configuration under Alternative 8 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental chronic non-cancer health hazards was estimated. Alternative-specific concentrations were not modeled for Alternative 8, as these values would fall between the high and low ends of the range. Instead, the incremental chronic non-cancer health hazards for Alternative 8 were estimated to be the maximum and minimum hazard indices for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental hazard indices. (As explained previously, the chronic non-cancer health hazards for Alternatives 5, 6, and 7 were based on TAC concentrations associated with both airfield and non-airfield sources.) The minimum and maximum of the ranges of peak hazards are presented in **Table 4.7.1-6**.

SPAS-related chronic non-cancer health hazard indices for Alternative 8 are estimated to range from 0.3 to 0.5 for adult residents and child residents living at the peak hazard location, to range from 0.06 to 0.09 for school children, and to be 0.1 for adult workers. Exposure to acrolein contributed to the majority of hazard indices with formaldehyde contributing less. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset impacts attributable to increases in modeled concentrations of acrolein, overall total hazard indices are still positive.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 8. Therefore, chronic non-cancer health hazard impacts under Alternative 8 would be less than significant.

Alternative 9

Alternative 9 focuses on ground access improvements. The ground access configuration under Alternative 9 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental chronic non-cancer health hazards was estimated. The annual average TAC concentrations for the ground access component of Alternative 9 were modeled and added to the airfield components of Alternatives 5, 6, and 7 to provide the low end of the range of impacts for those alternatives discussed above, since Alternative 9 has the lowest emissions for the ground access component. However, the range of impacts due to different ground access options did not alter the peak risk values when rounded to one or two significant figures. Therefore, the chronic non-cancer health hazards for Alternative 9 were estimated to be the maximum and minimum hazards for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental chronic non-cancer health hazards. The minimum and maximum of the ranges of peak hazards are presented in **Table 4.7.1-6**.

Although the improvements associated with Alternatives 8 and 9 are not the same (Alternative 8 has a busway whereas Alternative 9 has an APM), the incremental hazard indices for these alternatives are estimated to be the same. This is because chronic non-cancer health hazards at LAX are driven by concentrations of acrolein, whose source is primarily aircraft emissions, and aircraft emissions would not vary between these two alternatives.

SPAS-related chronic non-cancer health hazard indices for Alternative 9 are estimated to range from 0.3 to 0.5 for adult residents and child residents living at the peak hazard location, to range from 0.06 to 0.09 for school children, and to be 0.1 for adult workers. Exposure to acrolein contributed to the majority of hazard indices with formaldehyde contributing less. Although beneficial impacts attributable to decreases in modeled concentrations of DPM and chlorine offset the impacts attributable to increases in modeled concentrations of acrolein, the overall total hazard indices are still positive.

These estimates show that SPAS-related hazard indices for chemicals affecting the same target (i.e., the respiratory system) for all evaluated receptors (residential adults, residential children, school children, and adult workers) are predicted to be below the threshold of significance of 1 under Alternative 9. Therefore, chronic non-cancer health hazard impacts under Alternative 9 would be less than significant.

4.7.1.6.3 Acute Non-Cancer Health Hazards

Acrolein and formaldehyde are the only TAC of concern in emissions from LAX that might be present at concentrations approaching the threshold for acute effects. Acrolein is responsible for the majority of all predicted acute non-cancer health hazards associated with LAX SPAS operations and is primarily associated with aircraft emissions. (For a detailed discussion of uncertainties regarding the presence of acrolein in aircraft emissions, see Section 7.3 of Technical Report S-9a of the LAX Master Plan Final EIR.) Acute exposures to acrolein may result in mild irritation of eyes and mucous membranes. Primary sources of formaldehyde are emissions from gasoline and diesel powered equipment. Acute effects for exposure to formaldehyde would typically include irritation to the eye and respiratory system and possibly adverse effects to the immune system. Maximum acute non-cancer health hazards associated with exposure to acrolein and formaldehyde from LAX SPAS operations are summarized in **Tables 4.7.1-7** and **4.7.1-8**. **Figures 4.7.1-6** and **4.7.1-7** show the receptor locations with peak acrolein concentrations.

Table 4.7.1-7

Acute Hazard Indices for Acrolein under the SPAS Alternatives

	Summary of Acute Hazard Indices for Acrolein[1]								
Receptors	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5[6]**	**Alt. 6[6]**	**Alt. 7[6]**	**Alt. 8[7,8]**	**Alt. 9[7,8]**
Residential Locations									
Maximum HI[2]	**3.0[3]**	**2.0**	**2.7**	**2.7**	**2.9**	**2.8**	**2.4**	**2.0-3.0**	**2.0-3.0**
Average HI	0.93	0.98	**1.1**	**1.2**	0.88	0.90	0.96	0.88 to 0.98	0.88 to 0.98
Minimum HI	0.012	-0.02[4]	-0.27	0.11	-0.03	-0.00014	-0.04	-0.04 to -0.012	-0.04 to -0.012
Recreational Locations									
Maximum HI	**1.4**	**1.2**	**1.3**	**1.8**	**1.3**	**1.4**	**1.3**	**1.2** to **1.4**	**1.2** to **1.4**
Average HI	0.76	0.81	0.74	0.94	0.71	0.74	0.80	0.71 to 0.81	0.71 to 0.81
Minimum HI	0.44	0.19	-0.03	0.54	0.41	0.43	0.53	0.19 to 0.53	0.19 to 0.53
Off-Airport Worker Locations									
Maximum HI	**1.6**	**1.7**	**3.1**	**3.9**	**1.5**	**1.6**	**1.8**	**1.5 to 1.8**	**1.5** to 1.8
Average HI	0.75	0.80	**1.1**	**1.2**	0.71	0.74	0.80	0.71 to 0.80	0.71 to 0.80
Minimum HI	-0.08	0.34	0.04	0.05	-0.13	-0.10	0.006	-0.13 to 0.34	-0.13 to 0.34
School Child Locations									
Maximum HI	**1.2**	**2.2**	**2.4**	**1.3**	**1.1**	**1.1**	**1.5**	**1.1** to **2.2**	**1.1** to **2.2**
Average HI	0.75	**1.3**	**1.4**	0.94	0.70	0.71	0.85	0.70 to **1.3**	0.70 to **1.3**
Minimum HI	0.20	0.36	0.39	0.61	0.16	0.19	0.16	0.16 to 0.36	0.16 to 0.36
Overall Off-Airport									
Maximum HI	**3.0**	**2.2**	**3.1**	**3.9**	**2.9**	**2.8**	**2.4**	**3.0**	**3.0**
On-Airport Construction Worker Location[5]									
Maximum HI	0.71	**1.1**	**1.6**	0.97	0.67	0.71	0.73	0.67 to **1.1**	0.67 to **1.1**

Table 4.7.1-7

Acute Hazard Indices for Acrolein under the SPAS Alternatives

	Summary of Acute Hazard Indices for Acrolein[1]								
Receptors	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5[6]**	**Alt. 6[6]**	**Alt. 7[6]**	**Alt. 8[7,8]**	**Alt. 9[7,8]**

[1] Maximum and minimum locations are not at the same location for each scenario.
[2] HI = Hazard Index
[3] **Bold** HIs are greater than the significance threshold of 1.
[4] Negative values indicate a beneficial impact.
[5] Only one on-airport location was assessed.
[6] Alternatives 5 through 7 focus primarily on airfield improvements and related terminal and roadway improvements. Those improvements are compatible with the ground access improvements proposed under Alternatives 1, 2, 8, and 9. Acute non-cancer health hazards presented in this table for Alternatives 1, 2, 5, 6, and 7 are based on TAC concentrations that are specific to the airfield and terminal characteristics of each of these alternatives; however, TAC concentrations associated with non-airfield sources (i.e., roadways, parking, stationary, and off-airport) included in the analysis of Alternatives 5 through 7 reflect the range predicted for Alternatives 1, 2, 8, and 9. Ranges are shown where combined TAC concentrations associated with airfield and related terminal and roadway improvements, and improvements associated with non-airfield sources, results in a range of acute non-cancer health hazards. When only a single value is shown, it means that small differences among alternatives resulted in no changes in hazard estimates when rounded to two significant figures. The emissions presented relative to both airfield and non-airfield operations for Alternatives 3 and 4 are specific to the characteristics of each of these alternatives, which still provide a basis for comparison with the other alternatives.
[7] Alternatives 8 and 9 focus primarily on ground access improvements; however, those improvements are compatible with airfield improvements, and related terminal and roadway improvements, proposed under Alternatives 1, 2, 5, 6, and 7. The acute non-cancer health hazards presented in this table for Alternatives 1 and 2 are based on TAC concentrations that are specific to the non-airfield (i.e., roadways, parking, stationary, and off-airport) characteristics of each of these alternatives; however, acute non-cancer health hazards associated with Alternatives 8 and 9 reflect the range of hazards for Alternatives 1, 2, 5, 6, and 7.
[8] Although the improvements associated with Alternatives 8 and 9 are not identical (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover), acute non-cancer health hazards are predominantly driven by exposure to acrolein. Acrolein is only emitted from aircraft emissions, not from the ground access improvements represented in Alternatives 8 and 9. Therefore, the ranges represent acute non-cancer health hazards from the airfield improvements associated with Alternatives 1, 2, 5, 6, and 7. As these ranges would apply equally to Alternatives 8 and 9, the same ranges are shown for both Alternatives 8 and 9.

Sources: CDM Smith, 2012.

Table 4.7.1-8

Acute Hazard Indices for Formaldehyde under the SPAS Alternatives

	Summary of Acute Hazard Indices for Formaldehyde[1]								
Receptors	**Alt. 1**	**Alt. 2**	**Alt. 3**	**Alt. 4**	**Alt. 5[5]**	**Alt. 6[5]**	**Alt. 7[5]**	**Alt. 8[6,7]**	**Alt. 9[6,7]**
Residential Locations									
Maximum HI[2]	0.64	0.41	0.55	0.58	0.62	0.59	0.50	0.41 to 0.64	0.41 to 0.64
Average HI	0.18	0.18	0.18	0.23	0.17	0.17	0.18	0.17 to 0.18	0.17 to 0.18
Minimum HI	-0.05[3]	-0.04	-0.12	-0.02	-0.06	-0.06	-0.07	-0.07 to -0.04	-0.07 to -0.04
Recreational Locations									
Maximum HI	0.29	0.24	0.27	0.38	0.28	0.29	0.26	0.24 to 0.29	0.24 to 0.29
Average HI	0.15	0.16	0.13	0.18	0.14	0.15	0.16	0.14 to 0.16	0.14 to 0.16
Minimum HI	0.08	0.015	-0.05	0.08	0.07	0.08	0.09	0.015 to 0.09	0.015 to 0.09
Off-Airport Worker Locations									
Maximum HI	0.39	0.38	0.67	0.87	0.38	0.39	0.39	0.38 to 0.39	0.38 to 0.39
Average HI	0.13	0.14	0.18	0.22	0.12	0.13	0.14	0.12 to 0.14	0.12 to 0.14
Minimum HI	-0.08	0.02	-0.07	-0.06	-0.09	-0.09	-0.06	-0.09 to 0.02	-0.09 to 0.02

Table 4.7.1-8

Acute Hazard Indices for Formaldehyde under the SPAS Alternatives

Receptors	Summary of Acute Hazard Indices for Formaldehyde[1]								
	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5[5]	Alt. 6[5]	Alt. 7[5]	Alt. 8[6,7]	Alt. 9[6,7]
School Child Locations									
Maximum HI	0.23	0.47	0.49	0.24	0.22	0.22	0.30	0.22 to 0.47	0.22 to 0.47
Average HI	0.13	0.26	0.27	0.18	0.12	0.13	0.16	0.12 to 0.26	0.12 to 0.26
Minimum HI	-0.008	0.03	0.009	0.08	-0.02	-0.011	-0.02	-0.02 to 0.03	-0.02 to 0.03
Overall Off-Airport									
Maximum HI	0.64	0.47	0.67	0.87	0.62	0.59	0.50	0.41 to 0.64	0.41 to 0.64
On-Airport Construction Worker Location[4]									
Maximum HI	-0.03	0.06	0.11	-0.008	-0.04	-0.03	-0.03	-0.04 to 0.06	-0.04 to 0.06

1 Maximum and minimum locations are not at the same location for each scenario.
2 HI = Hazard Index
3 Negative values indicate a beneficial impact.
4 Only one on-airport location was assessed.
5 Alternatives 5 through 7 focus primarily on airfield improvements and related terminal and roadway improvements. Those improvements are compatible with the ground access improvements proposed under Alternatives 1, 2, 8, and 9. Acute non-cancer health hazards presented in this table for Alternatives 1, 2, 5, 6, and 7 are based on TAC concentrations that are specific to the airfield and terminal characteristics of each of these alternatives; however, TAC concentrations associated with non-airfield sources (i.e., roadways, parking, stationary, and off-airport) included in the analysis of Alternatives 5 through 7 reflect the range predicted for Alternatives 1, 2, 8, and 9. Ranges are shown where combined TAC concentrations associated with airfield and related terminal improvements, and improvements associated with non-airfield sources, results in a range of acute non-cancer health hazards. When only a single value is shown, it means that small differences among alternatives resulted in no changes in hazard estimates when rounded to two significant figures. Emissions presented relative to both airfield and non-airfield operations for Alternatives 3 and 4 are specific to the characteristics of each of these alternatives, which still provide a basis for comparison with the other alternatives.
6 Alternatives 8 and 9 focus primarily on ground access improvements; however, those improvements are compatible with airfield improvements, and related terminal and roadway improvements, proposed under Alternatives 1, 2, 5, 6, and 7. The acute non-cancer health hazards presented in this table for Alternatives 1 and 2 are based on TAC concentrations that are specific to the non-airfield (i.e., roadways, parking, stationary, and off-airport) characteristics of each of these alternatives; however, acute non-cancer health hazards associated with Alternatives 8 and 9 reflect the range of hazards for Alternatives 1, 2, 5, 6, and 7.
7 Although the improvements associated with Alternatives 8 and 9 are not the same (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover, acute non-cancer health hazards associated with formaldehyde are predominantly driven by aircraft emissions, not from the ground access improvements represented in Alternatives 8 and 9. Therefore, the ranges represent acute non-cancer health hazards from the airfield improvements associated with Alternatives 1, 2, 5, 6, and 7. As these ranges would apply equally to Alternatives 8 and 9, the same ranges are shown for both Alternatives 8 and 9.

Sources: CDM Smith, 2012.

Acute non-cancer health hazards for TAC other than acrolein and formaldehyde are orders of magnitude below 1 and below the acute non-cancer health hazards estimated for short-term exposure to acrolein and formaldehyde. Potential acute non-cancer health hazard impacts resulting from other TAC and from combining TAC are discussed in the Uncertainties Section of Appendix G1, *Human Health Risk Assessment*. Acute results are provided in Attachment 3 to Appendix G1, *Human Health Risk Assessment*.

Alternative 1

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 1 are estimated to be 3.0 for residents living at the peak hazard location, 1.2 for school children, 1.4 for recreational users, and 1.6 for off-site adult workers. 243 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 83 grid nodes with incremental acute hazard quotients for acrolein greater than 1, only five of the grid nodes are greater than 2. These grid nodes are located north of Runway 6L/24R in the north airfield (grid nodes 66 to 70).

The acute REL for acrolein has an uncertainty factor of 60.[377] This factor indicates a moderate uncertainty in the REL based on specific sources of variability not addressed in the toxicological studies, such as individual variation and interspecies differences. Although the maximum acute hazard quotients for acrolein after buildout of Alternative 1 is greater than 1, it should be noted that the acute REL is set at or below a level at which no adverse health impacts are expected for the majority of the population. Hence, it represents the tail-end of a distribution and not a specific "bright line" beyond which adverse effects are certain; instead any adverse acute non-cancer health effects (mucous membrane irritation) would be part of a complex probabilistic process. Although the maximum acute hazard quotient estimated as 3.0 is above the threshold of significance of 1, the value is still close to the threshold for acute effects, given the uncertainty in the toxicity factor, and may represent minimal actual acute non-cancer health hazards. Thus, an acute hazard quotient of 3.0 does not mean that adverse effects would definitely occur in the receptor population; rather, it indicates that such effects cannot be ruled out on the basis of current knowledge.

SPAS-related maximum acute hazard quotients for formaldehyde under Alternative 1 are estimated to be 0.6 for residents living at the peak hazard location, 0.2 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, recreational users, school child, and off-site adult workers are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 1 would be significant.

Alternative 2

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 2 are estimated to be 2.0 for residents living at the peak hazard location, 2.2 for school children, 1.2 for recreational users, and 1.7 for off-site adult workers. 207 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 116 grid nodes with incremental acute hazard quotients for acrolein greater than 1, the highest (greater than 2) four acute hazard quotients are located north northwest of Runway 6L/24R in the north airfield (grid nodes 48 to 51) near Saint Bernard High School.

SPAS-related maximum acute hazard quotients for formaldehyde under Alternative 2 are estimated to be 0.4 for residents living at the peak hazard location, 0.5 for school children, 0.2 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 2 would be significant.

Alternative 3

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 3 are estimated to be 2.7 for residents living at the peak hazard location, 2.4 for school children, 1.3 for recreational users, and 3.1 for off-site adult workers. 184 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 142 grid nodes that have incremental acute hazard quotients for acrolein greater than 1, the 27 highest (greater than 2) acute hazard quotients are located near the east end of Runway 7L/25R in the south airfield (grid nodes 229 to 231 and 236 to 239) and near the east end (grid nodes 169) and north (grid nodes 52 to 70) of Runway 6L/24R in the north airfield.

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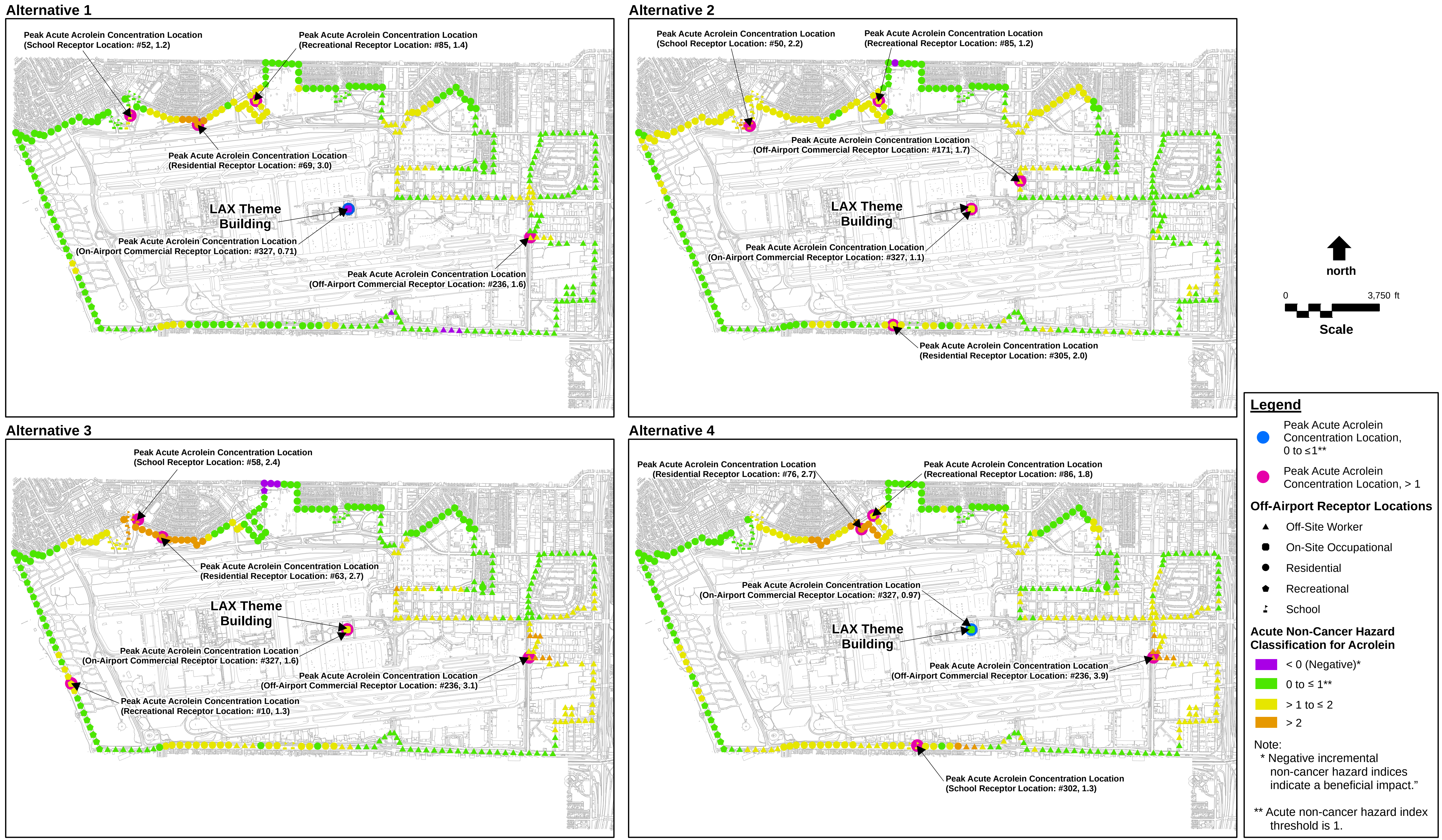
[377] California Environmental Protection Agency, Office of Environmental Health Hazard Assessment, Air Toxics Hot Spots Program Technical Support Document for the Derivation of Noncancer Reference Exposure Levels, December 2008.



Source: CDM Smith, 2012.

LAX Specific Plan Amendment Study Draft EIR

Geographic Representation of Operational Incremental Acute Non-Cancer Hazards from Acrolein by Receptor Type – Alternatives 1, 2, 3, and 4

Figure 4.7.1-6

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Source: CDM Smith, 2012.

LAX Specific Plan Amendment Study Draft EIR	Geographic Representation of Operational Incremental Acute Non-Cancer Hazards from Acrolein by Receptor Type – Alternatives 5, 6, and 7***	Figure 4.7.1-7

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Alternative 3 aircraft emissions would be greater than aircraft emissions under any other alternative. The primary reason for this difference in airside emissions is the comparatively greater aircraft taxi/idle time that would occur under Alternative 3 due to the "imbalance" in the number of aircraft gates on the north and south sides of the CTA (i.e., greater number of gates on the south side of the CTA, requiring more aircraft to taxi to and from the north runways when trying to balance operations between the north airfield and south airfield). In addition, Alternative 3 would have the highest construction emissions of any of the nine alternatives due to its substantially more ground access improvements than any of the other alternatives. Alternative 3 would require demolishing the CTA parking structures; building new parking/transportation facilities, interconnecting roadways, and an APM along the eastern airport boundaries; moving Runway 6R/24L and implementing extensive taxiway modifications; and rebuilding the northern concourse area in CTA.

SPAS-related maximum acute hazard quotients for formaldehyde under the operation of Alternative 3 are estimated to be 0.6 for residents living at the peak hazard location, 0.5 for school children, 0.3 for recreational users, and 0.7 for off-site adult workers.

Because the acute hazard quotient for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 3 would be significant.

Alternative 4

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 4 are estimated to be 2.7 for residents living at the peak hazard location, 1.3 for school children, 1.8 for recreational users, and 3.9 for off-site adult workers. 160 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 166 grid nodes with incremental acute hazard quotients for acrolein greater than 1, the 21 highest (greater than 2) acute hazard quotients are located near the east end of Runway 7L/25R in the south airfield (grid nodes 229 and 233 to 239), south of Runway 7R/25L near Sepulveda Boulevard (grid nodes 295 to 297) and north of Runway 6L/24R in the north airfield (grid node 67 to 70 and 74 to 80).

SPAS-related maximum acute hazard quotients for formaldehyde under the operation of Alternative 4 are estimated to be 0.6 for residents living at the peak hazard location, 0.2 for school children, 0.4 for recreational users, and 0.9 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 4 would be significant.

Alternative 5

Alternative 5 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 5 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 5 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental acute hazard quotients was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. Only the maximum values of the range are discussed below.

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 5 are estimated to be 2.9 for residents living at the peak hazard location, 1.1 for school children, 1.3 for recreational users, and 1.5 for off-site adult workers. 256 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 70 grid nodes with incremental acute hazard quotients for acrolein greater than 1, the five highest (greater than 2) acute hazard quotients are located north of Runway 6L/24R in the north airfield (grid nodes 66 to 70).

SPAS-related maximum acute hazard quotients for formaldehyde under Alternative 5 are estimated to be 0.6 for residents living at the peak hazard location, 0.2 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 5 would be significant.

Alternative 6

Alternative 6 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 6 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 6 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental acute hazard quotients was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. Only the maximum values of the range are discussed below.

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 6 are estimated to be 2.8 for residents living at the peak hazard location, 1.1 for school children, 1.4 for recreational users, and 1.6 for off-site adult workers. 248 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 78 grid nodes with incremental acute hazard quotients for acrolein greater than 1, the five highest (greater than 2) acute hazard quotients are located north of Runway 6L/24R in the north airfield (grid nodes 66 to 70).

SPAS-related maximum acute hazard quotients for formaldehyde under Alternative 6 are estimated to be 0.6 for residents living at the peak hazard location, 0.2 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 6 would be significant.

Alternative 7

Alternative 7 focuses on changes to airfield and terminal facilities. The airfield/terminal configuration under Alternative 7 could be paired with the ground access configurations under Alternatives 1, 2, 8, or 9. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), TAC concentrations associated with Alternative 7 improvements were combined with a range of concentrations associated with non-airfield sources, and a range of incremental acute hazard quotients was estimated. The range consisted of TAC concentrations associated with Alternatives 1 and 2, representing the high end, and concentrations associated with Alternative 9 representing the low end. TAC concentrations associated with Alternative 8 were not modeled, as these values would fall between the high and low ends of the range. Only the maximum values of the range are discussed below.

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 7 are estimated to be 2.4 for residents living at the peak hazard location, 1.5 for school children, 1.3 for recreational users, and 1.8 for off-site adult workers. 227 of 326 off-site grid nodes have incremental acute hazard quotients for acrolein of less than 1. Of the 99 grid nodes with incremental acute hazard quotients for acrolein greater than 1, the five highest (greater than 2) acute hazard quotients are located north of Runway 6L/24R in the north airfield (grid nodes 66 to 70).

SPAS-related maximum acute hazard quotients for formaldehyde under the operation of Alternative 7 are estimated to be 0.5 for residents living at the peak hazard location, 0.3 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 7 would be significant.

Alternative 8

Alternative 8 focuses on ground access improvements. The ground access configuration under Alternative 8 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental acute non-cancer health hazards was estimated. Alternative-specific concentrations were not modeled for Alternative 8, as these values would fall between the high and low ends of the range. Instead, the acute hazard quotients for Alternative 8 were estimated to be the maximum and minimum hazards for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental acute non-cancer health hazards. (As explained previously, the acute hazard quotients for Alternatives 5, 6, and 7 were based on TAC concentrations associated with both airfield and non-airfield sources.) The minimum and maximum of the ranges are presented in **Tables 4.7.1-7** and **4.7.1-8**. Only the maximum values of the range are discussed below.

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 8 are estimated to be 3.0 for residents living at the peak hazard location, 2.2 for school children, 1.4 for recreational users, and 1.8 for off-site adult workers. SPAS-related maximum acute hazard quotients for formaldehyde under the operation of Alternative 8 are estimated to be 0.6 for residents living at the peak hazard location, 0.5 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 8 would be significant.

Alternative 9

Alternative 9 focuses on ground access improvements. The ground access configuration under Alternative 9 could be paired with the airfield and terminal configurations proposed under Alternatives 1, 2, 5, 6, or 7. Therefore, for comparison purposes with other alternatives (i.e., fully integrated alternatives that include airfield, terminal, and ground access improvements combined), a range of incremental acute non-cancer health hazards was estimated. The 1-hour TAC concentrations for the ground access component of Alternative 9 were modeled and added to the airfield components of Alternatives 5, 6, and 7 to provide the low end of the range of impacts for those alternatives discussed above, since Alternative 9 has the lowest emissions for the ground access component. However, the range of impacts due to different ground access options did not alter the peak risk values when rounded to one or two significant figures. Therefore, the acute hazard quotients for Alternative 9 were estimated to be the maximum and minimum hazards for Alternatives 1, 2, 5, 6, and 7, resulting in a range of incremental acute non-cancer health hazards. The minimum and maximum of the ranges are presented in **Tables 4.7.1-7** and **4.7.1-8**. Only the maximum values of the range are discussed below.

Although the improvements associated with Alternatives 8 and 9 are not the same (Alternative 8 has a busway whereas Alternative 9 has an APM), the incremental acute non-cancer health hazards for these alternatives are estimated to be the same. This is because acute non-cancer health hazards at LAX are driven by concentrations of acrolein, whose source is primarily aircraft emissions, and aircraft emissions would not vary between these two alternatives.

SPAS-related maximum acute hazard quotients for acrolein after buildout of Alternative 9 are estimated to be 3.0 for residents living at the peak hazard location, 2.2 for school children, 1.4 for recreational users, and 1.8 for off-site adult workers. SPAS-related maximum acute hazard quotients for formaldehyde under the operation of Alternative 9 are estimated to be 0.6 for residents living at the peak hazard location, 0.5 for school children, 0.3 for recreational users, and 0.4 for off-site adult workers.

Because the acute hazard quotients for acrolein for all analyzed receptors (residents, school children, recreational users, and off-site adult workers) are above the threshold of significance of 1, acute non-cancer health hazard impacts under Alternative 9 would be significant.

4.7.1.6.4 Health Effects for On-Airport Workers

Effects on on-airport workers were evaluated by comparing estimated maximum 1-hour air concentrations of TAC for the SPAS alternatives to the CalOSHA 8-hour PEL-TWAs.[378] Estimated on-airport air concentrations and PEL-TWAs for TAC of concern for the SPAS alternatives are presented in **Table 4.7.1-9**. All estimates are based on modeling that incorporates select quantifiable mitigation measures from the LAX Master Plan MMRP (see Section 4.7.1.5), but makes no other assumptions regarding mitigation.

Alternative 1

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 1 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 1 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 2

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 2 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 2 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 3

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 3 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 3 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 4

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 4 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 4 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 5

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 5 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 5 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

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378 California Occupational Safety and Health Administration, Permissible Exposure Limits for Chemical Contaminants, Table AC-1, Available: http://www.dir.ca.gov/Title8/5155table_ac1.html, accessed June 21, 2012.

Table 4.7.1-9

Comparison of CalOSHA Permissible Exposures Limits to Maximum Estimated 8-Hour On-Airport Air Concentrations

TAC[1]	CAL OSHA PEL-TWA (mg/m3)[3]	On-Airport Air Concentrations (mg/m3)[2]								
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5[6]	Alt. 6[6]	Alt. 7[6]	Alt. 8[7,8]	Alt. 9[7,8]
acetaldehyde	45	0.013	0.015	0.014	0.013	0.013	0.013	0.013	0.015	0.015
acrolein	0.25	0.0051	0.0062	0.0074	0.0057	0.0050	0.0051	0.0051	0.0062	0.0062
Benzene	3.19	0.013	0.013	0.016	0.013	0.013	0.013	0.013	0.013	0.013
Formaldehyde	0.92	0.035	0.040	0.040	0.036	0.034	0.035	0.035	0.040	0.040
Methanol	260	0.0040	0.0047	0.0058	0.0044	0.0039	0.0040	0.0040	0.0047	0.0047
methyl ethyl ketone	590	0.00079	0.00079	0.00013	0.00065	0.00080	0.00080	0.0008	0.00080	0.00080
phenol	19	0.0015	0.0018	0.0022	0.0017	0.0015	0.0015	0.0015	0.0018	0.0018
styrene	215	0.00100	0.00110	0.0014	0.0011	0.00099	0.00100	0.0010	0.0011	0.0011
toluene	37	0.016	0.015	0.020	0.015	0.016	0.016	0.016	0.016	0.016
m-xylene	NA[4]	0.0066	0.0061	0.0075	0.0064	0.0066	0.0066	0.0066	0.0066	0.0066
o-xylene	NA	0.0045	0.0041	0.0058	0.0043	0.0045	0.0045	0.0045	0.0045	0.0045
p-xylene	NA	0.0032	0.0029	0.0046	0.0030	0.0031	0.0032	0.0032	0.0032	0.0032
Xylene (total)	435	0.0142	0.0131	0.0179	0.0138	0.0142	0.0142	0.0142	0.0142	0.0142
arsenic	0.01	0.0000028	0.0000027	0.0000040	0.0000030	0.0000028	0.0000028	0.0000028	0.0000028	0.0000028
chlorine	1.5	0.00045	0.00043	0.00031	0.00044	0.00045	0.00045	0.00044	0.00045	0.00045
copper	1	0.000017	0.000016	0.000022	0.000018	0.000017	0.000017	0.000017	0.000017	0.000017
mercury	0.025	0.000017	0.000016	0.000024	0.000018	0.000017	0.000017	0.000017	0.000017	0.000017
nickel	0.5	0.000012	0.000012	0.000015	0.000013	0.000013	0.000012	0.000012	0.000013	0.000013
vanadium[5]	0.05	0.000016	0.000016	0.000023	0.000017	0.000016	0.000016	0.000016	0.000016	0.000016
sulfates	NA	0.011	0.011	0.014	0.012	0.011	0.011	0.011	0.011	0.011

1 All TAC that were modeled for hourly concentrations and for which PEL-TWAs are available. TAC PEL-TWAs are not available for diesel exhaust and sulfates. Further, air dispersion modeling was conducted only for TAC identified as of concern for cancer risks and chronic non-cancer health hazards. As a result, a few TAC that have PEL-TWAs are not listed in this table because modeled concentrations were not available. These TAC include: 1,3-butadiene, ethylbenzene, naphthalene, n-hexane, chromium +6, lead, and manganese. PEL-TWA comparisons for these TAC were addressed in the LAX Master Plan EIR, which indicated that none of these TAC would present an important acute non-cancer health hazard. Uncertainties in the PEL-TWA analysis are discussed in the uncertainties section in Appendix G1.

2 Values listed are maximum 1-hour concentrations at on-airport location, receptor location #327, which represents concentrations in the middle of the CTA. These values represent reasonable estimates of 8-hour concentrations on-airport.

3 California Occupational Safety and Health Administration, Permissible Exposure Limits for Chemical Contaminants, Table AC-1, 2008, Available: http://www.dir.ca.gov/title8/5155table_ac1.html, accessed June 21, 2012.

4 NA = Not Available

5 Value listed for vanadium is for vanadium pentoxide, the most common form of vanadium.

Table 4.7.1-9

Comparison of CalOSHA Permissible Exposures Limits to Maximum Estimated 8-Hour On-Airport Air Concentrations

TAC[1]	CAL OSHA PEL-TWA (mg/m³)[3]	On-Airport Air Concentrations (mg/m³)[2]								
		Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5[6]	Alt. 6[6]	Alt. 7[6]	Alt. 8[7,8]	Alt. 9[7,8]

6 Alternatives 5 through 7 focus primarily on airfield improvements and related terminal and roadway improvements. Those improvements are compatible with the ground access improvements proposed under Alternatives 1, 2, 8, and 9. Concentrations presented in this table for Alternatives 1, 2, 5, 6, and 7 are based on TAC concentrations that are specific to the airfield and terminal characteristics of each of these alternatives; however, TAC concentrations associated with non-airfield sources (i.e., roadways, parking, stationary, and off-airport) included in the analysis of Alternatives 5 through 7 reflect the range predicted for Alternatives 1, 2, 8, and 9. The maximum of the range from the alternative combinations is shown. The concentrations presented relative to both airfield and non-airfield operations for Alternatives 3 and 4 are specific to the characteristics of each of these alternatives, which still provide a basis for comparison with the other alternatives.

7 Alternatives 8 and 9 focus primarily on ground access improvements; however, those improvements are compatible with airfield improvements, and related terminal and roadway improvements, proposed under Alternatives 1, 2, 5, 6, and 7. The concentrations presented in this table for Alternatives 1 and 2 are based on TAC concentrations that are specific to the non-airfield (i.e., roadways, parking, stationary, and off-airport) characteristics of each of these alternatives; however, TAC concentrations associated with Alternatives 8 and 9 reflect the range of those concentrations for Alternatives 1, 2, 5, 6, and 7. The maximum of the range from the alternative combinations is shown.

8 Although the improvements associated with Alternatives 8 and 9 are not the same (Alternative 8 has a busway whereas Alternative 9 has an Automated People Mover), the same range is shown for both Alternatives 8 and 9 because the receptor for these impacts is located on the airport and the major contributors to impacts at this location are on-airport sources (i.e., aircraft, GSE, APU, and CTA traffic). The influence of off-airport ground access sources is negligible at this location; therefore, results for Alternatives 8 and 9 are equivalent.

Sources: CDM Smith, 2012.

Alternative 6

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 6 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 6 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 7

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 7 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 7 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 8

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 8 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 8 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

Alternative 9

Estimated maximum 1-hour air concentrations at the on-airport grid point under Alternative 9 are a few to several orders of magnitude below PELs for all TAC. As air concentrations from airport emissions with implementation Alternative 9 would not exceed those considered "acceptable" by CalOSHA standards, health impacts to on-airport workers would be less than significant.

4.7.1.6.5 Summary of Impacts

The HHRA addressed possible incremental health impacts associated with the SPAS alternatives. The evaluation of impacts associated with cancer risks and chronic non-cancer health hazards included combined impacts from construction and operations. The evaluation of impacts associated with acute non-cancer health hazards only included impacts from operations. **Table 4.7.1-10** and the text below summarize the above conclusions, based on modeling estimates, regarding significant human health impacts, all of which are based on comparisons to baseline (2009) conditions.

Table 4.7.1-10

Summary of Human Health Risk Impacts After Mitigation

	Alt. 1	Alt. 2	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Alt. 7	Alt. 8	Alt. 9
Cancer Risks	LS	LS	LS	LS	LS	LS	LS	LS	LS
Chronic Non-Cancer Health Hazards	LS	LS	LS	LS	LS	LS	LS	LS	LS
Acute Non-Cancer Health Hazards	SU	SU	SU	SU	SU	SU	SU	SU	SU
Health Effects for On-Airport Workers	LS	LS	LS	LS	LS	LS	LS	LS	LS

Notes:

LS = Less than Significant Impact
SU = Significant Unavoidable Impact
Mitigation measures are LAX Master Plan Mitigation Measures MM-AQ-1, MM-AQ-2, MM-AQ-3, MM-AQ-4, and components from Section X, Air Quality, of the LAX Master Plan Community Benefits Agreement.

Source: CDM Smith, 2012.

- SPAS-related incremental cancer risks with implementation of the SPAS alternatives are anticipated to be below the threshold of significance of 10 in one million for all receptor types (i.e., child resident, school child, adult resident, and adult worker) within the study area. Incremental cancer risk estimates indicate that impacts would be less than significant for all alternatives.
- SPAS-related incremental cancer risks after implementation of the SPAS alternatives are projected to be less than risks associated with 2009 baseline conditions for all receptors, except for adult workers under Alternative 3, indicating a beneficial impact. SPAS-related incremental cancer risks after implementation of Alternative 3 would be less than significant impact.
- SPAS-related incremental chronic non-cancer hazard indices with implementation of the SPAS alternatives are anticipated to be below the threshold of significance for all receptor types (i.e., child resident, school child, adult resident, and adult worker). Incremental cancer risk estimates indicate that impacts would be less than significant for all alternatives.
- Some SPAS-related incremental acute non-cancer hazard indices would be at or slightly above the threshold of significance of 1 at locations of modeled peak TAC concentrations for all SPAS alternatives. At this time, select, quantifiable and feasible mitigation measures from the LAX Master Plan MMRP were assumed for the SPAS HHRA and acute non-cancer health hazard impacts are considered to be significant and unavoidable for small areas at or near the LAX fence-line. It should be noted that the primary TAC of concern contributing to this impact is acrolein from aircraft operations, which, when measured against 2009 baseline conditions, would result in a significant impact for all alternatives at buildout in 2025. Acute exposure to acrolein may result in mild irritation of eyes and mucous membranes. The increased acrolein emissions are attributable mostly to the increase in passenger activity levels and associated aircraft operations anticipated to occur between 2009 and 2025 for all alternatives. This increase in passenger activity levels is anticipated to occur irrespective of the SPAS alternatives (i.e., natural growth in passenger activity at LAX). In comparing impacts between the SPAS alternatives in 2025, which better characterizes the differences attributable to the airfield improvements specific to each alternative and "nets-out" the 2009 to 2025 activity growth impact common to all alternatives, it is evident that the airfield improvements proposed under most of the alternatives would result in lower acute non-cancer health hazard impacts than would otherwise occur if no airfield improvements were implemented. Specifically, the overall off-airport, acute non-cancer health hazard impacts associated with Alternatives 1, 2, 5, 6, and 7 (i.e., alternatives that propose specific airfield improvements) are less than those of Alternative 4 (i.e., the alternative that does not propose any airfield improvements other than those necessary to meet Runway Safety Area requirements). The one notable exception is Alternative 3, which does propose airfield improvements, but the design of those improvements results in a greater amount of aircraft taxiing time (i.e., longer periods of aircraft engine emissions) than would otherwise occur if no airfield improvements were made.
- Significant acute non-cancer health hazard impacts where hazard quotients are equal to or greater than 2 would affect a small area primarily north of the west end of Runway 6L/24R for all SPAS alternatives. For Alternative 3, areas affected include: north of the west end of Runway 6L/24R, east of Runway 7L/24L in the south airfield, and near the east end of Runway 6L/24R in the north airfield. For Alternative 4, an additional small area south of Runway 7R/25L near Sepulveda Boulevard would be affected. Although the hazard quotients are above the threshold of 1, acute non-cancer health hazard impacts are expected to be minor because of the uncertainty factor of the acute REL and because the acute REL represents the tail-end of a distribution and not a specific "bright line" beyond which adverse effects are certain; instead the onset of potentially induced symptoms is probabilistic. Similar to above, it is important to note that, while all of the alternatives would result in significant acute non-cancer health hazard impacts where hazard quotients are greater than 1, based on a comparison to 2009 baseline conditions, a comparison of impacts between all of the alternatives in 2025 indicates that impacts would be less for those alternatives that propose airfield improvements than would otherwise occur if no airfield improvements were made, with the exception of Alternative 3. It should also be noted that the significant acute impacts would occur at a small

number of locations at the LAX fence-line. It is expected that actual impacts in the community would be below levels of significance.

- Estimated maximum air concentrations for all TAC at the evaluated on-airport location at the LAX Theme Building would not exceed PEL-TWA for workers under all SPAS alternatives. Therefore, health impacts to on-airport workers would be less than significant.

4.7.1.7 Mitigation Measures

LAWA is committed to mitigating emissions to the maximum extent feasible from construction activities, temporary changes in operations associated with construction of SPAS alternatives, and long-term operational activities at LAX. A comprehensive mitigation program was developed as part of the LAX Master Plan Final EIR and the specific means for implementing the mitigation measures, described in Section 4.2.5, would also be applied to the SPAS project. Although developed to address air quality impacts, this program would also reduce impacts to human health associated with exposure to TAC. Because (1) this mitigation program establishes a commitment and process for incorporating all technically feasible air quality mitigation measures into each component of the SPAS alternatives as that element is constructed, and (2) cancer risks and chronic non-cancer health hazards are below levels of significance, and cumulative impacts are minor based on regional data (see Section 5.5.7.1), no mitigation measures to reduce impacts to human health specific to SPAS are required to address cancer risks and chronic non-cancer health hazards. Regarding acute non-cancer health hazard impacts, the comprehensive mitigation program developed as part of the LAX Master Plan Final EIR and the specific means for implementing the mitigation measures, described in Section 4.2.5 provide the most comprehensive means of ensuring impacts will be reduced to the maximum extent feasible. At the programmatic level of this EIR, there are no additional feasible measures available to address acute non-cancer health hazard impacts, which would remain significant. In addition, LAWA's construction contract specifications include requirements from the LAX Master Plan Community Benefits Agreement that serve to reduce construction equipment emissions, particularly those related to diesel emissions. Such measures include: reduce vehicle and equipment idling times, comply with Tier 4 emission standards for non-road diesel equipment, retrofit existing diesel equipment with particulate filters and oxidation catalysts, replace aging equipment with new low-emission models, consider the use of alternative fuels for construction equipment. These reductions in emissions would translate into reductions in risks and hazard impacts.

4.7.1.8 Level of Significance After Mitigation

LAX Master Plan mitigation measures would reduce TAC emissions associated with all of the SPAS alternatives. However, even with implementation of these measures, acute non-cancer health hazards at some fence-line receptors would exceed the threshold of significance under all of the alternatives, compared to 2009 baseline conditions. As such, acute non-cancer health hazard impacts under all of the SPAS alternatives are considered to be significant and unavoidable.

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