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OFFICE OF
AIR AND RADIATION

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MEMORANDUM

SUBJECT: Selection of Airports for the Airport Monitoring Study

FROM: Marion Hoyer, Office of Transportation and Air Quality Marion E. Hoyer
Meredith Pedde, Office of Transportation and Air Quality Meredith Pedde

TO: Lead NAAQS Docket EPA-HQ-OAR-2006-0735

The purpose of this memo is to describe the criteria used to select airports for the airport lead (Pb) monitoring study described in the Revisions to Lead Ambient Air Monitoring Requirements Final Rule; to provide the list of airports that meet the criteria; and to describe how these airports meet the criteria. This document is organized into three sections: Section I summarizes the criteria used to select the airports for the monitoring study and the rationale for the additional criteria we are applying beyond the inventory threshold; Section II provides the list of airports included in the study and how each airport met the criteria; and Section III provides details of the conversations EPA had with airport managers at airports that are not included in the study.

Section I. Criteria used to select airports for the monitoring study

Three criteria were used to select airports for the lead monitoring study:

1) Lead emissions greater than or equal to 0.50 tons per year (tpy);
2) Airport runway configuration and meteorology that lead to a greater frequency of operations from one or two runways; and,
3) Ambient air within 150 meters of the location(s) of maximum emissions.

These characteristics were selected because we expect that, collectively, they allow us to identify a subset of airports for the lead monitoring study, that are among those that have

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the highest potential to have ambient lead concentrations approach or exceed the NAAQS for Lead.[1]

Criterion 1) Identification of airports with lead emissions of 0.50 tpy or more and less than 1.0 tpy

To identify airports with lead emissions of 0.50 tpy or more, we used the 2008 National Emissions Inventory (NEI).[2] The 2008 NEI for airports was reviewed by state, local and tribal authorities in 2009-2010; in 2009 states and other local authorities reviewed landing and takeoff (LTO)[3] data for airport facilities and in 2010 lead and other criteria pollutant and hazardous air pollutant inventories were reviewed. As part of this review of the NEI, some local authorities supplied airport-specific information to EPA that was incorporated in the 2008 NEI.

There are 58 airports in the 2008 NEI for which lead inventories are greater than or equal to 0.50 tpy (Table 1). Six of these airports have emissions inventories of 1.0 tpy or more, making them subject to the current lead monitoring requirements (National Ambient Air Quality Standards for Lead 73 FR 66964).

Table 1: Airports with Lead Emissions of 0.50 tons of More in 2008*

Facility Name	County	State	2008 Lead Emissions (tons)
Phoenix Deer Valley	Maricopa	AZ	1.32
Falcon Field	Maricopa	AZ	1.21
Richard Lloyd Jones Jr.	Tulsa	OK	1.17
Daytona Beach International	Volusia	FL	1.09
Long Beach/Daugherty Field	Los Angeles	CA	1.03
Kendall-Tamiami Executive	Miami-Dade	FL	1.02
Chandler Municipal	Maricopa	AZ	0.92
Ernest A. Love Field	Yavapai	AZ	0.90
Gillespie Field	San Diego	CA	0.90
Montgomery Field	San Diego	CA	0.87
Van Nuys	Los Angeles	CA	0.77
Nantucket Memorial	Nantucket	MA	0.76
David Wayne Hooks Memorial	Harris	TX	0.75

[1] The Lead NAAQS was revised in 2008 to a level of 0.15 micrograms per cubic meter, measured as total suspended particles, averaged over a rolling 3-month period.
[2] The 2008 National Emissions Inventory for airports is available at: http://www.epa.gov/ttn/chief/net/2008inventory.html.
[3] An aircraft LTO is a landing and takeoff cycle with associated start-up, taxi and idle. An operation is either a takeoff or landing event with its associated activities (start-up, taxi, idle).

Centennial	Arapahoe	CO	0.73
Orlando Sanford International	Seminole	FL	0.72
Ryan Field	Pima	AZ	0.71
John Wayne Airport-Orange County	Orange	CA	0.71
Flagler County	Flagler	FL	0.71
Boeing Field/King County International	King	WA	0.70
New Smyrna Beach Municipal	Volusia	FL	0.69
Portland-Hillsboro	Washington	OR	0.68
Venice Municipal	Sarasota	FL	0.67
Palo Alto Airport of Santa Clara County	Santa Clara	CA	0.66
Phoenix-Mesa Gateway	Maricopa	AZ	0.66
North Perry	Broward	FL	0.63
Northwest Regional	Denton	TX	0.63
Livermore Municipal	Alameda	CA	0.62
Vero Beach Municipal	Indian River	FL	0.62
Merrill Field	Anchorage Borough	AK	0.62
Auburn Municipal	King	WA	0.61
Dekalb-Peachtree	De Kalb	GA	0.60
Grand Forks International	Grand Forks	ND	0.60
Phoenix Goodyear	Maricopa	AZ	0.60
McClellan-Palomar	San Diego	CA	0.59
Oakland County International	Oakland	MI	0.59
North Las Vegas	Clark	NV	0.58
Zamperini Field	Los Angeles	CA	0.58
Palm Beach County Park	Palm Beach	FL	0.58
Kissimmee Gateway	Osceola	FL	0.56
Carroll County Regional/Jack B Poage Field	Carroll	MD	0.56
Stinson Municipal	Bexar	TX	0.55
Pryor Field Regional	Limestone	AL	0.55
Hayward Executive	Alameda	CA	0.54
La Porte Municipal	Harris	TX	0.53
Greeley-Weld County	Weld	CO	0.53
Pueblo Memorial	Pueblo	CO	0.53
Reid-Hillview of Santa Clara County	Santa Clara	CA	0.53
San Carlos	San Mateo	CA	0.53
Republic	Suffolk	NY	0.53
St Lucie County International	St Lucie	FL	0.53
Ormond Beach Municipal	Volusia	FL	0.53
Melbourne International	Brevard	FL	0.52
Orange County	Orange	NY	0.50
Harvey Field	Snohomish	WA	0.50

Double Eagle II	Bernalillo	NM	0.50
Snohomish County (Paine Field)	Snohomish	WA	0.50
Brookhaven	Suffolk	NY	0.50
Addison	Dallas	TX	0.50

*Hours flown by piston-engine powered aircraft in 2008 were 7.4% lower than in 2005 (FAA did not report 2002 hours flown), generally reflecting the economic downturn. The number of hours flown by piston-engine aircraft is projected to increase 1.1% per year through 2030 (FAA Aerospace Forecast Fiscal Years 2010-2025. pp.8 & 97. Available at: http://www.faa.gov/data_research/aviation/).

Criterion 2) Airport runway configuration and meteorology that lead to a greater frequency of operations from one or two runway ends

Local-scale impacts of piston-engine aircraft emissions on air quality are expected to be greatest in areas immediately downwind from aircraft takeoff and run-up check locations.[4,5] Therefore, the highest lead concentrations would be expected to occur immediately downwind from the most frequently used runway. Airports where there is a higher frequency of operations from one or two runway ends are expected to have higher lead concentrations than airports where operations, and consequently emissions, are distributed on multiple runways, all other factors being equal.

Runways are oriented so that aircraft have the maximum opportunity to be aligned with the prevailing wind.[6] Therefore, a logical approach to rationally gauge which runway is used most frequently is to analyze local wind data and operations data – seasonally, if data allow.

We evaluated all airports with lead inventories of 0.50 tpy or more and below 1.0 tpy and identified those where there is evidence that one or two runway ends are used more frequently by piston-engine aircraft than the other runways. To identify the more frequently used runways at each airport we used meteorological information that was available from the airport or from the closest weather station.[7] We also used information provided in airport master plans, noise studies, or airport layout plans that were available on airport websites and in some cases, we contacted airport managers to obtain this information. Each of these sources of information (airport documents and contact with airport managers) is documented in the section below where we discuss how each of the airports included in the monitoring study meet the criteria outlined here. We evaluated meteorological information seasonally to gauge the most active runway ends, and for

[4] Draft Technical Note – Lead (Pb) Ambient Air Monitoring Network Design Issues. Revised 2/5/2009. Available at: http://www.epa.gov/ttn/amtic/files/ambient/pb/NetworkDesignQA.pdf

[5] U.S. EPA (2010) Development and evaluation of an air quality modeling approach for lead emissions from piston-engine aircraft operating on leaded aviation gasoline. EPA-420-R-10-007. Available at http://www.epa.gov/otaq/aviation.htm and in the docket for this final rule.

[6] FAA Advisory Circular for Airport Design. Appendix 1. p. 87. Available at: http://www.faa.gov/documentLibrary/media/Advisory_Circular/150_5300_13.pdf.

[7] We obtained meteorological data from 32-year National Weather Service average wind rose by season, the weather underground (at http://www.wunderground.com) and/or wind finder (at http://www.windfinder.com/).

airports with FAA towers, we evaluated seasonal variation in operations (airports that have an FAA control tower report daily operations in the Air Traffic Activity Database System, available on-line at http://aspm.faa.gov/opsnet/sys/).

To help gauge the ambient air impact related to operations by piston-powered aircraft on one specific runway, we used data from two available studies which provide ambient concentrations on time scales of at least three months (since the form of the NAAQS for Lead is a rolling three-month average). Both studies were conducted at the Santa Monica airport. One was a monitoring study in which a lead monitor was sited in close proximity to an area of anticipated maximum concentration and the other was a modeling study in which aircraft lead emissions were modeled for the calendar year 2008. In the monitoring study at the Santa Monica airport, ambient lead concentrations measured at a site near the most frequently used runway end averaged 0.096 $\mu g/m^3$ for the three-month period from April – June 2006,[8] 0.085 $\mu g/m^3$ for the four month period from April – July, 2006[9] and 0.077 $\mu g/m^3$ for the five month period from October 2006 – February 2007.[10] During these time periods, approximately 30,054, 30,478 and 45,912 operations were conducted by piston-engine aircraft, respectively.[11] We note that these average ambient lead concentrations measured during the monitoring study all exceed the threshold for which states could obtain monitoring waivers as noted in 40 CFR 58, Appendix D, paragraph 4.5(a)(ii).[12]

The second study that provides a perspective of the impact of piston-engine aircraft activity on ambient lead concentrations is an EPA modeling study conducted at the Santa Monica airport. In this study, piston-engine aircraft activity and their impact on ambient lead concentrations during 2008 was modeled at receptor sites 50 meters apart, both on airport property and in the surrounding neighborhoods. The maximum three-month average concentration of lead modeled at the Santa Monica airport exceeded 0.15 $\mu g/m^3$ during the three-month period from June – August during which time there were 28,078 operations by piston aircraft.[13] These two studies indicate that approximately 30,000 operations conducted by piston-engine aircraft occurring from one runway end in a three-month period could lead to ambient lead concentrations approaching or exceeding the NAAQS for Lead.

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[8] South Coast Air Quality Management District (2007) Community-Scale Air Toxics Monitoring – Sun Valley Neighborhood and General Aviation Airports. Presented by Dr. Philip Fine at the U.S. EPA Air Toxics Data Analysis Workshop - Chicago, IL. October 2 - 4, 2007.

[9] South Coast Air Quality Management District (2010) General Aviation Airport Air Monitoring Study Final Report. Available in the docket for this rulemaking.

[10] South Coast Air Quality Management District (2010) General Aviation Airport Air Monitoring Study Final Report. Available in the docket for this rulemaking.

[11] Data supplied to FAA Air Traffic and Activity Database System from the tower at SMO. We estimate the number of operations conducted by piston aircraft at this facility by multiplying operations by the percent of aircraft based at this airfield that are piston-engine powered.

[12] The threshold above which monitoring is required is an ambient concentration in excess of 50% of the NAAQS, or an average of 0.075 $\mu g/m^3$ over a rolling 3-month period.

[13] U.S. Environmental Protection Agency (2010) Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline. EPA-420-R-10-007. Available at: www.epa.gov/otaq/aviation.htm and in the docket for this final rule.

We used 30,000 operations (or 15,000 LTOs) conducted by piston-engine aircraft over a consecutive three-month time period as a guide to select airports in Table 1 for the airport lead monitoring study.[14] However, airports with fewer than 30,000 operations conducted by piston-engine aircraft at one runway end over a consecutive three-month period were not excluded from the study, but were also evaluated based on the proximity of ambient air to the maximum concentration site. The evaluation of the proximity of ambient air to the maximum concentration site is discussed immediately below.

Criterion 3) Ambient air within 150 meters of the location(s) of maximum emissions

Ambient air is any location to which the general public has access. On airports, the general public includes recreational pilots (referred to in Section II as 'general aviation pilots') and their passengers, members of the public who visit the airport for special events (e.g., tours, open house events, air shows), and may include other populations (people who rent hangars). Locations at airports to which this population has access include parking lots, observation decks, hangars and access roads to hangars.

We selected a distance of 150 meters between the maximum impact site and ambient air because the available information (described below) suggests that ambient lead concentrations will decrease sharply with distance from the source and it is less likely that an exceedance of the NAAQS for Lead will occur at greater distances. The Santa Monica airport monitoring study[15] discussed above reported a three- to four-fold decrease in ambient lead concentrations over a distance of 80 meters between two monitors sited to evaluate the lead gradient downwind from the runway. In the EPA modeling study at the Santa Monica airport[16] lead concentrations during the maximum three-month period (June through August 2008) decreased four-fold from the end of the runway to a site 150 meters downwind. At this distance, lead concentrations in these studies had not returned to background levels, but were at least half the concentration measured close to the runway. The lead gradient at this airport serves as a guide for the purposes of limiting the number of airports to consider for this exploratory airport monitoring study. We are not implying that there will be no exceedances of the NAAQS for Lead beyond the 150 meter distance.

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[14] For airports with an FAA tower or FAA contract tower, we used daily operations data (available at: http://aspm.faa.gov/opsnet/sys/Airport.asp.) to calculate rolling three-month average operations. For airports without an FAA tower, we used FAA's Terminal Area Forecast database available at: http://tafpub.itworks-software.com/taf2008/default.asp and FAA's Form 5010, Airport Master Record database available at: http://www.faa.gov/airports/airport_safety/airportdata_5010/.

[15] South Coast Air Quality Management District (2010) General Aviation Airport Air Monitoring Study Final Report. Available in the docket for this rulemaking.

[16] U.S. Environmental Protection Agency (2010) Development and Evaluation of an Air Quality Modeling Approach for Lead Emissions from Piston-Engine Aircraft Operating on Leaded Aviation Gasoline. EPA-420-R-10-007. Available at: www.epa.gov/otaq/aviation.htm and in the docket for this final rule.

The location of the predicted maximum lead concentration(s) at airports is downwind of the area(s) where pilots conduct the preflight run-up check and takeoff.[17,18] To identify areas of ambient air near the maximum impact sites, we used Google Earth images, information provided on airport websites, airport diagrams, and in some cases we contacted airport managers.

Section II. Airports selected for the lead monitoring study

We evaluated every airport in the draft 2008 NEI based on the three characteristics described in Section I and identified the 15 airports listed in Table 2 as those airports most likely to have the highest ambient lead impacts that could lead to ambient lead concentrations in excess of the lead NAAQS. Accordingly, these airports have been selected for the airport lead monitoring study described in the Revisions to Lead Ambient Air Monitoring Requirements Final Rule.

Table 2: Airports Included in the Lead Monitoring Study to Evaluate Compliance with the NAAQS for Lead

Airport (Location ID)	County	State	2008 Pb tpy
Auburn Municipal (S50)	King	WA	0.61
Brookhaven (HWV)	Suffolk	NY	0.50
Gillespie Field (SEE)	San Diego	CA	0.90
Harvey Field (S43)	Snohomish	WA	0.50
McClellan-Palomar (CRQ)	San Diego	CA	0.59
Merrill Field (MRI)	Anchorage	AK	0.62
Nantucket Memorial (ACK)	Nantucket	MA	0.76
Northwest Regional (52F)	Denton	TX	0.63
Oakland County International (PTK)	Oakland	MI	0.59
Palo Alto Airport of Santa Clara County (PAO)	Santa Clara	CA	0.66
Pryor Field Regional (DCU)	Limestone	AL	0.55
Reid-Hillview of Santa Clara County (RHV)	Santa Clara	CA	0.53
Republic (FRG)	Suffolk	NY	0.53
San Carlos (SQL)	San Mateo	CA	0.53
Stinson Municipal (SSF)	Bexar	TX	0.55

The following information is provided to describe the most actively used runway and ambient air at each airport included in Table 2. While all airports included in the study have lead inventories of 0.50 tpy or more and less than 1.0 tpy, the other two criteria were not weighted equally but were weighted according to the individual facts and

[17] Draft Technical Note – Lead (Pb) Ambient Air Monitoring Network Design Issues. Revised 2/5/2009. Available at: http://www.epa.gov/ttn/amtic/files/ambient/pb/NetworkDesignQA.pdf

[18] U.S. EPA (2010) Development and evaluation of an air quality modeling approach for lead emissions from piston-engine aircraft operating on leaded aviation gasoline. EPA-420-R-10-007. Available at http://www.epa.gov/otaq/aviation.htm and in the docket for this final rule.

circumstances of each airport. For example, as noted in more detail below, there are cases where ambient air at an airport is in close enough proximity to a runway that the airport is included in this study even if the meteorological data suggest that runway is not the most frequently used runway at the airport.

Auburn Municipal, King County, WA

Most active runway: Auburn Municipal has one runway: 34/16.[19] EPA contacted the Auburn Municipal airport manager, Mr. Mike Shipman on August 5, 2010. He indicated that almost all activity at the airport is piston-engine powered, although some charter or private jets come in. The only fuel sold at Auburn Municipal is leaded aviation gasoline (avgas), which limits the amount of traffic by jet aircraft.[20] Mr. Shipman indicated that the dominant winds at Auburn Municipal are from the north and aircraft take off most frequently from runway 34 and conduct their run-up check at one location just before entering the runway. This airfield does not have a tower; therefore, daily operations data are not available. EPA estimates that in a three-month period of time, an average of approximately 36,000 piston-engine operations occur on runway 34.

Ambient air: At Auburn Municipal, ambient air is less than 50 meters east of the maximum impact site at runway 34 in the area general aviation pilots use to park their car and access their aircraft and approximately 100 meters downwind from the maximum impact site at the hotel with the swimming pool visible in the Google Earth picture below (Figure 1).

[19] For identification purposes, each runway is given a two-number designation that is derived from the magnetic compass headings of the runway ends. The runway end numbers are reported in ten degree increments by dropping the last zero such that runway 27/9 is a runway with magnetic compass headings of 270 degrees and 90 degrees. If there are parallel runways, then they are given the identifiers 27R/9L and 27L/9R with the 'R' and 'L' denoting left and right runways according to the pilot's perspective on approach to the runway.

[20] The type of aviation fuel supplied at Auburn Municipal is available at: www.airnav.com/airports/S50 accessed 5 August 2010.

Figure 1: Ambient Air at Auburn Municipal Airport near Runway 34

Brookhaven, Suffolk County, NY

Most active runway: Brookhaven airport has two runways: 15/33 and 6/24. EPA contacted the Brookhaven airport manager, Mr. Jim Falbo, on August 5, 2010. He indicated that runways 24 and 33 are the most actively used runways with runway 33 used somewhat more than runway 24. The only fuel sold at Brookhaven airport is leaded avgas which limits the amount of traffic by jet aircraft.[21] Wind direction distribution data for the nearest site to Brookhaven airport (Long Island Mac Arthur Airport, approximately 18 km west of Brookhaven airport) in Figure 2 shows that the prevailing winds are from the northwest and southwest, supporting the fact that runways 24 and 33 are the most active runways at Brookhaven airport. This airfield does not have a tower; therefore, daily operations data are not available. EPA estimates that in a three-month

[21] The type of aviation fuel supplied at Brookhaven airport is available at:www.airnav.com/airports/KHWV accessed 5 August 2010.

period of time, an average of approximately 34,000 piston-engine operations occur at Brookhaven airport.

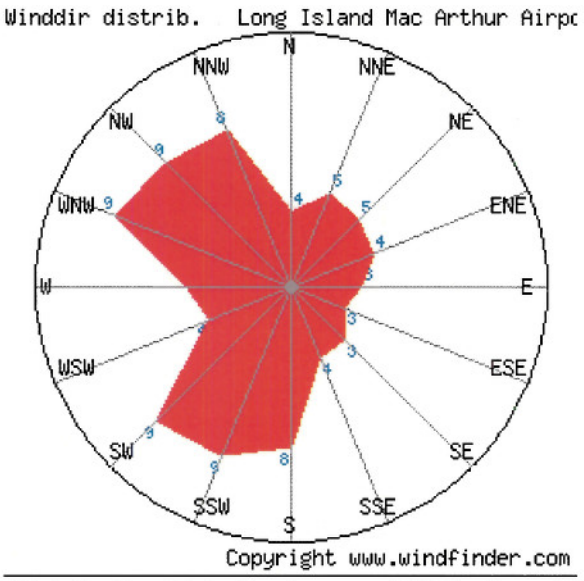

Figure 2: Wind Direction Distribution Data for January 2007 – June 2010 at the Long Island Mac Arthur Airport Weather Station (available via www.windfinder.com, accessed on July 12, 2010)

Ambient air: Mr. Falbo stated that aircraft conduct their run-up checks in the area immediately west of the end of runway 33 (Figure 3). At Brookhaven airport, ambient air is less than 120 meters downwind from the maximum impact site at the baseball diamond complex visible in the Google Earth picture below.

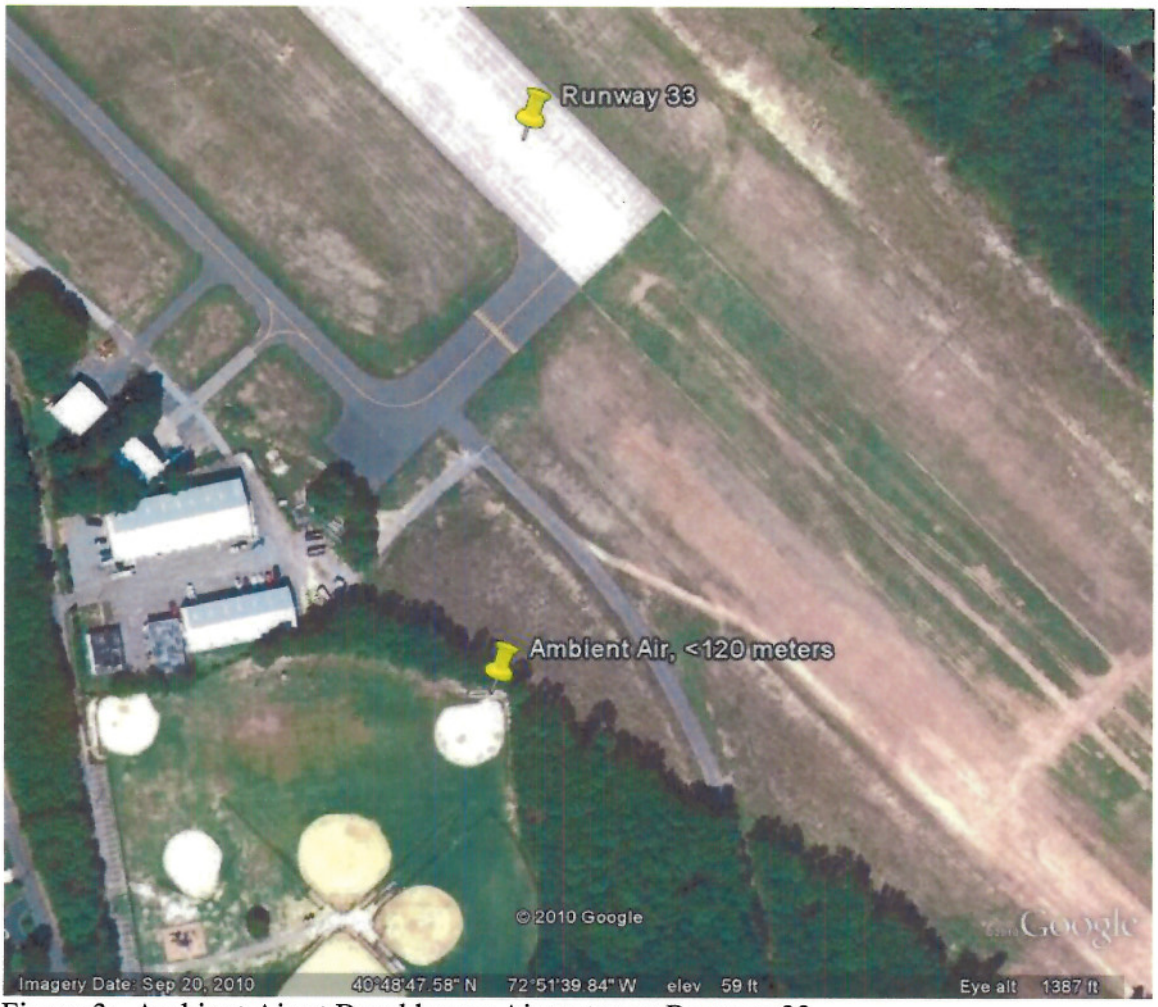

Figure 3: Ambient Air at Brookhaven Airport near Runway 33

Gillespie Field, San Diego County, CA

Most active runway: Gillespie Field has three runways: 27R/9L, 27L/9R and 17/35. The Airport Layout Plan Update Narrative Report for Gillespie Field includes a Noise Assessment conducted in 2004 reporting that single- and twin-engine piston-powered aircraft most frequently depart from runway 27R (56.6% of the operations compared with 37.1% of the operations by these aircraft occurring at runway 27L).[22] The daily operations data reported for the Gillespie Field to the Air Traffic Activity Data System and the fraction of piston-engine operations reported in the Gillespie Field Airport Layout Plan suggest that in the summer, three-month average operations by piston-engine aircraft range from 58,000 – 61,000. During this period, the meteorological data from a site four

[22] Gillespie Field Airport Layout Plan Narrative Report Prepared for County of San Diego Department of Public Works by P&D Aviation. 2005. Appendix C page 34. Available at: http://www.co.san-diego.ca.us/dpw/airports/gillespie.html

kilometers northwest of Gillespie Field indicate that winds are from the west and runway 27R would be the most actively used runway (Figure 4).

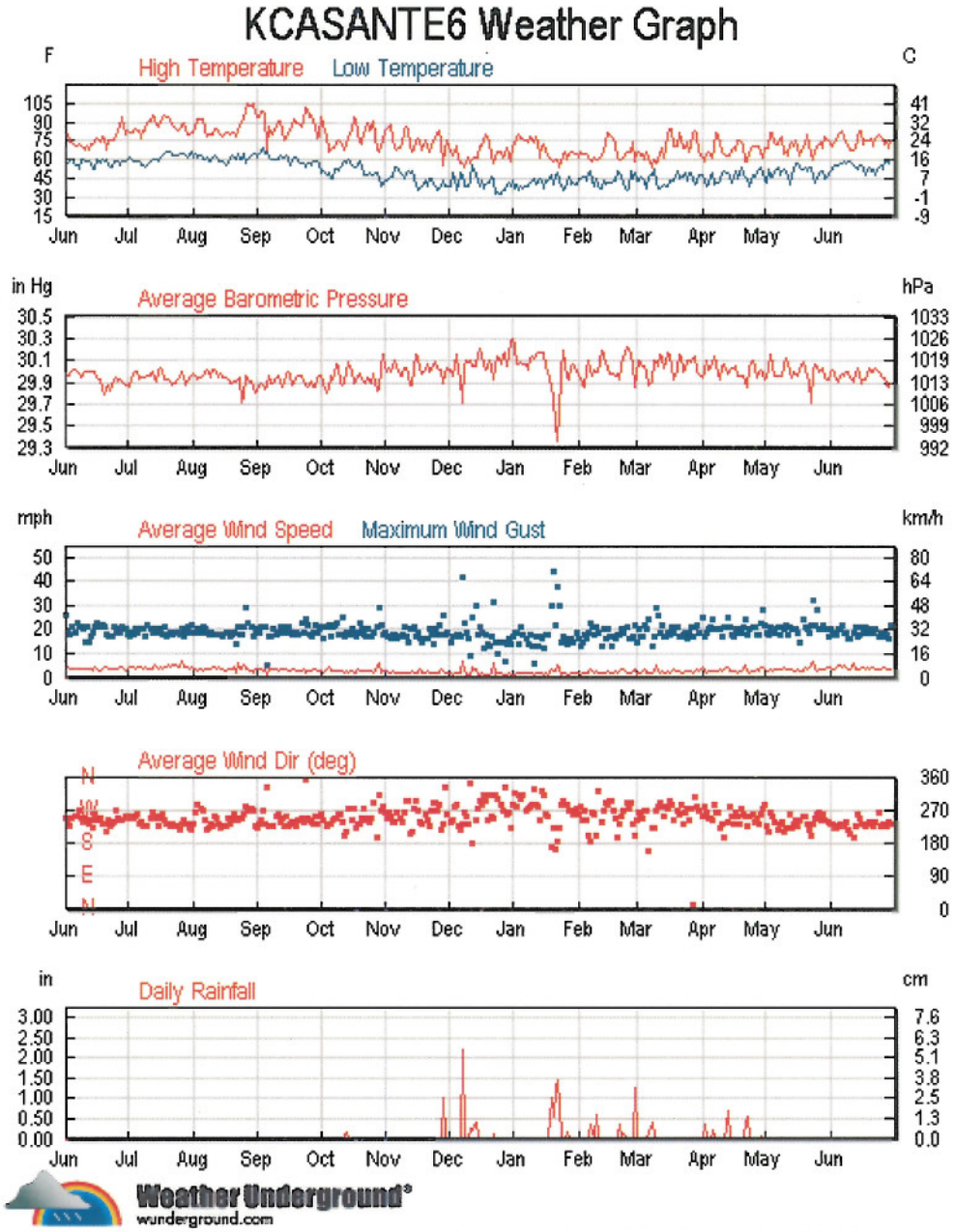

Figure 4: Meteorological Data for the Period June 1, 2009 – June 30, 2010 (www.wunderground.com, accessed April 6, 2010)

Ambient air: At Gillespie Field, ambient air is less than 50 meters from the maximum impact site near runway 27R at an internal road accessible by general aviation pilots and 150 meters away at an external road, N. Magnolia Ave. (Figure 5).

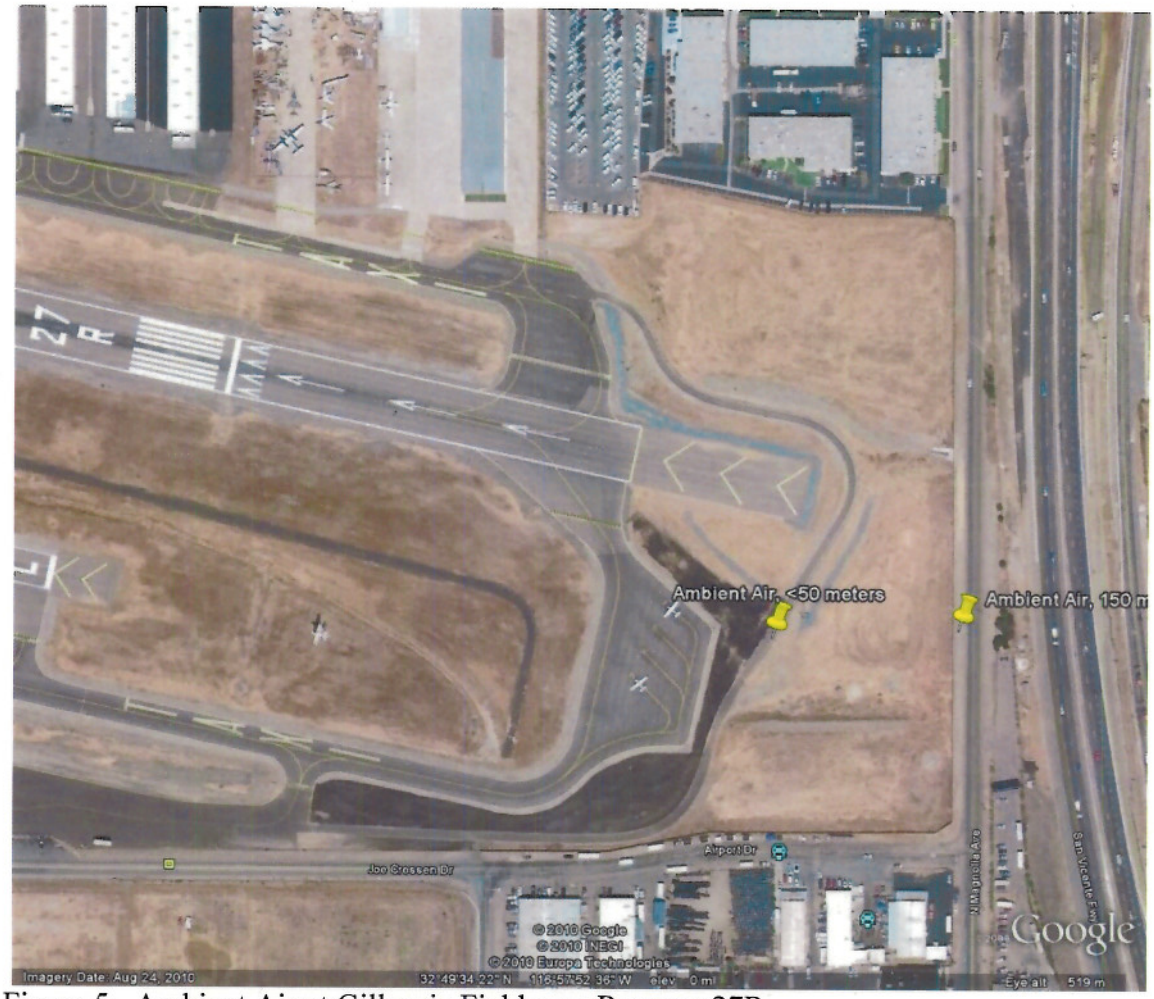

Figure 5: Ambient Air at Gillespie Field near Runway 27R

Harvey Field, San Diego County, CA

Most active runway: There is currently one runway at Harvey Field: 33/15. The website for Harvey Field indicates there was a grass strip parallel to 33/15 but the Google Earth Image from May 15, 2010 (Figure 8) has yellow Xs on the grass turf strip indicating that it is closed.[23] This airfield does not have a tower; therefore, daily operations data are not available. Some of the activities described on the airport website (e.g., sky diving, aero tours) suggest that aircraft operations may be higher in summer than in other seasons, but no seasonal activity data were available to gauge maximum three-month use at one runway end. EPA estimates that average three-month piston-engine operations are approximately 34,000. From June through August, winds are alternately from the north and south which would compel the use of runways 33 and 15 and the remainder of the

[23] FAA Advisory Circular on Standards for Airport Markings p. 18. Available at: http://www.faa.gov/documentLibrary/media/advisory_circular/150-5340-1J/150_5340_1j.pdf.

year, winds are largely from the south, during which time the preferred runway would be runway 15 (Figure 6).

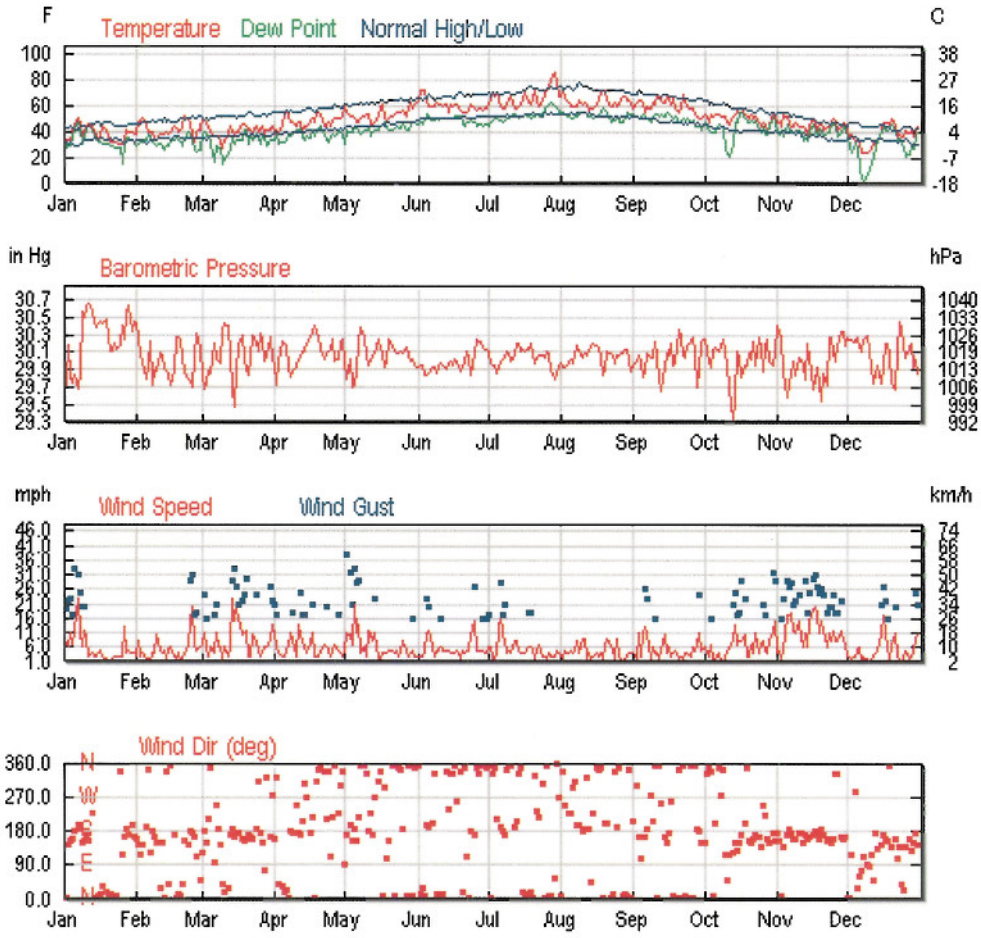

Figure 6: Meteorological Data for January 1, 2008 – December 31, 2008 (available at www.wunderground.com accessed July 12, 2010)

Ambient air: Both runway 15 and 33 have ambient air within 150 meters. Depending on the run-up location for runway 15 there is ambient air approximately 50-100 meters from the maximum impact site in the hangar area where general aviation pilots park their car and access their aircraft (Figure 7). Depending on the run-up location for runway 33 there is ambient air approximately 15-90 meters from the maximum impact site on the external road, Airport Way (Figure 8).

Figure 7: Ambient Air at Harvey Field near Runway 15

Figure 8: Ambient Air at Harvey Field near Runway 33

McClellan-Palomar, San Diego County, CA

Most active runway: The McClellan-Palomar airport has one runway: 24/6. The Land Use Compatibility Plan of 2006 for McClellan-Palomar reports annual piston-engine aircraft operations in 2006 that average 31,000 piston-engine aircraft operations every three-month period.[24] The FAA tower at McClellan-Palomar reported no strong seasonal variation in activity in 2008. The 2006 Noise Abatement Study for McClellan-Palomar indicates that a 1992 Noise Compatibility Program reported that 98% of the operations at the airport use runway 24 due to winds and operational procedures.[25] As part of the Noise Abatement Program, runway 24 is designated as the runway of choice during calm wind conditions.

[24] McClellan-Palomar Airport Land Use Compatibility Plan March 4, 2010. p. 4-13. Available at: www.ci.oceanside.ca.us/.../McClellan-Palomar_ALUCP_03-4-10_amendment.pdf. Accessed on April 6, 2010.

[25] Noise Abatement Study Chapter 11 page 11-19. Available at www.sdcounty.ca.gov/dpw/airports/palomar.html. Accessed on April 6, 2010.

Ambient air: Ambient air locations noted in Figure 9 are all within 150 meters of runway 24. Marker #1 is an internal airport road that general aviation pilots have access to; marker #2 is the tie-down area where general aviation pilots park their car and access their aircraft; and marker #3 is a sidewalk along the external road, Palomar Airport Rd.

Figure 9: Ambient Air at McClellan-Palomar Airport near Runway 24

Merrill Field, Anchorage Borough, AK

Most active runway: There are three runways at Merrill Field: 16/34, 7/25 and 4/22. Daily activity data for Merrill Field from the FAA Air Traffic Activity Data System indicate that the period from June through August is the most active three-month period. EPA estimates that approximately 55,000 piston-engine operations were conducted during the three-month summer period. Meteorological data from a weather station approximately one kilometer east southeast of Merrill Field suggests that in June, July and August, winds are from the north through the west (Figure 10). With northerly winds, aircraft would use runway 34 and with westerly winds, aircraft would use runway 25. In the winter, winds are largely from the north, during which time runway 34 would be the most frequently used runway.

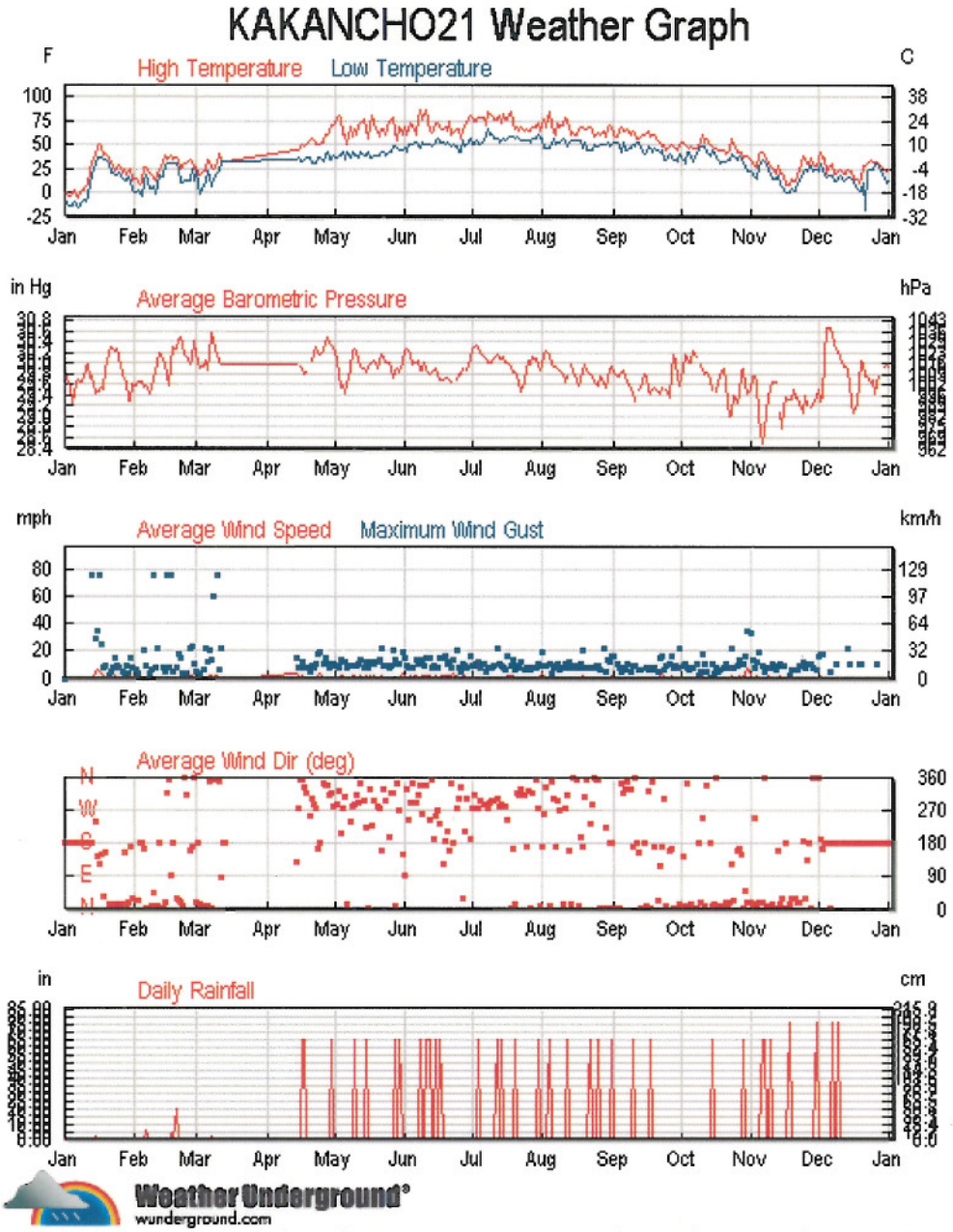

Figure 10: Meteorological Data from January 1, 2008 through December 31, 2008 (from www.wunderground.com accessed on May 13, 2010)

Ambient air: At Merrill Field, ambient air is less than 50 meters from runway 25 at the tie-down area where general aviation pilots access their aircraft (Figure 11) and less than 100 meters from runway 34 on a sidewalk along the external road, E. 15th Ave. (Figure 12).

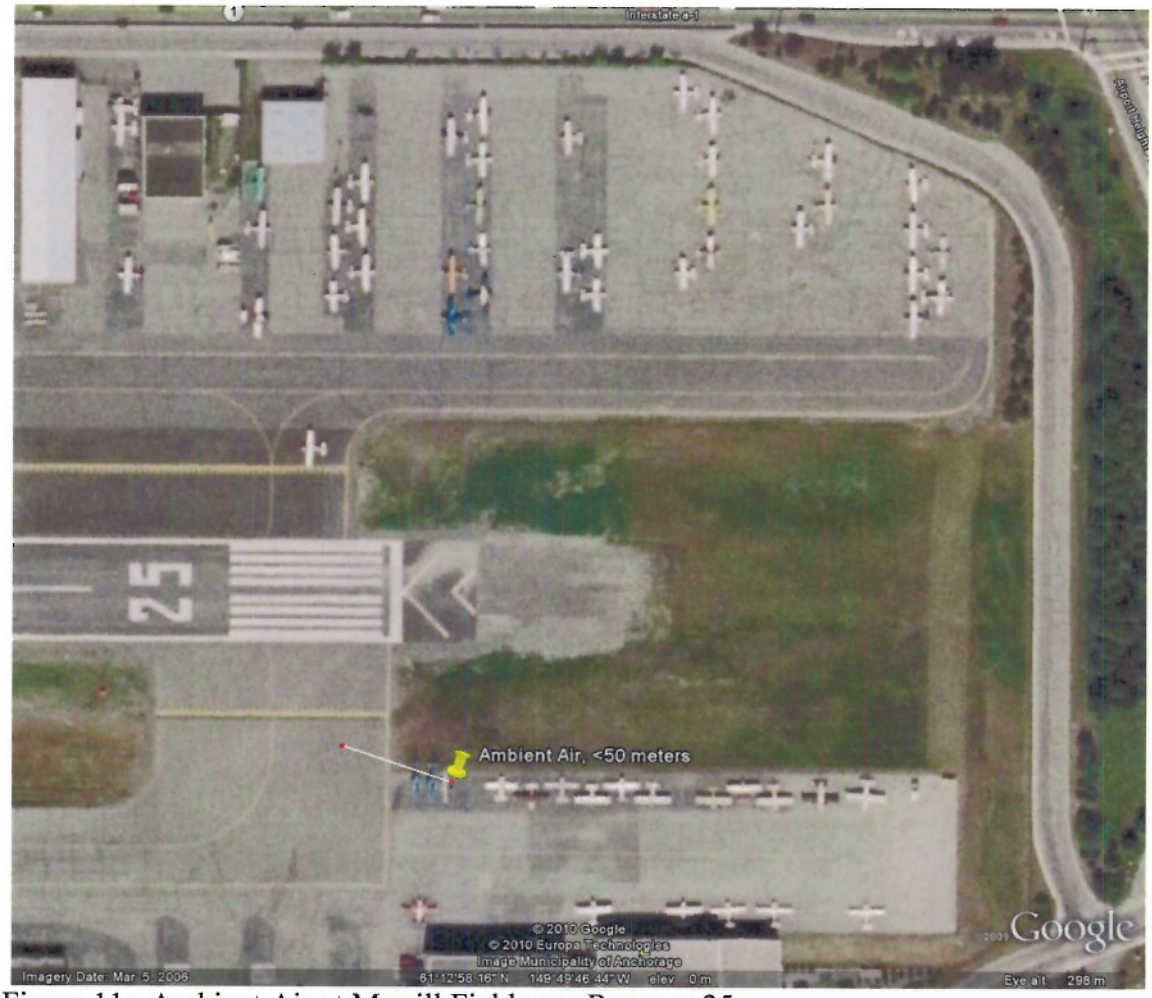

Figure 11: Ambient Air at Merrill Field near Runway 25

Figure 12: Ambient Air at Merrill Field near Runway 34

Nantucket Memorial, Nantucket County, MA

Most active runway: There are three runways at Nantucket Memorial airport: 06/24, 15/33 and 12/30. According to the description of typical runway use procedures on the airport's website, typical summer conditions during good weather have prevailing winds from the west or southwest resulting in the most frequent activity at runway 24.[26] Wind direction distribution data for the Nantucket Memorial airport in Figure 13 shows that on an annual basis, the prevailing winds are from the southwest direction which would also indicate that the most activity would occur on runway 24 at the Nantucket Memorial airport. Daily operations reported to the FAA Air Traffic Activity Data System for Nantucket Memorial airport indicate that May through August are typically more active months at this facility than others during the year. In 2008 the most active three-month period was from June to August, during which EPA estimates there were approximately

[26] Nantucket Airport website: http://www.nantucketairport.com/Noise%20Abatement/ACK-Operations.htm, accessed 10 July, 2010.

44,000 piston-engine operations, the large majority of which were conducted at runway 24.[27]

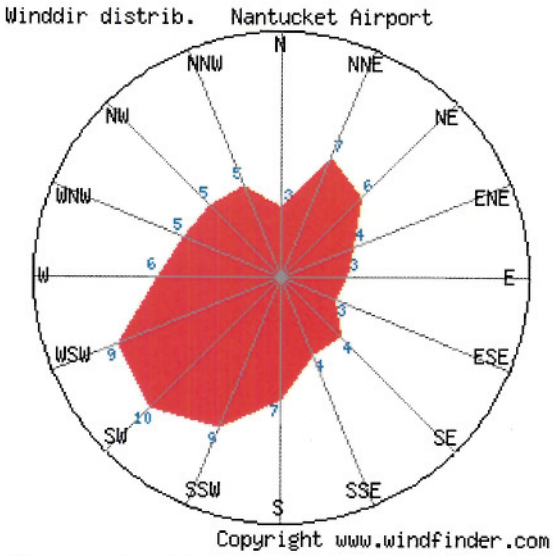

Figure 13: Wind Direction Distribution Data for January 2007 – October 2010 at the Nantucket Memorial Airport Weather Station (available via www.windfinder.com accessed on November 14, 2010)

Ambient air: At the Nantucket Memorial airport, ambient air closest to the maximum impact area at runway 24 is less than 75 meters away along Nobadeer Road and less than 45 meters away along Square Rigger Road. Both roads are access roads for general aviation pilots (Figure 14).

[27] Data available on FAA's Air Traffic Activity Data System website at: http://aspm.faa.gov/opsnet/sys/Airport.asp.

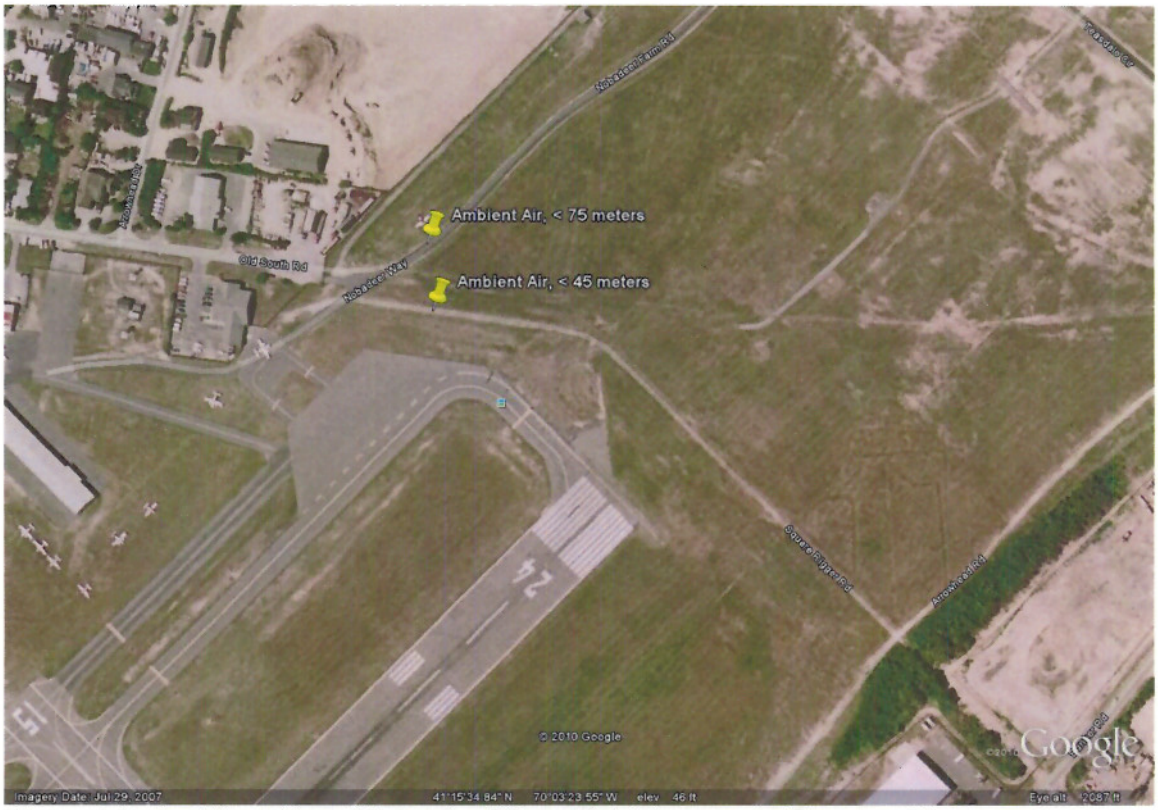

Figure 14: Ambient Air at Nantucket Memorial Airport near Runway 24

Northwest Regional, Denton County, TX

Most active runway: There is one runway at Northwest Regional airport: 17/35. Northwest Regional airport is a fly-in community and is used solely for general aviation purposes (i.e., there are not scheduled air taxi or charter flights).[28,29] The airport's website states that the airport is the largest privately-owned airport in the United States.[30] This airfield does not have a tower; therefore, daily operations data are not available. The only fuel sold at Northwest Regional is leaded avgas which limits the amount of traffic by jet aircraft.[31]

The meteorological data from the Fort Worth Alliance airport weather station (~10 km southwest of Northwest Regional airport) indicates that from May through July, winds are from the south which would compel the use of runway 17 (Figure 15). EPA estimates that the three-month average level of activity at Northwest Regional is approximately 42,000 piston-engine operations. If this level of activity occurs during the three-month period from May to July then these operations would occur almost exclusively at runway 17.

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[28] http://en.wikipedia.org/wiki/Northwest_Regional_Airport_(Texas) accessed 9 November, 2010.
[29] http://www.airportairparkhomes.com/homedetail.asp?id=37 accessed 9 November, 2010.
[30] http://www.nwratx.org/Home_Page.html.
[31] www.airnav.com/airports/52F, accessed 5 August 2010.

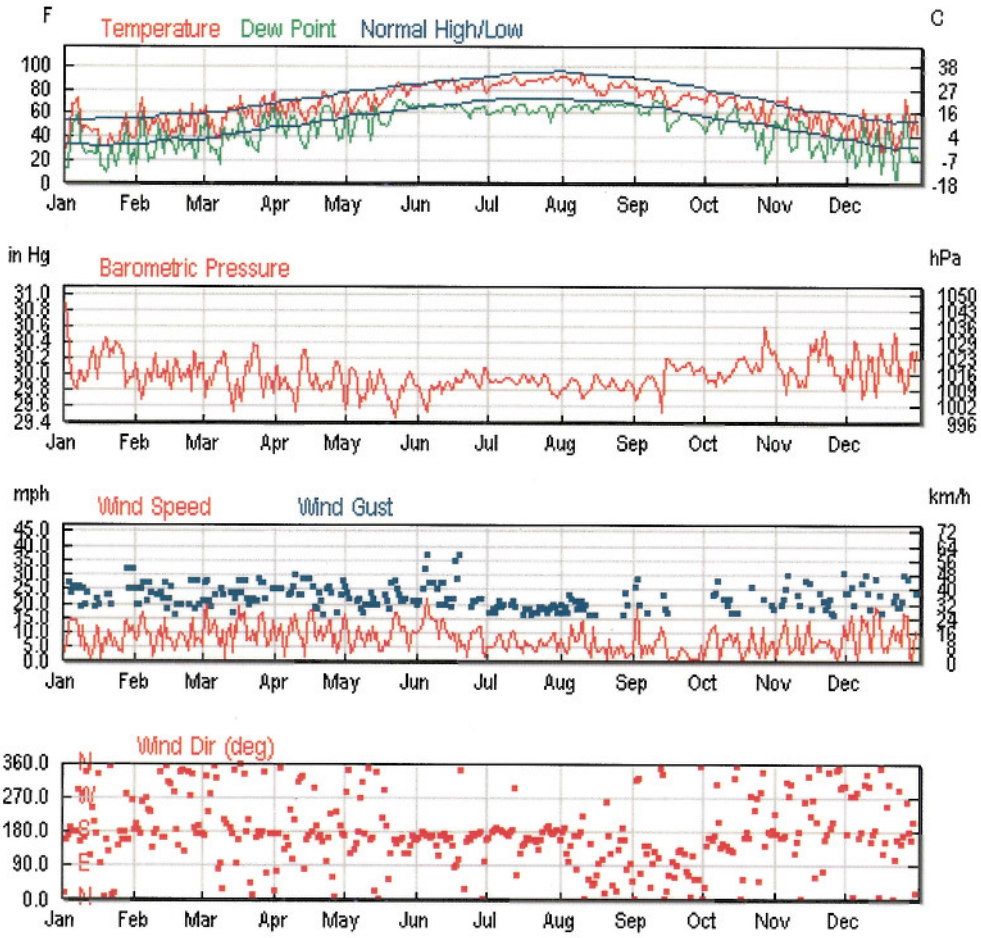

Figure 15: Meteorological Data for January 1, 2008 – December 31, 2008 at Fort Worth Alliance Airport Weather Station (~10 km southwest of Northwest Regional airport, available at www.wunderground.com, accessed on July 12, 2010)

Ambient air: At the Northwest Regional airport, ambient air closest to the maximum impact area at runway 17 is less than 20 meters away and is outside of the airport fence line along an external road, Kelly Drive (Figure 16).

Figure 16: Ambient Air at Northwest Regional Airport near Runway 17

Oakland County International, Oakland County, MI

Most active runway: There are three runways at Oakland County International airport: 9R/27L, 9L/27R and 18/36. EPA contacted the Oakland County International airport manager, Mr. Karl Randall, on August 4, 2010. He indicated that about 95% of the time piston-engine aircraft use runway 9L/27R since they don't need the extra length that runway 9R/27L provides and he stated that this runway use avoids the mixing of the jet and piston-engine aircraft use patterns. Of the piston-engine aircraft operations occurring at runway 9L/27R, Mr. Randall indicated that 75-85% of the time they use runway 27R.

Wind direction distribution data for the nearest site to Oakland County International airport (Cass Lake/Pontiac, MI, ~10 km southeast of Oakland County International airport) in Figure 17 shows that the prevailing winds are from the northwest to southwest directions, supporting the fact that runway 27R is the most active runway for piston-engine aircraft at Oakland County International airport.

Daily operations data reported to the FAA Air Traffic Activity Data System for Oakland County International airport indicates that in 2008 the most active three-month period was from June to August. Using Mr. Randall's piston-engine runway statistics, EPA estimates that 26,000 to 29,000 piston-engine operations occurred at runway 27R from June through August, 2008.

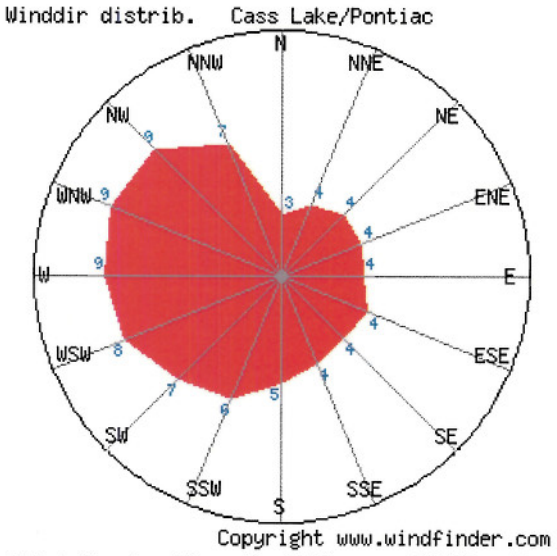

Figure 17: Wind Direction Distribution Data for February 2007 – June 2010 at the Cass Lake/Pontiac, MI Weather Station (available via www.windfinder.com, accessed on July 12, 2010)

Ambient air: Mr. Randall stated that piston-engine aircraft conduct their run-up checks in the marked area immediately north of the end of runway 27R. At the Oakland County International airport, ambient air closest to the maximum impact area at runway 27R is less than 80 meters away in the grassy area near the hangars where general aviation pilots park their car and access their aircraft (Figure 18).

Figure 18: Ambient Air at Oakland County International Airport near Runway 27R

Palo Alto Airport of Santa Clara County, Santa Clara County, CA

Most active runway: There is one runway at the Palo Alto Airport: 31/13. For the majority of the year, the winds at Palo Alto are from the north northwest (Figure 19). Under these wind conditions, aircraft will use runway 31. Daily operations reported to the FAA Air Traffic Activity Data System for the Palo Alto airport indicate that June through August are slightly more active months at this facility compared with others during the year.[32] EPA estimates that in 2008, approximately 49,000 operations occurred at this airport from June through August by piston-engine aircraft, the majority of which were likely conducted on runway 31.

[32] Data available on FAA's Air Traffic Activity Data System website at: http://aspm.faa.gov/opsnet/sys/Airport.asp.

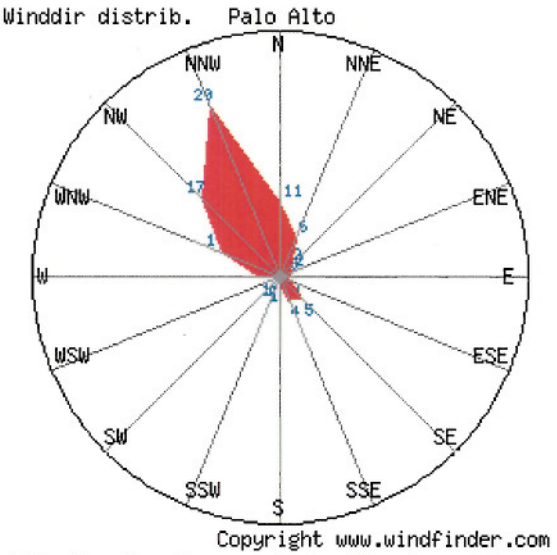

Figure 19: Wind Direction Distribution Data at Palo Alto from November 2006 through June 2010 (available at www.windfinder.com, accessed July 26, 2010)

Ambient air: At the Palo Alto airport, ambient air is less than 50 meters from runway 31 in the area general aviation pilots use to park their car and access their aircraft (Figure 20).

Figure 20: Ambient Air at Palo Alto Airport near Runway 31

Pryor Field Regional, Limestone County, AL

Most active runway: There is one runway at Pryor Field: 18/36. The meteorological data from the Decatur, AL weather station (approximately five kilometers southwest of Pryor Field) indicates that winds are scattered at Pryor Field, compelling the use of both runways 18 and 36 (Figure 21).

This airfield does not have a tower; therefore, daily operations data are not available. On average, approximately 36,000 piston-engine operations would occur during a three-month period. If those operations were split evenly between runways 18 and 36, there would be 18,000 piston-engine operations at each runway.

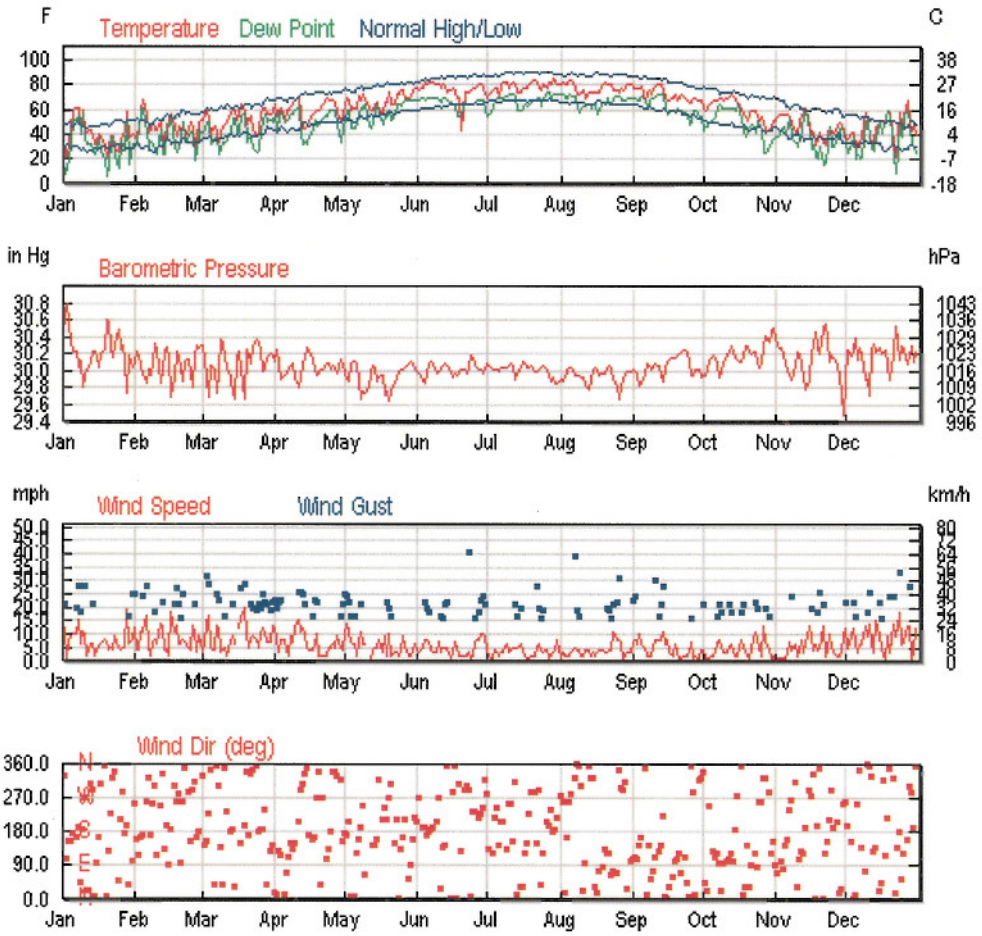

Figure 21: Meteorological Data for January 1, 2008 – December 31, 2008 at the Decatur, AL Weather Station (~5 km southwest of Pryor Field, available via www.wunderground.com, accessed on July 12, 2010)

Ambient air: At Pryor Field, ambient air closest to the maximum impact area at runway 36 is less than 70 meters away in the grassy area near the hangars where general aviation pilots park their car and access their aircraft and also downwind of the run-up area in the grassy field (Figure 22).

Figure 22: Ambient Air at Pryor Field near Runway 36

Reid-Hillview, Santa Clara County, CA

Most active runway: There are two parallel runways at Reid-Hillview airport: 31R/13L and 31L/13R. The Master Plan for Reid-Hillview indicates that prevailing winds are from the north northwest and the Comprehensive Land Use Plan for Reid-Hillview reports that 55% of all operations use runway 31R.[33,34] Daily airport operations at Reid-Hillview airport reported by the Air Traffic Activity Data System indicate that in 2008, June through August was the most active three-month period of the year, during which EPA estimates that approximately 42,000 piston-engine aircraft operations were conducted. During this time of year, the wind direction is consistently from the north northwest (Figure 23), making runways 31R and 31L the preferred runways.

[33] Reid-Hillview Airport Master Plan (July 2006) page 1-11. Available at: http://www.reidhillviewairport.com/docs/MasterPlan/PAO_Masterplan-complete.pdf.
[34] Comprehensive Land Use Plan Santa Clara County Reid-Hillview Airport. 2007. page 3-4. Available at http://www.reidhillviewairport.com/new_website/reports.html.

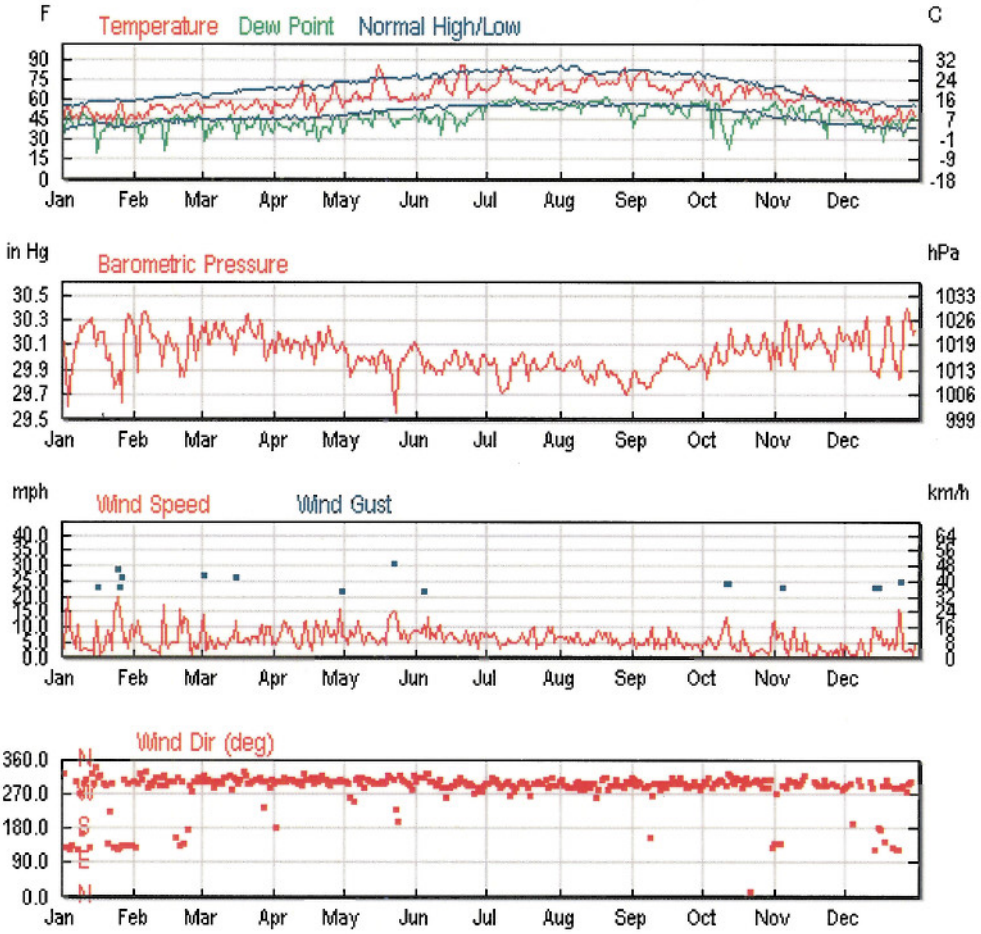

Figure 23: Meteorological Data from Reid-Hillview Airport, CA Jan 1, 2009 – December 31, 2008 (available from www.wunderground.com, accessed July 26, 2010)

Ambient air: Both runway 31L and 31R have ambient air approximately 50 meters away from the maximum impact site on a sidewalk along the external road, Tully Rd. (Figure 24).

Figure 24: Ambient Air at Reid Hillview Airport near Runways 31L and 31R

Republic, Suffolk County, NY

Most active runway: There are two runways at Republic airport: 01/19 and 14/32. A voluntary noise abatement program was established at Republic airport in 1984 to reduce sound levels in the vicinity of the airport. The program instructs pilots of light general aviation to use runway 01/19 whenever possible.[35]

Meteorological data for the nearest site to Republic airport (Copiague/Lindenhurst, NY, approximately six kilometers south of Republic airport) in Figure 25 shows that the prevailing winds are from the northwest and south southwest directions, with the south southwest winds being more predominant, therefore runway 19 would be the most active runway for piston-engine aircraft at Republic airport.

[35] http://www.republicairport.net/light-general-aviation-abatement.htm, accessed 12 July, 2010.

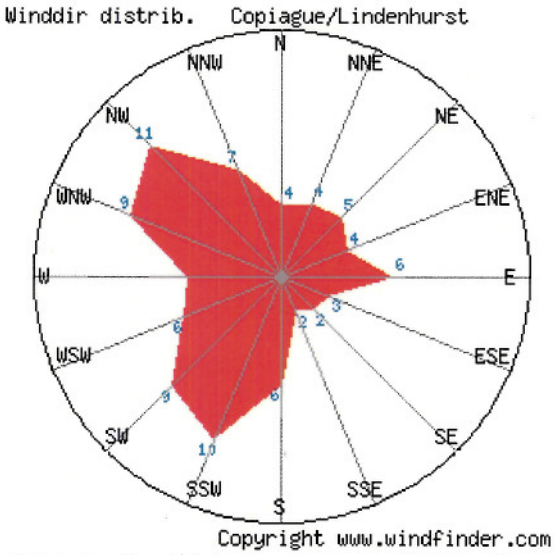

Figure 25: Wind Direction Distribution Data for January 2009 – June 2010 at the Copiague/Lindenhurst, NY Weather Station (available via www.windfinder.com, accessed on July 12, 2010)

Daily operations reported to the FAA Air Traffic Activity Data System for Republic airport indicate that June through October are typically more active months at this facility than others during the year. In 2008 the most active three-month period was from August to October.[36] During this period EPA estimates that approximately 38,000 piston-engine operations occurred at this airport, the majority of which occurred on runway 19.

Ambient air: At Republic airport, ambient air closest to the maximum impact areas at runway 19 is less than 80 meters away and in some places is less than 30 meters away, in the hangar areas where general aviation pilots park their car and access their aircraft (Figure 26).

[36] Data available on FAA's Air Traffic Activity Data System website at: http://aspm.faa.gov/opsnet/sys/Airport.asp.

Figure 26: Ambient Air at Republic Airport near Runway 19.

San Carlos, San Mateo County, CA

Most active runway: The San Carlos airport has one runway: 30/12. For the majority of the year, winds are out of the northwesterly directions which would focus the majority of activity at this airport on runway 30 (Figure 27). The San Carlos airport has an FAA tower which reports daily operations data to the Air Traffic Activity Data System. The 2008 activity data recorded at the San Carlos airport has a slight peak in three-month activity from June through August when EPA estimates that approximately 48,000 piston-engine aircraft operations occurred.

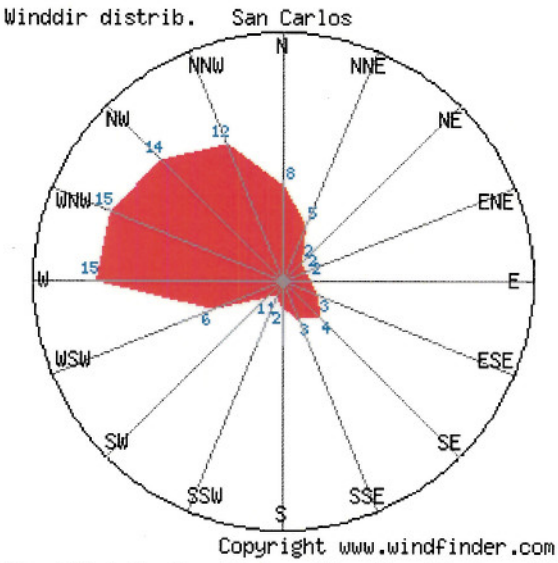

Figure 27: Wind Direction Distribution Data at the San Carlos Airport (available at www.windfinder.com)

Ambient air: At the San Carlos airport, ambient air is less than 50 meters from runway 30 on the north side of the runway along a road general aviation pilots have access to and less than 100 meters on the south side of the runway at a parking lot general aviation pilots use to park their car (Figure 28).

Figure 28: Ambient Air at the San Carlos Airport near Runway 30

Stinson Municipal, Bexar County, TX

Most active runway: There are currently two runways at Stinson Municipal airport: 9/27 and 14/32. The airport's website states that the airport has recently seen a 110% increase in the number of aircraft based at the airport and a 100% occupancy rate has prompted plans for even more expansion in the near future.[37] EPA contacted the Stinson Municipal airport manager, Mr. Morris Martin on August 5, 2010. He indicated that runway 14 is the runway primarily used by piston-engine aircraft (he did not offer an estimated fraction of the total piston-engine aircraft operations conducted at this runway). Mr. Martin stated that aircraft conduct their run-up checks in the marked area immediately east of the end of the runway.

The meteorological data from the Stinson Municipal airport weather station (Figure 29) indicates that the predominant wind direction, especially in the summer months when

[37] http://www.sanantonio.gov/Aviation/stinson_history.asp accessed on 2 August, 2010.

activity is the highest, is from the southeast, which also indicates that runway 14 would be the primary runway used by piston-engine aircraft. Daily operations reported to the FAA Air Traffic Activity Data System for Stinson Municipal airport indicate that April through September are typically more active months at this facility than others during the year. In 2008 the two most active three-month periods were from April to June and May to July.[38] During these periods EPA estimates that approximately 42,000 and 40,000 piston-engine operations, respectively, occurred at this airport, almost all of which occurred on runway 14.

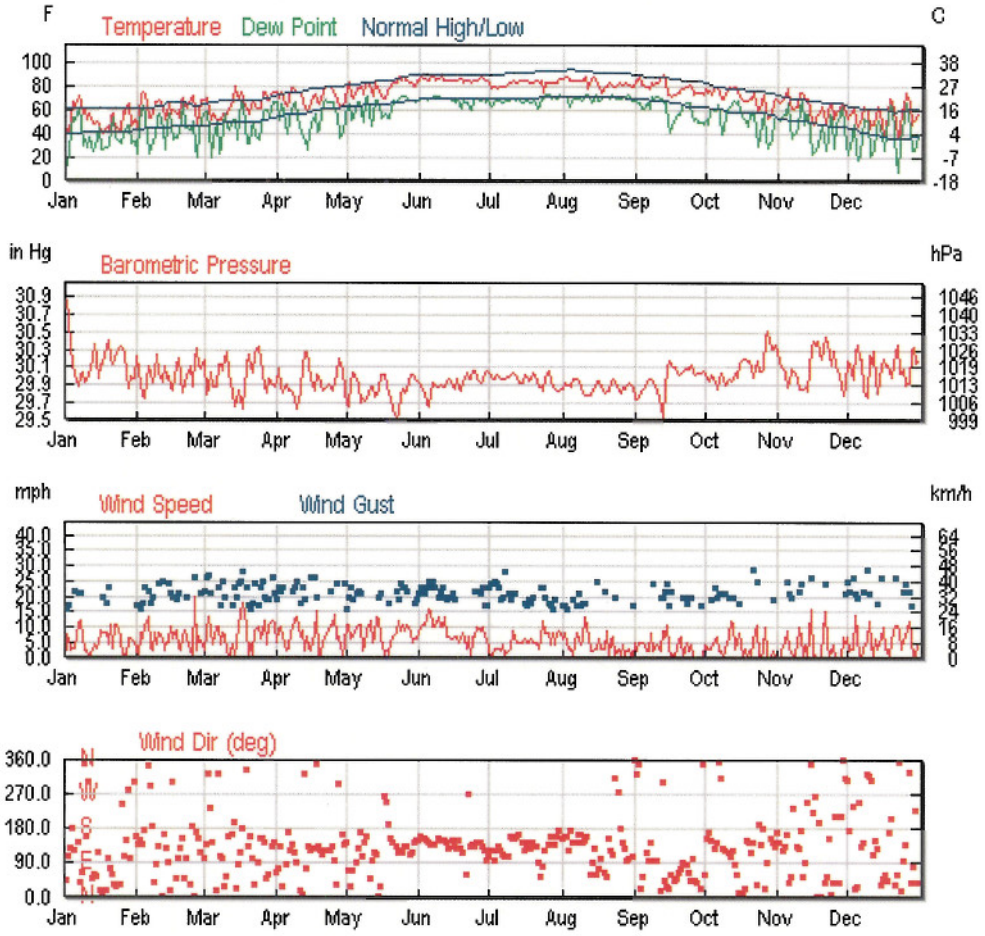

Figure 29: Meteorological Data for January 1, 2008 – December 31, 2008 at Stinson Municipal Airport Weather Station (available via www.wunderground.com, accessed on July 12, 2010)

Ambient air: At the Stinson Municipal airport, ambient air closest to the maximum impact area at runway 14 is less than 30 meters away, outside of the airport fence line

[38] Data available on FAA's Air Traffic Activity Data System website at: http://aspm.faa.gov/opsnet/sys/Airport.asp.

along the external road, Cadmus St. (Figure 30). On the opposite side of the road from the airport is a public park.[39]

Figure 30: Ambient Air at Stinson Municipal Airport near Runway 14

Section III. Airports EPA contacted that are not included in the study

In addition to the contacts noted above, we called airport managers at the following airports: Livermore Municipal in Alameda County, CA; Ernest A. Love Field in Yavapai County, AZ; David Wayne Hooks Memorial airport in Harris County, TX; Westchester County airport in Westchester County, NY; and Orlando-Sanford International airport in Seminole County, FL. These conversations are summarized briefly here:

[39] http://www.sanantonio.gov/planning/pdf/Stinson_Airport/SAirport_Vicinity_ohppt_ud_1_20_09.pdf accessed 8 November, 2010.

Livermore Municipal, Alameda County, CA
The airport manager at the Livermore Municipal airport in California, Leander Hauri, was contacted on August 5, 2010. He indicated that runways 25L and 25R are the main runways used by all aircraft and that approximately 98% of the activity at the airport is conducted by piston-engine aircraft. Mr. Hauri noted that the perimeter road that runs east of runways 25R and 25L is used by general aviation pilots to get to and from their hangars and aircraft. This road is just over 150 meters from the run-up area for runway 25R so this airport was not included in the airport lead monitoring study.

Ernest A. Love Field, Yavapai County, AZ
EPA contacted Ernest Love Field personnel in August 2010 to determine if the dirt road behind runway 21R is used by general aviation pilots to access their aircraft. The airport personnel indicated that this road is not accessible to pilots; therefore ambient air at this airport is more distant than 150 meters so the airport was not included in the airport lead monitoring study.

David Wayne Hooks Memorial Airport, Harris County, TX
EPA spoke with the manager of the David Wayne Hooks Memorial airport, Roger Schmidt, on 5 August 2010. Mr. Schmidt stated that runway 17R is the most used runway at the airport. The closest ambient air to the maximum impact site near runway 17R is more than 300 meters away; therefore EPA determined that the David Wayne Hooks Memorial airport should not be included in the lead airport monitoring study.

Westchester County Airport, Westchester County, NY
EPA spoke with the manager of the Westchester County airport, Peter Scherrer, on 9 August 2010. Mr. Scherrer stated that approximately 95% of the piston-engine operations at the airport occur on each end of runway 16/34 (the other 5% occurring on runway 29/11); however, those operations are split fairly evenly between runways 16 and 34. Mr. Scherrer's information suggested that 15,000-20,000 operations by piston-engine powered aircraft were occurring on each end of runway 16/34 annually. This level of activity would be 5,000 or less operations over a three-month period so EPA determined that the Westchester County airport should not be included in the lead airport monitoring study.

Orlando-Sanford International Airport, Seminole County, FL
EPA spoke with the manager of the Orlando-Sanford International airport, Larry A. Dale, on 5 August 2010. There are four runways at the Orlando-Sanford airport and he stated that the majority of the piston-engine powered aircraft operations occur on runways 9R and 9C. Meteorological data (Figure 31) suggests that 27L and 27C are also used, thereby resulting in four maximum impact areas at Orlando-Sanford International airport. Daily operations reported to the FAA Air Traffic Activity Data System for Orlando-Sanford International airport indicate that in 2008 the most active three-month period was from March through May. Dividing the piston-engine operations that occurred during that time period by the four runway ends results in approximately 12,000 piston-engine operations at each runway end; therefore EPA determined that the Orlando-Sanford airport should not be included in the lead airport monitoring study.

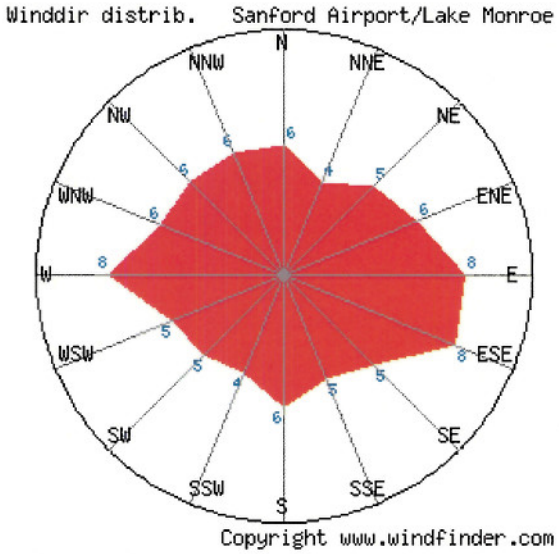

Figure 31: Wind Direction Distribution Data for 2009 7am to 7pm daily at the Sanford Airport/Lake Monroe Weather Station (available via www.windfinder.com)