

**MINUTES  
REGULAR COMMISSION MEETING  
THE PORT OF PORTLAND  
March 13, 2013**

In response to due notice, the regular meeting of the Commissioners of the Port of Portland was held at 9:30 a.m. in the Chinook conference room of the Port's administrative offices located at 7200 NE Airport Way.

**QUORUM**

Commissioners present were Jim Carter, President, presiding; Peter Bragdon; Tom Chamberlain; Steve Corey; Bruce Holte; Linda Pearce; Paul Rosenbaum and Tom Tsuruta. Also present were Bill Wyatt, Executive Director, participating staff members and members of the public.

**LEAVE OF ABSENCE**

Commissioner Carter called for a motion to grant a leave of absence to Commissioner Daggett, who was out of town. Commissioner Chamberlain moved to grant the leave of absence. Commissioner Holte seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Holte, Pearce and Tsuruta voted in favor of the motion. Commissioners Corey and Rosenbaum were not present for the vote.

**MINUTES**

Commissioner Carter called for a motion to approve the minutes of the Regular Commission Meeting of February 13, 2013. Commissioner Chamberlain moved to approve the minutes. Commissioner Holte seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

**EXECUTIVE DIRECTOR'S REPORT**

Bill Wyatt noted that this could be Commissioner Corey's last Commission meeting. He said that his term is up at the end of the month but will continue to serve on the Commission until a replacement is appointed and confirmed, neither of which have occurred. Mr. Wyatt said that Commissioner Corey is completing 10 years of service to the Port and it has been a great pleasure working with him. He said that Port staff also appreciates the time and effort he has put into his responsibilities as a Commissioner.

Commissioner Corey said that he has enjoyed the opportunity to serve with Mr. Wyatt, the dedicated staff and previous and current Commissioners. He said that he looks forward to crossing paths with everyone in the future.

Mr. Wyatt said that his formal Executive Director's report is incorporated in the agenda materials that are sent out prior to the Commission meeting and recaps the prior month's activities.

Mr. Wyatt said that generally speaking, it has been a pretty good month. He said that traffic at the airport continues to grow and spring travel is projected to be up three percent over last year. He noted that parking, rental cars and concessions are all up.

Mr. Wyatt said United Airlines announced that they will operate daily nonstop flights connecting PDX and Cleveland. He said that Cleveland serves as a United hub, providing summer travelers with more options for visiting the East Coast and Midwest. Mr. Wyatt said that Portland is one of only 12 cities that flies nonstop to all eight United hubs.

Mr. Wyatt said that Alaska Airlines will add a nonstop, daily flight between PDX and Fairbanks, Alaska, this summer. He also noted that Air Canada has advised they are suspending the summer seasonal route to Toronto. He said the good news is that Air Canada will continue providing daily, year-round service to Vancouver. Mr. Wyatt said that Air Canada is also increasing Calgary summer seasonal service to twice daily.

Mr. Wyatt said that if anyone has been following the continued saga of waterfront challenges and the grain negotiations that are going on, they know that the International Longshore and Warehouse Union and TEMCO have reached an agreement. He said that the remaining grain handlers, Columbia Grain in Portland, Louis Dreyfus and United Grain Corporation in Vancouver have not reached an agreement. Mr. Wyatt noted there is a lockout in force at Columbia Grain in Vancouver, but work is continuing.

Mr. Wyatt said that he, along with Commissioners Carter and Rosenbaum, returned from a weeklong trip to Amsterdam, Belgium and Berlin with the Governor. He said that while in the Netherlands, they celebrated the fifth anniversary of the nonstop flight from PDX to Schiphol at an event that drew more than 200 KLM, Delta and other Sky Team representatives as well as travel writers. Mr. Wyatt said that they traveled on to Laakdal, Belgium, to see the Nike distribution center. He said that it was quite an impressive facility powered by five of its own windmills. Mr. Wyatt said that their next stop was Berlin where they attended ITB Berlin, the world's largest trade show for the travel industry, and met with Daimler representatives.

Mr. Wyatt said that you may be able to gas-up your vehicle closer to PDX soon. He said the Port is currently seeking interested parties to develop a fueling/convenience store on three acres of property located on the corner of NE 82nd Avenue and NE Alderwood Road. He said that when implemented, the airport travel center location would be the closest fuel location to the airport terminal; the nearest fuel location is 3.5 miles away.

Mr. Wyatt noted that the parking guidance system in the long-term garage is currently under construction. He said that installation of the new, automated parking guidance system toward the end of this year will make parking spaces a little easier to find. Mr. Wyatt said the system is similar to the one already operating in the short-term parking garage.

Mr. Wyatt said that there is good news on the Columbia River Crossing front; the Oregon legislature voted on March 4 to approve the project to replace the Interstate 5 Bridge over the Columbia River on a bipartisan 18-11 vote. He said that Passage of HB 2800A, which was signed by the Governor yesterday, sends a signal to Washington State and Washington, D.C., that Oregon is ready to move ahead on efforts to build a safer crossing and fix the bottleneck near the current bridge. Mr. Wyatt said that this is a moment to savor because this project is critically important to the Port because, other than a couple of exceptions, virtually everything we own is on a parallel alignment with the Columbia River. Mr. Wyatt thanked the Port team and Annette Price for their hard work.

Mr. Wyatt said that the Port, through Stan Watters, Director of Development Services and IT, has played a big role in the Oregon Seismic Safety Policy Advisory Commission (OSSPAC). He said that OSSPAC has been developing the Oregon Resilience Plan, which is a document that brought together everything we know about the risk of a Cascadia Subduction Zone Earthquake and the impact it would have on critical infrastructure in the State of Oregon with recommendations on how to make the State more resilient to mitigate its impact and effects.

Mr. Wyatt noted the passing of Tom Hammond, President of Columbia Grain. He said Columbia Grain announced Mike Wong is the new President and CEO.

Commissioner Carter called for a motion to approve the Executive Director's Report. Commissioner Rosenbaum moved to approve the Executive Director's Report. Commissioner Corey seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

Commissioner Carter, on behalf of the Commission, thanked Commissioner Corey for his years of service to the Port. He said Commissioner Corey has spent a lot of his professional life contributing to Oregon through volunteer activities such as this and his efforts and dedication are appreciated.

## **GENERAL DISCUSSION**

### **PDX Community Advisory Committee (CAC) Annual Report**

Cam Gilmour, PDX CAC Chair, provided a brief commentary of the work done by CAC in the past year. He said the work has been valuable and the public involvement process was fantastic; he said there was good participation and great dialogue. Mr. Gilmour said that CAC's organizing principal has been around sustainability and they have spent the year learning more about social, economic and environmental balancing, and discussing and giving input on a number of projects that Port staff has brought to their attention. He said that they have asked and learned about the business of PDX: the finances, business aspects and capital planning, as well as the environmental and community programs. He said that they also learned about natural resource elements and how the Port works to ensure all of its operations take those elements into consideration. Mr. Gilmour said that as an advisory committee, they value the opportunity to influence the Port and other sponsors, as well as to plan together for a sustainable future.

Mr. Gilmour thanked Sam Imperati for his hard work and keeping CAC on track. He acknowledged Vince Granato, Sean Loughran, Chris White and Melissa Gall for their hard work; he said the Port is a large, complex organization and they simplify things for CAC so they can better understand what is going on.

Mike Sloan, PDX CAC Vice Chair, said that he has always been impressed that the Port and everyone associated with the airport reached out to Clark County to ensure the county and the city were involved in the process. Mr. Sloan said that he has had the opportunity to hear the opinions of the other 29 CAC members and concurs with Mr. Gilmour's comments.

Mr. Wyatt said the CAC's volunteer work is critically important to the operation of the airport and he appreciates their time and energy. He said one of the roles of the CAC is oversight, but it also provides an opportunity for our stakeholders to be certain that they are getting what they expected when the Airport Futures Plan was adopted.

Commissioner Corey said it takes a lot of dedication from the CAC; he said they have a great committee and their work is important for the Commission and the community.

Commissioner Carter thanked Mr. Gilmour and Mr. Sloan for their comments.

### **ACTION ITEMS**

#### **Agenda Item No. 1**

#### **WEST HAYDEN ISLAND ANNEXATION PRINCIPLES**

This agenda item recommended a set of principles to guide the Port of Portland in final deliberations with the City of Portland in support of annexation and future development of West Hayden Island (WHI).

Susie Lahsene presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That the Port of Portland Commission endorses the West Hayden Island Annexation Principles as a means of guiding Port of Portland staff and Commission evaluation of the City of Portland annexation proposal; and

BE IT FURTHER RESOLVED, That the Port of Portland Commission will review the City of Portland Planning and Sustainability Commission recommendations in light of these Principles; and

BE IT FURTHER RESOLVED, That the Port of Portland Commission directs staff to share these principles with City of Portland staff, the Planning and Sustainability Commission, and elected officials as the West Hayden Island annexation project progresses to the next stage.

Commissioner Corey said one thing the Commissioners share in their experiences when working with city, regional and state bodies is that mitigation aspects are critical. He said for the Port, it is important that we have certainty in what we are going to be asked to do in terms of mitigation. He said that changing standards always seem to disrupt what would otherwise be an orderly flow.

Commission Bragdon said that he echoes Commissioner Corey's comments; the principles support and reflect what his views are, but mitigation jumps out at him. He said that when looking at economic opportunity in this region, there are so many things we cannot control, and focusing on the things we can control and mitigation certainty is important.

Commissioner Carter said that he thinks the principals are really important and will require some further fleshing out as the process proceeds. He said that the Port is a private owner with a public spirit, and WHI is important property to the State of Oregon. Commissioner Carter said that part of our mission is economic development, and the creation of jobs is part of that and that simply cannot be done without industrial property and without the thoughtful, sensible development that goes along with it. He said that development is impossible with changing and shifting rules. Commissioner Carter said that it cannot be emphasized enough that we are not going to move forward in this trade-dependent state without acknowledging the importance of industrial development done with a conscience and appropriately by the Port.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Chamberlain moved that the Executive Director's recommendations be approved. Commissioner Bragdon seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

#### Agenda Item No. 2

#### SECOND READING AND ENACTMENT – AMENDED AND RESTATED PORT OF PORTLAND ORDINANCE NO. 389-R REGULATING LANDING AND FUEL FLOWAGE FEES ON GENERAL AVIATION AIRPORTS

This agenda item requested a second reading and enactment of the amendment and restatement of Port of Portland Ordinance No. 389-R, which pertains to landing and fuel flowage fees and regulates the operation of fuel transportation vehicles on general aviation airports.

Steve Nagy read Ordinance No. 389-R by title only.

Steve Nagy presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That the Port of Portland Ordinance No. 389-R, as amended, be given a second reading by title only; and

BE IT FURTHER RESOLVED, That the proposed Ordinance No. 389-R, in the form presented to the Commission, be enacted by roll call vote.

Miki Barnes, a resident of Banks, read the attached testimony and asked that it, along with a Santa Monica Airport Health Impact Assessment, be included with the minutes of the meeting. Ms. Barnes also responded to Mr. Nagy's response to her testimony at the February Commission meeting. She said that Mr. Nagy's providing her with educational materials falls far short of actually dealing with this issue and addressing the impacts. Ms. Barnes said that she has the education materials; she wants substantive change and she wants her livability and the environment preserved, as well as the health of children and adults in Washington County addressed.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Chamberlain moved that the Executive Director's recommendations be approved. Commissioner Bragdon seconded the motion, which was put to a roll call vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

#### Agenda Item No. 3

#### PUBLIC IMPROVEMENT CONTRACT – AIR TRANS CENTER PHASE III – PORTLAND INTERNATIONAL AIRPORT

This agenda item requests approval to award a public improvement contract to K&E Excavating, Inc., to construct the Air Trans Center Phase III (ATC PH III) project at Portland International Airport (PDX).

Chris Edwards presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That approval is given to award a public improvement contract for the Air Trans Center Phase III project to K&E Excavating, Inc., in accordance with its bid; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Corey moved that the Executive Director's recommendations be approved. Commissioner Chamberlain seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion. Commissioner Holte was not present for the vote.

#### Agenda Item No. 4

#### PROCUREMENT CONTRACT – REPLACEMENT OF 16 BOD METERS – PORTLAND INTERNATIONAL AIRPORT

This agenda item requested approval to award an equipment procurement contract to Hach Company for the purchase of 12 total organic carbon (TOC) meters for the Portland International Airport deicing stormwater collection system. The TOC meters will replace the system's existing biological oxygen demand meters. Authority to award the contract on a sole-source basis has previously been granted by the Port of Portland's Executive Director. Commission authority is required to award the contract because its amount, \$966,010, exceeds the Executive Director's delegated contracting authority.

George Seaman presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That approval is given to award an equipment procurement contract to Hach Company for the purchase of total organic carbon meters for the deicing stormwater collection system at Portland International Airport, consistent with the terms presented to the Commission; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Rosenbaum moved that the Executive Director's recommendations be approved. Commissioner Holte seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

Agenda Item No. 5**EXEMPTION FROM COMPETITIVE BIDDING – ITS-AVI TECHNOLOGY UPGRADE –  
PORTLAND INTERNATIONAL AIRPORT**

This agenda item requested approval of an exemption from competitive bidding under the Oregon Public Contracting Code. The Port of Portland must obtain the exemption in order to select a contractor for a public improvement project using a solicitation that utilizes evaluation criteria other than price. The project involves the design, acquisition, and construction of an integrated Automated Vehicle Identification (AVI) system at Portland International Airport (PDX). After the exemption is granted, the Port will conduct a competitive Request for Proposals solicitation process to select the project contractor.

Greg Sparks presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That the Port of Portland Commission, in its capacity as the Port of Portland Contract Review Board, approves the Findings in Support of an Exemption from Competitive Bidding set forth on the attached Exhibit A, dated February 12, 2013; and

BE IT FURTHER RESOLVED, That the Port of Portland Commission, in its capacity as the Port of Portland Contract Review Board, specifically exempts from competitive bidding the public improvement contract for the PDX ITS-AVI Technology Upgrade project, consistent with the terms presented to the Commission; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter recessed the Port of Portland Board of Commissioners and called to order the Port of Portland Contract Review Board.

Commissioner Carter called for a motion and second to approve the Findings in Support of the Exemption from Competitive Bidding, as set forth in Exhibit A and to exempt from competitive bidding the public improvement contract for the PDX ITS-AVI Technology Upgrade project. Commissioner Holte moved to approve the findings and the exemption. Commissioner Corey seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

Commissioner Carter adjourned the Port of Portland Contract Review Board and called to order the Port of Portland Board of Commissioners.

Agenda Item No. 6**AMENDMENT TO FEDERAL AVIATION ADMINISTRATION REIMBURSABLE AGREEMENT–  
RUNWAY 2/20 REHABILITATION – HILLSBORO AIRPORT**

This agenda item requested approval to execute an amendment to an existing reimbursable agreement with the Federal Aviation Administration for the relocation of navigational aids associated with the rehabilitation of Runway 2/20 and Taxiway C at Hillsboro Airport.

Greg Sparks presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That approval is given to execute Modification A to existing Federal Aviation Administration Reimbursable Agreement No. AJW-FN-FSA-11-S043, consistent with the terms presented to the Commission; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Chamberlain moved that the Executive Director's recommendations be approved. Commissioner Bragdon seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

#### Agenda Item No. 7

##### DREDGING CONTRACT – TERMINAL 4 BERTH 410 MAINTENANCE DREDGING 2013

This agenda item requested approval to award a maintenance dredging contract to Marine Industrial Construction, LLC, for the Terminal 4 Berth 410 Maintenance Dredging 2013 project in the amount of \$763,832.33.

Marcel Hermans presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That approval is given to award a dredging contract for Terminal 4 Berth 410 Maintenance Dredging 2013 to Marine Industrial Construction, LLC, in accordance with its bid; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Corey moved that the Executive Director's recommendations be approved. Commissioner Bragdon seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Holte, Pearce, Rosenbaum and Tsuruta voted in favor of the motion.

#### Agenda Item No. 8

##### PERSONAL SERVICES CONTRACT – DESIGN OF NE GRAHAM ROAD AND NE SWIGERT WAY IMPROVEMENTS – TROUTDALE REYNOLDS INDUSTRIAL PARK

This agenda item requested approval to award a personal services contract to David Evans and Associates, Inc. to design the NE Graham Road and NE Swigert Way Improvements in the Troutdale Reynolds Industrial Park.



Robin McCaffrey presented the Executive Director's recommendations as follows:

BE IT RESOLVED, That approval is given to award a personal services contract for the design of NE Graham Road and NE Swigert Way Improvements project in the Troutdale Reynolds Industrial Park to David Evans and Associates, Inc., in accordance with the terms presented to the Commission; and

BE IT FURTHER RESOLVED, That the Executive Director or his designee is authorized to execute the necessary documents on behalf of the Port of Portland Commission in a form approved by counsel.

Commissioner Carter called for a motion to approve the Executive Director's recommendations. Commissioner Chamberlain moved that the Executive Director's recommendations be approved. Commissioner Corey seconded the motion, which was put to a voice vote. Commissioners Bragdon, Carter, Chamberlain, Corey, Pearce, Rosenbaum and Tsuruta voted in favor of the motion. Commissioner Holte was not present for the vote.

The meeting adjourned at 11:15 a.m.

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President

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Assistant Secretary

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Date Signed

An audio recording of these proceedings and the full Commission agenda is available by contacting the Port of Portland administrative offices, 7200 N.E. Airport Way, Portland, Oregon 97218.

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Date: March 13, 2013

To: Port of Portland Board of Commissioners  
From: Miki Barnes  
Topic: Ordinance 389-R

*Please include this testimony in its entirety as well as accompanying documentation in the minutes of this meeting.*

My testimony last month focused in part on the negative health impacts of lead emissions generated by piston-engine aircraft at the Hillsboro Airport. The information presented today focuses on the adverse health effects of jet exhaust on public health. Towards this end I have included a copy of a Santa Monica Airport Health Impact Assessment from February 2010, a document authored by pediatricians in residency training at the UCLA Medical Center. Prior to this study, most airport environmental and health research focused on commercial airports. The Santa Monica study is one of the first that applies to a general aviation airport. The primary users of the Santa Monica Airport are corporate jets, flight training schools and recreational hobbyists. In 2010 this airport logged 108,584 annual operations, less than half as many as the Hillsboro Airport (HIO). Like HIO, this facility is bordered on three sides by residential communities.

The section below, excerpted from pages 3-4 of the assessment, lists some of key findings contained in the report.

1. Airport operations, particularly jet take-offs and landings, are contributing to elevated levels of black carbon in the area surrounding Santa Monica Airport. Elevated exposure to black carbon is associated with:
  - increased rates of respiratory and cardiovascular disease including asthma, bronchitis,
  - and increased risk for sudden death
  - irreversible decreases of lung function in children
  - increased carcinogenic risk
2. Elevated levels of ultrafine particles (UFP) are associated with aircraft operations and jet takeoffs and are found in the area surrounding Santa Monica Airport. Elevated exposure to UFPs are associated with:
  - increased inflammation and blockage of blood vessels in mice models
  - greater lung inflammation with exposure to UFPs than exposure to larger particulates in rodent models
3. Elevated levels of polycyclic aromatic hydrocarbons (PAH) are found in the area surrounding Santa Monica Airport. Exposure to PAH has been associated with:
  - increased carcinogenic risk
  - disruption of the hormonal balance in adults.
  - reproductive abnormalities with exposure during pregnancy
  - lower IQ scores in children
4. Levels of noise due to plane and jet take-offs from Santa Monica Airport are above Federal Aviation Airport thresholds. Excessive noise is associated with:
  - hearing loss.
  - higher levels of psychological distress
  - impaired reading comprehension and memory among children.

1 *Miki Barnes, Port of Portland Board of Commissioners Testimony, 3/14/13* (over)

In light of the significant negative impacts caused by Port of Portland general aviation activity, I strongly urge you to remove all language from Ordinance 389-R purporting that these airports "are of vital importance to the health, safety and welfare of the community" as this assertion is patently false and misleading. In fact, general aviation activity in Hillsboro poses a significant threat to the health and well being of area residents. I further recommend that the Port take immediate and definitive action aimed at reducing toxic exposure levels in communities impacted by Port promoted aviation activity.

2 *Miki Barnes, Port of Portland Board of Commissioners Testimony, 3/14/13*

# Santa Monica Airport Health Impact Assessment (HIA)

*A health-directed summary of the issues facing the community  
near the Santa Monica Airport*

February 2010

## Written by UCLA CHAT PGY-2 Pediatric Residents

Adrian Castro, M.D.  
Leian Chen, M.D.  
Bianca Edison, M.D.  
Johnny Huang, M.D.  
Kiran Mitha, M.D.  
Melissa Orkin, M.D.  
Zarin Tejani, M.D.  
Diana Tu, M.D.  
Lindsay Wells, M.D.  
Joanna Yeh, M.D.

## Supervised by UCLA Department of Pediatrics Faculty

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## Executive Summary

The Santa Monica Airport (SMO) has been located within a highly populated urban area for many decades. Nearby residents have long held concerns regarding the impact of the airport on their community. However, due to a recent growth in the number of jet operations, the community is increasingly worried about the health effects of both noise and air pollution on neighboring children and families. It is therefore important to examine how the continuation of current airport activity affects the conditions required for optimal health.

The proximity of SMO to schools, daycare centers, and parks, in addition to residential homes, poses great exposure risks to children and their families. In response to concerns from residents living around SMO, we have developed this Santa Monica Airport Health Impact Assessment (HIA) in order to organize, analyze, and evaluate existing information and evidence regarding SMO's impact on adverse health effects. The report includes an analysis of the impacts on three issue areas: lack of an airport buffer zone, noise, and air quality.

**We recognize there is significant public controversy associated with the continuation of Santa Monica Airport activity. Our goal is for the Santa Monica Airport Health Impact Assessment to provide constructive recommendations in the interest of supporting communities that promote health.**

## Key Findings

- Airport operations, particularly jet take-offs and landing, are contributing to elevated levels of black carbon in the area surrounding Santa Monica Airport. Elevated exposure to black carbon is associated with:
  - increased rates of respiratory and cardiovascular disease including asthma, bronchitis, and increased risk for sudden death
  - irreversible decrease lung function in children
  - increased carcinogenic risk
- Elevated levels of ultrafine particles (UFP) are associated with aircraft operations and jet takeoffs and are found in the area surrounding Santa Monica Airport. Elevated exposure to UFPs are associated with:
  - increased inflammation and blockage of blood vessels in mice models
  - greater lung inflammation with exposure to UFPs than exposure to larger particulates in rodent models
- Elevated levels of polycyclic aromatic hydrocarbons (PAH) are found in the area surrounding Santa Monica Airport. Exposure to PAH has been associated with:
  - increased carcinogenic risk
  - disruption of the hormonal balance in adults.
  - reproductive abnormalities with exposure during pregnancy
  - lower IQ scores in children.
- Levels of noise due to plane and jet take-offs from Santa Monica Airport are above Federal Aviation Authority thresholds. Excessive noise is associated with:
  - hearing loss.
  - higher levels of psychological distress
  - impaired reading comprehension and memory among children.

## Authors

We are pediatricians currently in our residency training at the UCLA Medical Center. We are members of UCLA CHAT (Community Health and Advocacy Training) program and as part of this training, we participate in community service-learning opportunities to improve children's health. As part of our community service-learning opportunity on environmental health, we evaluated the health impact of the Santa Monica Airport on the surrounding Santa Monica and Los Angeles communities. Many members of these communities seek care from our medical clinics, and we have a vested interest in their health and well-being. This project was supervised by faculty from the UCLA Department of Pediatrics. None of the resident authors or faculty received funding or financial support for this assessment nor do they have any economic interests in the Santa Monica Airport.

## Methods

This rapid non-participatory Health Impact Assessment was conducted during the month of February 2010. Our research methodology included empirical and scientific literature reviews; review of public standards, regulations and guidance relevant to airport planning and health; the use of expert consultants; review and analysis of public comment and testimony; and participation in community forums and meetings. Our primary resources for the literature review were found via the online databases PubMed, Lexis-Nexus, OVID, and CSA Environmental Sciences and Pollution Management. The expert consultants had expertise in the areas of health effects of jet exhaust, air quality, as well as atmospheric and environmental science.

- There is no buffer zone between the airport airfield and the surrounding community as observed in many other municipal airport communities.

## Recommendations

- Eliminate or significantly decrease the number of jet takeoffs to reduce exposure to both the byproducts of jet fuel exhaust and the loud "single event" noise of jet takeoff.
- Install HEPA (high efficiency particulate absorbing) filters in surrounding schools and residential homes to mitigate the exposure to PAHs and particulate air pollution.
- Enforce Federal Aviation Airport noise thresholds by implementing additional noise abatement strategies such as soundproofing of schools and significantly affected homes near SMO that would protect residents from hearing loss, psychological distress, and learning problems in children.
- Adopt the precautionary principle, given the evidence of the potential harm of UFPs and other byproducts of airport pollution on animal and human health.
- Notify all potential property buyers, residents, and affected community members in the vicinity of SMO of the noise and air pollution health risks.
- Maintain a runway buffer zone of at least 660 meters to protect surrounding residents from the harmful health effects of jet fuel exhaust byproducts during idling and take-off.
- Closure of SMO would eliminate all health risks associated with airport air and noise pollution.

## Introduction

### History

Santa Monica Airport (SMO) has been a presence in the city of Santa Monica for many decades, serving functions that have ranged from recreational flying to military use. It was originally built in 1919 and named *Clover Field*, which was the home base of the Douglas Aircraft Company. Today, SMO serves as a general aviation "reliever airport" for Los Angeles International Airport (LAX) and is primarily used by private operators. In recent history, a steady increase in the number of jet plane operations has resulted in increased air pollution and noise burden on the surrounding community, resulting in legal action by community members against the City of Santa Monica.

SMO is unique among airports, from a legal and contractual standpoint, as well as from a geographic and operational standpoint. SMO is owned and operated by the City of Santa Monica. In the early 1980s, after a Federal Court ruled against the city's total ban on jet planes, the city initiated efforts to close the airport entirely.[1] However, the Federal Aviation Administration (FAA), along with other aviation interests, threatened suit against the city. In 1984, a compromise agreement ensued, which committed the city to keeping the airport operational as a general reliever airport until July 1, 2015. The agreement also included decibel limits to noise from take-offs and landings and limited the operating hours by instituting a night curfew on departures and a voluntary night curfew on arrivals.[2]

Since the 1984 agreement, SMO has significantly expanded its jet plane operations, increasing from 1,176 in 1983 to over 18,000 in 2004. The number has since decreased to about 16,000 in 2008.[3] The increase in the number of flight operations has been accompanied by an increase in

noise as well as air pollution, creating a greater burden on the surrounding residential communities.[4]

#### **The Affected Community**

The airport is located at the southeast corner of the City of Santa Monica with the southern and eastern perimeter of the airport bordered by the City of Los Angeles. An estimated 150,000 residents live within a 2-mile radius of SMO. While the northern edge of the airport is primarily bordered by commercial buildings, residential neighborhoods surround the remainder of the airport. Within a 1-mile radius around the airport, there are at least 9 preschools and daycares, 11 elementary schools, 4 middle schools, 5 colleges or universities, 1 learning center, and 6 parks. Two of these parks are located right on the border of the airport. Clover Park is situated on the airport's northwest border, immediately abutting the path used by planes when taxiing to their gates. On the southeast end of the airport is the Airport Park, which includes an area built specifically for small children.

While reports of odors have come from all areas surrounding the airport[3], North Westdale, the Los Angeles neighborhood immediately downwind of the airstrip, has suffered the most from jet fuel exhaust. The area includes roughly 1,000 homes, with residents ranging from small children to the elderly. There are several daycares in the community, primarily run out of homes, as well as an elementary and middle school.

During the mid 1990s, a few North Westdale residents videotaped footage of jets taking off from the Santa Monica airport and the effect these planes had on the surrounding neighborhood. One piece of footage taken from a resident's backyard shows a jet in close proximity awaiting clearance to take-off. As the jet's engine idles, a trail of black soot blows into the camera's lens and the wind from the jet vigorously sways the surrounding trees. The footage then goes on to show the grass covered in black ash, the resident's overturned patio furniture, and a neighbor's destroyed fence.[3]

Numerous letters complaining about the noise and exhaust from the jets are posted on the website "Concerned Residents Against Airway Pollution," a site created by a Los Angeles based grassroots group to advocate against the SMO air and noise pollution. These complaints date from 2003 to February of 2010 and come from residents who live both across the street from the airport and those residents who reside more than a mile away. Common problems include complaints of the jet exhaust lingering in their yards and penetrating into their homes. Physical complaints include burning of the eyes, nose, and throat and headaches because of the jet exhaust. Many parents report frequently keeping their children indoors due to the overwhelming exhaust and noise. Nearby residents state they are unable to hear their television or have conversations in their homes because of the loud noise from overhead planes. Individuals also report that their sleep is interrupted multiple times, secondary to planes flying overhead as early as 6 a.m. and as late as midnight during all seven days of the week. Lastly, residents express fear regarding the limited amount of space at the Santa Monica Airport and the lack of a buffer/safety zone for planes who runoff the airport runway, potentially placing nearby communities in danger.[3]

antennas."[8] While this policy has since been amended, such a policy to protect the health of airport personnel raises concern for the safety of residents, many of whose homes currently sit less than 300 feet from both ends of Santa Monica Airport's runway.

The impact of aircraft exhaust on the surrounding community is further exacerbated by flight takeoff procedures at SMO. In 1990, new takeoff procedures required planes taking off from SMO to await permission from air traffic control at LAX because of the convergence of flight paths from these two airports.[9] Local residents have noted an increase in jet emissions due to the idling of jets awaiting permission for takeoff, especially since the idling jets are located close to the east end of the runway when in the hold pattern, and at the eastern most end of the runway during takeoff with the engines facing Bundy Drive and the houses just beyond.[3]

#### **Exposure to Jet Fuel Exhaust**

Various studies have examined jet fuel and the exhaust it creates. Jet fuel, supplied by JP-8 and JetA1 fuel for major aviation engines and civil aviation engines respectively, consists of a complex mixture of many components, including naphthalenes, diatomics, cycloalkanes, straight chain alkanes, and branched chain alkanes.[10] The exhaust from jet fuel contains dangerous compounds, including black carbon (BC), particle-bound polycyclic aromatic hydrocarbons (PB-PAH) and ultrafine particles (UFPs).

Researchers have investigated jet fuel byproducts' environmental effects, including air quality. A number of studies find that air quality near major airports can be significantly affected by emissions from air mobile sources. This research becomes increasingly important as the number of jet flights have heavily increased at Santa Monica Airport over the last decade. Eickhoff's study in 1998 looked at mass concentrations of polychlorinated dibenzo-*p*-dioxines (PCDD)/polychlorinated dibenzofurans (PCDF) and particle-bound polycyclic aromatic hydrocarbons (PB-PAH) in jet engine emissions and found that levels were higher during idling and take-off of jet aircraft.[11] Another study looking at the air quality around Zurich airport found that carbon monoxide concentrations in the vicinity of the terminals are dependent on aircraft motions and engine status (idling vs. take-off vs. landing).[12] Westerdahl's research found that concentrations of UFPs were markedly elevated in the vicinity of Los Angeles International Airport, particularly downwind of the takeoff runways.[13]

Even though research studies reveal elevated pollutant concentrations in the surrounding downwind areas around large commercial airports, some questioned if the same would be true for smaller airports. One study at a small regional airport in Warwick, RI that receives primarily commercial aircraft traffic measured black carbon concentrations at five monitoring sites surrounding the airport between July 2005 and 2006. Results from the study suggested "significant positive associations between hourly departures and arrivals at the airport and BC concentrations within the community, with departures having a more substantial impact." [14]

Additional research has been done around the Santa Monica airport indicating the elevated pollutant concentrations associated with smaller airports. The South Coast Consortium of the Air Quality Management District conducted a study of the area exposure to total suspended particles (TSPs), lead, and UFP around Santa Monica and Van Nuys airports.[15] The researchers of this particular study revealed there was no discernible elevation of 24-hour averaged PM2.5 mass.

#### **SMO: A unique problem**

##### ***Legal and Contractual Agreements and City Boundaries***

The legal and contractual agreements pertaining to SMO, as well as the airports location within both the communities of Santa Monica and Los Angeles, make efforts to mitigate the burden of noise and aircraft emissions difficult. Such efforts have been countered by the City's claim that it lacks the authority to regulate the airport's environmental impacts due to the terms of the 1984 Agreement as well as the Airport Noise and Capacity Act of 1990 (ANCA), which significantly limits proprietary rights for airport operators. These positions have been maintained despite legal analysis documenting that the city retains proprietary rights over the airport in areas not specifically denied in the 1984 Agreement, which primarily gave the rights over noise regulation to the FAA. Furthermore, the contractual agreement between the city and the FAA prevents the FAA from invoking ANCA to limit the city's rights. Nonetheless, the City has requested numerous times that the FAA impose stricter rules and regulations on SMO, only to be met by inaction from the FAA, which states that their sole charge is "to direct aircraft flight patterns and ensure safe and efficient use of navigable space." [5] The airports location results in divided political representative boundaries on the local, state and congressional levels, thereby also complicating the political process of addressing the airport's impacts.

##### ***Proximity to Homes, Parks, and Schools – Lack of a Buffer Zone***

The location of the airport contributes to the burden on the community. First, unlike other Los Angeles area airports, there is no buffer zone between the airfield and the surrounding community which, as mentioned above, is primarily comprised of homes, schools, and parks (see Figure 1). On both the western and eastern ends of the runway, planes are separated from houses by only a single street. Moreover, the eastern end of the runway sits on land that is elevated above the bordering street, Bundy Drive. Planes, which primarily idle and takeoff from this eastern end, therefore blow exhaust over the street and directly into the North Westdale neighborhood. Because of this impact, SMO erected a blast wall in 2002 at the eastern end of the runway. However, the community members reported no appreciable benefit from the wall.[6] FAA recommendations for buffer zones do exist and depend on the type of aircraft flying in and out of a given airport as well as their landing and takeoff speeds. However, existing airports are not required to follow these recommendations.[7] Nonetheless, similar municipal airports in the Los Angeles area such as those in Van Nuys and Long Beach do utilize significantly larger buffer zones between their runways and surrounding residences (see Figures 2 and 3). Reviewing maps of the Van Nuys, Long Beach, and Santa Monica airports reveal that the distance to the nearest homes on either side of the runways is 0.2 miles, 0.25 miles and 0.04 miles respectively indicating a 5-fold difference in the buffer zone between SMO and other local existing airports.

Rules regarding proximity to critical jet blast areas for personnel working on airports have also existed in the past. According to a Department of Transportation/FAA interdepartmental memo written in May 1989, "since prolonged exposure to jet fumes is dangerous to the health of personnel working on the systems, it is necessary to minimize this deleterious effect. Therefore, no jet aircraft shall be permitted to park or hold within 300 feet of the ILS [instrument landing system] equipment shelters, the localizer antenna array, or the glide slope antennas." The document also stated that "vegetation growth shall not be permitted to exceed 12 inches in height in the ILS critical areas within 2000 feet of the localizer and 800 feet from the glide-slope

Significantly higher levels of total suspended particulate lead were found surrounding the airport. The source of lead exposure is primarily due to aviation gas used by piston-engine planes. Immediately adjacent to the takeoff area, lead levels were found to be up to 25 times higher than background lead levels and in the remainder of the residential area, lead levels were found to be 7 times higher than background lead levels. Despite these elevations from baseline, lead concentrations in and around SMO were still below the Lead National Ambient Air Quality Standard (NAAQS), as established by the EPA.[16] Ultrafine particle number concentrations were also found to occur in significantly high spikes during jet departures although there are currently no standard guidelines or regulations related to UFP exposure.

Additional research by Hu et al. 2009 has demonstrated the correlation between UFPs and aircraft activity of the Santa Monica airport.[17] Using electric vehicle mobile platforms, Hu et al. measured real time air pollutant concentrations in the surrounding areas of Santa Monica Airport in 2009. Their research found markedly elevated peak concentrations of UFPs downwind of Santa Monica Airport with an effect extending at least 660 meters downstream in the direction of the wind's trajectory. Aircraft operations led to an increase of 10 and 2.5 times the concentration of UFP over background levels at 100 and 600 meters downwind, respectively. Though aircraft operations did not significantly elevate average BC and PAH levels, spikes in concentration of these pollutants were seen during jet takeoffs. Jet departures showed peak levels of UFP, PB-PAH, and BC elevated by factors of 440, 90, and 100, respectively.[17]

#### **Health Effects of Jet Fuel Exhaust**

Given the above findings of decreased air quality from jet fuel emissions, it is important to understand the burden of health risks on the surrounding community. A large body of evidence on the effects of air pollution as a whole has clearly linked air pollution to adverse medical outcomes. However, in recent years, there has been increasing interest in defining the medical outcomes associated with specific components of pollution. As there are documented elevated levels of black carbon, ultrafine particles, and PAH in the neighborhood surrounding the Santa Monica airport, examining the health effects of these pollutants for residents in this community is critical.

##### ***Black Carbon***

Black carbon is one component of jet fuel exhaust and has the ability to persist in the environment for days to weeks.[18] As mentioned above, black carbon levels correlate with airport activity, particularly with airplane departures. Multiple studies have linked black carbon to respiratory and cardiovascular disease. A study from the University of Southern California explored the long term effect of black carbon on lung development. In this study, children between the ages of 10 and 18 from multiple communities in southern California were evaluated over an eight-year period. Researchers observed a reduction in both lung capacity and forced expiratory velocity in the first second (FEV<sub>1</sub>), both of which are medical measurements of lung function, after prolonged exposure to black carbon and other pollutants. The decreased lung function noted in these subjects held true for individuals without asthma or a history of smoking.[19] Moreover, given that lung development is essentially complete in both girls and boys by the age of 18, this suggests that these changes in pulmonary function are irreversible.

Reduced lung function is a strong risk factor for medical complications and death in adulthood. Given the number of children exposed to jet fuel exhaust in homes and schools around SMO, the health impact from increased black carbon exposure is substantial.

Another study focusing on women residing in urban areas found a correlation between black carbon and reduced lung function. This effect was stronger in the summer months, when people were more likely to spend time outdoors, highlighting the acute effect of increased exposure on pulmonary capacity.[20] The East Bay Children's Respiratory Study demonstrated that even in San Francisco, an area with relatively good air quality, exposure to black carbon was associated with higher rates of asthma and bronchitis in school-aged children. Importantly, this association was stronger for children who had been living in this neighborhood for more than one year, indicating that prolonged exposures may have additive effects.[21] The increased number of flights at SMO is significantly elevating residents' exposure to black carbon and thus the risk of respiratory disease.

Additional studies have investigated the cardiovascular effects of black carbon. One such study found a strong correlation with black carbon and decreased heart rate variability, a risk factor for sudden death. The study also suggests that individuals with a history of cardiovascular problems, such as prior heart attacks, may be especially susceptible to the negative effects of black carbon on the heart.[22] Similar studies have shown the correlation between autonomic tone and black carbon.[23] This highlights the dangers of ambient pollution on cardiovascular autonomic function, particularly given the high rates of baseline heart disease in the general population.

More recent investigations have tied black carbon exposure to increased cancer risks. A study from the University of Milan showed that this exposure was associated with decreased DNA methylation in adult male blood samples. Global DNA hypomethylation has been found in patients with cancer as well as those with cardiovascular disease. In addition, in animal models, changes in methylation were found in sperm cells, indicating that the effects of these exposures could last multiple generations, even in the subsequent absence of the pollutant.[24] Another study evaluated the effects on black carbon on markers of inflammation, specifically soluble Vascular Cell Adhesion Molecule (sVCAM-1). The authors noted larger effects in obese individuals.[25] These studies propose mechanisms for environmental pollutants to cause long-lasting genetic changes and to predispose individuals to common multi-factorial diseases.

#### Ultrafine Particles

Along with black carbon, jet fuel exhaust contains particulate matter. There is strong epidemiological evidence linking the particulate components of air pollution to adverse human health effects. Particulate matter (PM) is composed of compounds varying in size, concentration, number, and chemical composition. The size of the PM is categorized according to their aerodynamic diameter PM 10 ("thoracic"), PM 2.5-10 ("coarse"), PM 2.5 ("fine") and UFP ("ultrafine particles", <0.2 micrometers). The numbers reflect maximum diameter, such that PM10 includes smaller particles like PM2.5 and UFP. Likewise PM2.5 as a class includes UFP. Multiple studies have been done linking the larger particulates with adverse health effects; studies involving ultrafine particles are emerging. As mentioned above, levels of UFP were significantly elevated in the community downwind of the Santa Monica Airport.

*There is clear evidence that particle deposition leads to systemic inflammation.* However, there is little evidence to explain just how the particles get from the lungs into the bloodstream. Several articles propose mechanisms such as incorporation by alveolar macrophages or diffusion through lung tissue to reach the blood circulation. Unfortunately, no study has convincingly demonstrated the exact route and this area of research must be expanded further to provide the answer. However, it is clear that these particulates are most likely to be retained in the respiratory tract and that they likely have adverse health effects given the data from the previous studies on larger particulates.

#### Polycyclic Aromatic Hydrocarbons

Polycyclic aromatic hydrocarbons (PAH) are another group of compounds found in jet fuel exhaust found to play a role in air pollution. PAH have been shown to be genotoxic (toxic to genes) and carcinogenic (cancer-causing). They have also been linked to disruptions of the endocrine system.[33] Though most of the research has been done on animal and adult models, some studies have shown that fetuses and infants are more susceptible than adults to the harmful effects of environmental toxicants. Because families live in homes surrounding the Santa Monica airport, the PAH in the air has serious implications for the health of the local children.

Prior laboratory and human studies in Central Europe have linked exposure of PAH during pregnancy to adverse birth outcomes.[34] In epidemiological studies, PAH exposure was associated with fetal growth reduction, including reduced birth weight and birth head circumference and/or small size for gestational age, in black, white, and Chinese newborns living in New York City.[35] In 2006, Perera and colleagues looked at the effect of prenatal exposure to PAH on neurodevelopment outcomes in the first 3 years of life in inner-city children. The mothers who participated in this study all had detectable levels of PAH in prenatal personal air samples. This study was able to show the likelihood that a child would have moderate mental delay at 3 years of age significantly increased as a result of PAH exposure.[36] The infants who had been exposed prenatally to the highest PAH levels scored significantly lower on the mental developmental index at 3 years of age than did those with lower levels of PAH exposure. Among the highly exposed children the odds of having moderate mental delay at 3 years of age were almost three times greater than the odds for children with no PAH exposure. However, this relationship was not seen at 1 and 2 years of age. This suggests that more exposed children are potentially at risk for learning and performing school deficits in their preschool years.

In 2009, Perera et al. followed up their previous study with another look at prenatal PAH exposure and the child's IQ at 5 years of age (same group of children studied in the 2006 study).[37] 249 children with PAH exposures ranging from 0.49 ng/m<sup>3</sup> to 34.48 ng/m<sup>3</sup> were studied. A total of 140 children were classified as having high PAH exposure (greater than 2.26 ng/m<sup>3</sup>). The results of this study found that women with high exposure to PAH during pregnancy were more likely to have children with lower verbal and full-scale IQ scores when tested at age 5. The IQ scores were 4.67 points and 4.31 points lower for high- vs. low-exposure children. This again has implications for future learning and school performance deficits in these children exposed to PAH during pregnancy.

Exposure to PM10 has been clearly shown to increase morbidity and mortality from respiratory and cardiovascular diseases.[26] PM2.5 (a subset of PM10) are particularly dangerous given the ability of these smaller particles to reach deeper parts of the lungs, and have been shown to have similar adverse health effects.[27] Data from large epidemiologic studies of UFP have yet to be published, largely because scientists have only recently been able to measure these particles. Nonetheless, a growing body of evidence on the pathophysiological effects of UFP leads us to expect significant adverse effects from exposure to these particles as well. For instance, studies in rodents have shown that UFP exposure results in even greater lung inflammation than does exposure to larger particulates.[28] Furthermore, research examining the interactions between insoluble ultrafine particles and biological systems (such as body fluids, proteins, receptors, and cells), have shown that not all particles deposited in the airway are cleared by the mucociliary transport system. To simulate inhalation of UFPs, test particles were inhaled as an aerosol bolus at the end of a breath of filtered air.[29] The studies clearly showed that the long-term retained fraction in airways depends on the particle size; the smaller the particle, the more the airways retained those particles. In short, residents near the Santa Monica Airport have increased exposure to particles known to be retained in human lungs which can cause significant airway inflammation.

Once retained in the airways, UFPs have the potential to affect other parts of the body. A review article by Araujo and Nel looked at the relationship between particulate matter and coronary artery disease.[30] Several studies showed that cardiovascular outcomes increase when exposures changed from PM 10 to PM 2.5 matter in animal models. Though there are few studies yet available for UFP exposure on human atherosclerosis, recent findings from the Southern California Particle Center (SCPC) are consistent with the idea of UFPs greater proatherogenic potential. Delfino et al. looked at residents in an independent living facility in Los Angeles with a history of coronary artery disease. They found positive associations of particle number and outdoor quasi-ultrafine PM 0.25 with markers of inflammation such as CRP, IL-6, and TNF-II.[31] In an animal study from the SCPC, Araujo et al. exposed mice to concentrated fine particles, UFP or filtered air for 5 hours a day, 3 days a week for 5 weeks. They found that UFP-exposed mice developed 25% and 55% more aortic atherosclerosis compared to PM 2.5 and filtered air-exposed mice.[30]

To explain the pathophysiology of why UFPs might induce blockage of blood vessels, several mechanisms have been proposed including free radical production, oxidative stress, and inflammation. Li et al.'s study showed that ambient UFPs trigger the induction of an enzyme [Nrf-2 regulated heme oxygenase-1 (HO-1)] in macrophage cells (part of the immune and inflammatory systems) to a greater degree than ambient fine or coarse particles.[32] HO-1 is associated with the first tier of defense in macrophages and epithelial cells. They also found that UFPs cause extensive mitochondrial damage in murine macrophages and human bronchial epithelial cells (see Table 4 below). In the study, mice were exposed to either UFP, fine particles or filtered air for 5 hours in a lab located in downtown Los Angeles. Whole-body images were then obtained of the mice after 3 hours and demonstrated that the HO-1 promoter gene was more readily induced in those animals exposed to concentrated UFP. The scans displayed increased emissions both in the chest and abdomen of the UFP exposed mice. Thus, it was postulated that UFPs have greater pro-oxidant effects, as they induce markers of inflammation and free radical production in mice.

#### Carcinogenic Risks

The multiple studies on the health hazards of black carbon, particulate matter, and PAH highlight the key concerns surrounding the Santa Monica Airport, as the rapidly increasing number of flights from SMO exposes residents to these toxins in ever-increasing quantities. Moreover, there are additional harmful effects of airport pollution, such as an increased risk of cancer. A health risk assessment conducted in 1993 for the U.S. Environmental Protection Agency (EPA) reported that aircraft engines are responsible for approximately 10.5 percent of the cancer cases within a defined geographic location (approximately 16 square miles) surrounding Chicago's Midway Airport. The authors of the report additionally note that "it is no surprise that emissions from aircraft engines may have a significant impact on the people living in the study area, especially to people living at receptors adjacent to the airport." [38] The National Resources Defense Council (NRDC) commenting on the U.S. EPA assessment believes that "the same conclusion might apply to people living immediately adjacent to airports all over the country."

In addition, one study in 1999 investigated the health impact of emissions overall from the Santa Monica Airport on the surrounding community. The Los Angeles Unified School District (LAUSD) study found the carcinogenic risk surrounding the airport markedly increased above "acceptable risk". More specifically, "cancer risks for the maximum exposed individual who resides in proximity of the airport were twenty-two, twenty-six and thirteen in one million for the baseline, increased turbojet and piston operational scenarios, respectively. These values represent discrete cancer risks associated with airport related exposures. 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 (1 x 10<sup>-6</sup>)." However, the study also found that the short-term (24 hour) and annual PM10 concentrations and lead quarterly concentrations would not exceed national standards.[39]

Although there remains a need for additional investigations to further delineate these risks, it is unwise to ignore the current evidence which suggests that airport-vicinity residents may be predisposed to respiratory, cardiovascular, and oncologic diseases as well as an increased rate of mortality. Using the knowledge we have thus far, we can make policy decisions that would prevent residents from further exposure to toxic pollutants and their negative health effects.

#### Exposure to Noise Pollution

In the past 30 years, there have been moderate advances in the development of noise policies in airport development, including those implemented at the Santa Monica Airport that attempt to reduce noise by eliminating flights over the residential area at night, checking noise monitors, and setting up a Noise Management Office to handle complaints.[40] While these changes are advances in a positive direction, the amount of noise exposure that remains is not inconsequential and has not been mitigated by these measures. The FAA, in agreement with SMO, currently adopts a noise threshold of 65 dB DNL (day-night average sound level) as compatible with residential areas.[41]



However, problems with this threshold have been identified since 1995, when the National Resources Defense Council found that the 65 dB DNL is based on an averaging of noise that does not account for the loud "single event" noise of aircraft takeoff (such as the 95 dB maximum emitted by a jet during takeoff from SMO). Furthermore, this threshold does not take into account the actual impact of this level of noise on the residents in airport communities. One quantitative study on the impact of noise around La Guardia Airport in New York found that residents living near the airport were exposed to up to four times the amount of noise as people in otherwise comparable communities; over 55% of residents living along the flight path were bothered by aircraft noise, with the majority of those residents living in areas exposed to less than 65 dB DNL.[42-43] Clearly, the 65 dB DNL limit currently adopted by SMO and the FAA does not recognize that this level, although perhaps improved as compared to previous standards, still has both physical and mental health effects on neighboring residents.

One of the efforts made by community airports to help reduce noise has been the practice of soundproofing, which to our knowledge has not been adopted by SMO as it has by other local airports. For example, according to the Los Angeles Times,[44] due to an increase in military flights through Long Beach airport, the city council had approved to soundproof homes most affected by the increased noise, including placement of acoustic windows and attic insulation. Another local airport, the Burbank Airport, publishes a Quarterly Noise Monitoring study, which in August 2009 evaluated the noise impact boundaries around the airport and identified 1080 acres of land exposed to 65 dB of noise. According to this study, the Burbank Airport has made attempts to acoustically treat all residences within the 65 dB contour, which included 1446 unit dwellings as of June 2007.[45] Residents near Los Angeles International Airport and Van Nuys Airport are also eligible to participate in a soundproofing effort to decrease the decibels of noise within homes.[46] In the literature, there are no such efforts to aid the residents living near Santa Monica Airport. Soundproofing is one consideration to help mitigate noise exposure around SMO when indoors, but unfortunately does not account for the possible adverse effects of noise pollution when outdoors around homes and parks. Although some regulations and programs are already in place at SMO to help limit noise exposure, further efforts at reduction are indicated given the significant risk of negative health effects of airport noise on surrounding communities.

#### Health Effects of Noise Pollution

The body of evidence supporting the harmful effects of excess noise on health is strong, especially in regards to its impact on children. As early as the 1980s, research has shown that chronic noise exposure creates both physical and psychological stress that manifests as elevated blood pressure, decreased memory, reading deficits, learned helplessness, and annoyance.[47] Children need quiet and appropriate environments to study and learn. According to the National Institute on Deafness and Other Communication Disorders (NIDCD), which is one of the National Institutes of Health, "long or repeated exposure to sounds at or above 85 decibels can cause hearing loss." [48] Jet plane take-off is up to 120 decibels, far above 85 decibels. Numerous studies have demonstrated that impaired hearing causes learning difficulties. A 2010 study found that primary school students who have poor academic performance are also significantly more likely to have mild hearing loss.[49] Remarkably, another study has suggested that exposure to even 50 decibels of noise in the daytime is associated with relevant learning difficulties in

#### Key Findings

1. Airport operations, particularly jet take-offs and landing, are contributing to elevated levels of black carbon in the area surrounding Santa Monica Airport. Elevated exposure to black carbon is associated with:
  - increased rates of respiratory and cardiovascular disease including asthma, bronchitis, and increased risk for sudden death
  - irreversible decrease lung function in children
2. Elevated levels of ultrafine particles (UFP) are associated with aircraft operations and jet takeoffs and are found in the area surrounding Santa Monica Airport. Elevated exposure to UFPs are associated with:
  - increased inflammation and blockage of blood vessels in mice models
  - greater lung inflammation with exposure to UFPs than exposure to larger particulates in rodent models
2. Elevated levels of polycyclic aromatic hydrocarbons (PAH) are found in the area surrounding Santa Monica Airport. Exposure to PAH has been associated with:
  - increased carcinogenic risk
  - disruption of the hormonal balance in adults.
  - reproductive abnormalities with exposure during pregnancy
  - lower IQ scores in children.
3. Levels of noise due to plane and jet take-offs from Santa Monica Airport are above Federal Aviation Airport thresholds. Excessive noise is associated with:
  - hearing loss.
  - higher levels of psychological distress
  - impaired reading comprehension and memory among children
5. There is no buffer zone between the airport airfield and the surrounding community as observed in many other municipal airport communities (See Figure 5)

#### Recommendations

In the interests of reducing exposure to toxic jet fuel exhaust byproducts and noise pollution and preventing their deleterious health effects, we recommend the following interventions:

1. Maintain a runway buffer zone of at least 660 meters to protect surrounding residents from the harmful health effects of jet fuel exhaust byproducts during idling and take-off.
2. Eliminate or significantly decrease the number of jet takeoffs to reduce exposure to both the byproducts of jet fuel exhaust and the loud "single event" noise of jet takeoff.
3. Install HEPA (high efficiency particulate absorbing) filters in surrounding schools and residential homes to mitigate the indoor effects of pollution
4. Implement additional noise abatement policies such as soundproofing of schools and significantly affected homes near SMO.
5. Adopt the precautionary principle, given the evidence of the potential harm of UFPs and other byproducts of airport pollution on animal and human health.
6. Notify all potential property buyers, residents, and affected community members in the vicinity of SMO of the noise and air pollution risks.
7. Closure of SMO would eliminate all health risks associated with airport air and noise pollution.

schoolchildren, well below the noise level of jet plane take-offs. Researchers from this study suggest aiming for noise exposure maximum values of 55 decibels during the daytime in order to protect the more sensitive segments of the population, such as children and the elderly.[50]

Beyond hearing impairment, even those students with normal hearing who are exposed to aircraft noise have been demonstrated to have worse educational outcomes. An extensive cross-national study conducted in Europe showed a direct correlation between exposure to aircraft noise and impaired reading comprehension and recognition memory. Children living and attending school near airports fell behind their peers in reading by about two months for every 5 dB noise increase in their environments. The researchers concluded that "schools exposed to high levels of aircraft noise are not healthy educational environments." [51] A similar study published in 2006 also found that "aircraft noise exposure at school was linearly associated with impaired reading comprehension; the association was maintained after adjustment for socioeconomic variables, aircraft noise annoyance, and other cognitive abilities." [52] Given that reading is a basic building block for continued effective learning throughout life, exposure to airport noise has critical and serious implications for not only short-term but also long-term effects on education and learning in children. Finally, children are not only affected by noise at school, they are also affected within their own homes. A 2004 article showed a significant dose-response relationship between aircraft noise at home and performance on memory tests of immediate and delayed recall. These results "suggest that aircraft noise exposure at home may affect children's memory." [53]

These studies are relevant in the case of SMO because not only are there private homes with children of all ages living right next to the airport, but also there are numerous schools for both children and young adults in the vicinity. There are two schools, Richland Avenue Elementary and Daniel Webster Middle School, that are located less than a 1/2 mile east of SMO and directly in the flight paths of SMO. Within two miles from the airport are Mar Vista Elementary School, Art Institute of Los Angeles, Walgrove Avenue Elementary School, Mark Twain Middle School, and Santa Monica College. Given the sheer number of students that these institutions serve, thousands of children are potentially being negatively affected.

Studies on the effects of airport noise pollution on adults is much more limited, but at present, a large 6000-subject study, the Hypertension and Exposure to Noise near Airports (HYENA) project, is under way to further delineate the negative health impacts of airport noise pollution on adults, particularly in terms of blood pressure and cardiovascular disease risk.[54] The outcomes from this study may also contribute to the growing body of evidence suggesting the negative effects of airport noise pollution on health beyond learning impairment in children. Regardless of the results of future studies, it is evident from the wealth of existing research that exposure to noise near airports has significant deleterious effects on physical and mental health, particularly for vulnerable populations such as children.

#### CONCLUSION

This Santa Monica Airport Health Impact Assessment serves to take into consideration scientific evidence concerning the link between public policy and health. While we do not claim to be able to provide definitive answers to all of the concerns raised regarding issues surrounding SMO, we do strive for this HIA to provide beneficial and constructive information to the stakeholders involved in determining SMO's future role in the community.

Figure 1: Santa Monica Airport



Figure 2: Long Beach Airport



Figure 3: Van Nuys Airport



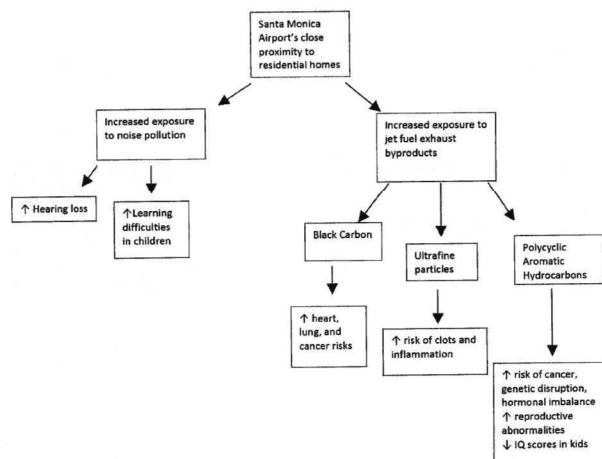
Table 1

Parameter	Coarse (PM <sub>2.5-10</sub> )	Fine (PM <sub>2.5</sub> )	Ultrafine
Size (µm)	2.5 - 10	0.15 - 2.5	< 0.15 µm
Number per µm <sup>3</sup>	+	++	+++
Mass (µg per µm <sup>3</sup> )	+++	++	+
Relative content (% of total mass) *			
Elemental carbon	+	++	+++
Organic carbon	+	++	+++
PAHs	+	+	+++
Metals	+++	++	+
Redox activity	+	++	+++
DTT assay **	+	++	+++
HO-1 induction*	+	++	+++
CD4 depletion *	+	+++	+++
Mitochondrial damage*	None	Some	Extensive
Surface area	+	++	+++
Bioreactivity of active compounds	+	++	+++
Lung penetrability	+	++	+++

Modified from Li et al [12]. \* Relative content was estimated using mass concentration and fractional composition of CAPs collected on Teflon and quartz filters in two locations from the Los Angeles basin as reported [47]. \*\* DTT assay was performed on similar CAPs samples [47]. # HO-1 induction, CD4 depletion and mitochondrial damage were determined in a murine macrophage cell line (RAW 264.7) and a transformed human bronchial epithelial cell line (BEAS-2B) exposed to similar CAPs samples [47].

- Section on letters from the FAA - Concerned Residents Against Airport Pollution. Available from: <http://www.jetairpollution.com>.
- Friends of Sunset Park - Spring 2002 Newsletter. Available from: <http://www.friendsofsunsetpark.org/spring2002.pdf>.
- National Business Aviation Association - Runway Safety. Available from: <http://www.nbaa.org/ops/safety/runway>.
- Department of Transportation/FAA Memo Citing criteria for instrument landing systems. May 26, 1989.
- Santa Monica Municipal Airport - Airport History. Available from: <http://www.smgov.net/departments/airport/>.
- Robinson, P.J., Pharmacokinetic modeling of JP-8 jet fuel components. I. Nonane and C9-C12 aliphatic components. AFRL-HE-WP-TR-2000-0046, U.S. Air Force Research Laboratory, 2000.
- Irene, T., Risk factors of jet fuel combustion products. Toxicology Letters, 2004. 149: p. 295-300.
- Schurmann, e.a., The impact of NOx, CO and VOC emissions on the air quality of Zurich airport. Atmospheric Environment, 2007. 41: p. 103-118.
- Westerdahl D, e.a., The Los Angeles international airport as a source of ultrafine particles and other pollutant to nearby communities. Atmos Environ, 2008. 42: p. 3143-3155.
- Dodson RE, H.E., Morin B, Levy JI, An analysis of continuous black carbon concentrations in proximity to an airport and major roadways," Atmospheric Environment, August 2009. 43(24): p. 3764-3773.
- Fine, P.M., Community-Scale Air Toxics Monitoringssun Valley Neighborhood and General Aviation Airport, in US EPA Air Toxics Data Analysis Workshop Presentation. 2007: Chicago, IL.
- Environmental Protection Agency "Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline" Feb 2010; Available from: <http://www.epa.gov/otaq/regs/nonroad/aviation/420r10007.pdf>.
- Hui, e.a., Aircraft Emission Impacts in a Neighborhood Adjacent to a General Aviation Airport in Southern California. Environ Sci Technol, 2009. 43: p. 8039-8045.
- Ramanathan, V. and G. Carmichael, Global and regional climate changes due to black carbon. Nature Geoscience, March 2008: p. 221-222.
- Gauderman WJ, e.a., The Effect of Air Pollution on Lung Development from 10 to 18 Years of Age. The New England Journal of Medicine, 2004. 351(11): p. 1057-1067.
- Suglia et al, Association between Traffic-Related Black Carbon Exposure and Lung Function among Urban Women Environmental Health Perspectives. October 2008. 116(10): p. 1333-1337.
- Kim et al, Traffic-related Air Pollution near Busy Roads. The East Bay Children's Respiratory Health Study. American Journal of Respiratory Critical Care Medicine, 2004. 170: p. 520-526.
- Schwarz et al, Traffic related pollution and heart rate variability in a panel of elderly subjects. Thorax, 2005. 60: p. 455-461.
- Adar, S.D. and J.D. Kaufman, Cardiovascular Disease and Air Pollutants: Evaluating and Improving Epidemiological Data Implicating Traffic Exposure. Inhalation Toxicology, 2007. 19(135-149).

Figure 5: Health Effects of Santa Monica Airport



## REFERENCES:

- Plaintiffs' Position Concerning the City of Santa Monica's Ongoing Legal Right to Regulate Aircraft Operations at Santa Monica Airport. August 17, 2000, Cole et al. vs. City of Santa Monica.
- FG, W., Evaluation of the City of Santa Monica's authority to address environmental impacts from Santa Monica Municipal Airport's operations, in Environmental Law Clinic. November 2006: UCLA School of Law.
- Concerned Residents Against Airport Pollution. Available from: <http://www.jetairpollution.com>.
- Testimony for Councilmember Bill Rosendahl's Santa Monica Airport Townhall Meeting. January 13, 2010.
- Baccarelli, A. and V. Bollati, Epigenetics and environmental chemicals. Current Opinion in Pediatrics, April 2009. 21(2): p. 243-251.
- Madrigano et al, Air Pollution, Obesity, Genes, and Cellular Adhesion Molecules. Occupational and Environmental Medicine, November 2009.
- Samet et al, Fine Particulate Air Pollution and Mortality in 20 U.S. Cities, 1987-1994. NEJM, 2000. 343(21): p. 1742-9.
- California Environmental Protection Agency: "Facts About Particulate Matter Mortality" Available from: <http://www.ncuaqmd.org/files/Particulate%20Matter%20Mortality%20Fact%20Sheet.pdf>.
- Oberdorster, G., Pulmonary effects of inhaled ultrafine particles. Environ Health, 2001. 74(1): p. 1-8.
- Stahlhofen et al, Measurement of lung clearance with pulses of radioactively-labelled aerosols." J. Aerosol Sci., 1986. 17: p. 333-336.
- Araujo, J. and A. Nel, Particulate matter and atherosclerosis: role of particle size, composition and oxidative stress. Particle and Fibre Toxicology, 2009: p. 6.
- Delfino et al, Circulating biomarkers of inflammation, antioxidant activity, and platelet activation are associated with primary combustion aerosols in subjects with coronary artery disease. Environ Health Perspect, 2008. 116(7): p. 898-906.
- Li et al, Nrf2 is a key transcription factor that regulates antioxidant defense in macrophages and epithelial cells: protecting against the proinflammatory and oxidizing effects of diesel exhaust chemicals. J Immunol, 2004. 173(5): p. 3467-348.
- Bostrom et al, Cancer risk assessment, indicators, and guidelines for polycyclic aromatic hydrocarbons in the ambient air. Environ Health Perspect, 2002. 110: p. 451-488.
- Dejmek et al, The impact of polycyclic aromatic hydrocarbons and fine particles on pregnancy outcome. Environ Health Perspect, 2002. 108: p. 1159-1164.
- Choi et al, International studies of prenatal exposure to polycyclic aromatic hydrocarbons and fetal growth. Environ Health Perspect, 2006. 114(11): p. 1744 - 1750.
- Perera et al, Effect of Prenatal Exposure to Airborne Polycyclic Aromatic Hydrocarbons on Neurodevelopment in the First 3 Years of Life among Inner-City Children. Environ Health Perspect, August 2006. 114: p. 1287-1292.
- Perera et al, Prenatal Airborne Polycyclic Aromatic Hydrocarbon Exposure and Child IQ at Age 5 Years. Pediatrics, 2009. 124: p. e195-e202.
- Estimation and Evaluation of Cancer Risks Attributed to Air Pollution in Southwest Chicago Final Summary Report, in prepared for EPA Region 5. April 1993: Chicago, Illinois.
- Piazza, B., Santa Monica Municipal Airport: A report on the generation and downwind extent of emissions generated from aircraft and ground support operations. June 1999, LAUSD Environmental Health and Safety Branch.
- Santa Monica Municipal Airport - For Our Neighbors Noise Management. Available from: [http://www01.smgov.net/airport/nairport\\_0.asp](http://www01.smgov.net/airport/nairport_0.asp).
- Girvin, R., Advancing Aircraft Noise Impacts Research: A White Paper. FAA Office of Environment & Energy. Noise Division, August 7, 2009.
- National Resources Defense Council - Flying Off Course: Environmental Impacts of America's Airports. October 1996.



43. Cohen et al, *Airport-related air pollution and noise*. Journal Occup Environ Hyg, February 2008. 5(2): p. 119-129.
44. *Long Beach to insulate some homes near airport to curb noise*, in *Los Angeles Times*. October 7, 2009.
45. *Quarterly Noise Monitoring at Bob Hope Airport Second Quarter 2009*. Aug 2009.
46. *Van Nuys Homes to Get Insulation; Airport Project Follows Soundproofing Near LAX*, in *Daily News (Los Angeles, CA)*. August 1, 1999.
47. Evans et al, *Chronic noise and psychological stress*. Psychological Science, Nov 1995. 6(6): p. 333-338.
48. *National Institute on Deafness and Other Communication Disorders - Noise Induced Hearing Loss*. Available from: <http://www.nidcd.nih.gov/health/hearing/noise.asp>.
49. Daud et al, *The effect of mild hearing loss on academic performance in primary school children*. Int Journal Pediatric Otorhinolaryngology, Jan 2010. 74(1): p. 67-70.
50. Kaltenbach et al, *Health consequences of aircraft noise*. Dtsch Arztebl Int, August 2008. 105(31-32): p. 548-556.
51. Stansfeld et al, *Aircraft and road traffic noise and children's cognition and health: a cross-national study*. Lancet, June 2005. 365(9475): p. 1942-1949.
52. Clark et al, *Exposure-effect relations between aircraft and road traffic noise exposure at school and reading comprehension: the RANCH project*. Am J Epidemiol, Jan 2006. 163(1): p. 27-37.
53. Matsui et al, *Children's cognition and aircraft noise exposure at home: the West London Schools Study*. Noise Health, Oct-Dec 2004. 7(25): p. 49-58.
54. Jarup et al, *Hypertension and exposure to noise near airports (HYENA): study design and noise exposure assessment*. Environ Health Perspect, Nov 2005. 113(11): p. 1473-1478.