THE PLANE TRUTH

Air Quality Impacts of Airport Operations and Strategies for Sustainability: A Case Study of the Los Angeles World Airports

A comprehensive project submitted in partial satisfaction of the requirements for the degree Master of Arts in Urban Planning from the University of California, Los Angeles

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Client: The Coalition for Clean Air

With support from: Environment Now

June, 2010
Disclaimer

Neither the University of California, the School of Public Affairs, the Coalition for Clean Air, nor Environment Now either supports or disavows the findings in the report listed herein. University affiliations are for identification only; the University is not involved in or responsible for the project.
Acknowledgments

I would like to thank all the air quality and aviation experts that provided valuable information for this report. Staff at the Coalition for Clean Air—particularly Martin Schlageter, Interim Executive Director, and Luis Cabrales, Deputy Director of Campaigns—provided support and guidance to make this project possible. I am grateful to Environment Now for financially supporting the report and Mara Burstein, Air and Communications Program Manager at Environment Now, for her strategic thoughts on this project. I also greatly appreciate the guidance and feedback from my academic advisors, Brian Taylor and Chris Tilly.
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Aviation facilitates economic and cultural exchange because it is one of the fastest and most efficient ways to transport products and people. Aviation is also one of the most energy intensive and polluting modes of transportation. Staff at the US Joint Planning Development Office predict that air pollution emissions from the aviation sector are likely to increase by 140 to 200 percent by 2025, unless aggressive actions are taken to control and reduce aviation’s environmental footprint.

This report was commissioned by the Coalition for Clean Air (CCA) — a non-profit organization that works to restore California’s air quality through advocacy, outreach, and education — as a first step to potentially develop a campaign to reduce air pollution from airports in the Los Angeles region. The report provides a case study of the Los Angeles World Airports (LAWA), which owns and operates Los Angeles International Airport, Van Nuys Airport, Ontario International Airport, and Palmdale Regional Airport. As such, the report explores the LAWA as the basis to explore the following: 1) aviation’s impact on local and global air pollution, 2) the sources of air pollution related to airport operations, 3) the current regulatory landscape that governs airport emissions, and 4) strategic opportunities to reduce emissions from these main sources of air pollution. The Los Angeles International Airport (LAX) is a focus of this report because LAX is the most significant source of airport-related air pollution in Southern California. In addition, the best emission source data and travel behavior data exist for LAX.

Airport-related pollution comes from numerous sources. Nitrogen oxides— a precursor to ozone smog— result in local and regional health impacts. The following sources contribute to nitrogen oxide (NOx) emissions from LAX-related operations:

1) Ground access transportation for travelers and cargo accounts for approximately 43 percent of NOx emissions from all LAX-related operations.
2) Aircraft accounts for 40 percent.
3) Ground service equipment accounts for 11 percent.
4) Airport vehicles account for four percent.
5) Stationary sources, primarily from energy production, account for two percent.

Any campaign to significantly and comprehensively reduce emissions from the LAWA-related operations should seek to address these emissions sources. There are myriad ways that clean air advocates could approach such a campaign. Based on communications with experts and an extensive literature review, I summarized 10 key findings and recommended associated actions for a clean air campaign based on these findings. My criteria for evaluating and prioritizing recommendations was based on: 1) impact—the importance of the recommended action in terms of emission reduction potential over the current baseline and 2) ease of implementation—the potential feasibility of a clean air advocacy organization based in Los Angeles to move the target agency to adopt the recommended action. I ranked the following five recommended actions as a high priority.

**Create a Clean Air Action Plan for the LAWA**

**Finding:** The LAWA’s various environmental data collection, programmatic, and policy efforts concentrate on LAX while often not applying to its other airports. Van Nuys Airport has the second largest number of landings and take-offs in the Los Angeles County, however, the airport is virtually ignored in the LAWA’s Sustainability Plan. Furthermore, there is only limited alignment between the environmental programs at LAX and at Ontario International Airport. Even at LAX, however, the LAWA does not coordinate its various air quality measures under a comprehensive plan.

**Recommendation and Target:** Clean air advocates should encourage the LAWA to set a health-based emission reduction goal for all three airports and develop a plan to comprehensively target airport-related emission sources through a consistent application of programs, goals, and policies among the three airports. Such a plan should be included as part of the Southern California Association of Governments’ Regional Transportation Plan.

As a starting point, the LAX Community Benefits Agreement contains commitments that should be enforceable and applied to the other airports. A comprehensive clean air action plan should also include measures to protect vulnerable populations living near the LAWA airports. Effective and relatively inexpensive air filtration systems are available on the market and have already been installed in schools near the Ports of Los Angeles and Port of Long Beach, with support from the ports and the South Coast Air Quality Management District.
**Ban Lead in Aviation Gasoline**

**Finding:** Lead is banned in all fuel in the US except aviation gasoline (avgas). Avgas is used in piston-engine, normally non-commercial aircraft that frequent generation aviation airports including Van Nuys Airport, the largest general aviation airport in the world. On a national basis, avgas is the largest single source of air-borne lead emissions. The lead found in leaded avgas is a potent neurotoxin. The US Centers for Disease Control and Prevention concluded in 2005 that there is “no safe threshold for blood lead.” The Federal Aviation Administration (FAA) certified a non-lead alternative, AGE85, but it is not widely used in part because the FAA has been slow to certify AGE85 for all types of small planes. On April 28, 2010 the EPA Administrator Lisa Jackson issued an “Advance Notice of Proposed Rulemaking on Lead Emissions From Piston-Engine Aircraft Using Leaded Aviation Gasoline.”

**Recommendation and Target:** Clean air advocates should submit comments to the EPA about the high levels of lead particulate found in the areas surrounding Van Nuys Airport and other general aviation airports in Los Angeles County, as well as the number of schools located within a three-mile buffer zone of key airports (see pages 37 through 39 for this information). Clean air advocates should then track the EPA’s rulemaking process and advocate for a rule that will protect the approximately three million children who attend school and the up to 16 million adults who reside in close proximity to one or more of the almost 20,000 airports in the U.S. frequented by piston-engine aircraft.

**Fully Implement the LAX Community Benefits Agreement**

**Finding:** Implementation of the LAX Community Benefits Agreement (CBA) is moving at a slow pace and the LAWA has much further to go to meet many of its commitments as part of the CBA. For example, the LAWA agreed to convert all on-airport ground service equipment (GSE) to the cleanest technology available by 2015. Currently, only approximately a quarter of LAX’s tenant GSE is zero-emission.

**Recommendation and Target:** Monitoring the LAWA’s progress in implementing the LAX Community Benefits Agreement (CBA) should be a high priority for clean air advocates because most major emission sources from LAX operations are addressed in the CBA. Clean air advocates should seek to ensure that the LAWA meets its commitments.
Focus on Heavy-duty Trucks

Finding: Ontario Airport is part of an expanding freight movement system in which trucks move freight from the Port of Los Angeles and Port of Long Beach to the Inland Empire’s freight loading facilities, warehouses, rail yards, and airports. Diesel trucks also deliver products to airport tenants and airliners at LAX, which ranks 13th in the world in air cargo tonnage handled. However, the LAWA does not track commercial truck trips at its airports. The lack of data indicates a lack of focus on this emission source.

Recommendations and Target: First of all, clean air advocates should request that the LAWA collect and make publically available data on truck trips and their contribution to airport-related air pollution. This is important because managing a source of pollution requires the ability to measure that pollution source. Second, clean air advocates should request that the LAWA pursue a policy to phase-out the oldest and dirtiest trucks that enter onto the LAWA property. The LAWA should explore the San Pedro Ports Clean Trucks Program, already implemented at the Port of Los Angeles and Port of Long Beach, as a model program. The Clean Trucks Program progressively bans all trucks that do not meet the most recent (2007) federal emission standards by 2012. The LAWA serves as a landlord at its airports and as such the LAWA should be able to set terms for the trucking companies that do business on its property.

Target Aircraft and Airports in State Implementation Plans

Finding: Although aircraft are a major source of air pollution comparable to industrial sources, they escape inclusion in State Implementation Plans, the US Environmental Protection Agency’s (EPA) principal means of achieving cleaner air in air quality nonattainment areas. This omission has serious consequences in efforts to both monitor and reduce air pollution. In California, the Air Resources Board faces obstacles in its ability to regulate airport-related sources. However, the agency faces similar challenges in regulating the shipping and railroad industries and has found some creative ways to target emissions related to these industries.

Recommendation and Target: Clean air advocates should work with staff at the California Air Resources Board (CARB) to explore creative ways to address emissions from aircraft and other airport-related sources. In addition to exploring regulatory strategies, CARB should conduct more research about the health impacts, including cancer risk, from airports.
REPORT CLIENT, OBJECTIVE, AND STRUCTURE

This report was commissioned by the Coalition for Clean Air (CCA). With offices in Los Angeles, Fresno, and Sacramento, the CCA is a statewide non-profit organization that since 1971 has worked to restore California’s air quality through advocacy, outreach, and education. The report serves as a first step for the Coalition for Clean Air to potentially develop a campaign to reduce air pollution from airport operations in the Los Angeles region. Support for this research comes from Environment Now, a private non-profit foundation based in Santa Monica. Environment Now’s mission is to be an active leader in creating measurably effective environmental programs to protect and restore California’s environment.

The focus of this report is on the Los Angeles World Airports (LAWA), which owns and operates four airports in Southern California. The report aims to set a roadmap for staff at the CCA and other clean air advocates wanting to understand: 1) aviation’s impact on local and global air pollution, 2) the sources of air pollution related to the LAW A operations, 3) the current regulatory landscape that governs the LAW A-related emissions, and 4) strategic opportunities to reduce emissions from these main sources of air pollution.

I begin the report by summarizing the problem of air pollution associated with airport-related emissions. Then, in the ‘Setting, Issues, and Analysis’ chapter, I describe the regional and governing context in which the LAW A operates, introduce important environmental initiatives at the LAW A’s airports, state the health and environmental impacts of key air pollutants, and describe what the literature reveals about air quality near airports. I then highlight the major sources of emissions from LAX operations. Finally, I analyze the state of regulations and programs that affect air pollution from the LAW A’s operations, analyze the effectiveness of these efforts, and identify regulatory gaps and potential opportunities for additional emission reductions.

In the ‘Findings and Recommendations’ chapter, I summarize 10 key problems and recommend associated actions that clean air advocates could encourage specific agencies to achieve. I develop these recommendations both
from my review of the literature and from my communications with citizen activists, scientists, airport operations, and air regulators. My criteria for evaluating and prioritizing recommendations is based on: 1) impact— the importance of the recommended action in terms of emission reduction potential over the current baseline and 2) ease of implementation— the potential feasibility of a clean air advocacy organization based in Los Angeles to move the target agency to adopt the recommended action.

Figure 1
OVERVIEW OF THE PROBLEM

The aviation industry emits air pollution

Aircraft and the vehicles, facilities, and operations that support aviation emit many types of “criteria air pollutants,” including nitrogen oxides (NOx), particulate matter (PM), carbon monoxide (CO), and sulfur oxides (SOx) that cause local environmental and health problems. For example, NOx — combined with volatile organic compounds (VOC) in the presence of sunshine — is a key precursor to ground-level ozone. Ozone (smog) is a powerful oxidant that can damage the respiratory tract and induce symptoms such as coughing, chest tightness, shortness of breath, worsening of asthma symptoms, and even death. The majority of our nation’s busiest airports fall in ozone non-attainment areas.

Aviation contributes approximately 0.5 percent of the total US inventory of NOx pollution. According to members of the State and Territorial Air Pollution Program Administrators, NOx emissions from major airports are often greater than emissions from large stationary sources such as refineries and electrical generating facilities. Table 1 shows the contributions that the nation’s largest airports have on regional NOx inventories. Considering the myriad sources of NOx pollution, even a small percentage in the total NOx inventory represents a large amount of pollution.

Los Angeles International Airport is one of the largest sources of NOx and VOC emissions in the South Coast Air Basin. The staff of the South Coast Air Quality Management District (SCAQMD) estimated that LAX contributes one percent of the Air Basin’s annual NOx emissions. To put the airport’s emissions in perspective, LAX’s 6,522 tons of NOx emissions in 1993 placed it as the top emitter of this pollutant in the South Coast Air Basin, well ahead of second place Mobil Oil Corporation (2,731 tons), and third place Chevron Corporation (1,921 tons).

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1 The U.S. Environmental Protection Agency sets National Ambient Air Quality Standards for six common air pollutants known as “criteria pollutants” because EPA develops human health-based and/or environmentally-based criteria for setting permissible levels for these six pollutants. These pollutants are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Source: U.S. Environmental Protection Agency, http://www.epa.gov/air/urbanair/.
tons). With regard to VOC, LAX’s 1993 VOC emissions were almost three times the emissions from the basin’s largest oil refinery and more than 10 times the VOC emissions from Santa Ana’s John Wayne Airport.\textsuperscript{18}

Table 1

<table>
<thead>
<tr>
<th>Airport</th>
<th>National Rank (Enplanements)</th>
<th>Ozone Non-Attainment Status</th>
<th>Airport Contribution to Area NO\textsubscript{x} Inventory</th>
<th>Airport Contribution to Non-Road NO\textsubscript{x} Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hartsfield Atlanta International</td>
<td>1</td>
<td>Marginal</td>
<td>2.8%</td>
<td>14.1%</td>
</tr>
<tr>
<td>Chicago Nonattainment Area (ORD, MDW)</td>
<td>2 (ORD), 28 (MDW)</td>
<td>Moderate</td>
<td>0.8-2.0%</td>
<td>10.5%</td>
</tr>
<tr>
<td>South Coast California (BUR, LAX, LGB, ONT, SNA)</td>
<td>3 (LAX), 44 (SNA), 51 (ONT), 61 (BUR), 93 (LGB)</td>
<td>Severe</td>
<td>1.5%</td>
<td>5.7%</td>
</tr>
<tr>
<td>Dallas/Fort Worth Air Quality Area (DFW, DAL, AFW)</td>
<td>4 (DFW), 53 (DAL)</td>
<td>Moderate</td>
<td>6.1%</td>
<td>19.9%</td>
</tr>
<tr>
<td>Houston Bush Intercontinental</td>
<td>8</td>
<td>Moderate</td>
<td>0.7%</td>
<td>3.3%</td>
</tr>
</tbody>
</table>


Aircraft—just one source of airport-related emissions—is a major source of SO\textsubscript{x} pollution in the South Coast Air Basin. As illustrated in Table 2, aircraft are the fifth largest source of SO\textsubscript{x} emissions. The SCAQMD expects this ranking to jump to number three by 2014.\textsuperscript{19} It should be noted that the most recent regional and state emission inventories do not address airport emissions cumulatively. Not included in the inventory are other sources of airport related emissions, such as the equipment that services the aircraft and the vehicles going to and from an airport. Therefore, the inventories underestimate the role that the aviation sector plays in emission inventories.
Table 2

Top 10 Sources of SOx Emissions (2002, 2014, and 2023) in the South Coast Air Basin, from Highest to Lowest

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2014</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Ships &amp; Commercial Boats</td>
<td>Ships &amp; Commercial Boats</td>
<td>Ships &amp; Commercial Boats</td>
</tr>
<tr>
<td>2</td>
<td>RECLAIM</td>
<td>RECLAIM</td>
<td>RECLAIM</td>
</tr>
<tr>
<td>3</td>
<td>Petroleum Refineries (non-RECLAIM)</td>
<td>Aircraft</td>
<td>Aircraft</td>
</tr>
<tr>
<td>4</td>
<td>Heavy-Duty Diesel Trucks</td>
<td>Manufacturing &amp; Industrial Combustion</td>
<td>Manufacturing &amp; Industrial Combustion</td>
</tr>
<tr>
<td>5</td>
<td>Aircraft</td>
<td>Light-Duty Passenger Cars</td>
<td>Light-Duty Passenger Cars</td>
</tr>
<tr>
<td>6</td>
<td>Trains</td>
<td>Light-Duty Trucks</td>
<td>Light-Duty Trucks</td>
</tr>
<tr>
<td>7</td>
<td>Off-Road Equipment</td>
<td>Service &amp; Commercial Combustion</td>
<td>Service &amp; Commercial Combustion</td>
</tr>
<tr>
<td>8</td>
<td>Light-Duty Passenger Cars</td>
<td>Petroleum Refineries (non-RECLAIM)</td>
<td>Petroleum Refineries (non-RECLAIM)</td>
</tr>
<tr>
<td>9</td>
<td>Manufacturing &amp; Industrial Combustion</td>
<td>Waste Burning &amp; Disposal</td>
<td>Waste Burning &amp; Disposal</td>
</tr>
<tr>
<td>10</td>
<td>Light-Duty Trucks</td>
<td>Residential Fuel Combustion</td>
<td>Residential Fuel Combustion</td>
</tr>
</tbody>
</table>

A total of 48 airports were identified as having reportable operations within the District boundaries.

Aircraft is currently not one of the top ten emitters of NOx in region, but SCAQMD expects aircraft’s contribution to NOx pollution in the South Coast Basin to grow significantly to the fourth top source of NOx pollution by 2023, as indicated in Table 3. This is due to expected growth in air travel and reductions in other sources of emissions.
Table 3

Top Ten Sources of NOx Emissions (2002, 2014, and 2023) in the South Coast Air Basin, from Highest to Lowest

<table>
<thead>
<tr>
<th></th>
<th>2002</th>
<th>2014</th>
<th>2023</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Off-Road Equipment</td>
<td>Heavy-Duty Diesel Trucks</td>
<td>Ships &amp; Commercial Boats</td>
</tr>
<tr>
<td>2</td>
<td>Heavy-Duty Diesel Trucks</td>
<td>Off-Road Equipment</td>
<td>Off-Road Equipment</td>
</tr>
<tr>
<td>3</td>
<td>Light-Duty Passenger Cars</td>
<td>Ships &amp; Commercial Boats</td>
<td>Heavy-Duty Diesel Trucks</td>
</tr>
<tr>
<td>4</td>
<td>Light-Duty Trucks</td>
<td>Light-Duty Trucks</td>
<td>Aircraft</td>
</tr>
<tr>
<td>5</td>
<td>Ships &amp; Commercial Boats</td>
<td>Light-Duty Passenger Cars</td>
<td>Trains</td>
</tr>
<tr>
<td>6</td>
<td>Medium-Duty Trucks</td>
<td>RECLAIM</td>
<td>RECLAIM</td>
</tr>
<tr>
<td>7</td>
<td>Heavy-Duty Gasoline Trucks</td>
<td>Heavy-Duty Gasoline Trucks</td>
<td>Light-Duty Trucks</td>
</tr>
<tr>
<td>8</td>
<td>Trains</td>
<td>Trains</td>
<td>Residential Fuel Combustion</td>
</tr>
<tr>
<td>9</td>
<td>RECLAIM</td>
<td>Residential Fuel Combustion</td>
<td>Light-Duty Passenger Cars</td>
</tr>
<tr>
<td>10</td>
<td>Residential Fuel Combustion</td>
<td>Aircraft</td>
<td>Heavy-Duty Gasoline Trucks</td>
</tr>
</tbody>
</table>

Source: South Coast Air Quality Management District, “2007 Air Quality Management Plan.” http://www.aqmd.gov/aqmp/07aqmp/draft/07aqmp.pdf. A total of 48 airports were identified as having reportable operations within the District boundaries.
**Aviation emits greenhouse gases**

The Intergovernmental Panel on Climate Change concluded in 1999 that aircraft alone accounted for 13 percent of all carbon dioxide emissions (CO2) from the transportation sector and was responsible for 3.5 percent of global climate change. CO2 is the greenhouse gas with the most significant impact on climate change. Airplanes emit more CO2 per passenger-mile than most other modes of transportation because of their high energy intensity.

While aircraft fuel efficiencies have steadily increased over the past several decades, demand for air travel has grown more rapidly than efficiency improvements, causing CO2 and other greenhouse gases emissions to continue to increase. These trends will continue under a “business-as-usual” scenario where the global economy continues to grow over the long-term and there are no specific policies targeting aviation related greenhouse gas emissions. Table 4 illustrates the growth in US world greenhouse gas emissions.

**Table 4**

**US and World Greenhouse Gas Emissions**

<table>
<thead>
<tr>
<th>Units: Millions of metric tons of CO2 equivalent</th>
<th>Year: 1990</th>
<th>Year: 2005</th>
<th>% Change from 1990 to 2005</th>
</tr>
</thead>
<tbody>
<tr>
<td>World Total Aircraft: Domestic and International</td>
<td>—</td>
<td>641.0</td>
<td>—</td>
</tr>
<tr>
<td>United States Commercial, Domestic</td>
<td>136.7</td>
<td>150.4</td>
<td>10% increase</td>
</tr>
<tr>
<td>United States General Aviation, Domestic</td>
<td>9.4</td>
<td>13.8</td>
<td>47% increase</td>
</tr>
</tbody>
</table>

Air travel is down, but long-term growth will likely occur

The US aviation industry experienced turbulence during the first decade of the twentieth century. Negatively impacted by the September 11, 2001 terrorist attacks, the industry rebounded by 2006. However, unprecedented fuel prices in 2008 followed by a worsening global economic recession constrained the airline industry in 2008 and 2009. In 2008, the US airline industry experienced $5.8 billion in operating losses for the year and multiple bankruptcies. Prior to the fourth quarter of 2007, the industry had experienced six consecutive quarters of operating profits totaling $11.8 billion.

During the first half of the decade, the Los Angeles World Airports announced several airport projects designed to accommodate expected growth in both passenger and cargo air traffic, but since then business at these airports has decreased. Such projects at Los Angeles International Airport (LAX) and LA/Ontario International Airport are still moving forward despite passenger and cargo operations that are lower than forecasted.

LA/Ontario International Airport (ONT) exemplifies the turbulence in the airline industry during this past decade. Until recently, ONT was setting growth records. Airlines flocked to the Inland Empire airfield in what Los Angeles Mayor Antonio Villaraigosa hailed as the "great first steps" to regionalizing air travel in Southern California. However, ONT has been hit harder than any other airport in Southern California by the aviation fuel and economic crisis. In the fall of 2008, flights were down approximately one-third from the previous year, frustrating promises by politicians to shift some service away from LAX. Officials for the Los Angeles World Airports say that ONT and LAX are particularly affected because they are neither hubs nor headquarters for major domestic airlines; when economic times are bad, airlines concentrate flights at their hubs to save money and to take advantage of their established markets.

Despite the recent dip in air traffic nationwide and locally, officials at the Federal Aviation Administration (FAA) continue to forecast long-term aviation growth. Their 2009 forecast for commercial aviation anticipates a sharp decline in activity in the near-term, with a return to growth over the long-term. Specifically, this forecast predicts that the US commercial aviation industry will break a new record and carry one billion passengers by 2016. At a more local level, staff at the Southern California Association of Governments (SCAG) predict that air passenger demand in the region will more than double to 170 million passengers in 2030 and that air cargo will more than triple to 8.7 million tons in 2030.
As aviation traffic increases, so will the environmental impacts

Airport-related air pollution and greenhouse gas emissions are projected to grow as the demand for air travel is expected to increase more than aviation technology, operations, or other advancements over the long-term. In 2005, staff at the US Department of Transportation (DOT) predicted that aircraft greenhouse emissions would increase 60 percent by 2025.

Other projections are even more staggering. In 2007, experts at the US DOT Volpe Center forecasted aviation-related CO₂ globally to rise from 572 million tons in 2000 to 1,228 million by 2025, a 114 percent increase. These experts also predicted that NOx pollution around airports would rise from 2.5 million tons in 2000 to 6.1 in 2025, a 144 percent increase. Finally, computations provided to the US House of Representatives by staff at the Joint Planning Development Office show that aviation noise pollution and air pollution emissions are likely to increase by a whopping 140-200 percent by 2025 under future aviation growth scenarios, unless aggressive actions are taken to control and reduce aviation’s environmental footprint.

While these predictions from 2005 and 2007 are likely somewhat inflated based on the recent downturn in air travel, the timeline for reaching these projected numbers has merely shifted. Given what will likely be a long-term increase in air travel, these emission forecasts cannot be ignored. Aviation will be able to count on technology to reduce some emissions per passenger mile, but the long-term growth in air travel— both an enabler and a product of the burgeoning global economy— is likely to outpace technology efficiency gains. This is at a time when other sources of pollution are decreasing. For most states and localities with major airports and seaports, aircraft and international marine vessels are the only two source sectors where emissions are projected to increase in the future.
Air quality regulators and airports managers face challenges—while also missing opportunities—to reduce airport-related air pollution

Airport-related emissions are subject to a complex, multidimensional patchwork of regulations and voluntary programs. Most airport-related emission sources are independently regulated through equipment specific regulations, standards, and operational guidelines, which are established by a variety of agencies. For example, stationary sources at airports, like power boilers and refrigeration chillers, must meet independent state regulations. And the Federal Aviation Administration is responsible for enforcing aircraft emissions standards established by the US Environmental Protection Agency based on the international standards set by International Civil Aviation Organization (ICAO).

The International Civil Aviation Organization (ICAO) is a United Nations intergovernmental body responsible for worldwide planning, implementation, and coordination of civil aviation. The United States is one of 188 participating member States. Under the basic ICAO treaty established in 1944, as long as a participating nation adopts aircraft emission standards that are equal to or more stringent than the ICAO’s standards, it satisfies its obligations under ICAO. Therefore, the ICAO sets emission standards for jet engines that are the basis of the FAA’s aircraft engine performance certification standards, established through the EPA’s regulations. The ICAO has long been the forum for evaluating the environmental performance of aircraft engines.

The ICAO has taken a “technology progressing” approach, raising standards within the capabilities of proven technologies and certified products (engines and aircraft) rather than a “technology forcing” approach, which set standards based on technology that is not yet certified, still in the development process, or may not even exist. The ICAO’s approach is based on the premise that the safety of aircraft operations restricts the use of unproven new technologies.

The FAA and the ICOA, in a sense, limit the EPA’s jurisdiction over airport related emission sources. The EPA has historically worked with the FAA and the ICAO in the development of international aircraft emission standards. The FAA enforces the aircraft emissions standards established by the EPA in alignment with the ICAO’s standards. The ICOA itself does not have much authority to enforce the standards that they set.
Furthermore, federal law complicates the ability of airport proprietors or state and local air regulators from setting emission standards for aircraft or otherwise regulating air carriers. Although aircraft are a major source of air pollution comparable to industrial sources, they escape inclusion in State Implementation Plans, the EPA's principal means of achieving cleaner air in air quality nonattainment areas. Citing the prevention of interstate commerce conflicts, Congress purposefully left the Federal Aviation Administration out of the State Implementation Process (SIP) process and thereby the regional Air Quality Management Plans (AQMPs). This omission has serious consequences in efforts to reduce air pollution. Because the FAA is not directly involved in the SIP planning process and emissions from aircraft cannot be addressed in AQMPs, state and local regulators must find ways to reduce emissions elsewhere.

In California, the state’s Air Resources Board (CARB) sets and oversees on-road vehicle emissions standards, fuel specifications, and some off-road sources, yet airport emissions are not represented cumulatively in the SIP. “Regional aircraft” is only a line item (not differentiated by airport), “ground service equipment” is hidden in the “off-road source” category, “stationary sources” are lumped with similar processes, and “ground access vehicles” are lost within the huge “regional on-road” category. While the CARB can regulate airport-related sources that do not cross state borders, because state regulators do not cumulatively consider airport emissions, state regulation often does not specifically target an airport-related source. Instead, airport-related sources are placed in broader categories with non-airport related sources. For example, the CARB lumps ground service equipment in its “In-Use Off-Road Diesel Rule.” Due in part to the broad scope of this rule, opponents of the diesel rule challenged it and the CARB ultimately severely weakened the rule. Emissions from this source remain significant.

Transportation to and from airports (for travelers and cargo) is another major source of air pollution, yet managing this source is particularly complex. On-road vehicles, which take passengers to and from the airport, meet federal tailpipe standards set by the US Environmental Protection Agency. While airport proprietors have only indirect control of this source, they and other local/regional agencies have significant influence over the factors that incentivize passengers and employees to use less pollution-inducing forms of travel to and from airports. The ‘Setting, Issues, and Analysis’ chapter elaborates on this point.

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* This does not constitute official legal analysis or counsel.
**International and national leadership is lacking in efforts to reduce greenhouse gas emissions from the aviation sector**

While some countries—New Zealand, Australia, and members of the European Union—have taken steps to include aviation in their domestic greenhouse gas (GHG) cap-and-trade programs, the majority of GHG emissions from aviation are unregulated. Specifically, the US does not regulate greenhouse gas emissions at a national level.

The Kyoto Protocol—a protocol to the United Nations Framework Convention on Climate Change aimed at fighting global warming—did not include GHG emission limits from international aviation, leaving the regulation of GHGs from international flights to the International Civil Aviation Organizations (ICAO). The ICAO has not set standards for either GHGs or fuel efficiency. According to the Federal Aviation Administration, it is working with the ICAO to evaluate policy options to limit or reduce GHG emissions from aviation. For several years the ICAO has been evaluating voluntary approaches and market approaches, such as emission trading, to limit aviation emissions growth while allowing continued expansion of air travel. Their preliminary results show that emission-related levies are not cost effective, but voluntary arrangements and emissions trading may be cost effective in limiting or reducing greenhouse gas emissions.

Due to a lack of strong leadership at the international and national levels, voluntary local and regional leadership has become increasingly important but is currently limited. Laura Zahn conducted an investigation of what airport managers are doing to reduce greenhouse gas emissions from airport-based emissions. In her study, “Cleaner Skies, Brighter Future,” she found that a limited number of airport managers—predominantly in Europe, Canada, and the United States—are taking concrete steps to reduce airport-based greenhouse gas emissions. Zahn concluded that there are opportunities for cities and city-owned airports to work together to reduce overall emissions but that two key barriers remain: no consistent way to measure the success of implemented projects and no central tool to communicate those successes to other airports. According to Zahn, future progress hinges on developing these two tools.
METHODOLOGY

The Los Angeles World Airports serves as a case study in this report. The Los Angeles World Airports (LAWA) owns and operates Los Angeles International Airport, LA/Ontario International Airport, and Van Nuys Airport. The LAWA also owns Palmdale Regional Airport, but because of virtually no operations at Palmdale Regional Airport, this report addresses only the aforementioned three airports. The Los Angeles International Airport (LAX) is a particular focus in this report, both because LAX is the most significant source of airport-related air pollution in Southern California and because the best emission source data and ground access travel behavior data exists for LAX.

Through an extensive literature review and by communicating with experts, I identified and analyzed the key regional, governance, political, economic, environmental, and regulatory conditions that affect the LAWA and air pollution from its operations. Specifically, I reviewed what the literature reveals about the air quality impacts of airports and then highlighted the emission sources associated with LAX. The LAWA has direct or indirect control over these emission sources but international, federal, state, and regional agencies also play a role. Consequently, my recommendations are not focused on merely one target agency or just one emission source.

I summarized 10 key findings and recommended associated actions. My objective was to prioritize the actions that clean air advocates could strategically request the target agency to pursue to maximize emission reductions. My criteria for evaluating and prioritizing actions was based on: 1) impact— the importance of the recommended action in terms of emission reduction potential over the current baseline and 2) ease of implementation— the feasibility of a clean air advocacy organization based in Los Angeles to move the target agency to adopt the recommended action. The findings and recommendations are organized by emission source. The people who I communicated with to write this report include:

- Joe Lyou, Executive Director of the California Environmental Rights Alliance and a leading member of the LAX Coalition
- Martin Rubin, Founder and Director of Concerned Residents Against Airport Pollution
- Ken Petche, US Environmental Protection Agency
- Jim Thomson, Aviation Data Base Products
Bill Piazza, Los Angeles Unified School District, Environmental Health and Safety
Suzanne Paulson, University of California, Los Angeles, Department of Atmospheric and Oceanic Sciences
Norene Hastings, Environmental Specialist, Los Angeles World Airports
Patrick Tomcheck, Senior Transportation Engineer, Los Angeles World Airports

While this report focuses on the opportunities to reduce local criteria and toxic air pollutants, I also address greenhouse gas emissions because there is a connection between local and global air pollution. In one specific circumstance there is a tradeoff, but in general, efforts to reduce criteria pollutants will also reduce greenhouse gas emissions. Unless specified, the recommendations that I provide apply to criteria, toxic, and greenhouse gas emissions. See the pull-out box on the following page for more details about this connection.

Given the nature of this topic, this report contains many terms and acronyms. The Appendix contains a glossary of definitions and acronyms.
Criteria Pollutants and CO2 Reductions Goals: Consistency and Tradeoff

Reducing the amount of fossil fuels burned in: 1) aircraft, 2) vehicles traveling to, from, and at airports, 3) airport ground support equipment, and 4) airport operations and construction, etc., in general, results in benefits both in terms of reducing criteria and toxic emissions associated with local health effects and also reducing greenhouse gas emissions associated with global climate change. Aircraft fuel efficiency improvements are made via: 1) aerodynamic aircraft improvements, 2) weight reductions, and 3) engine developments. The first two provide consistency between criteria pollutant reduction goals and greenhouse gas emission reduction goals. The engine development method involves emission tradeoffs.

Developments that reduce airplane weight or reduce aerodynamic drag can offer all-round emission benefits for criteria, toxic and greenhouse gas pollutants. Lightweight composite materials for the majority of the aircraft structure are beginning to appear and promise significant weight reductions and fuel burn benefits. The use of winglets, fuselage airflow control devices, and laminar fuel technology (which reduces airframe drag through control of the boundary layer), can increase aerodynamic efficiency and reduce fuel consumption.

On the other hand, engine developments require a balancing of the emissions produced to both satisfy operational need (fuel efficiency) and regulatory need (NOx and CO). This tradeoff is most difficult for those engines having the highest pressure ratios (PR). Higher PRs increase the temperature of the air used for combustion, exacerbating the NOx emissions challenge. Increasing an engine’s PR is one of the main options manufacturers have to improve engine efficiency. Thus, an engine may be optimized for minimum NOx emissions, at which design point the engine will burn more fuel than it might otherwise have done. However, in general, reducing local pollutants from an airport related sources will also have climate benefits.

**SETTING: SOUTHERN CALIFORNIA**

The Los Angeles World Airports (LAWA) owns and operates Los Angeles International Airport (LAX), LA/Ontario International Airport (ONT), and Van Nuys Airport (VNY). Although these represent just three of 57 airports in the five-county region of Southern California, they are the most significant in terms of traffic and air quality impacts. LAX is the sixth busiest airport in the world in terms of number of passengers and fourth busiest in terms of number of annual takeoffs and landings.

**Table 5**

**World’s Busiest Airports by Passengers in 2008**

<table>
<thead>
<tr>
<th>Rank</th>
<th>Airport</th>
<th>Location</th>
<th>Rank Change from 2007</th>
<th>% Change</th>
<th>Total # of Passengers in 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hartsfield-Jackson Atlanta Int'l</td>
<td>Atlanta, Georgia, US</td>
<td>—</td>
<td>▲ 0.7%</td>
<td>90,039,280</td>
</tr>
<tr>
<td>2</td>
<td>O'Hare Int'l</td>
<td>Chicago, Illinois, US</td>
<td>—</td>
<td>▼ 9.0%</td>
<td>69,353,876</td>
</tr>
<tr>
<td>3</td>
<td>London Heathrow</td>
<td>Greater London, U.K.</td>
<td>—</td>
<td>▼ 1.5%</td>
<td>67,056,379</td>
</tr>
<tr>
<td>4</td>
<td>Tokyo Int'l</td>
<td>Ota, Tokyo, Japan</td>
<td>—</td>
<td>▼ 0.2%</td>
<td>66,754,829</td>
</tr>
<tr>
<td>5</td>
<td>Paris Charles de Gaulle</td>
<td>Roissy, France</td>
<td>▲ 1</td>
<td>▲ 1.6%</td>
<td>60,874,681</td>
</tr>
<tr>
<td>6</td>
<td>Los Angeles Int'l</td>
<td>Los Angeles, California, US</td>
<td>▼ 1</td>
<td>▼ 4.7%</td>
<td>59,497,539</td>
</tr>
<tr>
<td>7</td>
<td>Dallas-Fort Worth Int'</td>
<td>Dallas/Fort Worth, Texas, US</td>
<td>—</td>
<td>▼ 4.5%</td>
<td>57,093,187</td>
</tr>
<tr>
<td>8</td>
<td>Beijing Int'l</td>
<td>Beijing, China</td>
<td>▲ 1</td>
<td>▲ 4.4%</td>
<td>55,937,289</td>
</tr>
<tr>
<td>9</td>
<td>Frankfurt</td>
<td>Flughafen, Germany</td>
<td>—</td>
<td>▼ 1.3%</td>
<td>50,900,000</td>
</tr>
<tr>
<td>10</td>
<td>Denver Int'l</td>
<td>Denver, Colorado, US</td>
<td>—</td>
<td>▲ 2.8%</td>
<td>46,164,063 (Jan-Nov)</td>
</tr>
</tbody>
</table>

*Source: Airports Council International.*
Van Nuys Airport is the world’s largest general aviation airport, used by non-commercial (private and government) aircraft. Table 6 and Figure 2 highlight the operations—number of annual landings and takeoffs—at LAX and Van Nuys Airport compared to other main commercial and general aviation airports in Los Angeles County.

Table 6

Number of Takeoffs and Landings in 2008 for Los Angeles County Airports

<table>
<thead>
<tr>
<th>Airport</th>
<th>Approximate Number of Annual Takeoffs and Landings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Los Angeles International Airport</td>
<td>623,000</td>
</tr>
<tr>
<td>Van Nuys Airport</td>
<td>380,000</td>
</tr>
<tr>
<td>Long Beach Airport</td>
<td>300,000</td>
</tr>
<tr>
<td>Zamperini Field</td>
<td>150,000</td>
</tr>
<tr>
<td>Santa Monica Airport</td>
<td>150,000</td>
</tr>
<tr>
<td>Burbank Airport</td>
<td>130,000</td>
</tr>
<tr>
<td>Whiteman Airport</td>
<td>115,000</td>
</tr>
<tr>
<td>El Monte Airport</td>
<td>90,000</td>
</tr>
<tr>
<td>Hawthorne Airport</td>
<td>80,000</td>
</tr>
<tr>
<td>Compton Airport</td>
<td>65,000</td>
</tr>
</tbody>
</table>

Figure 2

Airports In Los Angeles County

Source: UCLA Mapshare
By Colleen Callahan
AIRPORT OWNERSHIP AND GOVERNANCE

Most US commercial service airports are typically owned by a local or state government, either directly or through an authority (a quasi-governmental body established to operate the airport). While Congress established a "privatization program" in 1997 under which the airport ownership could be transferred to a non-governmental entity, no airports currently participate in this program. US airports are typically managed in one of three ways.49

1. Management by a city, county or state. Examples of airports in this category include Atlanta, Pittsburgh, and Honolulu. In a few instances, such as Los Angeles and St. Louis, the airport is governed by an appointed commission which in turn reports to the City Council or Board.

2. Management by an airport authority. These entities are autonomous and have an appointed board that makes policy and financial decisions. Orlando, Minneapolis, and San Diego are a few examples.

3. Port Authority management. These airports are managed as part of a multi-modal entity. Examples include the Port Authority of New York and New Jersey, Seattle, and Portland.

The airport operator is responsible for the airport’s long- and short-term planning, financial performance, maintenance, operation and compliance with numerous federal, state and local laws and regulations.50 Some airports operate multiple airports within its system, such as the Los Angeles World Airports.

The Los Angeles World Airports (LAWA) is a municipal department of the City of Los Angeles. A seven-member Board of Airport Commissioners governs Los Angeles World Airports. By the Charter of the City of Los Angeles, the Board is responsible for the formulation of airport policy. The Board is composed of business and civic leaders who are appointed by the Mayor, approved by the City Council, and serve staggered five-year terms.

Los Angeles Mayor Antonio Villaraigosa named five of the current members of the Los Angeles Board of Airport Commissioners on July 25, 2005. They are labor leader Joseph A. Aredas; Alan Rothenberg, an executive and business leader; Fernando Torres-Gil, associate Dean of the UCLA School of Public Affairs; attorney Michael A. Lawson; and Valeria C. Velasco, also an attorney. The mayor also reappointed Airport Commissioner Walter Zifkin. The City Council later confirmed Sam Nazarian. President Alan Rothenberg was first elected as president on Sept. 14, 2005.51
REGIONALISM

The current airport management system in the Southern California region is among the most decentralized and complex in the nation, if not the world.\textsuperscript{52} Ten separate governing bodies operate the 12 commercial airports. The organization of these bodies range from municipal departments (the LAWA and Long Beach’s Public Works Department), to county agencies (Orange County’s John Wayne Airport) to facilities operated as Joint Powers Authorities (Bob Hope Airport operated by the Burbank-Glendale-Pasadena Airport Authority).\textsuperscript{53}

Clifton Moore, Executive Director of the Los Angeles’ Department of Airports (later renamed the Los Angeles World Airports) from 1968-1992, was a strong advocate for airport regionalization. He came to argue that growing community opposition limited LAX expansion prospects and that new airport capacity was needed in outlying areas. Moore proposed the creation of a new regional airport authority to “appropriately accommodate regional aviation demand.”\textsuperscript{54} In 1985, the Counties of Los Angeles, Riverside, San Bernardino, and the City of Los Angeles signed a joint powers agreement, officially creating the Southern California Regional Airport Authority (SCRAA). Orange County originally declined membership but in 1992 decided to join the SCRAA on the condition that each member had contractual veto power over the authority’s decisions.\textsuperscript{55}

Soon thereafter, members of the SCRAA were in conflict over battles featuring the LAX Masters Plan and a proposed commercial airport at the recently closed Marine Corps Air Station El Toro in South Orange County. The group advocating against the airport proposal consisted primarily of residents of Irvine, Lake Forest, Laguna Niguel, and other cities in proximity to El Toro. The cities opposed to the airport created a joint powers authority, the El Toro Reuse Planning Authority to oppose the project.

After Orange County voters in 2002 rejected a commercial airport at El Toro (Measure W), members of the SCRCC advocated for a proposed “airport without runways” high speed rail system to run from Anaheim to Inland Empire airports. But by 2004 the SCRCC became dormant for a lack of a quorum when Orange and Riverside Counties withdrew because of airport development conflicts and the City of Los Angeles failed to send a representative, ostensibly because of L.A. County’s use of the SCRCC to oppose the LAX Master Plan.\textsuperscript{56}
In recent years there has been a shift in the policy focus and political tenor of aviation debates in Southern California. The focus has changed from adding capacity to making better use of capacity already available at suburban airports in a strategy termed “regionalism.” The SCAG’s Regional Aviation Plan—part of the 2004 Regional Transportation Plan—recommends strategies for decentralizing passenger and air cargo service from congested urban airports to suburban airports. The Regional Aviation Plan also recommends a new “Regional Airport Consortium” for coordinating airport master planning, facilities construction, and ground access transportation policies and planning. Staff at the SCAG note that the SCRAA could be reinvigorated to serve as a consortium.

Figure 3

2002 Air Passenger Demand

2003 Air Passenger Demand
(SCAG’s Preferred Plan)

2002 Air Cargo Passengers

2030 Air Cargo Passenger
(SCAG’s Preferred Plan)

THE LAWA OWNED AND OPERATED AIRPORTS

Ontario Airport

LA/Ontario International Airport (ONT) is an airport with commercial jet service to major US cities and international destinations. The airport is the centerpiece of one of the fastest-growing regions in the United States. ONT’s service area includes a population of six million people living in San Bernardino and Riverside Counties and portions of north Orange County and east Los Angeles County. Passenger traffic at ONT has increased over the past 10 years. In 2006, 7 million passengers used the airport. ONT’s has approximately 220 flights per day and a total of approximately 120,000 landings and takeoffs per year.57

**History:** The "new" Ontario International Airport opened September 27, 1998. The $270 million project included two new terminals at 265,000 square foot each, a new ground transportation center, an additional parking lot, a new roadway system, airfield improvements, landscaping, and a site storm-drain system. The new terminals are eight times larger than the former terminal and can accommodate up to 10 million passengers a year. LAWA plans to construct a third terminal when passenger traffic at ONT reaches 10 million in two consecutive years.58

**Freight transport:** ONT is part of a freight movement system that includes the airport, two railroads, and four major freeways. Although ONT is not located as close to the Ports of Los Angeles and Long Beach as many other airports in the region, it is located in proximity to the freight transfer facilities, warehouses and logistics centers where trucks and trains take freight to be loaded, organized, and distributed to its final destination. The airport moved 602,326 tons of air freight in 2006. Major US air freight carriers include Ameriflight, Federal Express, Kalitta Air, and United Parcel Service.59

**Master Plan:** LAWA is in the process of developing a new master plan for the Ontario International Airport. As such, LAWA has forecasted major growth in operations, as illustrated from the following three tables.
Table 7
Proposed Ontario Airport Master Plan Recommendation 2030

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2030</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aircraft Passenger Gates</td>
<td>26</td>
<td>71</td>
<td>173 %</td>
</tr>
<tr>
<td>Rental Car Facilities (Acres)</td>
<td>26.5</td>
<td>73</td>
<td>175 %</td>
</tr>
<tr>
<td>Cargo Facilities (Acres)</td>
<td>100</td>
<td>254</td>
<td>154 %</td>
</tr>
<tr>
<td>Parking Spaces</td>
<td>6,575</td>
<td>30,680</td>
<td>366 %</td>
</tr>
</tbody>
</table>


Table 8
The LAWA’s Forecast for Ontario Airport

<table>
<thead>
<tr>
<th></th>
<th>2006</th>
<th>2030</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Operations (Takeoffs and Landings)</td>
<td>108,191</td>
<td>383,987</td>
<td>254 %</td>
</tr>
<tr>
<td>Total Cargo Volumes (Tons)</td>
<td>544,600</td>
<td>3,260,000</td>
<td>500 %</td>
</tr>
<tr>
<td>Passengers</td>
<td>9 million</td>
<td>33.4 million</td>
<td>271 %</td>
</tr>
</tbody>
</table>

Van Nuys Airport

Surprisingly to many Angelinos, Van Nuys Airport (VNY) ranks as the world’s busiest general aviation airport. As such, VNY is dedicated to non-commercial air travel, serving a variety of private, corporate, and government aircraft.\(^6^0\)

VNY averages close to 400,000 takeoffs and landings annually. The Mayor of Los Angeles signed the VNY Master Plan in 2006. The Master Plan does not add acreage to the existing 730-acre airport, but does state the LAWA’s intent to establish VNY as the Southern California general aviation center for the next 20 years.\(^6^1\)

Los Angeles International Airport

Los Angeles International Airport (LAX) is the world’s busiest origin and destination (O & D) airport. O&D passengers are those beginning or ending their trips in Southern California rather than using the airport for connecting flights. Based on number of passengers, LAX is the sixth busiest airport in the world. In 2008, the airlines of LAX served 59.8 million passengers.\(^6^2\)

**Freight:** LAX ranks 13th in the world in air cargo tonnage handled.\(^6^3\) In 2008, the airlines of LAX handled 1.8 million tons of freight and mail, with more than 1,000 flights departing and arriving every day carrying cargo. The majority of the air cargo at LAX arrives and departs in the bellies of passenger aircraft, allowing airlines serving LAX to offer some of the lowest airfares to travelers. More than 50 percent of LAX air cargo activity is international in origin or destination.\(^6^4\)
**Economics:** The annual budget for LAX was more than $524.1 million for 2008. According to the LAWA, LAX contributes $61 billion to the economy annually, and is a source of jobs.65

**Regional issues:** LAX handles 70 percent of the passengers and an estimated 79 percent of the air cargo for a five-county Southern California region.66 Thirteen percent of LAX passengers come from Orange County.67 In the 1990’s and early 2000’s, Orange County residents opposed proposals to build an international airport in South Orange County at the former Marine Corps Air Station, El Toro. The area is now designated as park land.

**LAX Master Plan:** In 2001, staff at the Los Angeles World Airports (LAWA) announced a new airport expansion plan. In December 2004, the Los Angeles City Council approved the LAX Master Plan and related entitlements for the future development of LAX. The LAX Master Plan provides the first major airport expansion plan since 1984. A main goal of the LAX Master Plan was to accommodate the expected growth in the number of passengers at LAX through the year 2015. Specifically, the gates would be reconfigured to accommodate larger planes and approximately 90 million annual passengers, up from its then current traffic of 61 million. In addition, the plan initially proposed doubling the airport’s cargo capacity from almost two million tons to more than four million, but ultimately settled for expanding to about three million tons.68

The LAX Master Plan serves as a broad policy statement regarding planning for projects, such as the Bradley West Project. The draft Environmental Impact Report for this project, released in May, 2009, states that this project, consistent with the LAX Master Program, would result in “unavoidable significant air quality impacts for construction and operations-related emissions” (1-14).69

In summary, the LAX Master Plan and the elements therein, are moving forward and are designed to accommodate increases in passengers and cargo. While the airport is used by residents of the entire country and beyond, the LAX-adjacent communities that suffer the daily impacts of airport operations – traffic congestion, air pollution, and noise pollution – could find those problems exacerbated with implementation of the LAX Master Plan.70
LAX COMMUNITY BENEFIT AGREEMENT

In 2000, Attorney Jerilyn Lopez Mendoza, who at the time worked for the nonprofit organization Environmental Defense, was monitoring the proposed LAX expansion and she suggested the obvious plan of attack for the environmental justice community: a Title VI complaint under the Civil Rights Act of 1964. "Based on LAWA’s own analysis of the expansion—more cars, more trucks, more people—it would have a disparate impact on people of color," Lopez Mendoza said. However, in April 2001, the United States Supreme Court tossed a wrench in Mendoza’s plan with its decision in Alexander v. Sandoval (2001). The Supreme Court held that Title VI did not give rise to a private cause of action, which means that only public agencies (rather than private citizens) can file suits based on evidence of disparate impact. With a Title VI lawsuit no longer in the cards, Lopez Mendoza and others began to explore strategies that did not involve litigation.

In the summer of 2003, members of the Los Angeles Alliance for a New Economy (LAANE) met with community members, elected officials, and representatives from several nonprofits and churches to discuss pursuing a community benefit agreement as a way to address and mitigate LAX expansion impacts without litigation. By September 2003, the essential participants had gathered—25 groups strong—into the LAX Coalition, which consisted of two school districts (Inglewood Unified School District and Lennox School District), twelve community organizations, seven environmental organizations, and four labor unions.

In February 2004, LAX Coalition representatives had their first meeting with officials of the LAWA. Reverend William Smart from the LAANE led the negotiations for the Coalition. Jim Ritchie, Deputy Airport Director, was the principal negotiator for the LAWA. The LAWA staff had a powerful negotiating tactic in their communication with the Federal Aviation Administration and the revenue diversions rule, which states that airport revenue cannot be used for funding of non-airport-related purposes. Officials from the LAWA would claim that some of the measures on the LAX Coalition’s program request list did not constitute a close enough nexus with airport operations.

Although officials from the LAWA and members of the LAX Coalition often wanted different things, they both wanted an agreement. On February 15, 2005, the LAX Coalition and the LAWA signed the community benefits agreement
(CBA) and cooperation document. The cooperation document is the legally binding contract between the LAX Coalition and LAWA. The CBA serves an attachment to the cooperation agreement and describes all the programs and policies agreed on in the cooperation agreement.  

The Final Agreement

The CBA “sets forth a range of community benefits and impact mitigations that will be provided by the Los Angeles World Airports as part of the LAX Master Plan Program, and an ongoing role for the LAX Coalition in implementation and oversight of these benefits and mitigations.” The main environmental benefits and mitigations related to air pollution are as follows:

1. Air quality study. Details are in a preceding section of this report.
2. Health study. The LAWA will fund a study to measure and investigate upper respiratory and hearing loss impacts for LAX operations due to the LAX Master Plan Program.
3. Air quality mitigation measures. The main components include:
   a. Electrification of Passenger Gates: By 2010, 100 percent of the passenger gates shall be equipped and able to provide electricity to parked aircraft.
   b. Electrification of Cargo Operations Areas: The LAWA shall ensure that unless determined operationally and/or technically infeasible, five years from the effective date of this Agreement, 100 percent of all cargo operations areas shall be equipped and able to provide electricity to parked aircraft.
   c. Electrification of LAX hangars: The LAWA shall conduct an assessment of operations at LAX hangars.
   d. Construction equipment: The LAWA shall require that all diesel equipment used for construction related to the LAX Master Plan Program be outfitted with the best available control devices primarily to reduce diesel emissions of PM, including fine PM, and secondarily, to reduce emissions of NOx.
   e. ULSD and other fuels: All construction equipment shall use only Ultra-Low Sulfur Diesel fuel (15 parts per million or lower), as supplies allow.
f. Ground service equipment diesel emissions reduction incentive program: LAWA shall create a program providing incentives for the reduction of emissions from ground service equipment, expending at least $500,000 on the program.

g. Ground service equipment inventory: The LAWA shall prepare a study detailing all ground service equipment operated on-site.

h. Emission reductions from On-Road trucks, buses, and shuttles: LAWA shall fund a study of on-road heavy-duty vehicle traffic related to LAX operations. LAWA shall ensure that by 2010, 50 percent of the covered vehicles (on-road vehicles, including trucks, shuttles, passenger vans, and buses that are 8,500 gross vehicles weight rating or more and are used in operations related to LAX) operated by any airport contractor, airport lessee, and airport licensee are alternative-fuel vehicles or operational low NOx standard vehicles. By 2015, LAWA shall bring that percentage up to 100 percent.

i. Limits on diesel idling: LAWA shall prohibit diesel-powered vehicles from idling or queuing for more than 10 consecutive minutes on-site, unless CARB adopts a stricter standard, in which case LAWA shall enforce that standard.

j. Cleaner burning jet fuels: LAWA shall support efforts to encourage the airlines and petroleum industries to embark on a study to promote the use of jet fuels that minimize air pollutant emissions from jet engines.

4. Green building principles. LAWA agreed to incorporate Leadership in Energy and Environmental Design (LEED) building standards into the all aspect of LAX Master Plan to the extent practical and feasible.


a. LEED Building Standards: On January 22, 2007, the Board of Airport Commissioners (BOAC) adopted a policy requiring new remodeling and tenant improvement construction projects at all LAWA facilities to include design and construction elements that comply with or are substantially consistent with the highest possible Leadership in Energy and Environmental Design (LEED) standards, or their practical equivalent.
b. LAWA has agreement with the City’s Department of Water and Power committing to 25 percent Green Power in all LAWA facilities.

c. Dedicated in September 1998, the LA/Ontario International Airport complex was designed with energy conservation in mind.

d. The Tom Bradley International Terminal at LAX is undergoing major renovations that will make the facility more energy efficiency. This project has been registered for LEED certification and the facility will offer a 15 percent energy savings over the ASGRAE 90.1-2001 Energy Standard.

**Implementation of the CBA**

Since the CBA signing, members of the LAX Coalition and officials from the LAWA continue to meet to move the implementation process forward. However, there have been several setbacks and delays. The mayoral election in 2005 affected the pace of implementation. The new mayor appointed Lydia Kennard as executive director of the LAWA and Kennard was generally less in favor of the CBA compared to the former executive director, Kim Kay.\(^77\) The political scene was further complicated by a settlement agreement between the LAWA and the City of Inglewood, City of El Segundo, County of Los Angeles, and the Alliance for a Regional Solution to Airport Congestion, that were not partners in the CBA. According to members of the LAX Coalition, the litigation diverted valuable city staff time and slowed down implementation of the CBA.\(^78\)

By far the biggest challenge for the LAX Coalition was the Federal Aviation Administration (FAA), which needed to approve some of the CBA’s components in order to ensure that provisions did not violate the revenue diversion rule. The FAA denied the job training program as outlined in the CBA. In addition, the FAA approval of the school settlement agreement has been difficult because the FAA believed that the school districts’ 1980s agreement precluded the need for an additional agreement. While approval was finally granted by the FAA, the school districts have not been awarded any mitigation funding as of the spring of 2009.\(^79\) As a result, the schools located in the flight path of LAX continue to experience significant levels of noise and air pollution that impact student learning and the ability to participate in physical education.

Officials at the LAWA have used the economic downturn as an explanation for the slow progress in implementing many measures of the CBA.
For example, off-airport parking companies are required by the CBA to have 50 percent of their fleet run on alternative fuel by 2012, but little progress has been made. According to LAX staff, there are very few alternative fuel off-airport parking shuttles, taxicabs, door-to-door vans being used in the LAX CTA. In addition, the LAWA agreed to convert all on-LAX ground service equipment to the cleanest technology available; however, only approximately 25 percent of ground service equipment is zero-emission electric.

Despite setbacks and delays in implementation of the CBA, the members of the LAX Coalition continue to monitor and guide the process. Doing so until the cooperation agreement expires in 2020 requires a major commitment from the members of the LAX Coalition, many of which are nonprofit and community group with small budgets and limited staff and/or volunteer capacity.

**LAX Air Quality and Source Apportionment Study**

As required by the CBA, the Los Angeles World Airports is in the process of undertaking the largest and most comprehensive study ever of air quality around a major airport with the goal of fully identifying emission sources in the area around the airport and also attempting to, for the first time, scientifically and measurably apportion the contribution of ambient air quality of these sources. Efforts to initiate the LAX Air Quality and Source Apportionment Study go back nearly a decade, but were short-circuited after the events of September 11, 2001. As part of the CBA and the Stipulated Settlement as part of the LAX Master Plan, the LAWA agreed to re-initiate the Study.

The effort to kick-off this project involved the development of a Technical Working Group composed of air quality scientists, researchers, and engineers from the various governmental agencies as well as representatives of the LAX Coalition and the City of El Segundo. While the LAWA retains ultimate decision-making authority and responsibility for the study, the Technical Working Group strives for consensus-based decision-making.

Efforts are currently underway to complete the study, which is broken into two main components:

1. **Technology and Methodology Feasibility Demonstration Project (Phases 1 & 2)** - Monitoring is to be conducted at five on-airport locations to evaluate techniques.
2. **Long-Term Study (Phase 3)** - Using the results of the Demonstration Project, the final phase of work will evaluate and document the contribution of LAX to area emissions.\(^{84}\)

The Study’s Technical Working Group has reviewed the draft documentation from the Technology and Methodology Feasibility Demonstration Project (Demonstration Project) and recommended that before launching into the Long-Term Study (Phase 3), additional evaluation of the Demonstration Project data is needed. This ongoing additional evaluation of the Demonstration Project is termed “Phase 2.5.” After the work in Phase 2.5 is completed, the LAWA will then go back to the Board of Airport Commissioners with the newly developed Phase 3 scope to seek authorization and funding for the Long-Term Study.\(^{85}\) Once Phase 2.5 is authorized and funded, staff at the LAWA will formulate a public outreach plan and schedule a public meeting about the project.\(^{86}\)
THE LAWA’S SUSTAINABILITY EFFORTS

In 2007, Mayor Villaraigosa released "Green LA-An Action Plan to Lead the Nation in Fighting Global Warming." The goal of the plan is to reduce the City of Los Angeles' greenhouse gas emissions by 35 percent below 1990 levels by 2030. Likewise, the LAWA set a target of reducing its greenhouse gas emission levels to 35 percent below 1990 levels by the year 2030. In order to quantify its emissions, identify areas for improvement, and evaluate the effectiveness of its reduction measures, the LAWA is performing a comprehensive GHG emission inventory.

In addition to the Green LA plan, Mayor Villaraigosa released his Executive Directive on sustainable practices in 2007. Echoing Mayor Villaraigosa’s commitment, Los Angeles Councilmember Bill Rosendahl introduced a motion that requires LAX to be “built and held to the highest green standards.” In response, the Los Angeles Board of Airport Commissioners adopted the “Los Angeles World Airports Sustainability Plan” in 2008. The plan establishes the following fundamental objectives:

1) Increase water conservation in all airport facilities and for all operations.
2) Increase use of environmentally and socially responsible products.
3) Increase recycling and source reduction efforts at all facilities and for all operations.
4) Reduce energy usage and increase usage of green power at all airport facilities and in all operations.
5) Reduce emissions from all operations.
6) Reduce single occupancy trips to, from, and within LAWA airports.
7) Incorporate sustainable planning, design, and construction practices into all airport projects.
8) Promote sustainability awareness to airport employees and the greater community.
9) Integrate sustainable practices into internal policies, business processes, and written agreements.

There is considerable overlap between the measures that the LAWA agreed to implement as part of the CBA and the measures that the LAWA now promotes as part of its Sustainability and Environmental Initiatives. The ‘Findings and Recommendations’ section elucidates on this point and highlights the specific efforts that the LAWA is taking to achieve these objectives.
AIR POLLUTION

The Clean Air Act requires the EPA to set National Ambient Air Quality Standards for six common air pollutants found all over the US. They are: particulate matter, ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead. Airports operations emit all of these pollutants along with toxic air pollutants and greenhouse gases. I have already described some of pollutants and their impacts earlier in this report. The following section provides more detail about key pollutants related to airports in the Los Angeles region.

Lead Pollution

Lead is a metal now banned in the kerosene fuel used in commercial aircraft in the US. In fact, due to its toxicity, the Clean Air Act of 1990 originally stated that all leaded fuels would be eliminated by 1996. However, the Clean Air Act of 1990 was later amended to include one exemption— for aviation gas (avgas). Avgas is a leaded fuel used in non-commercial, piston-engine aircraft (private, corporate, and government jets) that frequent general aviation and air taxi airports. Avgas contains four times more lead than leaded gasoline before it was banned from new cars in 1973. Emissions of lead from avgas are the largest single source category for emissions of airborne lead in the US, comprising approximately half of the national inventory.

The tetra-ethyl lead found in leaded avgas and its combustion products are potent neurotoxins. The US Centers for Disease Control and Prevention (CDC) concluded in 2005 that no “safe threshold for blood lead has been identified.” Lead can adversely affect the nervous system, kidney function, immune system, reproductive and developmental systems and the cardiovascular system. The lead effects most commonly encountered in current populations are neurological effects in children and cardiovascular effects (e.g. high blood pressure and heart disease) in adults. Infants and young children are especially sensitive to even low levels of lead, which may contribute to behavioral problems, learning deficits and lowered IQ. Lead exposure can occur from breathing or swallowing lead particles/dust, or by eating soil or paint chips containing lead.

Figures 4 and 5 illustrate that lead levels are elevated near airports. The correlation is especially apparent near airports with high levels of general aviation operations (takeoff and landings of private, corporate, and government jets), such as Van Nuys Airports with almost 400,000 general aviation operations in
2008, Long Beach Airport with about 300,000 general aviation operations in 2008, Santa Monica Airport with approximately 150,000 general aviation operations, and Whiteman Airport with about 115,000 general aviation operations.

**Figure 4**
As illustrated in Figure 5, there are three airports within an approximately five mile area in the San Fernando Valley of Los Angeles County that are frequented by general aviation aircraft. These jets use leaded fuel. Figure 10 also illustrates a correlation between the locations of the three airports— in the middle of the three-mile buffer zones— and the highest levels of lead. There are 82 schools and day care centers within this three-mile buffer zone of an airport in the San Fernando Valley.
**Particulate Pollution**

Particle pollution (also called particulate matter or PM) is the term for a mixture of solid particles and liquid droplets found in the air. Some particles—such as dust, dirt, soot, or smoke—are large or dark enough to be seen with the naked eye. Others are so small that they can only be detected using an electron microscope. There are three main types of particles based on size: 1) "inhalable coarse particles‖ or PM10 with diameters larger than 2.5 micrometers (2.5 μm) and smaller than 10 micrometers; 2) “fine particles” with diameters that are .1-2.5 micrometers; and 3) ultrafine/nano-particles that are less than 100 nanometers (nm). In comparison, the average human hair is about 70 micrometers in diameter – making it 30 times larger than the largest fine particle.96

The size of the particle is directly linked to its potential for causing health problems. Small particles pose the greatest problems because they can get deep into the lungs and even enter the bloodstream. Numerous scientific studies have linked particle pollution exposure to a variety of problems, including:

- increased respiratory symptoms
- decreased lung function
- aggravated asthma
- development of chronic bronchitis
- heart attacks
- pre-mature death in people with heart or lung disease.97

The study of ultrafine particles is relatively nascent compared to the study of fine particles. Early research indicates reason to be very concerned. Nanoparticles are deposited on the deep lung regions even more efficiently than fine particles.98

In addition to size, particles vary by composition depending on their source. Sources of particulate pollution include fires, dust, industrial processes, and fossil fuel combustion. Particulate pollution emitted from the combustion of diesel fuel is especially problematic in terms of health impacts. In 1998 the ARB identified diesel particulate matter as a toxic air contaminant, which means that it is linked to cancer.99
Figures 6 and 7

Estimated Cancer Risk from Toxic Air Pollutants, Without Diesel PM

Estimated Cancer Risk from Toxic Air Pollutants, including Diesel PM
Toxic Air Pollutants

Toxic air pollutants, also known as hazardous air pollutants, are known or suspected to cause cancer or other serious health effects, such as birth and reproductive effects. Many toxic air pollutants are emitted in the form of volatile organic compounds (VOC) or particulates. Specific examples include benzene, which is found in gasoline, diesel particulate matter, which is emitted by diesel powered trucks, trains, and ships, and lead particulate, which is found in aviation gasoline.

People are exposed to toxic air pollutants in many ways that can pose health risks, including but not limited to:

- Breathing contaminated air.
- Eating contaminated food products, such as fish from contaminated waters.
- Drinking water contaminated by toxic air pollutants.
- Ingesting contaminated soil. Young children are especially vulnerable because they often ingest soil from their hands or from objects they place in their mouths.
- Touching contaminated soil, dust, or water.

People exposed to toxic air pollutants at sufficient concentrations and durations may have an increased chance of getting cancer or experiencing other serious health effects. These health effects can include damage to the immune system, as well as neurological, reproductive (e.g. reduced fertility), developmental, respiratory and other health problems. In addition to exposure from breathing air toxics, some toxic air pollutants such as mercury can deposit onto soils or surface waters, where they are taken up by plants and ingested by animals and move up through the food chain.

Figures 6 and 7 (preceding page) indicate the large role that diesel particulate matter plays in cancer risk from toxic air contaminants in the South Coast Air Basin, including the area surrounding LAX. Figure 6 also illustrates elevated levels of other toxic pollution, excluding diesel PM, in the area near
LAX. Figure 8 confirms that toxic pollution levels are high in the area surrounding LAX. This map contains data from the EPA’s National Scale Air Toxic Assessment, a database that provides emissions and health risk information on around 300 air toxins that present the greatest threat to public health in the largest number of urban areas.\textsuperscript{104}

Figure 8
Figure 9

An astonishing 153 schools and day care centers are located within a three-mile buffer zone around LAX. The schools located in the area directly east of the airport—the direction that the wind blows and the direction of the airplane flight path—and along the 405 and 105 freeways are exposed to multiple sources of air pollution. Not surprising, these schools are most at risk from exposure to toxic air pollutants according to data from the US Environmental Protection Agency's National Scale Air Toxic Assessment.
Climate Impacts of Non-CO2 Emissions from Aviation

The largest source of aviation-related greenhouse gas emissions are aircraft. According to the Intergovernmental Panel on Climate Change, aircraft account for 13 percent of all carbon dioxide emissions from the transportation sector, and in 1999, were responsible for 3.5 percent of global climate change.¹⁰⁵

While the principal greenhouse gas related to aircraft is carbon dioxide (CO₂), other non-CO₂ emissions have a significant impact on radiative forcing and climate change. These include nitrogen oxides (NOₓ) and particulate matter. Non-CO₂ emissions tend to be much shorter lived than CO₂ emissions, and depending on where they occur may have a positive (warming) or negative (cooling) radiative force impact.¹⁰⁶ No agreement has been reached on a suitable metric for calculating the radiative forcing effects of non-CO₂ emissions on an equivalent basis to CO₂. This is in part due to inherent difficulty in treating long-lived (CO₂) and short-lived (non-CO₂) pollutants the same way.¹⁰⁷

Aircraft emit significant amounts of NOₓ, which promotes the formation of ozone smog, a radiatively active gas with a warming effect. Yet, NOₓ can also accelerate the removal of atmospheric methane. Since methane has a strong warming effect, removing methane can have a cooling effect on the global climate.¹⁰⁸ The total radiative forcing of NOₓ is an area of active research.

In addition to being an air pollutant linked to severe local health effects, scientists are discovering that particulate matter in the form of black carbon (soot) — from burning diesel fuel — is a potent agent of global climate change. NASA scientists now estimate that black carbon is responsible for about 12 percent of the man-made global warming.¹⁰⁹ While CO₂ lasts hundreds of years in the atmosphere, black carbon lasts only months or years. As a result, several climate models suggest that reducing particulate pollution can produce an immediate cooling effect on climate faster than any action on emissions like CO₂.¹¹⁰ According to NASA scientists, trimming black carbon represents an alternate and more immediate global warming solution for regulators stymied by the complexities of greenhouse gases such as CO₂.¹¹¹ Scientists are only beginning to give attention to the climate impacts of black carbon, but this issue will likely gain in importance because reducing black carbon has both primary climate benefits and immediate secondary benefits. Therefore, reducing diesel particulate matter from airport operations can have both immediate local health benefits and global climate benefits.
AIR QUALITY IMPACTS OF AIRPORTS

Research on Air Quality and Commercial Airports

Several studies have documented seriously elevated levels of both toxic air pollutants and criteria pollutants such as nitrogen oxides and particulate matter levels near commercial airports.\textsuperscript{112}

The Multiple Air Toxics Exposure Study of 1999 (MATES II) conducted by the South Coast Air Quality Management District involved sampling of diesel particulate matter and volatile organic compounds at 24 sites near LAX, including residential and “fixed” location sites. The researchers of the South Coast Air Quality Management District (SCAQMD) measured high concentrations of elemental carbon (a surrogate for diesel particulates), benzene, and 1,3 butadiene at locations adjacent to LAX compared to sites further away from the airport. All key compounds are associated with mobile sources. Compounds were especially elevated at Aviation and Felton School sites, which are located near major arterials (Aviation Blvd. and 405 Freeway) and LAX. The staff at the SCAQMD contend that the higher concentrations of pollution near LAX were due primarily to the on-road vehicle activity resulting from airport operations.\textsuperscript{113}

A study of toxic pollutants near Chicago O’Hare Airport in 2000 also documented elevated levels of pollutants such as acetaldehyde, benzene, formaldehyde, toluene and lead.\textsuperscript{114} Yet another study found significantly higher levels of some toxic volatile organic compounds near the Teterboro Airport in New Jersey in 2006, with spikes in pollution recorded when wind was blowing from the runway/taxiway.\textsuperscript{115}

As part of the California Air Resources Board and University of Southern California’s LAX and Ultrafine Particulate Matter Study, scientists performed air monitoring in the vicinity of LAX during the spring of 2003 to determine the extent of airport emissions on downwind ambient air in a mixed-use neighborhood that includes residences. The scientists found markedly higher ultrafine particulate (UFP) counts at a site 500 meters downwind of the airport, in an area that was strongly influenced by aircraft landings and where the community interfaced with airport facilities.\textsuperscript{116} Figure 10 illustrates that particle numbers are highest in the airplane takeoff zone, an order of magnitude higher than even on the 710 Freeway. Levels are highest during takeoff, taxing, and landing when the sizes of the particles are about 20 nanometers in diameter.
In another study of LAX supported by the California Air Resources Board, scientists from UCLA performed three field studies during 2005-2006. The results are compiled in a 2007 report titled “Monitoring and Modeling of Ultrafine Particles and Black Carbon at the Los Angeles International Airport.”\textsuperscript{117} The scientists observed elevated levels of high ultrafine particle concentrations 900 meters downwind of a runway. The study authors concluded that “airports are important sources of PM in urban air sheds, yet regulators and public health agencies have little data available to them that address the characteristics of particles emitted from aircraft and their impacts on exposure and health in adjacent communities. Toxicological research is needed to fully characterize the potential health impacts.”\textsuperscript{118}
Figure 11

Particle Size and Concentration at LAX Runway Blast Fence, Community Site near LAX, and the Regional Average


In respect to nitrogen oxides (NOx), in 2006 scientists studied NOx in the vicinity of Heathrow Airport in England and reported elevated NOx levels more than two and a half kilometers from the airport.\textsuperscript{119} Approximately 27 percent of the annual mean NOx in the region was due to airport operations at the downwind airfield boundary.\textsuperscript{120}
Air Quality Studies and General Aviation Airports

While several studies have documented poor air quality in the vicinity of major commercial airports, studies near general aviation airports— that serve private and government aircraft— are more limited. Three key studies related to general aviation airports exist from the Los Angeles region. Bill Piazza of the Los Angeles Unified School District conducted a Health Assessment of the Santa Monica Airport in 1999. He estimated that for individuals who reside in closest proximity to the airport, elevated cancer risk exists at a level of 26, 22, and 13 in a million (depending on assumptions made about the type of plane traffic). These values represent discrete elevated cancer risks associated with airport-related exposure because no background or ambient concentrations were incorporated into the risk quantification. In consideration of the Federal Clean Air Act, emissions associated with airport operations were clearly found to exceed the “acceptable risk criterion” of one in a million.121

In addition, scientists at the South Coast Air Quality Management District conducted a Santa Monica and Van Nuys Airports Study. The scientists recorded no discernible elevation of fine particles (with diameters that are .1-2.5 micrometers, also called PM2.5) but did find spikes in ultrafine number concentrations associated with aircraft departures. They also observed highly elevated total suspended particulate lead at levels that were seven times higher than background levels.122

Most recently, in 2009, scientists at UCLA published a study titled “Aircraft Emission Impacts in a Neighborhood Adjacent to a Ground Aviation Airport in Southern California.” The scientists reported that average ultrafine particle (UFP) concentrations 600 meters downwind of Santa Monica Airport were two and a half to three times the background level, higher than typical major roadway concentrations.123 Figure 12 illustrates that black carbon and ultrafine particles are elevated at residential sites downwind of the Santa Monica Airport. The study authors also noted that while Van Nuys Airport has a buffer zone between the airport and residences, the Santa Monica Airport does not; houses are adjacent to the runway.
Figure 12

Black Carbon Mass and Ultrafine Particles Elevated at Residential Sites East (Downwind) of the Santa Monica Airport

MAIN SOURCES OF POLLUTION FROM AIRPORT OPERATIONS

Airport-related pollution comes from numerous sources. These sources include: 1) aircraft while on the ground and in the air, 2) transportation to and from the airport for travelers, employees, and cargo (called ground access transportation or regional vehicles), 3) on-airport vehicles owned by the airport, 4) ground service equipment (GSE) that services the aircraft, 5) airport infrastructure (stationary sources), and 6) auxiliary power units. The source apportionment varies depending on the type of air pollutant.

Figure 13 illustrates that aircraft is a main source of sulfur oxides (SOx) emissions at LAX while Figures 14, 15, and 16 illustrate that ground access vehicles/regional vehicles moving passengers, employees, and cargo can produce as much or even more nitrogen oxides (NOx), volatile organic compounds (VOC), and particulate matter (PM10) as planes. Missing from the source apportionment data is information about fine or ultrafine particles, which air quality monitoring and modeling studies reveal are of particular concern near airports.

The LAX emission source apportionment data illustrated in the following four graphs has policy implications. The major sources of LAX emissions serve as an organizing method used in this report to categorize, recommend, and prioritize emission reduction strategies.
Figure 13
SOx Emissions from Total LAX-related Operations

- Aircraft: 83%
- Ground Access Vehicles: 11%
- GSE: 1%
- Stationary: 1%
- APU: 4%

Figure 14
NOx Emissions from Total LAX-related Operations

- Aircraft: 40%
- Ground Access Vehicles: 42%
- GSE: 11%
- On-Airport Vehicles: 4%
- Stationary: 2%
- APU: 1%
Due to the many sources of emissions, types of pollutants emitted, and the difficulty in their characterization, controlling the pollutants generated by an airport’s operations is a complex, multi-faceted issue. The main air quality mitigation measures for airports and associated activities include replacing, repowering, retrofitting, refueling, and reducing idling of regional vehicles, aircraft, airport vehicles, and ground service equipment. Other mitigation measures include redirecting passengers and cargo to less congested airports or to other less polluting alternatives, such as public transit.

This section focuses on the key standards, regulations, and programs at a national, state, regional, and local level that affect the main sources of emissions related to the LAWA operations. The focus is on LAX. As previously described, particulate matter (PM) emissions are of particular concern from a local and global environment and health perspective. Therefore, the emissions sources are ordered from greatest to least effect on total LAX related PM emissions.

**Emission Source Target: Ground Access Transportation**

As previously illustrated in Figures 14, 15, and 16, ground access transportation is the most significant source of air pollution associated with airports like LAX. In fact, 90 percent of PM10 emissions are from ground access/regional vehicles. Nationally, ground access vehicles emit 56 percent of VOCs, while aircraft taking off and landing give off only 32.6% (including emissions from auxiliary power units). Air pollution is emitted from private cars and trucks traveling at, to, and from the airport. These trips are generated by: 1) airport employees, 2) arriving and departing passengers, and 3) cargo and mail transport to and from the airport.

A root cause of the problem is not how many people travel to the LAWA airports, but how they do so. For example, if every employee and passenger arrived to the airport on low-emission and readily available public transit and every airplane departed completely full, the pollution problem would be minimized while the travel benefits would be maximized. However, according to 2006 LAX Passenger Survey, public transit represents only one percent of mode access to/from LAX for both Southern California residents and visitors. More than half of all LAX passengers (56 percent) are Southern California residents and seventy-five percent of Southern California based LAX passengers took a
private vehicle to/from the airport. Of those LAX passengers, over half used either the I-405 Freeway or the I-105 Freeway. Based on Caltrans’ 2006 traffic counts, the I-105 and the I-405 carry an annual average daily traffic volume of approximately 247,000 and 305,000 vehicles per day near LAX, respectively. These volumes are among the highest in the nation. The California Department of Transportation and the Los Angeles County Metropolitan Transportation Authority (Metro) expect that peak period traffic volumes on the freeway segments near LAX will rise by 20 to 90 percent from 2006 and 2030.

Figure 17

Mode of Transportation for Southern California Residents Traveling to/from LAX

Figure 18

The LAX/Crenshaw Corridor Area

Source: Los Angeles County Metropolitan Transportation Authority
Table 9

Route Driven to LAX by Residents
Annual, 2001 and 2006

<table>
<thead>
<tr>
<th>Route</th>
<th>2006**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used San Diego Freeway (1-405)</td>
<td>37%</td>
</tr>
<tr>
<td>Used 105 freeway</td>
<td>25%</td>
</tr>
<tr>
<td>Did not use freeway</td>
<td>26%</td>
</tr>
<tr>
<td>Used both</td>
<td>6%</td>
</tr>
<tr>
<td>Don’t know/refused to answer</td>
<td>6%</td>
</tr>
</tbody>
</table>

* 16,576 respondents.


As mentioned in the ‘Introduction’ section, the EPA sets tailpipe standards for most vehicles, such as cars and trucks. Airport operators have virtually no direct control over emissions from the vehicles that passengers and cargo handlers drive to and from the airport. However, there are many indirect ways that airport operators and regional partners, such transportation agencies, can help maximize the number of airport passengers while minimizing the number of trips to and from the airport. The goal should be to increase the ratio of passengers to vehicles. By reducing vehicle trips, improvements in traffic flow, mass transport, and shuttle service will decrease traffic congestion, reduce emissions, and enhance the quality of life of the people who work and live near airports.

With the large number of vehicles that travel to, from, and within the three operating airports, the LAWA is in a unique position to seek efficiencies in on- and off-site transportation systems. To this end, one of the objectives in the LAWA Sustainability Plan is to reduce the number of single occupancy trips associated with its operations. Efforts to reduce pollution from ground access transportation are both ongoing and proposed.
Existing Efforts to Reduce Emissions from Ground Access Transportation

Rideshare and Carpool Program: LAWA’s Rideshare Program consists of 63 vanpools, 64 carpools and free monthly transit passes, as well as marketing and advocacy activities to recruit and retain program participants. Approximately a quarter (27 percent in March 2009) percent of LAWA’s employees participate in this program saving over 1,000 vehicle trips to LAWA airports every day and 7.9 billion pounds of air pollutants per year.\(^{131}\)

Hotel Courtesy Shuttle Trip Reduction Program: Many airport-area hotels provide courtesy transportation from LAX terminals to hotels along the Century Boulevard corridor. In December 2006, the Board of Airport Commissioners approved a consolidated hotel courtesy shuttle operation to reduce traffic congestion in the central terminal area at LAX. The two-phase program requires hotels to set trip reduction targets and establishes financial penalties for excess trips. Phase I of the program started on July 1, 2007 and required hotels to reduce shuttle trips by at least 15 percent from a 2004 base year, with penalties of $10 per trip for non-compliance. Phase II began on February 1, 2008 and required hotels to reduce shuttle trips an additional 20 percent with penalties of $5 per trip for non-compliance.

According to the LAWA, since implementation of the program, vehicle miles traveled have been reduced by 55 percent and emissions have been reduced 65 percent over baseline years. However, more research is needed to determine the effectives of the current $5 penalty to incentivize compliance with LAX’s Hotel Courtesy Shuttle Trip Reduction Program.\(^{132}\)

LAX FlyAway Program: The FlyAway is a non-stop shuttle bus service operated by the LAWA that transports people to and from four locations and LAX. The LAWA is required to operate the FlyAway program as a mitigation measure of the LAX Master Plan (the stipulated settlement agreement). The FlyAway service was used by approximately 97,000 passengers in 2009, which removed approximately 1.2 million vehicle trips, reduced 133 tons of criteria pollutants, and reduced 8,540 tons of CO2 pollution.\(^{133}\)

Yet, only one percent of Southern California residents take FlyAway as their mode of access to LAX.\(^{134}\) The reason for this low percentage may be due in part to limited service, with only four pick-up/drop-off locations in a large region. As required by the stipulated settlement agreement, the LAWA plans to add five new FlyAway locations by 2015.\(^{135}\) However, the increasing cost to ride FlyAway may be a deterrent. A trip from Union Station in downtown Los Angeles...
to LAX costs $7 one-way or $14 round trip. The newly added FlyAway line from Irvine to LAX costs $50 round trip. Fifty dollars is more expensive than paying for parking at a lot near LAX for a few days. Not surprisingly, only 84 people rode FlyAway to/from the Irvine location in 2009 after it the line opened in November. Notwithstanding other issues of convenience and accessibility, taking FlyAway mostly makes economic sense for long trips.

Figure 19

Existing (Indicated by Red Circles) and Proposed FlyAway Locations


Rental Cars: In January 2003, the Board of Airport Commissioners approved on-airport concessions for 10 rental car companies at LAX. These 10 concessionaires are the only firms permitted to provide curbside pick-up and drop-off at passenger terminals. The program calls for on-airport rental car
operators to reduce the number of monthly courtesy vehicles trips by at least 20 percent from a 2004 baseline year.\textsuperscript{138}

**Alternative Fuel Fleets:** Two of the major contributors to vehicle traffic at LAWA facilities are passenger shuttle buses and taxis. The LAWA is working with its tenants and airport service providers to develop requirements and incentives for incorporating cleaner vehicles into their fleets. The LAWA has developed and is implementing an Alternative Fuel Vehicle (AFV) policy with a target of converting 50 percent of the larger vehicles (over 8,500 pounds gross weight) fleets to AFVs by December of 2010 and 100 percent by 2015. While it is too early to know whether LAX will meet these goals, experts are concerned that the airport will fail to reach these targets.

**Consolidated Rental Car Facility (ConRac):** Since 1999, LA/ONT has operated a ConRac that houses six rental car companies with tram service from the terminals to alleviate traffic congestion on the terminal roadways.
Proposed Plans to Reduce Emissions from Ground Access Transportation

**Consolidated Rental Car Facility (ConRac):** With the success of LA/ONT’s ConRac (see immediately preceding paragraph), the LAWA plans to open a Consolidated Rental Car Facility in operation at LAX by 2015. 139

**Alternative Fuel Fleets:** The LAWA plans to work with the taxi concessionaires at LA/ONT to develop a program to require that 10 percent of taxis run on alternative fuel vehicles. 140 There is no such goal at LAX and this remains an area of need. However, regulating the taxi industry at LAX has been problematic for the LAWA. Taxi services are operated by nine city-authorized taxi companies and regulated by Authorized Taxicab Supervision Inc. (ATS). City Controller Laura Chick audited ATS in Jan. 2007 and found ATS was mismanaging monies collected from passengers at LAX. Despite the audit, staff at the LAWA recommend that the Board of Airport Commissioners award a five-year concession agreement from the City to ATS.

**Centralized Delivery Facility:** Another significant source of vehicle traffic at LAX is the delivery of products to tenants and airlines. 141 Delivery trucks tie up passenger loading areas and increase congestion in the central terminal area. To reduce these impacts, the LAWA plans to reutilize an existing building as a centralized delivery facility, where the trucks will unload their materials and delivery trips will be consolidated. 142 The LAWA pledged to have the centralized delivery facility in operation by 2010. This will be something to monitor in the upcoming year.

**Crenshaw/LAX Transit Rail Line:** Over the past 40 years, the Los Angeles County Metropolitan Transportation Authority (Metro) and its predecessors have undertaken numerous plans and studies that documented the need for transportation improvements in the Crenshaw Corridor near LAX. The LAWA became an active member of the Green Line Task Force, which now also includes the California Department of Transportation, Metro, and local community groups. Their goal was to develop integrative approaches to relieve congestion around LAX with the proposed Crenshaw/LAX Transit Corridor Project.

The Draft Environmental Impact Statement (Draft EIR) for the proposed Crenshaw/LAX Transit Corridor Project analyzed two main project options—rapid bus transit and light rail along the Crenshaw Corridor—and recommended the light rail transit alternative. In December 2009, Board members of Metro adopted the light rail transit alternative as the preferred alternative, thereby allowing the final review of the Crenshaw/LAX Transit Rail Line to move forward. Metro will

**Figure 20**

The Proposed Crenshaw/LAX Transit Corridor Project

The stated explanation in the Draft EIR for recommending the light rail alternative was that rail—compared to bus rapid transit—would generate the greatest travel time savings, reliability, and higher ridership as well as promote connections with other elements of the Metro rail system. This argument has some merit given that the Crenshaw Corridor already has a rapid bus line plagued by slow travel speeds due to road congestion. Adding a dedicated line for bus rapid transit would mean taking away an existing road lane. This poses political and operations challenges that a rail line would help to avoid. A rail line—able to combine at grade, below grade, and aerial service—could provide faster service and more reliability.

However, the eight and a half mile rail line would not solve all problems of connectivity. The vast majority of LAX passengers live outside of the Crenshaw Corridor and the proposed rail line stops short of connecting to the Purple Line on Wilshire Boulevard and the residential and employment centers in that area. Moreover, it is unclear whether the proposed rail line would indeed provide more connectivity to LAX compared to the current Green Line, which requires a free shuttle trip to connect to LAX. The proposed rail line’s Aviation Station will also not directly connect to the LAX terminal and therefore the current proposal calls for an automatic people mover along Century Boulevard, a very busy street dominated by cars, to connect the Aviation Station to LAX.

*Century Boulevard and Aviation Boulevard—cross streets of the proposed Aviation Station of the LAX/Crenshaw Corridor project. The airport plans to construct an automatic people mover to provide connection to LAX terminals.*

*Photo source: LA County Metro.*
Furthermore, any benefit of the proposed LAX/Crenshaw Corridor rail line would come at a cost. Metro staff estimate the project construction cost at $1.76 billion or approximately 207 million dollars per mile.\textsuperscript{144} If the construction cost were divided by an estimated 50,000 riders per year for 10 years, the cost per passenger would be a whopping $3,520. This does not include operating costs, which, based on the experience from other rail lines in the Los Angeles region, will likely not be fully covered by the fares. For example, research indicates that riders of the Blue Line, a light rail line from downtown Los Angeles to Long Beach, pay a fare that covers only about eleven percent of the operating costs.\textsuperscript{145} In comparison, local buses in Los Angeles cover close to 40 percent of the costs from the fare paid, and some crowded city routes manage to cover nearly 90 percent of their operating costs through revenue.\textsuperscript{146} The funding that Metro is counting to build the Crenshaw/LAX Transit Corridor project will come mainly from Measure R, the half-cent local sales tax that Los Angeles County voters approved in November of 2008, and the federal government.

**Analysis**

The LAWA is taking significant steps to reduce air pollution associated with ground access transportation. However, none of the existing or proposed initiatives will address the fundamental issue of relative mode cost and will therefore not solve the pollution problem. The ‘kiss and fly’ mode— in which a passenger is dropped-off or picked-up in a private vehicle— is the least costly ground access mode for the individual and most costly ground access mode for society because it results in four, one-way private vehicle trips instead of two or none. Through the ground access pricing system, the LAWA incentivizes the most polluting and least efficient transportation mode and creates a disincentive to take transit, FlyAway, shuttle, or taxi. For example, LAX collects $2.50 every time a cab enters the airport, but there is no charge for private vehicles to enter the LAX circle and the immediate roads into LAX.

A more efficient way to address the issue of ground access transportation would be to accurately price trips to the LAWA operated airports in order to internalize the negative externalities. The LAWA, Metro, and Caltrans could explore market based strategies in which vehicles pay a toll to enter a designated area such as the LAX driving pick-up and drop-off loop. The fee could be variable, increasing during peak travel times as a way to incentivize travel during less congested times or by alternative modes. If the price was set right, the LAWA would generate income to go toward its air quality and ground transportation programs while airport passengers would be incentivized to take a
less polluting mode of transportation. Tolling at LAX may be a political none-starter today. However, toll roads, like the 91 Express Lanes owned and operated by the Orange County Transportation Authority, are becoming more politically acceptable.¹⁴⁷

**Emission Source Target: Aircraft**

Airplanes account for 90 percent of SOx, 40 percent of NOx, 23 percent of VOC, and three percent of PM10 emissions from operations at LAX. Policy, technological, and operational options are available to limit the growth in aircraft emissions. These include regulating the amount of emissions released, improving aircraft fuel efficiency via technological advancements, reducing aircraft fuel use while at airport gates, reducing congestion through either demand management strategies or operations advancements in air traffic control, and shifting from petroleum-based kerosene jet fuel to alternative fuels. The leadership to pursue most of these strategies must come from the federal government because federal law preempts states from setting emission standards for aircraft. However, airports owners may be able to employ their landlord authority to require or incentivize operations changes and the use of specific fuel while planes are on their property.

**NOx standards:** In 2005, the EPA amended its nitrogen oxides (NOx) emission standards for new commercial aircraft engines. These new standards are equivalent to the International Civil Aviation Organization’s NOx emission standards (adopted in 1999 for implementation beginning in 2004) and bring the US aircraft standards into line with the international standards. The new standards reflect a 16 percent NOx reduction over the 1996 standards and a 33 percent reduction over the original standards agreed to in 1981. However, the combined effect of these standards with previously adopted standards will be a reduction in NOx emissions of only about 40 to 50 percent from new engine models relative to uncontrolled levels.¹⁴⁸ By comparison, emission standards and regulations set by air regulatory agencies require that other emission sources are controlled to well over 50 percent and some as high as 95 percent.¹⁴⁹

The International Civil Aviation Organization’s policy is to set “technology supporting” rather than “technology forcing” standards. In fact, approximately 85 percent of aircraft engines already met the standards when they were adopted by ICAO in 1999.¹⁵⁰ In contrast, emission standards set by air regulatory agencies for other sources of air pollution define a “technology-forcing” performance level that goes beyond what sources are currently achieving.¹⁵¹
Further limiting the impact of the standards, aircraft engines that do not meet the new standards are not required to do so because the standards only apply to new aircraft and not to existing aircraft. The turnover of the approximately 15 percent of older engines that do meet the standards will not happen immediately due to the long fleet turn-over rate of aircraft (60 percent of aircraft are in service at 30 years of age.)\(^{152}\)

**Reducing fuel use through research and development:** Historically, technological advances have resulted in the bulk of aviation emission reductions, but current research funding is lacking. Over the past three decades US manufacturers, with support from the US government, have invested billions of dollars in aircraft research and development. They have made significant strides in engine innovations and other technologies that save fuel and decrease emissions. The Boeing 787 aircraft, for example, achieves a 20 percent decrease in fuel use and CO2 emissions, 60 percent reduction of noise, and 28 percent less NOx than the B787 airplane that it replaces.\(^{153}\)

The National Aeronautics and Space Administration (NASA) has historically been the lead US governmental agency involved with aircraft research and development. In 2004, NASA established a five-year goal to deliver technologies to reduce CO2 emissions of new aircraft by 25 percent. However, NASA’s budgets for this work have declined since 2004 and, in early 2006, the agency realigned, leaving most of this proposal underfunded.\(^{154}\) Manufacturers have expressed concerns that the US risks losing its global leadership in aeronautics due to reduced NASA and FAA research and development programs.\(^{155}\)

There are incentives for airlines to reduce fuel use because fuel costs can over 50 percent of airline operating costs in the US\(^{156}\). Investing in new aircraft is a key way for air carriers to reduce their fuel costs, but aircraft have a long product lifetime and are expensive to replace. Therefore, air carriers are employing a variety of other procedures to reduce fuel consumption, including: 1) selective engine shutdowns during ground delays, 2) cruising longer at higher altitudes and employing shorter, steeper approaches, and flying slower, 3) investing in winglets to reduce aircraft drag and reduce fuel burn, 4) experimenting with towing aircraft during some portion of travel to and from the gate, and 5) using airport power rather than onboard auxiliary power units when at the gates.\(^{157}\) Several of these methods require coordination with federal agencies and airport operators; the fifth method is applicable to the LAWA and is highlighted in the following section.
**Reducing fuel use at gate:** Some airports, including LAX, are moving toward 100 percent electrification of airport gates. This allows planes to plug into electric power at gate instead of burning kerosene jet fuel or using an auxiliary power unit. As part of the LAX Community Benefits Agreement, LAWA agreed to equip 100 percent of passenger gates at LAX to electric power and be able to provide electricity to parked aircraft by 2010. This commitment only applies to LAX and not the other airports owned and operated by the LAWA.

**Reducing airport congestion:** There are three main ways to reduce airport congestion and the related energy use and air pollution without reducing overall air travel. One is to invest in infrastructure, but new runways take a considerable amount of time and money to build, plus construction periods are associated with increased congestion and emissions. A second way to reduce congestion is via airport demand management, either through 1) congestion pricing 2) restrictions on airport slots.

In respect to pricing, currently airlines pay land fees to airports depending only on aircraft weight. The land fees do not vary by time of day. Under congestion pricing, the landing fees paid by airlines would rise at peak hours, and in response, airlines would move some flights to off-peak hours. The LAWA does not employ a timed-based congestion pricing system nor does it employ a slot system. Under a slot system, flights cannot exceed the total available number of hourly slots. One way to set up a slot system is to distribute the slots among the airlines and then allow trading. The FFA governs such as system at four congested US airports (LaGuardia, JFK, O’Hare, and Reagan-National). Another possibility is to auction the available airport slots to the airliners. In 2008, the FAA proposed a partial auction for the New York area airports, but the airliners strongly objected (they were being asked to pay for something that they now hold for free), and the FAA recently withdrew its auction proposal.

A third way to reduce aviation congestion— referred to in the previous section on ‘research and development’— is through technological advancements in air traffic control. The Next Generation Air Transportation System (NextGen) is the FAA’s plan to modernize the National Airspace System through 2025 while simultaneously improving safety and reducing environmental impacts. Core elements of NextGen include improving operational procedures, introducing new technology in aircraft and engines, and developing alternative fuels. For example, conversion to a satellite-based NextGen navigational system could cut emissions and delays by approximately 15 percent. This system would support continuous descent arrivals, which allow aircraft to remain at cruise altitude longer
and avoid excess fuel burn associated with traditional landing procedures. The NextGen navigational system is still in the development phase.

**Alternative fuels:** Alternative fuels are not widely used or accepted in the aviation industry, but this could change with more research and development. In partnership with the airlines, airports, and manufacturers, FAA launched the Commercial Aviation Fuels Initiative (CAAFI). CAAFI is leading efforts to develop alternative, environmentally progressive aviation fuels. Their goal is to develop a 100 percent synthetic fuel by 2010 and 100 percent bio-fuel by 2013.\(^{163}\)

Representatives from Boeing, the world’s largest aircraft manufacturer, claim that bio-fuel powered aircraft could be on the market as early as 2011 and expect authorities to certify a 30 percent bio-fuel blend for commercial aircraft in the near future.\(^ {164}\)

But harvesting enough biomass to meet the industry’s need remains a huge barrier to widespread adoption of the alternative fuel. The airline industry burns about 85 billion gallons of kerosene annually.\(^ {165}\) *The Guardian* estimates that fueling the world’s 13,000 commercial airplanes with nothing but soybean-based fuel would require using the equivalent of the entire land mass of Europe to grow soybeans.\(^ {166}\) Moreover, the CO2 reduction benefits of crop-based bio-fuels are questionable when considered under a full lifecycle analysis because the entire process of growing, harvesting, and distilling the crop is quite energy and CO2 intensive.

The drawbacks of crop-based bio-fuels are one reason that Boeing is pursing algal fuels. The startup company Solazyme, based in San Francisco, has developed an algal jet fuel that behaves like kerosene. Called Solajet, this jet fuel has passed all of the eleven essential tested specifications required to meet the Jet-A1 standard.\(^ {167}\) It is the world’s first microbially-derived jet fuel to do so. Another family of fuels called synthetic paraffinic kerosene— which includes those distilled from the oils of Helianthus (sunflowers) and jatropha— are close to becoming certified.\(^ {168}\)

The importance of bio-fuel research, development, certification, and procurement is particularly apparent when seen as part of a larger US government strategy to control aviation CO2 emissions. As Graph 21 illustrates, even with currently available solutions to control CO2 emissions from the aviation industry, operational and technological improvements, and possible CO2 standards, aviation’s carbon footprint will continue to increase without the widespread use of alternative fuels.
In addition to use in large commercial aircraft, alternative fuels are also needed for use in small planes. As described earlier in this report, lead is banned in the kerosene fuel used in larger commercial aircraft and every other fuel in the US except the aviation gas (avgas) used in non-commercial, piston engine aircraft (private, corporate, and government jets) that frequent general aviation airports. The lead additive has been the most economical method for achieving 100-octane fuel in these high performance planes.\textsuperscript{169} Avgas contains four times more lead than in leaded gasoline before it was banned from new cars in 1973.\textsuperscript{170}

An alternative bio-fuel mix is available for use in some small planes. In 1999, the FAA certified a fuel known as AGE85, which is about 85 percent ethanol and contains a high-octane petroleum product and agriculturally derived ‘biodiesel’ for lubrication.\textsuperscript{171} It is unleaded and burns cleaner than avgas. However, its use is limited in part because FAA has been slow to establish a standard for the fuel and develop standards for aircraft flying with AGE85.\textsuperscript{172}
Analysis

Aircraft is a challenging emission source for local clean air advocates and local airport operators to target. Most regulatory and standard setting authority exists at the international and national levels, but there are key ways for local clean air advocates to exert an influence. The most immediate way is to respond to the EPA’s ‘Advanced Notice of Proposed Rulemaking on Lead Emissions from Piston-Engine Aircraft Using Leaded Aviation Gasoline.’ More details on this rule-making and comment period can be found in the ‘Findings and Recommendations’ chapter of this report.

Emission Source Target: Ground Support Equipment

Ground support equipment (GSE) accounts for four percent of PM10, one percent of SOx, four percent of VOC, and 11 percent of NOx emissions from LAX operations. This equipment that services aircraft include tugs, baggage loaders, catering trucks, and fueling vehicles. The main strategies for reducing emissions from this source involve federal emission standards, voluntary national and state programs, and more binding local fuel requirements.

**EPA Standards for Non-Road Diesel Engines:** The EPA does not specifically target ground support equipment in any of its regulations, but new ground support equipment with diesel engines that are used only on airport property will be required to meet EPA’s Non-Road Diesel Engine Standards. The EPA is phasing in these standards from 2008 to 2014. According to the FAA, the new equipment will achieve emission performance comparable to today’s automobiles.\(^{173}\) The standards do not apply to existing ground support equipment or to non-diesel equipment, such as gasoline or other alternative fueled equipment in use at airports like LAX.

**Voluntary Federal GSE Programs:** The EPA, the FAA, and the Department of Energy developed a pilot program, called the Inherently Low-Emissions Airport Vehicle Pilot Program, to demonstrate air quality improvements with alternative fuel ground support equipment. These agencies recently expanded the program, now called the Voluntary Airport Low Emission Program, to increase eligibility for airport low-emission projects for commercial service airports in all air quality nonattainment areas. Through the use of funding and emission credit incentives, this voluntary program includes the conversion of ground support equipment to low emission technologies, among other emission reduction projects.\(^{174}\)
United Airlines made notable progress in reducing emissions from their ground service equipment fleet, but overall industry progress has been limited. United’s 1,797 alternative-fueled and zero-emitting vehicles represent nearly 25 percent of their active ground service equipment fleet.175

**Voluntary GSE Initiative in Southern California:** As part of the 1994 California State Implementation Plan (SIP) for ozone attainment, control measure M15 focused on the need for emission reductions from airports. The South Coast Air Quality Management District led the consultative process to focus on airport activities. One of the main goals of this process was to develop a Memorandum of Understanding (MOU) for ground service equipment that would be a voluntary program providing reductions in hydrocarbon (HC) and nitrogen oxide emissions beyond what is required. The MOU was developed in cooperation with the EPA, the FAA, the Air Transport Association representing the major airlines, and the five major airports in the South Coast Air Basin. It was signed in December 2002. Under the terms of the MOU, the airlines would have been exempted from new regulation of in-use programs until the MOU expired. However, the airlines chose to exercise their option to terminate the MOU, effective January 1, 2006.176 Instead of continuing with the MOU, the airlines choose to focus their efforts and resources on new and future regulatory programs.

**State Regulations that Apply to GSE:** The state of California has not specifically targeted ground support equipment in its binding regulations. However, Board members of the California Air Resources Board (CARB) did adopt regulations that apply to in-use fleets, including airport ground service equipment (GSE). Those measures include the air toxic control measure for portable engines, new emission standards and fleet requirements for forklifts and other industrial equipment, and in-use requirements for off-road diesel vehicles.

This approach of using multiple broad regulations (non-industry specific) makes it challenging to focus in and analyze the effectiveness for emission reductions from ground service equipment. For example, the CARB approved the In-Use Off-Road Diesel Vehicle Regulation in July 26, 2007. This regulation applies to GSE. However, the GSE component of the regulation is caught up in the heated controversy over the entire regulation after industry opposition arose during the recent economic recession in California. As part of the 2009 California budget, the California legislature directed the CARB to make several changes to the In-Use Off-Road Diesel Vehicle Regulation. These changes in effect reduce the emission benefits associated with the rule by extending compliance deadlines and making other requirements less stringent.177
LAWA’s GSE Conversion Program: The LAWA and its tenants have made an effort to convert GSEs to more efficient and less polluting models. As part of the LAX Community Benefits Agreement, the LAWA is committed to converting all on-LAX GSE to the cleanest technology available by 2015. Currently, only approximately a quarter (25 percent) of LAX’s tenant GSEs are zero-emission vehicles. This will be an area to monitor because of the potential for additional emission reductions.

Analysis

Full implementation of the CARB’s In-Use Off-Road Diesel Vehicle Regulation and the LAX Community Benefits Agreement could result in significant emission reductions from ground support equipment. However, the full potential of both are certainly not guaranteed and are areas that warrant monitoring and pressure from clean air advocates.

Emission Source Target: Airport Vehicles Fleet

On-airport vehicles account for three percent of particulate matter and four percent of nitrogen oxide emissions from LAX operations. The main way that airport operators are reducing emissions from airport owned vehicles is by transitioning to less polluting fuel sources. I am not aware of federal or state programs designed specifically to target airport vehicles (which is in a separate category from ground support equipment). However, the LAWA has a long history of integrating alternative fuel vehicles into its fleet. As part of the LAX Community Benefits Agreement, the LAWA agreed to expedite this transition, but it is still off its final goal of 100 percent conversion.

Figure 22 illustrates that LAX’s fleet includes liquid natural gas (LNG), compressed natural gas (CNG), gasoline/electric hybrids, electric, solar, and hydrogen powered vehicles. Currently, about three-fourths of LAX’s fleet is comprised of alternative fuel vehicles (AFV).
Figure 22

LAX Fleet Vehicles


Analysis

The LAWA has not publicized its fleet ratio for its other airports, an indication that the alternative fuel vehicle percentage of its fleets is significantly lower elsewhere. This is an area of more potential emission reductions that warrants attention. In terms of LAX, the most important effort for clean air advocates to pursue is to monitor and ensure that the LAWA fully meets its commitment to clean vehicles as part of the LAX Community Benefits Agreement.
**Emission Target: Stationary Sources**

Although mobile sources constitute the bulk of emissions related to airport operations, stationary sources—primarily from energy production—also certainly matter. The LAWA has a Central Utilities Plant (CUP) onsite at LAX to heat and cool the airport terminals. In November 2009, the LAWA Board of Airport Commissioners approved a new central utility plant at LAX. The existing CUP is an obsolete facility that no longer meets energy and safety codes. While the new utility plant will decrease emissions relative to current levels, the effort does not go as far as some airports—like Denver International—that are investing in on-site solar arrays. To its credit, however, in October 1999 the Board of Airport Commissioners adopted a resolution establishing the LAWA’s participation in the City’s Department of Water and Power’s “Green Power for LA” program to purchase electricity from renewable resources. LAWA purchases approximately 15 percent of its power from renewable energy resources.\(^1\)

In addition, in January 2007, the LAWA Board of Airport Commissioners committed the LAWA to incorporate the highest possible LEED (Leadership in Energy and Environmental Design) standards in all future construction projects at the LAWA’s airports. However, the LAWA airports lag behind some other airports in terms of LEED certification. For example, Hangar 25 at the Bob Hope Airport in Burbank was recently designated by the US Green Building Council as a "LEED Platinum" facility, the highest LEED ranking.\(^2\) Representatives from Shangri-La Construction, the firm that created and constructed the hanger, state that Hanger 25 is the "most sustainable airplane hangar in the world." The Hanger 25 building contains solar arrays that will produce 400 kWH per year of clean, renewable energy to supply 110 percent of the building’s total energy needs.\(^3\) Airplane process loads will be powered by solar charging carts, avoiding jet fuel consumption and improving air quality.\(^4\)

The LAWA also strives to reduce energy consumption at its airports. The new terminal at LA/ONT includes energy efficient windows and a ceiling system that maximizes light distribution without radiating heat in the terminal. Other efforts have included retrofitting 90 percent of light fixtures at LAX for higher efficiency and installing light sensors in the LAWA administrative buildings.\(^5\)
Analysis

The LAWA has taken steps to reduce emissions from stationary sources, but there is certainly more that the LAWA could do to invest in renewable energy and improve energy efficiency in its facilities and operations. The Board of Airport Commissioners established a target of reducing energy use by 10 percent per passenger and/or cargo tonnage by the end of 2010. In order to meet these targets, the LAWA plans to perform the following initiatives: install energy efficient light fixtures when changing burned out bulbs; install new or increase efficiency of existing heating and cooling equipment; purchase more energy efficient computer servers; install energy efficient variable speed motors during replacement; and when replacing older building-related process energy systems and equipment, upgrade with energy efficient systems.

Several of these initiatives depend on an unknown replacement schedule and/or opportunities that could be maximized during new construction projects related to the LAX Master Plan and the Ontario Master Plan. In addition, the LAWA has an unrealized potential to invest in solar and fuel cell infrastructure as renewable sources of energy.
Findings and Recommendations

After communicating with experts and conducting an extensive literature review, I summarized key findings and based on these findings, I prioritized recommended objectives for a campaign to reduce pollution from the LAWA’s owned and operated airports. Each recommendation is assigned a suggested priority level. My criteria for evaluating and prioritizing recommendations was based on: 1) impact—the importance of the recommended action in terms of emission reduction potential over the current baseline—and 2) ease of implementation—the feasibility of a clean air advocacy organization based in Los Angeles to move the target agency to adopt the recommended action. The recommendations are listed in order of top emission sources of PM10, NOx, and VOC pollution from LAX operations.

RECOMMENDATIONS FOR OVERALL EMISSION REDUCTIONS

1) Create a Clean Air Action Plan for the LAWA

Finding: The LAWA’s various environmental data collection, programmatic, and policy efforts concentrate on LAX while often not applying to its other airports. Van Nuys Airport has the second largest number of landings and take-offs in the Los Angeles County, however, the airport is virtually ignored in the LAWA’s Sustainability Plan. Furthermore, there is only limited alignment between the environmental programs at LAX and at Ontario International Airport. Even at LAX, however, the LAWA does not coordinate its various air quality measures under a comprehensive plan.

Recommendation: Clean air advocates should encourage the LAWA to set a health-based emission reduction goal for all three airports and develop a plan to comprehensively target airport-related emission sources through a consistent application of environmental programs, goals, and policies among the three airports. A LAWA clean air action plan should be included as part of the Southern California Association of Governments’ Regional Transportation Plan.

As a starting point, the LAX Community Benefits Agreement contains commitments that should be applied to the other airports. A comprehensive clean
air action plan should also include measures to protect vulnerable populations living near the LAWA airports. Effective and relatively inexpensive air filtration systems are available on the market and have already been installed in schools near the Ports of Los Angeles and Port of Long Beach with support from the ports and the South Coast Air Quality Management District.

The San Pedro Bay Ports Clean Air Action Plan could serve as a general model for the LAWA to develop a plan to more comprehensively and consistently target multiple emission sources across all of its airports. The San Pedro Bay Ports Clean Air Action Plan (the CAP) targets all port-related emission sources—ships, trains, trucks, terminal equipment and harbor craft— to significantly reduce health risks posed by air pollution. The CAP is landmark for both its comprehensiveness and agency cooperation. It was created with participation of the South Coast Air Quality Management District, the California Air Resources Board and the US Environmental Protection Agency. The Harbor Commissioners of the Port of Los Angeles and the Harbor Commissioners of the Port of Long Beach Plan approved the CAP in a joint meeting on November 20, 2006. By doing so, the Harbor Commissioners committed the ports to an aggressive plan to reduce pollution by at least 45 percent in the next five years. The San Pedro Ports Bay Clean Air Action Plan was the culmination of years of organizing and advocacy work by residents and environmental organizations.

Clean air advocates could target the Los Angeles World Airports as the lead agency while also reaching out to the South Coast Air Quality Management District, the California Air Resources Board, and the US Environmental Protection Agency about cooperatively designing a plan, as these agencies did for the CAP.

Priority: The action ranks as a high priority. If designed properly, a comprehensive clean air plan could lead to significant emission reductions at all of the LAWA’s airports. Results of the forthcoming LAX Air Quality and Source Apportionment Study may highlight the need for a comprehensive approach to reducing air pollution and will provide a forum for the public to discuss such action. In addition, as air traffic increases at LA/ONT and the Ontario Airport Master Plan moves forward, advocates will have the opportunity to weigh in on the future direction of the airport.
2) Target Aircraft and Airports in State Implementation Plans

**Finding:** Although aircraft are a major source of air pollution comparable to industrial sources, they escape inclusion in State Implementation Plans, the US Environmental Protection Agency’s (EPA) principal means of achieving cleaner air in air quality nonattainment areas.\(^{186}\) This omission has serious consequences in efforts to reduce air pollution.\(^{187}\) In California, the Air Resources Board faces obstacles in its ability to regulate airport-related sources. However, the California Air Resources Board faces similar challenges in regulating the shipping, trucking, and railroad industries and has found creative ways to target emissions related to these industries.

**Recommendation 2.1 and Target:** Clean air advocates should work with staff at the California Air Resources Board to explore creative ways to reduce emissions from aircraft and other airport-related sources. This should involve conducting research about the health impacts, including cancer risk, from airports, as the CARB has done with rail yards.

**Priority of Recommendation 2.1:** Working with staff from the California Air Resources Board should be a high priority for clean air advocates. While the California Air Resources has limited control over airport-related emission sources, the state has more power and authority than local or regional agencies and the proven ability to work creatively to target major emission sources.

**Recommendation 2.2 and Target:** Clean air advocates should lobby US Senators to authorize and support legislation that would give states more ability to regulate airports—like other major sources of pollution—as part of the State Implementation Plan process. Allowing states to include control strategies for ground-level aircraft emissions in their SIPs and regional air districts to more easily control other airport-related sources in their air quality management plans would definitely help achieve air quality goals.\(^{188}\) The South Coast Air Quality Management District could potentially be an ally in this effort.

**Priority of Recommendation 2.2:** This action ranks as a medium priority. While the action could have major impacts on reducing emissions from airport-related operations in the Los Angeles region, achieving the desired action would be particularly challenging for clean air advocates based in Los Angeles to achieve given the amount of resources needed to affect federal legislation.
SOURCE TARGET: GROUND ACCESS TRANSPORTATION

3) Increase the Viability of Alternative Ground Access Options via Cordon Pricing and Improved Public transit

**Finding:** Ground access transportation accounts for 63 percent of VOC emissions, 42 percent of NOx emissions, and 90 percent of PM10 emissions from LAX-related operations.\(^9\) Nationally, ground access vehicles emit an average of 56 percent of VOCs from airport-related sources, while aircraft taking off and landing give off only 32.6% (including emissions from auxiliary power units) from airport-related sources.\(^9\) Ground access trips are generated by: 1) airport employees, 2) arriving and departing passengers, and 3) cargo and mail transport to and from the airport.\(^9\)

A root cause of the problem is not how many people travel to LAX and other airports owned by the LAWA, but how they do so. If every employee and passenger arrived to the airport on low-emission and readily available public transit, the pollution problem from ground access transportation would be minimized while the travel benefits would be maximized. However, public transit represented only one percent of the trips to/from LAX in 2006. During this same year, three-fourth of LAX passengers who lived in Southern California took a private vehicle to LAX and more than three-fourths of these passengers were dropped-off at the curb. This ‘kiss and fly’ mode is the least expensive for the individual and most expensive mode for society because it results in congestion and air pollution from four, one-way vehicle trips. Through its ground access pricing system, the LAWA incentivizes the most polluting and least efficient mode of transportation while creating disincentives to take less polluting modes like transit, FlyAway, and shared shuttle. A more efficient way to address the issue of ground access transportation would be to accurately price trips to the LAWA operated airports in order to internalize the negative externalities.

**Recommendation 3.1 and Target:** Clean air advocates should ask the LAWA and other regional partners to explore cordon pricing in which private vehicles would be accessed a toll to enter an airport pick-up and drop-off circle. If the price was set right, the LAWA would generate income to go toward its air quality and ground transportation programs while airport passengers would be incentivized to use a less polluting mode of ground access transportation.
**Priority of Recommendation 3.1:** This action ranks as a medium priority. While ground access is the most significant source of air pollution from LAX operations and pricing could have the most significant impact on mode choice, road pricing is currently not particularly politically viable at this time. However, toll roads—like the 91 Express Lanes owned and operated by the Orange County Transportation Authority—are becoming more acceptable and therefore, the political calculation could shift in the future.\(^{192}\) Regardless, clean air advocates would need to be willing to risk supporting a controversial measure.

**Recommendation 3.2 and Target:** Clean air advocates should ensure that the Los Angeles County Metropolitan Transportation Authority (Metro) properly designs the proposed Crenshaw/LAX Transit light rail line, which would run past LAX and connect the Green Line with the Expo Line. If properly designed, this eight and a half mile rail line could lure some passengers and employees to take public transit to LAX versus driving. However, access and convenience to LAX will impact the viability of this proposed transit option. The current plan calls for a transit station at Century Boulevard and Aviation Boulevard—a busy intersection about a mile outside of LAX—and the construction of a people mover between this station and LAX terminals. The location of this transit station in a non-pedestrian friendly area and the distance from LAX could serve as a barrier to attracting riders. Clean air advocates should request that Metro address concerns with LAX connectivity and safety at the proposed LAX transit station.

**Priority of Recommendation 3.2:** This action ranks as a medium but urgent priority. The project planning is well underway and clean air advocates will want to meet with Metro staff member as soon as possible. The Final Environment Impact Study/Environment Impact Report could be ready by the end of 2010, with the line scheduled to open in 2018.
4) Focus on Heavy-duty Trucks

Finding: Ontario Airport is part of an expanding freight movement system in which trucks move freight from the Port of Los Angeles and Port of Long Beach to the Inland Empire’s freight loading facilities, warehouses, rail yards, and airports. Diesel trucks also deliver products to airport tenants and airliners at LAX, which ranks as the 13th in the world in air cargo tonnage handled. However, while the LAWA tracks some commercial vehicle traffic, it does not track commercial truck trips at any of its airports. This lack of data indicates a lack of focus on this emission source.

Recommendation and Target: First of all, clean air advocates should request that the LAWA collect and make publically available data on cargo-handling trucks. Managing a source of pollution requires the ability to measure that pollution source. Second, clean air advocates could request that the LAWA pursue a policy to phase-out the oldest and dirtiest trucks that enter onto the property of the LAWA. The model that the LAWA should explore is the Clean Trucks Program at the Port of Los Angeles and Port of Long Beach. The Clean Trucks Program progressively bans all trucks that do not meet the most recent emission standards by 2012. Like at the Port of Los Angeles, the City of Los Angeles serves as a landlord at its airports and as a landlord, the City can set terms for companies that do business on its property.

Priority: These two interrelated actions rank as a medium and potentially high priority. Without good data, it is hard to know how significant cargo handling vehicles are to air pollution related to the LAWA’s operations. Obtaining this data is important and could help determine next steps.
5) **Ban Lead in Aviation Gasoline**

**Finding:** Studies of emissions near airports in Los Angeles County demonstrate highly elevated levels of lead particulate. Lead is banned in all fuel in the US except aviation gasoline (avgas). Avgas is used in non-commercial, piston-engine aircraft that frequent generation aviation airports including Van Nuys Airport, the largest general aviation airport in the world. On a national basis, emissions of lead from aircraft engines using leaded avgas are the largest single source category for emissions of lead to air, comprising approximately half of the national inventory in 2005. The tetra-ethyl lead found in leaded avgas and its combustion products are potent neurotoxins. The US Centers for Disease Control and Prevention (CDC) concluded in 2005 that no “safe threshold for blood lead has been identified.” The Federal Aviation Administration (FAA) certified a non-lead alternative, AGE85, but it is not widely used in part because the FAA has been slow to certify AGE85 for all types of small planes.

On April 28, 2010 the EPA Administrator Lisa Jackson issued an Advance Notice of Proposed Rulemaking on Lead Emissions From Piston-Engine Aircraft Using Leaded Aviation Gasoline. Until June 28, 2001, the EPA will accept comments on the “data available for evaluating lead emissions, ambient concentrations, and potential exposure to lead from the continued use of leaded avgas in piston-engine powered aircraft,” as well as “additional information that will inform future action.”

**Recommendation 5.1 and Target:** Clean air advocates should submit comments to the EPA—prior to the June 28th, 2010 comment period deadline—about the high levels of lead particulate found in the areas surrounding Van Nuys Airport and other general aviation airports in Los Angeles County, as well as the number of schools located within a three mile buffer zone of these airports (see pages 37 to 39 for this information). Clean air advocates should then track the EPA’s rulemaking process and advocate for the removal of lead in avgas.

**Priority of Recommendation 5.1:** This action ranks as a high and urgent priority given that the EPA is in the beginning of their rulemaking process and there is the potential to affect regulation that could protect the public from lead exposure from avgas.
**Recommendation 5.2 and Target:** Airport owners and operators, such as the LAWA, could potentially structure their lease agreements with users of their airport to require the use of non-leaded fuel while on their airport property. More legal research would be required to determine exactly how such a lease agreement could be structured. Clean air advocates in conjunction with legal experts should pursue more legal research on this topic.

**Priority of Recommendation 5.2:** Additional legal research is a high but not urgent priority given that clean air advocates may first want to strategically concentrate on the EPA rulemaking process.

### 6) Restore Research Funding to Develop Clean and Efficient Aviation Technology

**Finding:** Historically, most of the aviation environmental gains have come from new technologies, with the National Aeronautics and Space Administration (NASA) as a lead agency in this process. In 2004, NASA established a five-year goal to deliver technologies that reduce CO2 emissions of new aircraft by 25 percent. However, NASA’s budgets have declined since 2004, leaving this specific proposal underfunded and the goal unmet.

**Recommendation and Target:** Clean air advocates should ask federal legislators to restore research funding for cleaner aviation technology development. Funding criteria should be performance based and meant to accelerate breakthroughs in and commercialization of clean and efficient aviation technology. Funding could come from reinstating the Aviation Trust Fund. Revenue that was once collected through a 10 percent domestic ticket tax could instead be collected through an aviation fuel tax, thus providing an incentive to increase airline operational efficiency and to modernize the aging fleet with more efficient airframes and engines.¹⁹⁹

**Priority:** This action ranks as a low priority for clean air advocates based in the Los Angeles region. Impacting funding at a national level would be a challenge for clean air advocates in Southern California and perhaps outside the scope of a campaign to target emission from operations at the LAWA owned and operated airports. However, doing so could be very important. The International Civil Aviation Organization (ICAO) sets emission standards for aircraft engines that the EPA adopts. The ICAO’s policy is to set “technology supporting” rather than “technology forcing” standards, which means that research and development of cleaner aircraft engines is critical.
SOURCE TARGET: GROUND SUPPORT EQUIPMENT

7) Ensure Implementation of the LAX CBA

Finding: Ground service equipment account for four percent of VOC emissions, two percent of PM10 emissions, and 11 percent of NOx emissions. As part of the LAX Community Benefits Agreement (CBA), the LAWA agreed to convert all on-airport ground service equipment (GSE) to the cleanest technology available by 2015. Currently, only approximately a quarter of LAX’s tenant GSE are zero-emission.200

Recommendation and Target: Clean air advocates should monitor and ensure that the LAWA meets its commitments in the CBA.

Priority: This action ranks as a high priority. Significant resources are required to monitor and put pressure on the LAWA to meet its commitment to clean GSE and other air quality components as part of the CBA. Yet doing so is important because of the potential for significant emission reductions and the logic in fully implementing an existing agreement rather than developing new and potentially duplicative policies.

8) Defend California’s On-Road Diesel Regulation and/or Advocate for a New Regulation that Targets GSE

Finding: The state of California does not specifically target ground support equipment (GSE) in any of its binding regulations. While the CARB’s In-Use Off-Road Diesel Vehicle Regulation applies to GSE, among many other emission sources, as part of the 2009 California budget, the California legislature directed the CARB to make several changes to the rule that reduce the emission reduction and health benefits associated with the rule by extending compliance deadlines and making other requirements less stringent.201

Recommendation and Target: Clean air advocates should work with the CARB to defend this important rule. If the CARB does not strengthen the rule, clean air advocates should encourage the CARB to develop a separate rule that specifically and aggressively addresses airport GSE.

Priority: This action ranks as a medium priority. An effective statewide rule could have significant emission reduction potential, but strengthening or creating a new rule to effectively target emissions from GSE at airports would be
challenging given the current political and regulatory climate

TARGET SOURCE: AIRPORT VEHICLE FLEETS

9) Ensure that the LAWA Meets its Commitment to Cleaner Airport Vehicles and Extend the Commitment to Ontario and Van Nuys Airports

Finding: Airport-owned vehicles contribute nine percent of VOC emissions, four percent of NOx emissions, and three percent of PM10 emissions from LAX-related operations. As part of the LAX Community Benefits Agreement, the LAWA agreed that 100 percent of its fleet vehicles would be alternative fueled, or vehicles with comparable emissions, by 2015. Currently, the LAX fleet is comprised of approximately 72 percent alternative fuel vehicles (AFV). LAWA has not publicized its fleet ratio for its other airports, an indication that the AFV rate is significantly lower elsewhere.

Recommendation 9.1 and Target: Clean air advocates should monitor and ensure that the LAWA meets its commitment to a 100 percent transition of its LAX fleet to alternative fuel vehicles, or vehicles with comparable emission reductions, as part of the LAX Community Benefits Agreement.

Priority for Recommendation 9.1: In general, monitoring the LAWA’s progress in implementing the LAX Community Benefits Agreement (CBA) should be a high priority for clean air advocates.

Recommendation 9.2 and Target: The commitment to alternative fueled vehicles via the CBA should be extended to Ontario Airport and Van Nuys Airports. Although the LAWA is behind in its original schedule for the Ontario Master Plan due to the recent downturn in air travel, the LAWA will likely move forward with development plans for Ontario Airport at some point in the future. Clean air advocates could use that opportunity to ensure that the LAWA is maximizing opportunities for emission reductions from its vehicle fleet as part of any plan to expand.

Priority of Recommendation 9.2: This action ranks as a low to medium priority. While creating something like a community benefits agreement for Ontario Airport could result in significant emission reductions, doing so would take a significant amount of resources and a comprehensive clean air action plan, per recommendation number one, is the preferred strategy.
TARGET: STATIONARY SOURCES

10) Go Solar at the LAWA Airports

Finding: Although mobile sources constitute the bulk of emissions related to airport operations, stationary sources—primarily from energy production—account for two percent of both NOx and PM10 emissions from LAX operations. In November 2009, the LAWA Board of Airport Commissioners approved a new central utility plant at LAX that will decrease emissions relative to current levels. However, the effort does not go as far as some airports—like Denver International—that are investing in onsite solar arrays.

Recommendation and Target: Clean air advocates should ask the Los Angeles World Airports and the Los Angeles Department of Water (DWP) to invest in solar panels at every airport owned and operated by the LAWA. In particular, the LAWA and the DWP should follow through with the proposal to build a large solar facility on unused land on Palmdale Airport property.

Priority: This action ranks as a medium priority. Stationary sources are not the most significant source of criteria air pollution from airport operations, but reducing emissions associated with airport energy use would be achieved simply by shifting to more solar power. The LAWA certainly has the space to install solar panels on its properties and doing so could help meet the City of Los Angeles’ renewable energy goals and advance the City’s Solar Plan.
Table 10

<table>
<thead>
<tr>
<th>Recommended Actions</th>
<th>Emission Source</th>
<th>Suggested Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Create a clean air action plan for the LAWA</td>
<td>Several sources</td>
<td>High</td>
</tr>
<tr>
<td>Target aircraft and airports in State Implementation Plans</td>
<td>Several sources</td>
<td>Medium to high</td>
</tr>
<tr>
<td>Increase the viability of alternative ground access transportation via cordon pricing and improved public transit</td>
<td>Ground access</td>
<td>Medium</td>
</tr>
<tr>
<td>Focus on heavy-duty trucks</td>
<td>Ground access</td>
<td>Medium to high</td>
</tr>
<tr>
<td>Ban lead in aviation gasoline</td>
<td>Aircraft</td>
<td>High and urgent</td>
</tr>
<tr>
<td>Restore research funding to develop clean and efficient aviation technology</td>
<td>Aircraft</td>
<td>Low</td>
</tr>
<tr>
<td>Ensure implementation of the LAX Community Benefits Agreement, in particular the commitment to clean GSE</td>
<td>Several, including ground service equipment</td>
<td>High</td>
</tr>
<tr>
<td>Defend California’s On-Road Diesel Regulation and/or advocate for a new regulation that targets GSE</td>
<td>Ground service equipment</td>
<td>Medium</td>
</tr>
<tr>
<td>Ensure that the LAWA meets its commitment to cleaner airport vehicles and extend the commitment to Ontario and Van Nuys Airports</td>
<td>Airport vehicles</td>
<td>High</td>
</tr>
<tr>
<td>Go solar at the LAWA airports</td>
<td>Stationary</td>
<td>Medium</td>
</tr>
</tbody>
</table>
Aviation is one of the most rapidly growing sources of both criteria pollutants and greenhouse gas emissions. This trend will continue if the long-term demand for air travel increases without policy, technology, and operational changes. Fortunately, many opportunities exist for emission reductions that clean air advocates can pursue. A combination of international, national, state, regional, and local entities have a role in reducing emissions from a variety of sources at the Los Angeles World Airports (LAWA). These emission sources include: ground access transportation, aircraft, airport fleet vehicles, ground support equipment, and stationary sources.

Any campaign to significantly reduce emissions from the LAWA’s airports should seek to move the LAWA to develop a comprehensive plan to reduce emissions from all airport-related emission sources through a consistent application of air quality goals and policies at all of the LAWA’s airports. While not simple, designing a successful clean air campaign is important given significant air quality and health impacts of airports.
GLOSSARY OF TERMS AND ACRONYMS

**air carriers** — airlines holding a certificate issued under section 401 of the Federal Aviation Act of 1958 that operate aircraft designed to have a maximum seating capacity of more than 60 seats or a maximum payload capacity of more than 18,000 pounds or conduct international operations. There are four different types of air carriers: major, national, large regional, and medium regional. Their annual operating revenues are, respectively, greater than $1 billion, $100 million to $1 billion, $20 million to $100 million, and up to $20 million.

**air taxis** — planes that 1) perform at least five round trips per week between two or more points according to flight schedules that specify the times, days of the week, and places between which such flights are performed or 2) transport mail pursuant to a current contract with the US Postal Service.

**airport operations** — the number of arrivals and departures from the airport at which the airport traffic control tower is located.

**AFV** — alternative fuel vehicle

**attainment area** — an area considered to have air quality as good as or better than the national ambient air quality standards as defined in the Clean Air Act. An area may be an attainment area for one pollutant and a nonattainment area for others. See also **nonattainment area**.

**CARB** — California Air Resources Board

**CBA** — community benefits agreement

**commercial aircraft** — the sum total of air carrier and air taxi flights.

**CO2** — carbon Dioxide

**criteria pollutant** — The US Environmental Protection Agency sets National Ambient Air Quality Standards for six common air pollutants, which are known as
"criteria pollutants" because EPA develops human health-based and/or environmentally-based criteria for setting permissible levels. These pollutants are particle pollution (often referred to as particulate matter), ground-level ozone, carbon monoxide, sulfur oxides, nitrogen oxides, and lead.

**day-night sound level (DNL)** — a level of noise derived by measuring average sound levels in a 24-hour day, in decibels. Night time noise, between the hours of 10:00 p.m. and 7:00 a.m. is "weighted"; that is, given an additional 10 decibels to compensate for sleep interference and other disruptions caused by loud nighttime noise. For airport noise exposure purposes, an annual average of the daily day-night average sound levels is used. 65 dB DNL is the noise threshold at which the FAA defines areas as "compatible" with residential use; areas at or above 65 dB DNL are designated as "incompatible" with residential use.

**decibel (dB)** — a unit of sound measurement. A sound doubles in loudness for every increase of ten decibels.

**emission** — pollution discharged into the atmosphere from smokestacks, other vents, and surface areas of commercial or industrial facilities; from residual chimneys; and from motor vehicle, locomotive, or aircraft exhausts.

**EPA** — Environmental Protection Agency

**EU** — European Union

**general aviation** — all aviation that is not commercial or military.

**GHG** — greenhouse gas

**GSE** — ground service equipment

**hazardous air pollutants (HAP)** — also known as toxic air pollutants, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. See also toxic air pollutants.

**HC** — hydrocarbon
ICAO — International Civil Aviation Organization

IPCC — International Panel on Climate Change

FAA — Federal Aviation Administration

LA — Los Angeles

LAWA — Los Angeles World Airports

LAX — Los Angeles International Airport

**landing and takeoff cycle (LTO)** — the basis of ground-level aircraft emissions calculations. The components of an LTO are approach, taxi/idle-in, taxi/idle-out, take-off, and climb-out. LTO cycle calculations include only the emissions planes create within 3,000 feet of the earth’s surface, all of which affect ground-level air quality.

**MOU** — memorandum of understanding

**National Ambient Air Quality Standards (NAAQS)** — air quality standards established by EPA that apply to outside air throughout the country.

**nitrogen oxide (NOx)** — a product of combustion from transportation and stationary sources, a major contributor to acid deposition and the formation of both ground level and upper tropospheric ozone.

**non-attainment area** — geographic area that does not meet one or more of the National Ambient Air Quality Standards for ozone, nitrogen dioxide, carbon monoxide, particulates, sulfur dioxide, and lead.

**ONT** — Ontario International Airport

**ozone (O3)** — a form of oxygen found in two layers of the atmosphere: the stratosphere and the troposphere. This report refers to ozone in the troposphere— the layer extending up seven to 10 miles from the earth's surface. Ozone is a chemical oxidant and major component of photochemical smog. Ozone can seriously affect the human respiratory system and is one of the most prevalent and widespread of all the criteria pollutants for which the Clean Air Act...
required EPA to set standards. Ozone in the troposphere is produced through complex chemical reactions of nitrogen oxides, hydrocarbons, and sunlight.

**PM** — particulate matter

**RTP** — Regional Transportation Plan

**SCAG** — Southern California Association of Governments

**SCAQMD** — South Coast Air Quality Management District

**SCRAA** — Southern California Regional Airport Authority

**SIP (State Implementation Plan)** — EPA-approved state plans for the establishment, regulation, and enforcement of air pollution standards. States that violate federal air quality standards for carbon monoxide, nitrogen dioxide, ozone, PM10 (particulate matter smaller than 10 microns), lead or sulfur dioxide must prepare SIPs.

**smog** — air pollution caused by chemical reactions of various pollutants emitted from different sources.

**sulfur dioxide (SO2)** — a pungent, colorless gas formed primarily by the combustion of fossil fuels; becomes a pollutant when present in large amounts.

**sulfur oxides (SOx)** — the entire group of sulfur oxides that include SO2 and the less common SO3. EPA’s National Ambient Air Quality Standard for SO2 is designed to protect against exposure to the entire group of sulfur oxides. Emissions that lead to high concentrations of SO2 generally also lead to the formation of other SOx. Control measures that reduce SO2 can generally be expected to reduce people’s exposures to all gaseous SOx.

**Toxic air pollutants** — also known as hazardous air pollutants, are those pollutants that are known or suspected to cause cancer or other serious health effects, such as reproductive effects or birth defects, or adverse environmental effects. The EPA is working with state, local, and tribal governments to reduce the release of 188 toxic air pollutants.
**Toxic Release Inventory (TRI)** — a national database of information on toxic chemical releases and transfers, administered by the EPA.

**US** — United States

**VNY** — Van Nuys Airport

**volatile organic compound (VOC)** — any organic compound that participates in atmospheric photochemical reactions except for those designated by EPA as having negligible photochemical reactivity.

**Sources for definitions:**


Traditionally, the airline industry has provided middle-class jobs. However, job quality may have decreased in the industry in part due to economic concessions and contracting policies that have driven down wages and benefits. Labor costs have been a major focus for the industry’s cost-cutting. According to the Wall Street Journal, airlines have cut wages and benefits so much that they are having problems with attracting and retaining workers. Major network carriers cut more than 170,000 workers, or 38 percent of the total workforce, between August 2001 and October 2006, according to the Air Transport Association.

In Los Angeles, labor issues have been a focus of airport oriented organizing efforts. The Los Angeles Alliance for a New Economy was the lead organization behind the community benefits (CBA) agreement reached with the Los Angeles World Airports. The main labor related components of the CBA are as follows:

1. **Job training.** The LAWA committed to providing $3 million per year for five years to fund job training, with funding priority given to low-income individuals, special needs individuals, and individuals working in airport jobs or aviation-related jobs. Programs include job readiness programs, skills development, and career ladder programs.

2. **First source hiring program.** This program is geared toward low-income individuals who have lived in the project impact area for at least one year and special needs individuals given priority for available airport jobs. Second priority is given to low-income individuals living in the city.

3. **Living wage, worker retention, and contractor responsibility.** The City’s Living Wage Ordinance applies to all Airport Contractors, Lessees, and Licensees.
OTHER AIRPORT-RELATED ENVIRONMENTAL IMPACTS

In January 1995, the nonprofit organization the Natural Resources Defense Council (NRDC) undertook a study and survey of airports throughout the country to determine the most important environmental issues connected with airports. The NRDC found that while airports vary in terms of size and geographical characteristics, significant environmental impacts were common to most of the airports in their survey. These impacts included: noise pollution, air pollution, climate/energy impacts, and water pollution and use. The following two sections are a summary of the findings and policy implications in respect to noise pollution and water pollution impacts from airport operations.

Noise pollution

The bulk of the research on the health effects of airport operations have focused on noise pollution. Research suggests that aircraft noise affects millions of people every day in a variety of ways both short-term and long-term, both obvious and difficult to gauge. Research proves that noise affects one’s ability to concentrate and can cause hearing loss and sleep deprivation, resulting in potentially deleterious effects on health and well-being.

A myriad of studies have also found that community exposure to aircraft noise is associated with hypertension (high blood pressure). For example, in 2001, M. Rosenlund evaluated aircraft noise exposure for 2,959 adults and found an association between the increase in raised blood pressure and a continuous 24 hour aircraft noise level above 55 dB and at maximum levels above 72 dB. Eriksson et al. studied 2,037 men in the 40 to 60 year age group over a 10 year period and found that exposure to aircraft noise above 50 dB was associated with a significant 20 percent increase in the risk of hypertension. The HYENA study of 4,861 adults aged 45 to 70 years living in the close vicinity of six European airports, reported that a 10 dB increase in the continuous night-time noise level was found to be significantly associated with a 14 percent increase in the probability of being diagnosed with hypertension. The largest study of medication use was performed in the vicinity of Cologne/Bonn Airport in...
Germany). The study revealed significant relationships between the intensity of aircraft noise and the number of antihypertensive medications prescribed per patient. Antihypertensive medications for women were prescribed 27 percent more often at for women exposed to continuous aircraft noise at a level of 40 to 45 dB and 66 percent more often at level of 46 to 61 dB.

Research also links airport noise to an increased risk of stroke and heart disease. A recent (2010) study commissioned by Germany's Federal Environment Agency studied data from public health insurers on more than 1 million Germans ages 40 and over who live near Cologne-Bonn Airport in western Germany. According to the study, men who are exposed to jet noise have a 69 percent higher risk of being hospitalized for cardiovascular disease. Women living under flight paths fare even worse, logging a 93 percent higher rate of hospitalization with cardiovascular problems, compared with their counterparts in quiet residential areas. The study also found that women who are exposed to jet noise (of about 60 decibels) during the day are nearly two-times as likely to suffer a stroke as women not exposed jet noise.

Policy Implications

These studies clearly demonstrate that health effects are seen at levels below 65 db DNL. The FAA’s threshold of 65 dB for residential use is problematic because: 1) it is based on an averaging of noise, rather than the loud "single event" noise that specifically characterizes aircraft noise, and 2) the threshold of 65 dB significantly underestimates the level at which many people are impacted by aircraft noise. The most recent studies on noise and health have been conducted mostly in Europe rather than the United States. This is due, at least in part, to the current limited role of the US Environmental Protection Agency (EPA) in the field of aircraft noise. More research in the US is needed to perhaps revisit safe noise levels. While most airports have some type of program in place to lessen noise for their neighbors (such as using flight paths farther away from residential areas at night), a fundamental key to good aircraft noise policy lies in setting appropriate land uses adjacent to airports.
**Water Pollution**

The presence of snow, ice, or slush on runways or aircraft frequently causes hazardous conditions that can contribute to aircraft accidents, delays, and flight cancellations. Consequently, deicing or anti-icing (preventing the formation of ice) of aircraft and runways is a necessary part of operations at most US airports in winter months. The most common method of controlling ice is through the use of chemicals, particularly ethylene or propylene-based glycol mixtures with additives. Given that many, if not most, of the country's largest airports are sited along waterways, the control disposal of deicing chemicals and other chemicals, solvents, and metals used at airports constitute a significant water pollution issue. In addition, the use of deicing chemicals (particularly ethylene glycol) and other toxic substances at airports may present threats to human health, particularly to airport workers. Ethylene glycol and the issue of worker health and safety needs to be further addressed.\(^{221}\)

Revisions to the Clean Water Act revisions in 1987 recognized storm water run-off for the first time under federal law. The result was a national storm water permit system. However, the run-off management system that airports are required to implement under the national storm water system is problematic because of gaps in the areas of effluent standards, enforcement, and monitoring.

**Policy Implications**

Currently, aircraft deicing is not subject to a traditional effluent guideline permitting process.\(^{222}\) The EPA could reinstate aircraft deicing in its Transportation Cleaning effluent guidelines. The FAA could revise its Advisory Circular on Airport Winter Safety and Operations (AC 150/5200-30A) to include information on the latest, least environmentally-damaging deicing procedures that also meet safety requirements.\(^{223}\) In addition, more research should be conducted and information made available on the health effects of and the alternatives to chemicals for deicing.\(^{224}\)
OTHER ENVIRONMENTAL INITIATIVES OF THE LOS ANGELES WORLD AIRPORTS

The LAWAs environmental programs—beyond the air quality related initiatives highlighted in the body of this report—include the following:225 226

1) Hazardous Materials Management Programs

a. The LAWAs technicians removed 2,200 pounds of mercury in old instruments from the LAX Central Utilities Plan and replace them with mercury-free electronic transmitters.

2) Noise Management Program

a. Residential Soundproofing Program. The number of eligible dwelling units around LAX is approximately 8,200. (The LAWAs has not revealed how many have actually been soundproofed, which probably means a lower number). The Van Nuys Airport Residential Soundproofing Program encompasses 1,054 dwelling units that are scheduled to be completed by 2010.

b. Land Use Mitigation Program. This program is designed to administer, monitor, and expedite the LAWAs funding for noise mitigation programs, including land acquisition and soundproofing in impacted areas around LAX and within the cities of Inglewood, El Segundo, and unincorporated areas of Los Angeles County as well as areas surrounding ONT.

c. Voluntary Residential Acquisition and Relocation Program. This program involved relocating approximately 1,400 unit owners who voluntarily requested the LAWAs to acquire their residential properties and provide relocation assistance to owners and renters.

d. Federal Aviation Regulations, Part 161 Studies. LAWAs initiated a study in 2005 that was intended to restrict departures between midnight and 6:30 am over the communities east of the airport. (Residents note that the flight restrictions are not enforced to a manner that significantly limits night flights). The goal of the VNY Part 161 Study is to implement...
seven noise control measures. The scope of the work has expanded and additional restrictions proposed include the phase-out of Stage 2-type corporate jet aircraft and expanding the existing curfew to 9 am and weekends.

e. LA/Ontario Airport Noise Advisory Committee and LAX Community Noise Roundtable.

3) **Source Reduction and Recycling Program**
   a. LAWA recycled and reused more than 64 percent of trash it generated in 2007.
   b. LAWA also uses recycled materials in its construction projects. More than 75 percent of the construction and demolition waste from the LAX Tom Bradley International Terminal Renovation Project will be recycled or salvaged.

4) **Water Conservation and Management Programs**
   a. All LAWA toilets and sinks use low-flow devices.
   b. Presently, 35 percent of all landscaped areas at LAX are irrigated by reclaimed water, saving approximately 40.2 million gallons per year.

5) **Storm-water Monitoring**
   a. Prevention. LAWA staff conducts state-mandated storm-water management programs at LAX, ONT, and VYN.
   b. Inspection. Airport tenant sites are inspected annually to ensure compliance with storm-water regulations.
   c. Training. LAWA holds storm-water training sessions annually.

6) **Wildlife and Habitat Conservation Programs**
   a. LAX Sand Dunes Restoration.
   b. Palos Verdes Peninsula Land Conservancy.
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