

No. 14-71180

IN THE UNITED STATES COURT OF APPEALS
FOR THE NINTH CIRCUIT

MICHELLE BARNES, ET AL.,
Petitioners,

v.

THE FEDERAL AVIATION ADMINISTRATION,
Respondent,
and

THE PORT OF PORTLAND,
Intervenor-Respondent.

**ON PETITION FOR REVIEW OF AN ORDER OF THE
FEDERAL AVIATION ADMINISTRATION**

SUPPLEMENTAL EXCERPTS OF RECORD

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CITY OF HILLSBORO



November 18, 2009

Bill Wyatt, Executive Director
Port of Portland
121 NW Everett Street
Portland, Oregon 97200

RE: Proposed Runway 12L/30R and associated improvements

Dear Mr. Wyatt:

This letter is written in support of the Port of Portland's application for Connect Oregon III funding for the proposed construction of Runway 12L/30R and associated improvements at the Hillsboro Airport (HIO). The improvements in this Project include construction of the Runway and Taxiway D and associated infrastructure, including lighting, signage, an access roadway, and drainage facilities for the newly created impervious surfaces. All of these improvements were shown in the Hillsboro Airport Master Plan adopted in 2005.

The purpose of the new Runway 12L/30R and Taxiway D is to increase capacity at Hillsboro Airport to relieve existing and future congestion and delay. In 2007 and 2008, HIO operated at almost 100 percent capacity, with 259,000 take-offs and landing in 2008 alone. In the absence of airfield capacity improvements, Hillsboro Airport is projected to operate at 146 percent of capacity by 2025, which can be translated into a forecast of 325,000 take-offs and landings in 2025. Average delays per operation at HIO would increase from 1.2 minutes in 2007 to 6 minutes by 2025. Reducing these future delays would reduce air emissions, aircraft operation time, and aircraft operating costs due to reduced fuel consumption, thereby meeting the Connect Oregon III criterion of reducing transportation costs for Oregon businesses.

The City of Hillsboro and the Port of Portland have a long-standing cooperative partnership in planning improvements at HIO. Together, we are nearing the completion of our 3-year effort to adopt and apply an AU Airport Use Zone and an ASCO Airport Safety and Compatibility Overlay zone to implement the Hillsboro Airport Compatibility study and the Statewide Airport Planning Rule. As stated in the Purpose section of the ASCO zone, the City will continue to encourage and support the continued operation and vitality of the Hillsboro Airport.

Mr. Bill Wyatt – November 18, 2009

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Hillsboro also recognizes that HIO is an important part of Oregon's system of airports, and serves as the center for business aviation and flight training in the Portland metro region. Maintaining capacity at HIO directly benefits the broader transportation system in Oregon, thereby meeting the Oregon Connection III criterion of providing critical link connecting elements of Oregon's transportation system that will measurably improve utilization and efficiency of the system.

We look forward with pleasure to working with the Port of Portland during the construction process for Runway 12L/30R and Taxiway D. As you may know, Hillsboro has an outstanding reputation in the Portland metropolitan region for facilitating efficient and expedient project construction. We believe our expertise will benefit the Port in meeting the Connect Oregon III criterion of project readiness for construction.

The City of Hillsboro firmly supports the Port of Portland's application for Connect Oregon III funding for the third runway at Hillsboro Airport, and we further appreciate the efforts made by the Port to actively engage our community regarding this important project for HIO.

Please contact Assistant City Manager Robert Dixon at (503) 681-6409 or Planning Department Project Manager Deborah Raber at (503) 681-6155 with any questions you may have on this matter.

Sincerely,

CITY OF HILLSBORO



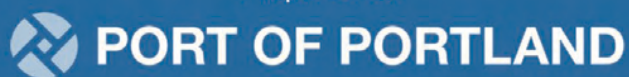
Aron Carleson, President
Hillsboro City Council

cc: Sarah Jo Chaplen, City Manager
Stephen Nagy, HIO General Manager

DR:/WORDATA/letters/Airport third runway November 18, 2009

Hillsboro Airport Parallel Runway 12L/30R Draft Environmental Assessment

Prepared for



VOLUME 1

Responsible FAA Official

Date

This environmental assessment becomes a Federal document when evaluated, signed, and dated by Responsible FAA Official.

Prepared by:

CH2MHILL

October 2009

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**Hillsboro Airport
Parallel Runway 12L/30R
Draft Environmental Assessment**

Prepared for
Port of Portland

Prepared by
CH2MHILL

October 2009

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Executive Summary

Hillsboro Airport (HIO) is the busiest general aviation (GA) airport in the State of Oregon, and relative to total aircraft operations, is the second busiest airport in the state behind Portland International Airport (PDX). HIO is a designated reliever airport for PDX. The Federal Aviation Administration (FAA) encourages the development of such high capacity GA airports in major metropolitan areas. These specialized reliever airports provide pilots with safe, efficient, and attractive alternatives to using congested commercial airports and provide facilities for GA users in the surrounding area.

As the Airport sponsor, the Port of Portland (the Port) prepared the 2005 Hillsboro Master Plan, which identified facility improvements to enable the Airport to continue serving as an effective GA reliever as activity levels increase. The improvements recommended in the Master Plan include a new runway parallel to the existing primary runway, which would be used by small, primarily single-engine propeller aircraft. This new runway would require the relocation of an existing helipad used for helicopter training flights. The recommended improvements also include new taxiways to provide access to the new runway. The continued increase in aircraft operations at HIO now requires the implementation of these improvements.

This Environmental Assessment (EA) is being prepared to meet the requirements of the National Environmental Policy Act of 1969, as amended (NEPA).

The Proposed Action

This proposed project includes three components: 1) construction of Runway 12L/30R and associated taxiways, 2) the relocation of the existing Charlie Helipad, and 3) associated infrastructure improvements.

Construction of the proposed runway and associated taxiways would be initiated in 2010 and the capacity-enhancing infrastructure would be in operation by the end of 2011. The relocated Charlie Helipad would be under construction in 2014, and would be in operation by 2015. Stated more specifically, the proposed improvements include the following:

- The proposed Runway 12L/30R would be parallel to and 700 feet east of Runway 12/30 (to be re-designated Runway 12R/30L), the Airport's main runway. The new runway would be 3,600 feet long and 60 feet wide, consistent with the runway's intended use by fixed-wing, piston-engine, propeller-driven airplanes. This new runway would occupy the location of the existing Charlie Helicopter Landing and Take-Off Pad, commonly known as the Charlie Helipad.
- Taxiway D would be parallel to and 240 feet east of the new Runway 12L/30R and would connect to Taxiway C. Taxiway D would provide access to aircraft landing and taking off from the new Runway 12L/30R. Taxiway D would also be used as an interim replacement for the existing Charlie Helipad.

- Four runway exit taxiways would connect the proposed Runway 12L/30R to Taxiway D.
- One connector taxiway would cross the existing Runway 12/30 and provide access to the new runway from the ramp area.
- Relocated Charlie Helipad would be located 500 feet to the east of and parallel to the proposed Runway 12L/30R.

Purpose and Need

The purpose of the proposed action is to reduce congestion and delay at HIO in accordance with planning guidelines established by the FAA. The proposed action is needed because the HIO airfield is currently operating at close to 100 percent of annual service volume (ASV) and current Airport activity levels exceed the FAA capacity planning criteria. The FAA National Plan of Integrated Airport Systems (NPIAS) states: "Current FAA guidance recommends that capacity planning start when aircraft activity reaches 60 to 75 percent of an airport's capacity."¹ Forecast activity levels through 2025 are expected to substantially exceed the ASV of the current airfield, with increasing levels of unnecessary congestion and delay corresponding to the increased demand.

Alternatives

A wide range of alternatives was considered to meet the Purpose and Need for the proposed project. These alternatives included several new runway locations and configurations, use of new technologies, and demand management. These alternatives were evaluated with respect to their ability to meet the Purpose and Need for the proposed action, site constraints, and environmental factors. This evaluation concluded that the following three alternatives should be retained for detailed consideration in this EA:

- **Alternative 1 – No Action.** NEPA requires consideration of the No Action Alternative. 40 CFR 1502.14(d) (agencies shall “include the alternative of no action”). This alternative also serves as the basis of comparison for other reasonable alternatives.
- **Alternative 2 – Proposed Runway 12L/30R with Charlie Helipad Option A.** This alternative includes the improvements described above. In this alternative, the relocated Charlie Helipad would be located at the southern end of the area available for siting.
- **Alternative 3 – Proposed Runway 12L/30R with Charlie Helipad Option B.** This alternative differs from Alternative 2 only in the location of the relocated Charlie Helipad. In this alternative, the relocated Charlie Helipad would be located at the northern end of the available area.

Chapter 3 provides details concerning the alternatives considered.

¹ U.S. Department of Transportation, FAA (2004), *Report to Congress, National Plan of Integrated Airport Systems (NPIAS) 2005-2009*, Chapter 2, page 12.

Affected Environment

Hillsboro Airport is located in the city of Hillsboro in Washington County, Oregon, approximately 2 ¼ miles from Hillsboro city center and 12 miles west of downtown Portland. The Airport and surrounding Port-owned property occupy approximately 965 acres of land. The Airport is generally bound by NE Brookwood Parkway to the east, NE 25th Avenue to the west, NW Evergreen Road to the north, and NE Cornell Road to the south. The Airport is owned and operated by the Port of Portland. While the Airport is located almost entirely within the city of Hillsboro, it is located on the northern boundary of the city and Port-owned lands north of NW Evergreen Road are under the jurisdiction of Washington County. Chapter 4 of the EA discusses the environment potentially affected by the proposed project alternatives.

Noise

The existing 65-decibel day-night average sound level (DNL 65) contours that define “significant” aircraft noise exposure are entirely on the Airport. No noise-sensitive uses are currently exposed to significant levels of aircraft noise.

Land Use

Areas to the east and south of the Airport are generally developed in residential uses with commercial development at the intersections of major roadways. Areas to the north and west of this corridor remain in agricultural uses generally.

Air Quality

HIO is located in the Portland-Vancouver Air Quality Maintenance Area (AQMA), which is in attainment for all pollutants but is subject to maintenance plans developed to ensure continued compliance with carbon monoxide standards.

Water Quality and Floodplains

HIO lies on higher ground between two watersheds: the McKay Creek watershed, which includes Glencoe Swale, which drains the northern portion of the Airport; and the Dawson Creek watershed, which drains the southern portion of the Airport. Both watersheds are sub-basins of the Tualatin River watershed.

Currently, Glencoe Swale is designated as a “Zone A” regulatory floodplain, as designated in the Flood Insurance Study of Washington County (unincorporated areas), revised March 18, 1987. A “Zone A” floodplain is an approximate floodplain designation used outside the area of detailed study in the Flood Insurance Study.

Fish, Wildlife, and Plants

No plant or terrestrial animal species in the project vicinity are listed as threatened or endangered under the federal Endangered Species Act (ESA). There are no ESA-listed fish species in the immediate project area. Fish species in the project vicinity listed as threatened or endangered under the federal Endangered Species Act include the Upper Willamette River Distinct Population Segment (DPS) steelhead and the Upper Willamette River

Evolutionarily Significant Unit (ESU) Chinook salmon. Upper Willamette River DPS steelhead are believed to have been present historically in the McKay Creek watershed. There are no records of Upper Willamette River ESU Chinook salmon occupying the McKay and Dairy creeks systems (Oregon Natural Heritage Information Center, 2008). During the project team's August 2008 site visits at the Airport, most of the streambed of Glencoe Swale was dry, and no fish were observed.

Wetlands

There are approximately 51 acres of wetlands on airport property. Airport land and surrounding land on which wetlands have been identified have been developed for public and commercial uses, and consequently, wetlands that are present are managed for purposes other than maintenance of high-quality wetland functions. These wetlands are subject to tilling, seeding, and/or mowing on a frequent or regular basis. Very little native vegetation remains in the wetlands.

There are three types of wetland resources in the study area:

- Palustrine emergent, depressional, isolated wetlands
- Palustrine emergent wetlands in or associated with drainages
- Unvegetated stormwater ditches

Environmental Consequences

Consistent with the requirements of FAA Orders 1050.1E, Change 1, and 5050.4B, the following sections summarize the impacts of the project alternatives as they relate to the specific environmental resource categories.

Noise

No residential or other noise-sensitive land uses would be within the DNL 65 contours that define significant aircraft noise exposure for any of the alternatives under consideration. No noise-sensitive land uses would experience significant project-related aircraft noise impacts or significant noise exposure from construction activities.

Compatible Land Use

As noted above none of the alternatives under consideration would generate a significant noise impact, and no residential or other noise-sensitive land uses would fall within the DNL 65 contours for any of these alternatives. The Airport is noted within the City of Hillsboro and Washington County land use plans and policies and thus is a consistent land use. None of the alternatives would require change of use approval, annexation or relocation that would disrupt land use patterns in the Airport environs. The project alternatives would not therefore create non-compatible land use.

Historical, Architectural, Archeological, and Cultural Resources

No archaeological or historic resources on or eligible for the National Register of Historic Places were found in the project Area of Potential Effect (Appendix C.2). The background

research and field observations conducted in this analysis indicate that a “No Properties Affected” determination by the FAA in consultation with the Oregon State Historic Preservation Office (SHPO) is appropriate. The SHPO concurred with this determination on June 12, 2009.

DOT Section 4(f) Resources

No potential DOT Section 4(f) or Land and Water Conservation Fund Section 6(f) properties are present within the existing or future DNL 65 noise contours. No property would be acquired as part of this project and no change in noise levels would occur off of Airport property as a result of implementing any of the Alternatives. Therefore, no significant direct or indirect impacts to potential Section 4(f) or Section 6(f) resources would occur.

Socioeconomic Impacts, Environmental Justice, Children’s Environmental Health and Safety Risks

No significant adverse socioeconomic impacts or disproportionate risks to children’s environmental health and safety are expected due to the proposed project. None of the alternatives would result in the relocation of any residences or businesses, division or disruption of any communities in the surrounding area, or change in surface transportation facilities or traffic volumes. Neither Alternative 2 nor Alternative 3 would cause significant noise impacts off-airport. Neither Alternative 2 nor 3 would result in adverse impacts on environmental resources that could lead to disproportionately high and adverse impacts on minority and/or low-income populations.

Secondary (Induced) Impacts

No significant adverse secondary impacts would occur as a result of the proposed project. None of the project alternatives would result in land use, noise, or direct social impacts that could lead to shifts in patterns of population movement and growth, increased demand for public services, or changes in business and economic activities.

Air Quality

Construction of either Alternative 2 or Alternative 3 would temporarily increase air emissions due to construction of the proposed runway, taxiways, and the Charlie Helipad. These construction emissions would not be significant. Once constructed, the project alternatives would reduce airfield congestion and aircraft delay compared to the No Action Alternative, resulting in long-term, ongoing emissions reductions. The project alternatives would not, therefore, cause significant air quality impacts.

Water Quality

Surfaces at Hillsboro Airport drain to Glencoe Swale, a tributary of McKay Creek, on the north and Dawson Creek on the south. Both Alternative 2 and Alternative 3 would represent an increase in impervious surface of 15.3 acres, a 42 percent increase in impervious area draining to Glencoe Swale relative to the No Action and an approximate 0.9 percent increase in the impervious area draining to Dawson Creek. Because the increase in impervious area for Dawson Creek is below the margin of error for modeling and the increase in flows and pollutants would not be measurable, impacts to Dawson Creek are

considered negligible. Increased flow to Glencoe Swale would be approximately 5.9 percent in a 10-year storm event and approximately 4.0 percent in a 100-year storm event, which does not exceed the defined threshold of significance. Thus, with respect to water *quantity*, no significant impacts are expected under either Alternative 2 or 3.

Stormwater runoff from the new impervious surface in Alternatives 2 and 3 would be treated through a vegetated filter strip to reduce pollutant levels to below water quality criteria. Downstream pollutant concentrations in Glencoe Swale would be lower for Alternatives 2 and 3 compared to the No Action Alternative because the receiving water concentrations would be diluted by the increased runoff. Thus, no significant water *quality* impacts are expected with either Alternative 2 or 3.

Fish, Wildlife, and Plants

No significant impacts on fish, wildlife, or plants are expected from Alternative 2 or Alternative 3. Either Alternative 2 or Alternative 3 would affect approximately 70.4 acres of Airport land that are currently vegetated and undeveloped, converting 68.12 acres of mostly improved pasture and 2.22 acres of wetland to impervious pavement or managed vegetation for parallel runway 12L/30R, the associated taxiways, and the relocated Charlie Helipad. The area between the proposed parallel runway and the existing Runway 12/30 would also be maintained more frequently as a grass infield area, instead of pasture land. Of the affected lands, the improved pasture area currently provides small mammal habitat and the wetlands are used by a variety of waterfowl. Filling wetlands within the construction footprint may reduce waterfowl use of Airport lands. A slight reduction in potential for birdstrikes may occur as some aircraft flight activity moves farther away from wetlands associated with Glencoe Swale. These changes are consistent with the *Hillsboro Airport Wildlife Hazard Management Plan* (Port of Portland, 2007). Impacts of stormwater runoff on water quality and quantity discussed in the Water Quality section above would not have an adverse effect on fish species in downstream water bodies.

No federally-listed threatened or endangered plant or animal species are present in the study area. FAA has determined the project would have “no effect” on federally-listed fish species (see No Effects Memorandum in Appendix C.5). There would be no impacts on any federal or state listed threatened or endangered species.

Wetlands

Alternative 2 and Alternative 3 would both result in permanent loss of 2.22 acres of scattered, low value wetlands. Wetlands that would be impacted range in size from 0.01 acre to 1.71 acres, with the largest wetland being only partly impacted. All wetlands that would be impacted are vegetated primarily, if not exclusively, by non-native grasses and opportunistic weedy species. These impacts would be mitigated through restoring 2.22 acres of wetlands at the nearby Jackson Bottom Wetland Preserve. This restored wetland would provide several wetland functional characteristics that would exceed the functions of the impacted wetlands. They would be higher functioning in characteristics of native vegetation, wildlife habitat, fish habitat, flood water storage, sediment retention, and possibly removal or storage of nutrients.

Floodplains

No work is proposed within the 100-year floodplain for Glencoe Swale or Dawson Creek under any Alternative. The stormwater runoff analysis discussed in the Water Quality section above was used to determine that the estimated floodplain impacts for Alternatives 2 and 3 would not reach the threshold of significance as defined by FAA.

Hazardous Materials, Pollution Prevention, and Solid Waste

No significant impacts related to hazardous materials, pollution prevention, or solid waste were identified for the proposed project. No recorded contaminated sites were identified inside the area to be disturbed for the project alternatives. Neither Alternative 2 nor Alternative 3 would affect any known contaminated soil; however, it is possible contaminated media from unknown sources could be encountered during construction. Neither of these alternatives is expected to generate hazardous or toxic wastes.

Various non-hazardous solid wastes would be generated during demolition and construction of the project. The concrete, asphalt, soil, and other wastes would be segregated and recycled or reused when possible. For example, clean soil would be used as fill, if appropriate. Solid waste generation from the construction activities is not expected to exceed 50 cubic yards of material.

The Airport generates municipal type solid waste and other nonhazardous wastes associated with the operation and maintenance of general aviation aircraft. The project alternatives would not increase solid waste generation, with the exception of incremental increases of pavement cleaning waste, storm filters, and light tubes. The Port of Portland's waste management system separates waste streams so that materials that can be recycled are captured and remaining materials are properly disposed. The facilities constructed in Alternative 2 or 3 would not increase the number of Airport users compared to the No Action Alternative; therefore a substantial increase in solid waste generation once construction is completed is not expected.

Farmlands

With respect to farmlands classified as prime, unique, or of statewide importance, as defined by the US Department of Agriculture Natural Resource Conservation Service (NRCS), approximately 50 acres of prime farmland or farmland of statewide importance would be directly or indirectly converted to non-farmland use as a result of Alternative 2 or 3. Coordination with the NRCS under the Farmland Protection Policy Act resulted in a Farmland Conversion Impact Rating Score of 107, which is below the threshold of significance of 200. No further action other than documentation for record with the NRCS is required.

Energy Supply, Natural Resources, and Sustainable Development

Implementation of either Alternative 2 or Alternative 3 would decrease demand for energy and would not lead to increased activity at HIO compared to the No Action Alternative. The expected reduction in aircraft delay would decrease aviation fuel consumption by 103 tons in 2012 and 183 tons in 2015. Although operation of the new runway and associated taxiways would entail a small increase in electrical demand for the new taxiway and

runway lights, this increase would not be substantial. As part of its sustainability practices, the Port reduces waste generation through its waste management program, which includes waste segregation, recycling, and energy recapture programs. Construction and operation of the project alternatives would not, therefore, cause significant impacts with respect to energy supply, natural resources, and sustainable development.

Light Emissions and Visual Impacts

Construction of either Alternative 2 or Alternative 3 would not involve new approach lighting systems or other lights that could affect surrounding areas. Other on-airport lighting such as taxiway and runway lighting would not affect surrounding areas. Also, continued Airport development is consistent with the existing pattern of development. Construction and operation of the project alternatives would not, therefore, cause significant impacts with respect to light emissions and visual impacts.

Cumulative Impacts

Construction and operation of the project alternatives would not contribute cumulatively to significant impacts on any environmental resource.

Mitigation

The only environmental impact of potential significance is the loss of 2.22 acres of scattered wetlands. Compensatory mitigation would be provided for these unavoidable wetland impacts and would involve restoring historic wetlands at an offsite location at a ratio of 1:1 impact to mitigation. 2.22 acres of wetland would be restored for mitigation.

Construction and operation of the project alternatives would not generate significant impacts on any other environmental resource and no other mitigation is required.

Measures to Avoid and Minimize Impacts

Best management practices would be specified during construction to minimize noise, dust, erosion, and sedimentation. Minimum requirements are included in FAA Advisory Circular 150/5370-10C, Standards for Specifying Construction of Airports, and are provided in Port standard construction specifications. Construction BMPs would be implemented to avoid or effectively minimize erosion and sedimentation from exposed soils during construction. Design of the alternatives has avoided and minimized impacts on wetlands to the extent possible. Impacts on remaining wetlands would be further minimized by keeping the construction footprint as small as possible while enabling construction that meets all requirements for HIO's operation. The construction contractor would be required to avoid and minimize unnecessary impacts on wetlands during construction. The Port also has a construction waste recycling specification that sets goals for recycling construction and demolition work on Port property.

1. Background and Proposed Action

This chapter describes Hillsboro Airport and the planning background for the proposed project. The Port of Portland (the Port) is the sponsor for the Hillsboro Airport Parallel Runway Project 12L/30R. This chapter also describes the project that the Port is proposing to build to reduce airfield congestion and delay at Hillsboro Airport. This chapter also explains how the project relates to the Airport Layout Plan (ALP) amendment for which the Port will seek Federal Aviation Administration (FAA) approval, and the planned schedule for implementation of the proposed improvements.

1.1 Background

Hillsboro Airport (the Airport, or HIO) is the busiest general aviation (GA) airport in Oregon, and is the state's second-busiest airport. The FAA's National Plan of Integrated Airport Systems (NPIAS) lists HIO as a designated GA reliever airport for Portland International Airport (PDX). The NPIAS¹ describes the role of GA reliever airports in the National Airspace System (NAS) as follows.

Due to different operating requirements between small general aviation aircraft and large commercial aircraft, general aviation pilots often find using a congested commercial service airport can be difficult. In recognition of this, FAA has encouraged the development of high capacity general aviation airports in major metropolitan areas. These specialized airports, called relievers, provide pilots with attractive alternatives to using congested hub airports. They also provide general aviation access to the surrounding area.

The following sections describe the existing facilities at HIO and the Port's planning efforts to ensure that HIO continues to serve as an effective GA reliever airport. As a part of its planning process, the Port conducted a Master Plan to identify future development needs based on forecasts of aviation activity and capacity estimates for the existing airfield at HIO.

1.1.1 Existing Facilities

Exhibit 1-1 shows the existing facilities at HIO. The existing airfield includes the primary Runway 12/30, which is 6,600 feet long and 150 feet wide, and crosswind Runway 2/20, which is 4,049 feet long and 100 feet wide. Three taxiways parallel these runways. Taxiway A runs parallel to the west of Runway 12/30, Taxiway B runs parallel to the south side of Runway 2/20, and Taxiway C runs parallel to the north side of Runway 2/20, west of Taxiway A. These runways and taxiways accommodate fixed-wing aircraft flown by corporate, private, and instructional users. In addition to fixed-wing aircraft, HIO accommodates a large amount of helicopter training activity. Helicopter training flights use three designated training patterns identified as the Alpha, Bravo, and Charlie patterns (see Section 5.1, Noise). These are separate and distinct from the fixed-wing traffic patterns.

¹ National Plan of Integrated Airport Systems 2007-20011, FAA, September 29, 2006, page 8.



LEGEND

-  Port Property
-  - Taxiway Identifier

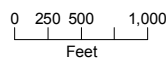


EXHIBIT 1-1
Existing Facilities
Hillsboro Airport Parallel Runway
12L/30R Environmental Assessment



The Alpha pattern landing and take-off site is located at the north end of Taxiway A, the Bravo site is located at the east end of Taxiway B, and the Charlie Helipad, 1,500 feet long and 50 feet wide, is located 700 feet east of Runway 12/30. These traffic patterns enable controllers to segregate fixed-wing and rotary-wing flight operations, thus making more efficient use of the existing runway.

1.1.2 Planning History

During the preparation of the Hillsboro Airport Master Plan (Port of Portland, 2005), the annual service volume (ASV) for the Airport was calculated in accordance with FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. The ASV represents the capacity of the Airport's current runway system. In 2007, the airfield operated at almost 100 percent of the ASV.² In the absence of airfield capacity improvements, the airfield is projected to operate at 146 percent of the ASV by 2025. Current FAA guidance recommends that planning for capacity enhancement begin when airport activity reaches 60 to 75 percent of the ASV to allow sufficient time for airfield improvements to be developed.³ The Port's planning goal of maintaining aircraft activity levels below 80 percent of capacity is consistent with this guidance.

The Hillsboro Airport Master Plan concluded that current activity levels at HIO exceeded the FAA capacity planning criteria. As activity levels increase, congestion and delay would also increase in the absence of additional airfield capacity. The Master Plan therefore recommended development of a new runway parallel to the main runway in order to segregate small training aircraft operations (primarily piston-powered) to a separate runway away from the larger business aircraft operations (primarily turbine-powered). The parallel runways would accommodate simultaneous operations under visual flight rules (VFR), thus increasing airfield capacity. This new runway would occupy the site of the current Charlie Helipad. As noted above, the Airport accommodates a substantial amount of helicopter training activity. The Master Plan therefore recommended construction of a replacement helipad to maintain the ability to segregate fixed-wing and rotary-wing operations.

1.1.3 Aviation Activity Forecast

The aircraft operational forecast used in this EA was prepared for the Hillsboro Airport Master Plan completed by the Port in 2005. The 2005 Master Plan evaluated several industry standard approaches to aviation forecasts, including a linear trend line based on national general aviation trends; regression analyses based on Portland Metropolitan population, personal income, and employment trends; the constant share of U.S. active aircraft at HIO; the constant share of Washington County registered aircraft; and the FAA Terminal Area Forecast (TAF). Based on these forecast approaches, the Port developed a "Selected Planning Forecast" that was approved by the FAA for use in the Master Plan.

FAA Order 5050.4B (paragraph 504 b) requires that forecasts used in FAA National Environmental Policy Act (NEPA) documents must be "reasonably consistent" with FAA's TAF. FAA's guidance for acceptability of forecasts is a 5-year forecast within 10 percent of

² Despite national trends showing decreases in airport operations during 2008, operations at HIO in 2008 increased 9.45 percent over 2007.

³ National Plan of Integrated Airport Systems 2007-20011, FAA, September 29, 2006, page 14.

the TAF, and a 10-year forecast within 15 percent of the TAF. For this project, 2013 would be the fifth year, and 2018 would be the tenth year. Exhibit 1-2 shows that the Master Plan forecast of aircraft operations falls outside of the FAA's recommended range of variation from the 2007 TAF⁴ at the 5-year period (2013), but is within recommended parameters for the 10-year period (2018). As a result of this difference, additional consultation was conducted between the FAA and the Port of Portland. Based on FAA's independent review, the Port's Master Plan forecasts were approved for use in this Environmental Assessment.⁵

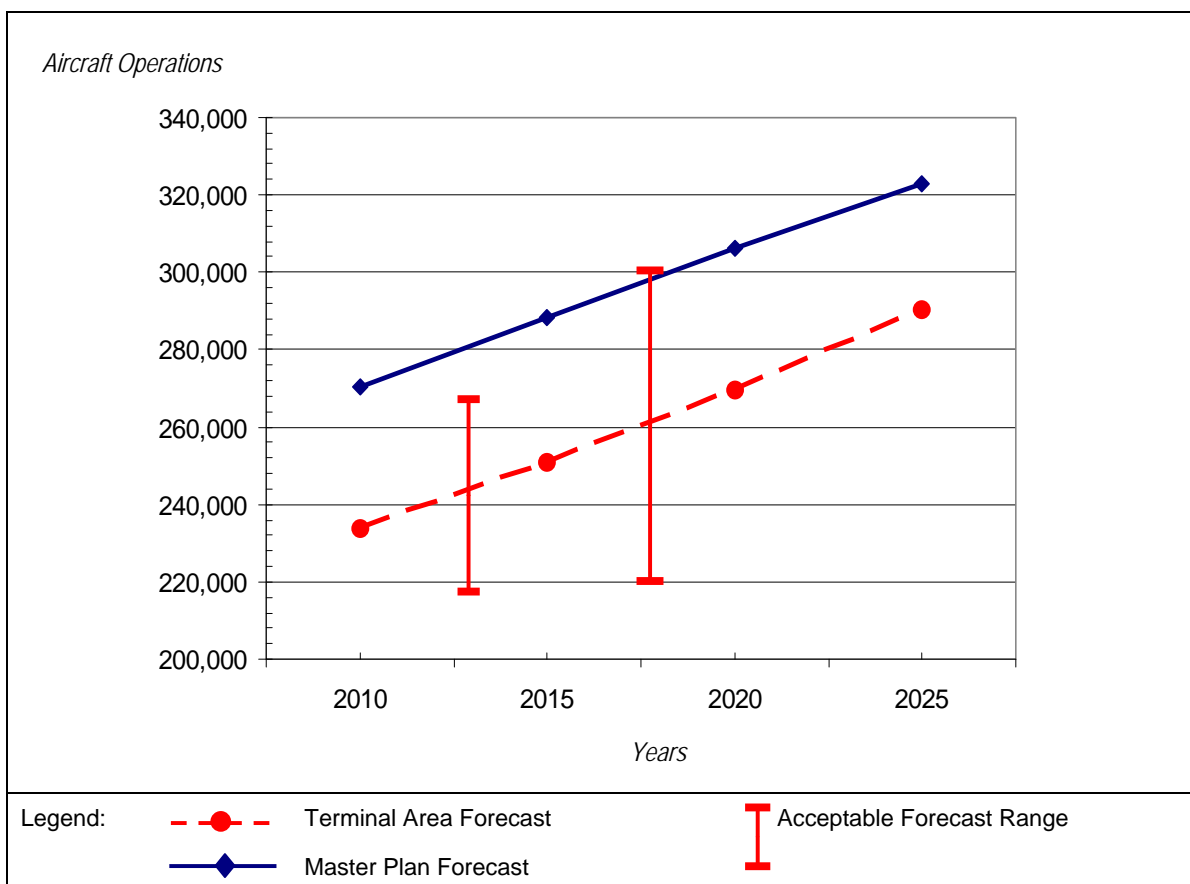


Exhibit 1-2
Comparison of FAA Terminal Area Forecast and Master Plan Forecast

The Master Plan forecast is appropriate to use for the following reasons:

- Existing activity levels at HIO already exceed FAA capacity planning criteria.
- The need for the project is based on existing activity levels, not the forecast activity levels.
- The Master Plan forecast represents a conservative basis for environmental analysis and is consistent with the facility requirements analyses reflected in the Master Plan. For the purposes of this EA, "conservative" means that the expected impacts based

⁴ Downloaded from FAA website January 2008

⁵ E-mail from Don M. Larson to TJ Stetz, 04/24/2008 02:53 PM (see Appendix A).

on a higher forecast level would tend to be greater than those based on a lower level, and therefore impacts identified would represent the high end of a range of potential impacts.

Alternative forecast scenarios were examined to assess the effects of lower levels of demand on the need for the project. This examination confirmed the continued need for airfield capacity enhancement to maintain acceptable levels of service at HIO. Further information on the development and evaluation of forecasts, their consistency with the FAA TAF, and their effect on the need for the project is provided in Appendix B.1, Hillsboro Airport Forecast Update and Verification.

Although the forecast guidance in FAA Order 5050.4B also applies to the consistency of passenger forecasts with the TAF, passenger activity levels would not affect the need for the proposed improvements, which are solely related to aircraft operations levels. The TAF does not forecast passenger activity at the Airport, nor does the Master Plan address passenger activity. For these reasons, the consideration of forecast consistency with the TAF is limited to the aircraft operations factors discussed above.

1.1.4 Airfield Capacity and Delay

Aircraft operations have an important effect on airfield capacity – not only the total number of annual operations, but also the manner in which they are conducted. The percent of operations occurring during peak periods, the number of touch-and-go operations, and the percent of arrivals during peak periods affect the number of annual operations that can be conducted at an airport over a sustained period. For planning purposes, airfield capacity is often described in terms of the ASV – the number of operations that an airport could accommodate over a year under anticipated conditions and at acceptable levels of service. The ASV calculated for an airport is based on a number of factors, including:

- Airfield characteristics - The layout of the runways and taxiways directly affects an airfield's capacity. This not only includes the location and orientation of the runways, but also the percent of time that a particular runway or combination of runways is in use and the length, width, weight-bearing capacity, and instrument approach capability of each runway.
- Meteorological conditions – Airfield capacity is diminished as weather conditions deteriorate and cloud ceilings and visibility are reduced. As weather conditions deteriorate, the separation of aircraft must increase to provide allowable margins of safety. This increased distance between aircraft has the effect of reducing the total number of aircraft that can operate during any given period. This consequently reduces overall airfield capacity.
- The types or “mix” of aircraft using the airport – Aircraft mix refers to the speed, size, and flight characteristics of aircraft operating at an airport. As the mix of aircraft operating at an airport increases to include larger aircraft, airfield capacity begins to diminish. This is due to larger separation distances that must be maintained between aircraft of different speeds and sizes.
- Demand characteristics - Both the total number of annual operations and the manner in which they are conducted have an important effect on airfield capacity. Peak operational

periods, touch-and-go operations, and the percent of arrivals affect the number of annual operations that can be conducted at an airport.

The ASV for HIO was calculated in the Master Plan in accordance with FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*. Appendix B2, Hillsboro Airport Airfield Capacity Update and Validation, provides a more detailed explanation of the ASV and the estimated capacity of the airfield. As noted above, this ASV represents the capacity of the Airport's current runway system. A helicopter flight school located at HIO generates a substantial number of helicopter training operations. These operations use existing taxiways and a separate helipad rather than the runway system and do not represent demand for runway capacity.

Delay is the most common descriptor of adverse effects of high annual operations to ASV ratios. As more aircraft attempt to access an airport at the same time, some aircraft operations must be slowed or held in place to allow sufficient time and distance between other aircraft operating in the vicinity of the airport. This need to ensure adequate separation between aircraft causes delay.

Table 1-1 compares the ASV to historic and forecast annual activity levels excluding estimated helicopter training operations. In 2007, the airfield operated at almost 100 percent of the ASV. In the absence of airfield capacity improvements, the airfield is projected to operate at 146 percent of the ASV by 2025. As the number of operations approaches the airfield's capacity, aircraft delay increases. Delays result in longer hold times for aircraft prior to landing or departure.

Exhibit 1-3 shows that current Airport activity levels exceed FAA capacity planning criteria. Forecast activity levels will substantially exceed the ASV of the current airfield in the future. As demand reaches capacity, delays increase exponentially. As noted above, the ratio of demand to ASV would reach 1.46 by the end of the forecast period without airfield capacity improvement. Average delays per operation at HIO would increase from 1.2 minutes in 2007 to 6 minutes by 2025 (see Appendix B). Increased delay would in turn increase aircraft operation time and operating costs due to increased fuel consumption, and would increase air emissions. (See Section 2.1.2. For example, operation of the new runway would reduce carbon monoxide (CO) emissions by 19 tons per year in 2012 compared to the No Action Alternative.)

1.2 Proposed Project

The proposed project includes three components: construction of Runway 12L/30R and associated taxiways, the relocation of the existing Charlie Helicopter Landing and Take-Off Pad (commonly known as the Charlie Helipad), and associated infrastructure improvements as shown in Exhibit 1-4. Section 3.2 describes the operational characteristics of the Port's proposed project.

4. Affected Environment

Consistent with FAA Order 5050.4B, Paragraph 706 e, this chapter “...describes only those environmental resources the proposed action and its reasonable alternatives, if any, are likely to affect” (FAA Order 1050.1E, Change 1, paragraph 405e). Two resource categories identified in Appendix A of FAA Order 1050.1E, Change 1, Coastal Resources and Wild and Scenic Rivers, are not present in the project area and thus would not be affected by the Proposed Action and its alternatives. Therefore, these resources are not discussed in this chapter.

4.1 Project Location

Hillsboro Airport is located in the city of Hillsboro in Washington County, Oregon, approximately 2 ¼ miles from Hillsboro city center and 12 miles west of downtown Portland (Exhibit 4-1). The Airport and surrounding Port-owned property occupy approximately 965 acres of land. The Airport is generally bound by NE Brookwood Parkway to the east, NE 25th Avenue to the west, NW Evergreen Road to the north, and NE Cornell Road to the south. The Airport is owned and operated by the Port of Portland. While the Airport is located almost entirely within the city of Hillsboro, it is located on the northern boundary of the city, and Port-owned lands north of NW Evergreen Road are within unincorporated Washington County.

4.2 Noise

Exhibit 4-2 shows the existing (2007) day-night average sound level (DNL) contours used by the federal government to assess the significance of noise impacts and to establish land use compatibility guidelines. According to FAA guidelines (see Section 5.2) most land uses are compatible with sound levels of DNL 65 A-weighted decibels (DNL 65 dBA, herein referred to as DNL 65) or less. The State of Oregon also requires the disclosure of noise levels down to DNL 55. The noise contours shown in Exhibit 4-2 reflect the typical patterns of runway and flight track use for fixed wing and helicopters at HIO. Runway 12/30 accommodates over 90 percent of the aircraft takeoffs and landings at HIO, as indicated by the extent of the noise contours along its northwest to southeast runway alignment.

Appendix C.1 shows the runway use and flight track assumptions used to develop these contours. The shape of these contours, wider to the northwest and longer and thinner to the southeast, is consistent with the most common direction of runway operations; landings from the southeast and takeoffs to the northwest.

4.3 Compatible Land Use

This section provides an overview of existing and planned land use in the vicinity of the Airport; generally the area in or near the Airport’s aircraft traffic pattern.

TABLE 5.7-4
State of Oregon CO Emissions Inventory Projections

Analysis Year	Annual CO Emissions (tons/year)
2005	497,156
2010	486,359
2017	540,670

Source: Portland Area Carbon Monoxide Maintenance Plan, Oregon Department of Environmental Quality, December 10, 2004, Table 8.

General Conformity

As noted above, a general conformity determination is required for a federal action proposed in a nonattainment or maintenance area if the project's total direct and indirect emissions would equal or exceed the annual *de minimis* emission levels in Title 40 Code of Federal Regulations (CFR) Part 93 Subpart 153, or if the project would be regionally significant (if the project emissions represent 10 percent or more of total regional emissions). Because the Portland region is a maintenance area for the CO standard, the applicable *de minimis* threshold level is 100 tons per year for CO.

FAA Order 1050.1E, Appendix A, Section 2 defines direct and indirect emissions as follows.

Direct emissions are those that are caused by or initiated by the Federal action and occur at the same time and place as the action. Indirect emissions are those caused by the Federal action, but occur later in time and/or may be removed in distance from the action. Temporary construction emissions must be considered in determining whether emission threshold levels are exceeded. (See EPA General Conformity Questions and Answers, dated November 1994.)

The Order further defines direct and indirect emissions as follows.

In addition, the General Conformity Rule adopted the exclusive definition of indirect emissions, which excludes emissions that may be attributable to the Federal action, but that the FAA has no authority to control. The FAA is responsible for assessing only direct and indirect emissions of criteria pollutants and precursors that are caused by a Federal action, are reasonably foreseeable, and can practicably be controlled by the FAA through its continuing program responsibility. The FAA may compare emissions with and without the proposed Federal action during the year in which emissions are projected to be greatest in determining whether emission threshold levels are exceeded.

NAAQS

The FAA must also determine that the federal action would not exceed the NAAQS for any criteria pollutant for the timeframe used in the NEPA analysis.

5.7.2.2 Thresholds of Significance

FAA Order 1050.1E, Change 1, Appendix A, Section 2.3 provides the following guidance. "Potentially significant air quality impacts associated with an FAA project or action would be demonstrated by the project or action exceeding one or more of the NAAQS for any of the time periods analyzed." Chapter 1, paragraph 6, e, (5) of the FAA Environmental Desk Reference for Airport Actions provides the following additional guidance on determining significance:

(b) When the emissions inventory shows total net emissions are below de minimis levels. *If total net emissions of the proposed airport action or alternative analyzed are below de minimis thresholds, and is determined not regionally significant, no further air quality analysis is needed. Therefore, the responsible FAA official may conclude the following:*

(1) For NEPA purposes, *The action and/or alternatives (if alternatives are evaluated) will not cause a significant air quality impact, since it is unlikely the pollutant concentration analyzed would exceed a NAAQS (See FAA Air Quality Handbook, pg. 14, Section 2.1.5)); and/or*

(2) For General Conformity purposes. *FAA need not conduct additional analysis or make a General Conformity Determination.*

5.7.2.3 Methodology and Assumptions

An inventory of airport-related criteria pollutant emissions was prepared to summarize impacts that may occur with and without construction of either of the two project alternatives under consideration. A summary of the methods and assumptions used to estimate air emissions follows. More detailed descriptions of model inputs and assumptions are provided in Appendix C.3, Air Quality.

Emissions from Aircraft Operations

As required by FAA guidance, the evaluation of airport-related emissions was conducted using the most recent version of the FAA's Emissions Dispersion Modeling System (EDMS) Version 5.1 (FAA, 2008). Emissions were estimated for year 2007, 2012, and 2015 based on the activity forecast for the Airport, as described in the Hillsboro Airport Forecast Update and Verification (CH2M HILL, 2008). Neither of the two project alternatives would affect roadway traffic, parking lot activities, or stationary sources as compared to the No Action Alternative. Therefore, emissions from those sources are not evaluated.

As described in Chapter 3, Alternatives, the proposed projects would improve the operational efficiency of the airfield. Alternative 1, No Action, reflects operations assuming that the proposed parallel runway, taxiways, and Charlie Helipad would not be constructed. Alternatives 2 and 3 involve construction of the same runway and taxiway improvements. These two alternatives differ only with respect to the location of the relocated Charlie Helipad. The development of these proposed facilities would reduce the delay experienced by aircraft operating in each of the forecast years.

Aircraft emissions were estimated for each aircraft on a landing and takeoff (LTO) cycle basis. An LTO consists of two operations, a landing and a take-off. A complete LTO cycle includes 4 "modes" of operation: approach, taxi (in and out)/idle, take-off, and climb-out. Many aircraft also perform pilot training activities called touch-and-go cycles (TGOs). TGOs also comprise two operations consisting of the same aircraft modes except that there is no taxi/idle time while the aircraft is on the ground. Aircraft operations below 3,000 feet above ground level (AGL), including all TGO operations, are included in the inventory. The EDMS produces estimates of the fuel burned by each aircraft as it operates in these modes as well as emissions.

The amount of time that each type of aircraft typically spends in each of the modes described above was used in emission calculations. The EDMS calculations assume default

Appendix C.3 Air Quality

Contents

Existing Conditions

Air Quality Analysis Assumptions Technical Memorandum

Existing Conditions

Air Quality Existing Conditions

Hillsboro Airport is located in Washington County in the city of Hillsboro, about 15 miles west of downtown Portland. The Airport and its surrounding communities are part of the Portland/Vancouver attainment/maintenance region for the carbon monoxide (CO) standard. The State of Oregon's SIP for this area includes a regional maintenance plan for CO demonstrating that it will continue to achieve attainment for carbon monoxide. The following subsections summarize existing conditions with a review of available air quality monitoring data in the general vicinity of the Airport and estimates of emissions for existing (2007) Airport operations.

Regional Air Quality Monitoring

The Oregon DEQ operates a network of ambient air monitoring stations throughout the Portland-Vancouver Air Quality Management Area. Exhibit 1 lists the maximum measured pollutant levels for the pollutants of interest for this project, measured at the nearest monitoring location from 2002 to 2006. The southeast Lafayette air quality monitor is the nearest fully instrumented site, but it is located about 17 miles east of Hillsboro. Compliance with air quality standards is based on a statistical summary of concentrations, which varies by pollutant and averaging time.

Airport Emissions Inventory

Emission estimates for existing conditions using operational data from 2007 are shown in Exhibit 2. The Air Quality Analysis Assumptions Technical Memorandum in this appendix describes the assumptions incorporated in this emissions inventory. Aircraft activity represents the largest source of all criteria pollutants. Aircraft piston engines require leaded aviation gasoline and are the only source of lead emissions at HIO. Although only aircraft-related emissions would differ among the alternatives under consideration, the inventory in Exhibit 2 also includes emissions from ground support equipment (GSE) and auxiliary power units (APU), surface vehicle parking and on airport roadways, and stationary sources.

EXHIBIT 1

Summary of Maximum Ambient Air Monitoring Levels Near Project Area ^a

Pollutant	Averaging Time and Standards ^b	2002	2003	2004	2005	2006
Carbon monoxide (ppm)	8-hour (9.0 ppm)	3.1	3.4	4.0	2.6	2.9
	1-hour (35 ppm)	6.1	3.7	4.9	3.2	3.8
Ozone (ppm)	8-hour (0.075 ppm)	-	0.068	0.072	0.062	0.079
	1-hour (revoked)	-	0.098	0.087	0.084	0.098
Nitrogen dioxide (ppm)	1-hour (0.053 ppm)	0.046	0.061	0.040	0.057	0.060
Sulfur dioxide (ppm)	annual ^c (0.02 ppm)	-	-	-	-	0.0015
	24-hour (0.10 ppm)	-	-	-	0.007	0.008
	3-hour (0.050 ppm)	-	-	-	0.018	0.016
PM ₁₀ (µg/m ³)	annual ^c (revoked)	14.5	13.2	17.1	17.2	-
	24-hour (150 µg/m ³)	48	27	47	44	-
PM _{2.5} (µg/m ³)	annual ^c (12 µg/m ³)	8.4	8.2	9.3	9.2	9.8
	24-hour (35 µg/m ³)	45	26	47	34	39

^a At 5824 SE Lafayette, Portland, Oregon. All short-term concentrations represent maximum values.

^b Lowest (most restrictive) standard.

^c Annual arithmetic mean.

Source: 2006 Oregon Air Quality Data (DEQ, 2007).

EXHIBIT 2

Emissions Inventory – 2007 Existing Conditions (tons/year)

Source	CO	VOCs	NOx	SOx	PM ₁₀	PM _{2.5}	Pb
Aircraft	1,074.0	30.9	15.4	2.6	0.2	0.2	0.7
GSE	38.0	1.4	4.5	0.2	0.1	0.1	NA
APUs	0.6	<0.1	0.3	0.1	0.1	0.1	NA
Parking	0.6	0.1	0.1	<0.1	<0.1	<0.1	NA
Roadways	2.4	0.2	0.3	<0.1	<0.1	<0.1	NA
Stationary sources	<0.1	3.0	0.2	<0.1	<0.1	<0.1	NA
Total	1,116.0	35.5	20.7	2.9	0.4	0.4	0.7

Note: Estimates reflect 10.0 total minutes of aircraft taxi/idle time and 240,690 total aircraft operations. NA = not applicable.

Source: CH2M HILL analysis, 2008.

Air Quality Analysis Assumptions Technical Memorandum

Air Quality Analysis Assumptions

PREPARED FOR: Port of Portland
PREPARED BY: Jim Humphries, CH2M HILL and Bill Willkie, CH2M HILL
DATE: March 31, 2009

This technical memorandum documents the assumptions used in the air quality analysis for the Environmental Assessment (EA) of the proposed airfield improvements at Hillsboro Airport (HIO). This appendix provides the following information.

- Operational Emissions Modeling Methods and Assumptions
- Toxic Air Contaminants
- Construction Emissions

1. Operational Emission Modeling Methods and Assumptions

This section describes the methods and assumptions used to estimate emissions attributed to airport related emission sources. The ongoing operation of aircraft, ground support equipment (GSE), surface vehicles, and stationary sources represent permanent or continuous sources of air emissions at HIO. All of the alternatives under consideration would experience the same level of aircraft activity. The numbers of passengers, pilots, and support personnel using the Airport would therefore be the same for all of the alternatives. Similarly, GSE and stationary sources such as generators and fuel tanks would experience the same level of activity for all of the alternatives. The emissions associated with the alternatives under consideration would differ only in terms of the amount of time (a function of congestion and delay) that aircraft at HIO require to conduct operations.

1.1 Aircraft Fleet Mix

Aircraft emissions were estimated using the FAA's Emissions and Dispersion Modeling System (EDMS) Version 5.1 (FAA, 2008). CH2M HILL reviewed the analysis documented in the HIO Master Plan (Port of Portland, 2005), and the FAA Terminal Area Forecast (TAF) for 2008 (FAA, December 2007). The TAF provides existing and future aircraft operations by generalized aircraft categories: air carrier, commercial, air taxi, general aviation, and military. The HIO Master Plan provided additional detail regarding the operation of single-engine fixed propeller, single-engine variable propeller, multi-engine piston, turboprop, turbojet, helicopter piston, and helicopter turbine aircraft. More detailed existing fleet mix data were obtained from 12 months of *Flight Aware* data (Flight Aware, 2008) which lists aircraft filing a flight plan either originating or terminating at HIO. The Flight Aware data included operations of over 100 specific types of aircraft. Because the EDMS model does not contain every type of aircraft, representative aircraft were consolidated by engine type to develop the EDMS input. Table 1 shows the existing fleet mix. This fleet mix was expanded to represent the number and types of aircraft operations forecast for 2012 and 2015 in the Master Plan as shown in Tables 2 and 3, respectively.

TABLE 1. CONSOLIDATED AIRCRAFT FLEET MIX FOR 2007 EXISTING OPERATIONS						
Aircraft Class	Engine Class	TGOs	LTOs	Total	Representative Engine Class (EDMS 5.1)	Representative Aircraft (EDMS 5.1)
Single Engine (Fixed Prop)	o 235	5,474	4,259	9,733	O-200	Cessna 150 Series
	o 320	18,042	14,037	32,079	O-320	Cessna 172 Skyhawk
	o 360	268	209	477	IO-360B	Cessna 182
	io 360	2,502	1,947	4,450	IO-360B	Cessna 182
	tio 540	1,786	1,389	3,175	TIO-540-J2B2	Cessna 210 Centurion
	io 540	1,447	1,126	2,573	TIO-540-J2B2	Cessna 210 Centurion
Single Engine (Variable Prop)	io 360	2,912	3,348	6,260	TIO-540-J2B2	Raytheon Beech Bonanza 36
	io 540	157	181	339	TIO-540-J2B2	Cessna 210 Centurion
	tio 540	366	421	787	TIO-540-J2B2	Cessna 210 Centurion
Multi-Engine Piston	o 360	236	1,253	1,489	IO-360B	Cessna 377 Skymaster
	io 320	24	129	153	IO-360B	Cessna 377 Skymaster
	io 360	33	175	208	IO-360B	Cessna 377 Skymaster
	tio 540	238	1,263	1,501	TIO-540-J2B2	Cessna 310
Turboprop	pt6a-42	11	228	240	PT6A-42	Raytheon Super King Air 200
	pt6a-67	107	2,142	2,249	PT6A-67D	Raytheon Beech 1900-D
	pt61-114	13	270	284	PT61-144A	Cessna 208 Caravan
	tpe331	32	652	684	TPE331-10	Rockwell Commander 690
Turbojet	ae3007	0	1,389	1,389	AE3007A1/3 Type 2	Embraer ERJ135
	jt 15d	0	397	397	JT-15D-5	Cessna 560 Citation XLS
	tfe 731	0	432	432	TFE731-3	Gulfstream G150
	tfe 731-2-2b	0	1,058	1,058	TFE 731-2-2B	Bombardier LearJet 35
	ge cf34-3a	0	163	163	CF34-3A LEC II	Bombardier Challenger 601
	br700-710a2	0	73	73	BR700-710A2-20	Bombardier Global Express
Helicopter Piston	o 360	35,145	10,177	45,322	IO-360-B	Robinson R22
	io 540	1,849	536	2,385	TIO-540-J2B2	R-44 Helicopter
Helicopter Turbine	rr 250	77	454	531	250B17B	Bell 206 Jet Ranger
	t53 11	50	294	345	T53-L-11D	Bell AH-1S
	hio 360	229	1,346	1,575	IO-360-B	Robinson R22
Totals		71,001	49,344	120,345		

Source: CH2MHILL, 2008 and EDMS default aircraft characteristics

TABLE 2. CONSOLIDATED AIRCRAFT FLEET MIX FOR 2012 OPERATIONS						
Aircraft Class	Engine Class	TGOs	LTOs	Total	Representative Engine Class (EDMS 5.1)	Representative Aircraft (EDMS 5.1)
Single Engine (FP)	o 235	7,301	5,539	12,839	O-200	Cessna 150 Series
	o 320	24,065	18,257	42,322	O-320	Cessna 172 Skyhawk
	o 360	357	271	627	IO-360B	Cessna 182
	io 360	3,337	2,531	5,868	IO-360B	Cessna 182
	tio 540	2,381	1,806	4,187	TIO-540-J2B2	Cessna 210 Centurion
	io 540	1,927	1,462	3,389	TIO-540-J2B2	Cessna 210 Centurion
Single Engine (VPP)	io 360	4,027	4,254	8,281	TIO-540-J2B2	Raytheon Beech Bonanza 36
	io 540	217	230	447	TIO-540-J2B2	Cessna 210 Centurion
	tio 540	506	535	1,041	TIO-540-J2B2	Cessna 210 Centurion
Multi-Engine Piston	o 360	415	1,545	1,960	IO-360B	Cessna 377 Skymaster
	io 320	43	158	201	IO-360B	Cessna 377 Skymaster
	io 360	58	216	275	IO-360B	Cessna 377 Skymaster
	tio 540	420	1,564	1,984	TIO-540-J2B2	Cessna 310
Turboprop	pt6a-42	18	302	321	PT6A-42	Raytheon Super King Air 200
	pt6a-67	172	2,864	3,037	PT6A-67D	Raytheon Beech 1900-D
	pt61-114	21	356	377	PT61-144A	Cessna 208 Caravan
	tpe331	52	862	914	TPE331-10	Rockwell Commander 690
Turbojet	ae3007	0	2,570	2,570	AE3007A1/3 Type 2	Embraer ERJ135
	jt 15d	0	724	724	JT-15D-5	Cessna 560 Citation XLS
	tfe 731	0	789	789	TFE731-3	Gulfstream G150
	tfe 731-2-2b	0	1,942	1,942	TFE 731-2-2B	Bombardier LearJet 35
	ge cf34-3a	0	295	295	CF34-3A LEC II	Bombardier Challenger 601
	br700-710a2	0	133	133	BR700-710A2-20	Bombardier Global Express
Helicopter Piston	o 360	34,675	4,893	39,568	IO-360-B	Robinson R22
	io 540	1,825	258	2,083	TIO-540-J2B2	R-44 Helicopter
Helicopter Turbine	rr 250	77	459	536	250B17B	Bell 206 Jet Ranger
	t53 11	49	292	341	T53-L-11D	Bell AH-1S
	hio 360	225	1,349	1,574	IO-360-B	Robinson R22
Totals		82,167	56,455	138,622		
Source: CH2MHILL, 2008 and EDMS default aircraft characteristics						

TABLE 3. CONSOLIDATED AIRCRAFT FLEET MIX FOR 2015 OPERATIONS						
Aircraft Class	Engine Class	TGOs	LTOs	Total	Representative Engine Class (EDMS 5.1)	Representative Aircraft (EDMS 5.1)
Single Engine (FP)	o 235	7,703	5,844	13,547	O-200	Cessna 150 Series
	o 320	25,392	19,264	44,657	O-320	Cessna 172 Skyhawk
	o 360	376	286	662	IO-360B	Cessna 182
	io 360	3,520	2,671	6,191	IO-360B	Cessna 182
	tio 540	2,512	1,906	4,418	TIO-540-J2B2	Cessna 210 Centurion
	io 540	2,033	1,542	3,575	TIO-540-J2B2	Cessna 210 Centurion
Single Engine (VPP)	io 360	4,268	4,506	8,774	TIO-540-J2B2	Raytheon Beech Bonanza 36
	io 540	230	243	474	TIO-540-J2B2	Cessna 210 Centurion
	tio 540	536	566	1,103	TIO-540-J2B2	Cessna 210 Centurion
Multi-Engine Piston	o 360	438	1,630	2,068	IO-360B	Cessna 377 Skymaster
	io 320	45	167	212	IO-360B	Cessna 377 Skymaster
	io 360	61	228	290	IO-360B	Cessna 377 Skymaster
	tio 540	443	1,650	2,093	TIO-540-J2B2	Cessna 310
Turboprop	pt6a-42	20	328	348	PT6A-42	Raytheon Super King Air 200
	pt6a-67	187	3,112	3,299	PT6A-67D	Raytheon Beech 1900-D
	pt61-114	23	386	409	PT61-144A	Cessna 208 Caravan
	tpe331	56	936	992	TPE331-10	Rockwell Commander 690
Turbojet	ae3007	0	2,754	2,754	AE3007A1/3 Type 2	Embraer ERJ135
	jt 15d	0	775	775	JT-15D-5	Cessna 560 Citation XLS
	tfe 731	0	846	846	TFE731-3	Gulfstream G150
	tfe 731-2-2b	0	2,082	2,082	TFE 731-2-2B	Bombardier LearJet 35
	ge cf34-3a	0	316	316	CF34-3A LEC II	Bombardier Challenger 601
	br700-710a2	0	143	143	BR700-710A2-20	Bombardier Global Express
Helicopter Piston	o 360	34,675	4,893	39,568	IO-360-B	Robinson R22
	io 540	1,825	258	2,083	TIO-540-J2B2	R-44 Helicopter
Helicopter Turbine	rr 250	77	459	536	250B17B	Bell 206 Jet Ranger
	t53 11	49	292	341	T53-L-11D	Bell AH-1S
	hio 360	225	1,349	1,574	IO-360-B	Robinson R22
Totals		84,695	59,430	144,125		
Source: CH2MHILL, 2008 and EDMS default aircraft characteristics						

1.2 Aircraft Times in Mode

All of the alternatives under consideration would accommodate the forecast levels of aviation activity, although without airfield improvements, congestion and delay would increase. Table 4 shows that under Alternative 1, the No Action Alternative, aircraft would require more time to taxi in and out than under Alternatives 2 or 3 because congestion and delay would increase without the addition of runway capacity.

TABLE 4. SUMMARY OF EDMS INPUTS AND ASSUMPTIONS

Year	Scenario	Annual Aircraft Operations (Helicopter and Fixed Wing)	TGO Cycles	LTO Cycles	Average Aircraft Taxi-In/Out (minutes)
2007	Existing Condition	240,690	71,001	49,344	10.0
2012	Alternative 1	277,244	82,167	56,455	11.1
2012	Alternatives 2 & 3	277,244	82,167	56,455	9.1
2015	Alternative 1	288,250	84,695	59,430	12.4
2015	Alternatives 2 & 3	288,250	84,695	59,430	9.1

Source: CH2M HILL Analysis

By 2012, HIO is forecast to accommodate 277,244 aircraft operations annually. By 2015, annual operations are forecast to reach 288,250. As the volume of aircraft operations would not be affected by the proposed project, the alternatives under consideration would not differ with respect to the fleet mix of aircraft types using HIO.

At present, the average delay per aircraft is about 1 minute, contributing to a total taxi in and out time of 10 minutes. Without the proposed capacity improvements, delays would increase by an additional 1.1 minutes, contributing to a total taxi in and out time of 11.1 minutes. Either of the project alternatives would reduce annual delay per aircraft to less than 1 minute. This reduction in aircraft delay would decrease aircraft emissions relative to the No Action Alternative.

Aircraft emissions were computed by EDMS for each aircraft on a landing take-off (LTO) or touch and go (TGO) cycle basis. An aircraft LTO consists of two operations; a landing, and a take-off. A complete LTO cycle consists of the following modes:

- **Approach** - from the time that an aircraft descends below the mixing level (assumed to be 3,000 feet above ground level) until the aircraft exits the runway.
- **Taxi/idle ground time** - the time required for an aircraft to taxi from the runway to the gate, including delays, and the time required to taxi from the gate to the runway, including delays. Observed ground times of 10-minutes were used to estimate taxi/idle times for existing (2007) conditions. As noted above, these values were adjusted to account for the increased delay associated with each alternative for the future years.
- **Take-off** - from the time the aircraft applies take-off power until it reaches approximately 800 feet above ground level. This analysis used the EDMS default assumptions.

- **Climb-out** – from the time the aircraft reaches 800 feet above ground level until it reaches 3,000 feet above ground level. This analysis used the EDMS default assumptions.

Many aircraft also perform pilot training activities by conducting a series of continuous take-offs and landings, called touch and go cycles (TGOs). The TGOs also comprise two operations consisting of the same aircraft modes, except that there is no taxi/idle time while the aircraft is on the ground. Hillsboro Airport experiences many flight training activities, especially helicopter TGOs. Piston aircraft are commonly used to minimize training costs.

The amount of engine thrust required for each of the LTO and TGO modes influences emissions. The amount of time that each type of aircraft typically spends in each of the modes is used to calculate emissions. The EDMS calculations assumed default time values for the airborne times in mode (approach, take-off, and climb-out). These values are specific to the performance characteristics of each type of aircraft. The estimated total taxi in/out times ranged from 10 minutes in 2007 to 12.4 minutes in 2015 without the project

EDMS computes criteria pollutant emissions for each mode of operation for each aircraft type, and sums them to provide a total of pollutants. The amount of fuel burned by each aircraft is also computed by EDMS, and serves as an indicator of the amount of Greenhouse gasses produced. Because the piston engines utilized in the majority of the general aviation aircraft are older technology, they require lead (Pb) in their fuel. Estimates of lead emitted from the piston engines were based upon the lead content of Avgas burned during the LTO or TGO cycle. The lead content of Avgas was specified at 0.0046 pounds/gallon by the American Standards for Testing and Materials (ASTM, 2005). Annual Pb emissions from the operations of piston aircraft were estimated by multiplying the annual amount of Avgas burned, by the fraction of lead contained in the fuel.

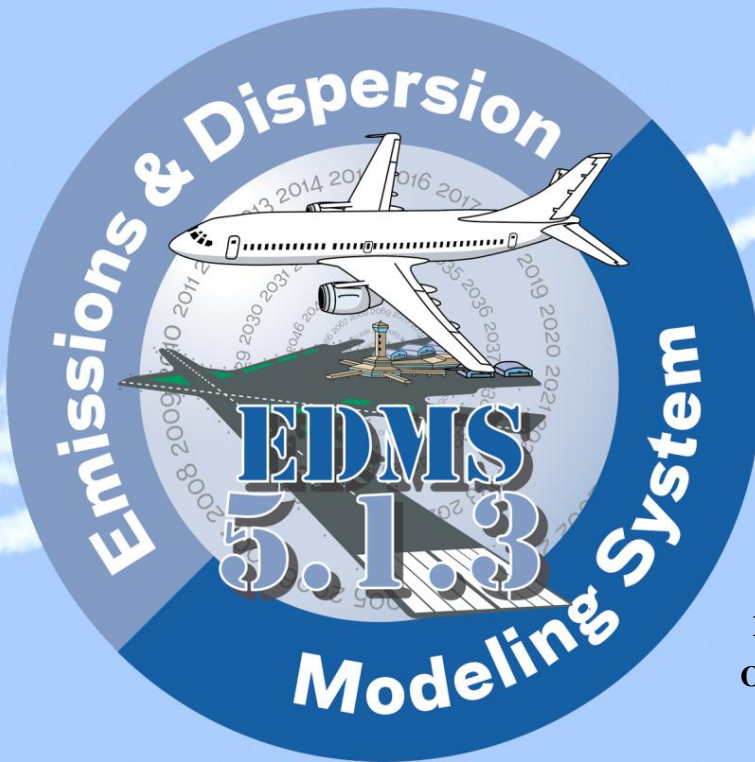
2. Toxic Air Contaminants

Toxic air contaminants (TAC) comprise approximately 400 chemicals listed and regulated under the state and local air toxics regulations, while HAPs are comprised of 189 chemicals regulated by the federal CAA. Because the list of TACs includes all HAPs, the term TACs is used here to represent both. TACs are components of volatile organic compounds (VOCs) and particulate matter (PM). For example, a small fraction of the total PM emissions from diesel exhaust may be cadmium, and a small portion of the VOC is toluene. TAC emissions are, therefore, proportional to VOC and PM emissions.

Because the data available for estimating TACs from aircraft and other on-airport activities are severely limited, VOC and PM are used as an indicator of the effect of airport improvements on toxic air pollutant emissions. In 2012 operation of the parallel runway in Alternatives 2 or 3 would slightly decrease aircraft VOC and PM emissions by reducing congestion and delay. Emissions of TACs would therefore be decrease as well. Likewise, because the predicted emissions of VOC and PM are lower for the project than under No Action in 2015 TAC, emissions for Alternatives 2 or 3 would also be lower than for Alternative 1.

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Emissions and Dispersion Modeling System (EDMS) User's Manual



Prepared for
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Office of Environment and Energy
Washington, DC

Prepared by
CSSI, Inc., Washington, DC

November 2010

Revision Notes:

Revision 2 (02/09/07)

1. Section 6.2.7. Import & Export: Removed a figure in to make it consistent with the export functionality in EDMS, which only has 2 steps instead of three.
2. Section 6.4.2.1. Weather Data Requirements: Expanded sections *Use Annual Averages* and *Use Hourly Meteorological Data* to provide a more detailed explanation. Added section *Base Elevation*.
3. Section 6.6.5. All Model Inputs: Added section to describe the *All Model Inputs* functionality.
4. Updated several instances where the section reference was zero (e.g. section 0) with the correct reference number.

Revision 3 (03/21/07)

1. Section 6.2.3. Open. Added a note concerning conversion of user-created objects and flight profiles for helicopters in EDMS 5.0.
2. Appendix A. EDMS Tutorial. Updated screenshots to show results obtained using the new release of EDMS (5.0.1).
3. Appendix B. Import/Export File Formats. Updated tables and examples to make them consistent with the functionality of the new EDMS release (5.0.1).

Revision 4 (06/29/07)

1. Section 6.3.1.2. Schedule: Added a table with the schedule format and updated the description of the schedule fields.
2. Appendix A. EDMS Tutorial. Updated screenshots to show results obtained using the new release of EDMS (5.0.2).
3. Section 6.1.1 Study Tree: Added text to the study tree display detailing the changed study and emissions out of date flag.
4. Section 6.2.1.2. Study Properties: Updated the section on FOA 3.0 Sulfur-to-Sulfate Conversion Ratio
5. Section 6.2.1.4. Study Properties: Updated the Airport Properties dialog with country code requirements for FOA3a for US airports
6. Section 6.2.3. Study Conversion: Updated the study conversion section detailing the need for MOBILE6.2 to run after study conversion.
7. Section 6.3.1. Aircraft Operations & Assignment Window: Added section on the new aircraft search capability.
8. Section 6.3.1.6. Added information on FOA3a for U.S airports
9. Section 6.6.3. Airport: Updated Airport Graphical display screenshot and added note to describe the crosshairs at the origin (0,0) of the airport.
10. Section 6.5.3.4. Step 4 AERMOD: Added section describing the 8th Highest 24-hour Averages at Each Receptor
11. Section 6.7.2. User-Created Aircraft: Revised note on the basis of Aircraft categories and weight classes in of User-created Aircraft.

Revision 5 (09/19/08)

1. Acknowledgments: Updated names of contributors for CSSI, EPA, and DRG Members.

2. Section 1.3.2.2. EDMS Modeling Options: Added a section about the new Speciated Organic gas modeling option.
3. Section 1.3.8. Features and Limitations: Updated the section to include the new pollutants modeled in the current version of EDMS.
4. Section 2.1. Emission Inventory Pollutants: Added a new section to discuss the new pollutants modeled in the current version of EDMS, along with providing details on the OG speciation profiles.
5. Section 2.3. Aircraft Activity: Updated the third mode (Startup) of operation.
6. Table 2.1. MOBILE 6.2 Control Flag Settings. Updated table entries to reflect current MOBILE settings.
7. Section 2.9. Emissions Inventory Output: Updated the section to include the new pollutants modeled in the current version of EDMS, along with the option to export the emissions inventory into a text file.
8. Section 4.1. Dispersed Pollutants: Added a new section to discuss the pollutants which are used for dispersion calculations.
9. Section 4.3.2. Aircraft: Updated the third mode (Startup) of operation
10. Section 4.3.10 Buildings. Added important note regarding the effect of buildings on the concentrations.
11. Section 6.2.1 Study Properties: Added the enable speciated organic gas checkbox option.
12. Section 6.2.3.2. EDMS 5.0.x Study Conversion. New section to discuss the conversion process from earlier versions of EDMS 5 series.
13. Section 6.3.1.2. Schedule Tab. Updated schedule related information.
14. Section 6.3.1.6 Engine Emissions Tab. Updated Fuel Sulfur Content Emission Index information.
15. Section 6.5.4. Run AERMOD. Added description of the updated ARMOD confirmation screen.
16. Section 6.6.1. Emissions Inventory. Included description for export button.
17. Section 6.7.2. User-Created Aircraft. Added paragraph to discuss the Jet Engine Parameters.
18. Appendix A. EDMS Tutorial. Updated screenshots to show results obtained using the current release of EDMS (5.1).
19. Appendix D. Matrix showing sources for each speciated organic gas included in EDMS.

Revision 6 (09/30/09)

1. Updated all references of “speciated hydrocarbons” to “speciated organic gases.”
2. Section 1.3.3. and 1.3.5 Updates to the EDMS Study Structure and Screen Layout
3. Section 6.1. Study Window: Updated pane related information
4. Section 6.3.1.2. Schedule Tab: Updated section to reflect the new functionality of sorting aircraft schedules that are not in chronological order.
5. Section 6.5. The Dispersion Menu: Updated the Steps in Dispersion Analysis.
6. Section 6.5.3. Pollutants: Added section to discuss the pollutant selection for dispersion.
7. Section 6.6.2. Emissions Reduction Report: Updated section to reflect changes made to be consistent with the current Vale program effective 10/01/09.
8. Section 6.6.8. Standards (NAAQS). Updated NAAQS table and footnotes
9. Appendix A. EDMS Tutorial. Updated for the current release of EDMS (5.1.1).

Revision 7 (11/06/09)

1. Updated EDMS 5.1.1 references to EDMS 5.1.2 and updated related screenshots.
2. Appendix A. EDMS Tutorial. Updated for the current release of EDMS (5.1.2)

Revision 8 (11/15/10)

1. Updated EDMS 5.1.2 references to EDMS 5.1.3 and updated related screenshots.
2. Section 1.3.1. Components and Modules: Added a table with the external interfaces used in EDMS.
3. Section 6.2.1 Study Properties: Added the section for the *Enable Voluntary Airport Low Emissions (VALE) Program Reporting* checkbox option
4. Section 6.3.7. VALE Settings: Added the section to discuss the new VALE Settings window.
5. Section 6.6.2. VALE Emissions Reduction Report: Updated section to reflect changes made to VALE program report.
6. Section 6.6.8. Standards (NAAQS). Updated NAAQS table and footnotes
7. Appendix A. EDMS Tutorial. Updated for the current release of EDMS (5.1.3)

EDMS 5 Series Releases:

- EDMS 5.0 released on January 29, 2007
- EDMS 5.0.1 released on March 21, 2007
- EDMS 5.0.2 released on June 29, 2007
- EDMS 5.1 released on September 19, 2008
- EDMS 5.1.1 released on September 30, 2009
- EDMS 5.1.2 released on November 06, 2009
- EDMS 5.1.3 released on November 15, 2010

Preface

This User's Guide is intended to provide detailed information on the functionality of the model and acts as an extension and elaboration of the on-line help. The section on References provides an extensive listing of documents that may be of further assistance to the user in the use of EDMS and the preparation of an Environmental Impact Statement (EIS).

This user manual provides instructions for installing and using EDMS version 5.1.3. The manual describes how to enter data, how to obtain various forms of output, and includes an example that exercises many commonly-used features of the software. The chapters are organized in the following manner:

- Chapter 1 provides a brief history of the evolution of EDMS, instructions for installing the software, a note to users of EDMS from outside of the United States, a high level overview of the model architecture, and a summary of the features and limitations of EDMS.
- Chapter 2 gives a summary of the types of data accepted by EDMS for generating an emissions inventory.
- Chapter 3 gives information about weather data and the airport layout.
- Chapter 4 is similar to chapter 2 and provides a description of the data used to estimate concentrations.
- Chapter 5 describes the functionality offered by the EDMS utilities, including: operational profiles, user-created aircraft, ground support equipment and auxiliary power units.
- Chapter 6 in contrast to the previous chapters gives specific step-by-step instructions for interacting with each of the EDMS screens. It is anticipated that most users will read chapters 2 through 5 to familiarize themselves with EDMS and then will use chapter 6 as a reference when working with the model.
- Appendix A contains an example study to allow new users to learn the basics of performing an emissions and dispersion analysis with EDMS. **The example uses fictitious data and should not be the basis for any regulatory action.**
- Appendix B describes that import and export formats used by EDMS 5. Advanced users can use the import and export utility to bypass most of the EDMS user interface.
- Appendix C provides photographs of the GSE Reference Models used in EDMS 5 to allow for a more accurate selection of GSE for a study.
- Appendix D provides a matrix of speciated organic gases (OG) by source type.

As a companion to this user manual, the *EDMS Technical Manual* provides detailed descriptions of the algorithms and data used by EDMS 5.1.3. In addition, the answers to Frequently Asked Questions and contact information for receiving additional support are posted to the EDMS web site. A link to the EDMS web site can be found at

http://www.faa.gov/about/office_org/headquarters_offices/aep/models/edms_model/.

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We also appreciate the contributions of Roger Wayson and Gregg Fleming with the Department of Transportation's Volpe National Transportation Systems Center and Ralph Iovinelli with the Federal Aviation Administration. Their research and analysis activities for AEE have yielded increased insights, and led to improvements in the modeling software. In addition, we thank Warren Peters and Joe Touma from the Environmental Protection Agency (EPA) for their help with AERMOD, Craig Harvey from EPA on support of the NONROAD model, and David Brzezinski from EPA OTAQ for his help on MOBILE.

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APPENDIX A: EDMS TUTORIAL

APPENDIX B: IMPORT/EXPORT FILE FORMATS

APPENDIX C: GSE REFERENCE MODELS

APPENDIX D: SPECIATED ORGANIC GASES

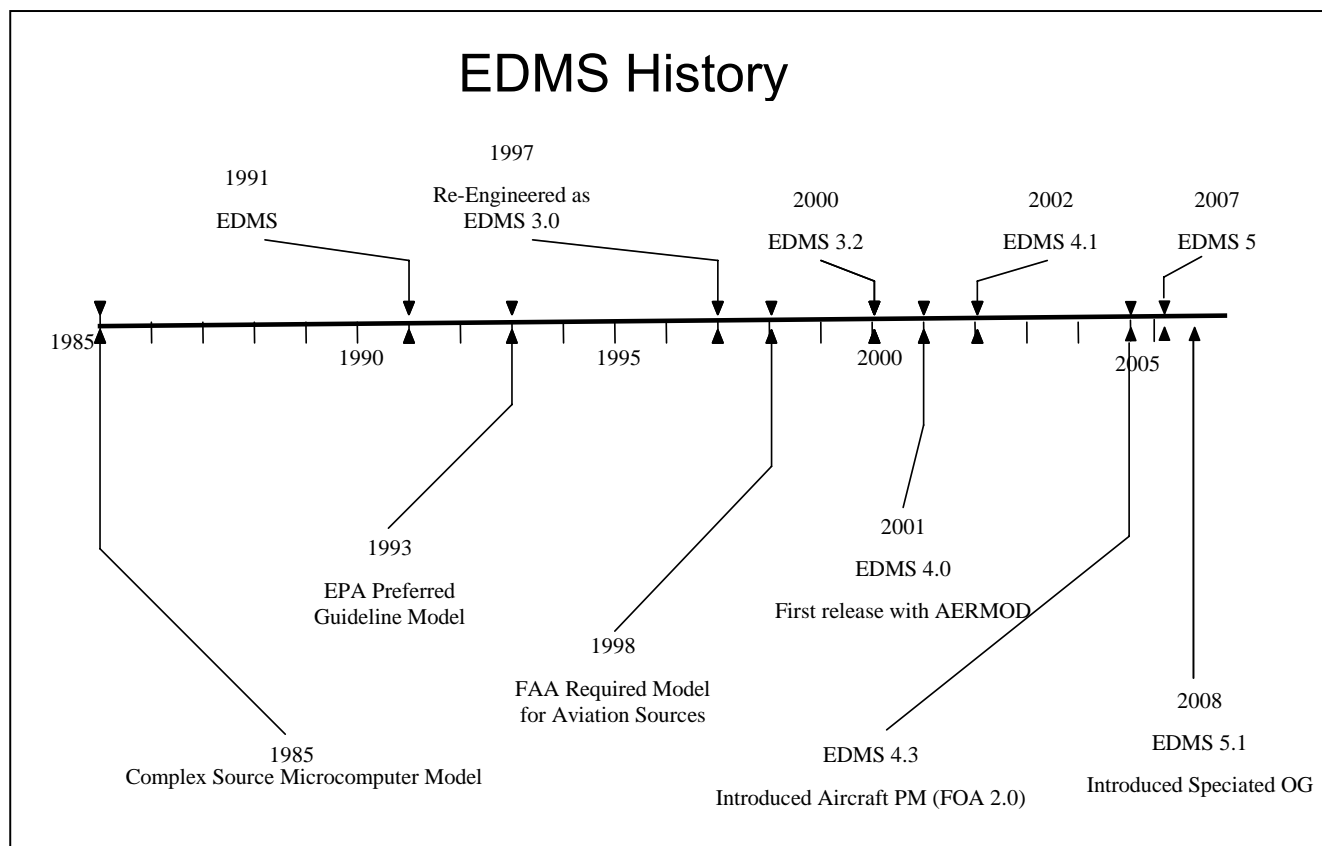
REFERENCES

1 BACKGROUND INFORMATION

1.1 History

EDMS is a combined emissions and dispersion model for assessing air quality at civilian airports and military air bases. The model was developed by the Federal Aviation Administration (FAA) in cooperation with the United States Air Force (USAF). The model is used to produce an inventory of emissions generated by sources on and around the airport or air base, and to calculate pollutant concentrations in these environments. A timeline of development history of EDMS is given in Figure 1-1.

Figure 1-1: EDMS History.



In the early 1970s, the FAA and the USAF recognized the need to analyze and document air quality conditions at and around airports and air bases. Each agency independently developed computer programs to address this need. The USAF developed the Air Quality Assessment Model and the FAA developed the Airport Vicinity Air Pollution Model (AVAP). These models were used to perform limited air quality assessments in the late 1970s. Recognizing the inefficiency of maintaining two non-EPA approved models, the agencies agreed to cooperate in developing a single system that would have regulatory, operational and economic benefits. The result was the EDMS development effort jointly supported by both agencies and leading to a model listed among the EPA's preferred guideline models.

Emissions modeling in the FAA began with the early Simplex A modeling efforts using the HP-97 calculator. The Simplex A algorithms included calculations for aircraft takeoff plume dispersion. In the 1980s, the model was moved to the Apple II computer and the Simplex A

algorithm was expanded to include dispersion calculations for roadways, parking lots, and power plant sources. The revised and enhanced Simplex A model became known as the Graphical Input Microcomputer Model (GIMM). GIMM was ported to a PC and further enhanced by improvements in processing speed and refinement of the emissions inventory calculations. This enhanced version of GIMM became known as EDMS. In 1997 EDMS was reengineered for Microsoft® Windows™ and included the algorithms from the Environmental Protection Agency (EPA) dispersion models PAL2 and CALINE3. With the release of version 3.0 in 1997, EDMS became the FAA-preferred model for air quality assessment at the airport and air bases. In 2001 EDMS 4.0 was released which marked the transition to EPA's next generation dispersion model AERMOD as the main dispersion engine behind EDMS, and the introduction of aircraft performance data to allow EDMS to estimate the contribution to concentrations from aircraft up to 1,000 feet above the ground.

In 2004, the FAA re-engineered EDMS once again to take advantage of new data & algorithm developments and released the software as EDMS Version 4.2. This version of EDMS allowed users to select the version of EPA's MOBILE model (5a, 5b, or 6.2) to use for on-road vehicle emissions estimation. An interface to EPA's AERMAP terrain processing module was also provided for the first time in this release. AERMOD version 02222 was bundled with the EDMS software and was the most current version of AERMOD available as of September 30, 2004. Incremental releases of EDMS 4.3 in 2005, EDMS 4.4 in 2006, and EDMS 4.5 also in 2006 provided updates to the system data, and updates of EPA models. In particular, EDMS 4.4 contained an upgrade of AERMOD and AERMET to version 04300, which was the first version of AERMOD promulgated by the EPA.

Also in 2004, the FAA embarked on development of its next generation of airport analysis tools, known as the Aviation Environmental Design Tool (AEDT). The development of this toolset is a 6-year effort that will result in the ability to model noise and emissions interdependencies. AEDT is being developed in phases and leverages the investment made in EDMS and the Integrated Noise Model (INM). The first phase of development is complete, which represents a 2 year effort, and harmonizes the underlying system data from both of those models as well as the aircraft performance calculation methods.

EDMS 5 has been given a new architecture and includes over 150,000 new lines of code to support additional enhancements to its capabilities and the evolution toward AEDT. A study can now contain multiple scenarios, multiple airports and span multiple years, with emissions or dispersion being run for all at once. The First Order Approximation (FOA) version 3.0 / 3.0a has been incorporated for estimating PM emissions from jet aircraft. Aircraft fleet data have been harmonized with INM, and a common dynamic flight performance module exists in both tools as well, that accounts for aircraft weight and meteorological conditions. EDMS 5 represents the state of the art for airport emissions modeling and an important step toward the development of AEDT.

1.2 EDMS Requirements and Installation Procedures

1.2.1 Hardware Requirements

The EDMS software runs on a PC with the following *minimum* hardware requirements:

- Intel Pentium 4 processor or compatible operating at 1.3 GHz or greater
- 512 MB RAM (1 GB recommended for dispersion analyses)
- 2 GB free disk space minimum, 10 GB free disk space recommended
- CD-ROM drive

- Mouse or other pointing device

1.2.2 Operating System Requirements

The EDMS software is a 32-bit Windows™ native application, compatible with the following operating systems:

- Microsoft® Windows™ 2000, XP, Vista or 7¹

1.2.3 Installation Procedures

The EDMS software, data files, and example studies are provided on CD-ROM. To install the EDMS software and components:

- Insert the EDMS CD into your CD-ROM drive.
- Run the program Setup.exe on the CD.

The EDMS setup program will then guide you through the installation process. You will have the option of installing the EDMS 5 software files complete with bitmaps, sounds and fonts or installing the software files only. A complete installation (software, bitmaps, sounds and fonts) requires about 700 megabytes of hard drive space. The typical installation (software alone) requires about 60 megabytes of hard drive space. When the installation setup is complete, an EDMS folder will be created with icons to launch the model, the on-line help and the un-installer program for removing EDMS from the system.

1.2.4 A Note for EDMS Users Outside of the United States of America

In order to run dispersion, surface weather data is required in one of the following formats:

- TD-3280
- TD-3505
- CD-144
- HUSWO
- SCRAM
- SAMSON

Surface weather data must be converted to one of those formats to be used in EDMS.

In addition, an early morning upper-air sounding is required in either TD-6201 or FSL format. Typically, these soundings occur at 00:00 GMT and 12:00 GMT, which does not provide a sounding at the necessary time for much of the globe. If an appropriate sounding is not available for your location, the Lakes Environmental Upper Air Estimator (available from www.weblakes.com) may be appropriate. Specific guidance regarding the AERMET data requirements are provided in the AERMET User's Guide, available from www.epa.gov/scram001/7thconf/aermod/aermetugb.pdf.

¹ EDMS functions correctly in a Windows™ Vista/7 environment but EDMS was designed for Windows™ XP. Therefore, when using Windows™ Vista/7, the display of some dialogs and menus which may not have the optimal display configuration.

1.3 System Architecture

1.3.1 Components and Modules

In offering functionality for performing both an emissions inventory and dispersion modeling, EDMS consists of several layers of interaction as depicted in Figure 2-1. This figure is a high level representation of the interaction between different components within the framework of a single integrated environment.

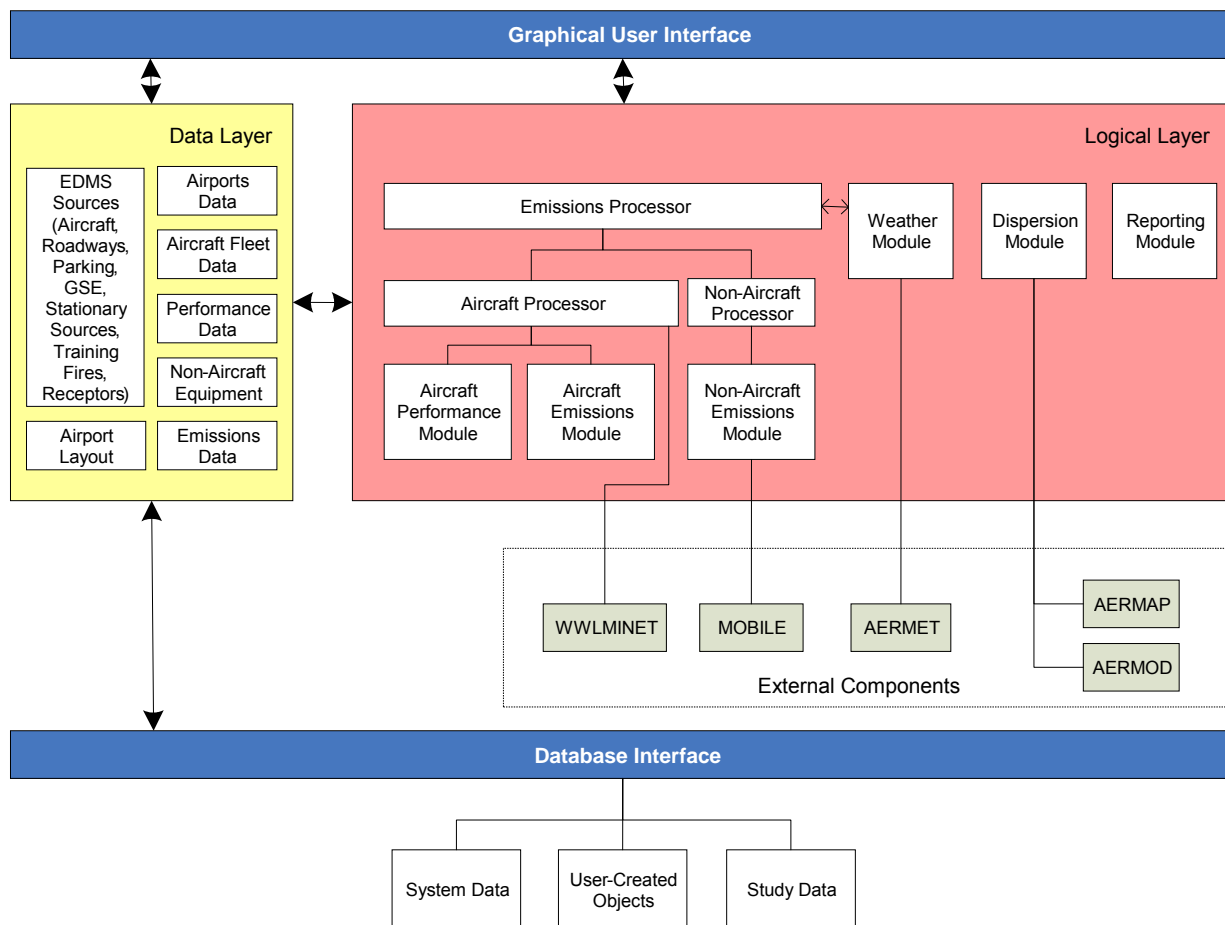
The back-end for both the emissions inventory and dispersion modeling is the database comprising tables for system data and user-created sources. The front-end is the graphical user interface (GUI). The user interacts with the model and the database through the GUI. At the GUI level, the user performs data entry (with parameter validation), executes commands, and receives visual feedback of both data entered and results generated. The middle portion between the GUI and the data tables is the core of the EDMS application, and contains the set of classes and functions that represent each emissions source and dispersion object and its associated properties. This middle layer allows for study and system data to be retrieved from disc and stored in memory while the study is open to enable the user to make changes without those changes immediately altering the original study on disc.

This architecture is typical of current-day multi-tiered applications and allows for modularity of components by separating the database-related functions from the core business logic from the graphical user interface. Providing modularity will prove to be an important benefit as EDMS continues its transition into the AEDT environment in the future.

External interfaces to EDMS are shown below in Table 1-1 and also in a dashed border in Figure 1-2. These programs include: AERMAP (v.06341), AERMET (v.06341), AERMOD (v.09292), and MOBILE (v.6.2), all of which are maintained by the EPA. For all of these programs, inputs are collected through the GUI, passed to the business layer, and sent to the external program for processing. Once the run is complete, the results and associated messages are interpreted by EDMS and displayed to the user.

Table 1-1: External Interfaces & Version Used in EDMS

<i>External Interfaces used in EDMS</i>	<i>Version of Interface</i>
AERMAP	Version 06341
AERMET	Version 06341
AERMOD	Version 09292
MOBILE	Version 6.2
WWLMINET	N/A

Figure 1-2: EDMS System Architecture.

In addition, EDMS contains an Aircraft Performance Module and Aircraft Emissions Module that are common to components in AEDT.

The emissions processor uses a combination of EPA models and best available models from other sources such as CAEP for calculating aircraft emissions, on-road and off-road vehicles emissions, and stationary source emissions. On-road vehicle emissions are calculated by the version of EPA's MOBILE model selected. The dispersion-modeling module generates input for the EPA-developed dispersion model, AERMOD. EDMS offers the flexibility of allowing the user to perform an emissions inventory only or in addition also perform dispersion modeling.

The view modules permit the user to view output, receptor concentrations and system data stored in the database. They also allow the user to view a graphical representation of the various sources in the database. EDMS contains a reporting component for generating emissions inventory results formatted for the printer. Dispersion results and reports are generated by AERMOD.

In addition, the model incorporates utilities for importing and exporting some types of data, and allows the user to add customized aircraft types and ground support equipment to the system database. A detailed description of the algorithms and data used by EDMS can be found in the *EDMS Technical Manual*.

1.3.2 EDMS Modeling Options

EDMS performs two primary functions: generating emissions inventories and performing dispersion analyses. Performing a dispersion analysis requires first generating the emissions inventory for the same set of user inputs.

1.3.2.1 Enabling Dispersion

The first option is whether to enable dispersion. Enabling dispersion forces the selection of several other options in order to provide greater precision and greatly increases the amount of time needed to generate the emissions inventory, and thus should not be selected unless needed.

1.3.2.2 Enabling Speciated Organic Gas (OG) Emissions

The second option is whether to *Enable Speciated Organic Gas (OG) Emissions*. Enabling speciated organic gas emissions causes EDMS to calculate speciated organic gas emissions for all sources except aircraft main engine startup. This option calculates an emission inventory only, and thus speciated organic gas emissions cannot be dispersed at this time with EDMS.

1.3.2.3 Aircraft Times in Mode Basis

“Times in mode” refers to the amount of time an aircraft spends in different portions of a landing-takeoff cycle (LTO). In EDMS an LTO cycle is divided into six phases: approach, taxi in, startup, taxi out, takeoff and climb out. The airborne modes consist of the following portions of the LTO cycle: approach, takeoff and climb out. The landing roll portion of the approach segment is incorporated into the taxi in time. There are two options for determining the times in mode for the aircraft being modeled: *Performance Based* and *ICAO/USEPA Default*. Performance based modeling uses the specific airframe and engine characteristics along with weather data to model each flight dynamically. ICAO/USEPA defaults are standardized values read from a table.

Performance based modeling is required when dispersion is enabled.

1.3.2.4 Aircraft Taxi Time Modeling

The two options for determining taxi times are *User-specified taxi times for each aircraft* and *Delay and Sequence Modeling*. For user-specified taxi times, the user can define defaults for taxi in and taxi out times that apply to each aircraft added to the study. These taxi times can then be changed for each aircraft if necessary. Delay and Sequence modeling takes into account the aircraft operational schedule demands, active runway configurations, and delays associated with airport capacity to model the ground movement of the aircraft and determine specific taxi times for each aircraft operation.

Sequence modeling is required when dispersion is enabled.

1.3.2.5 Aircraft Schedule Options

If the user has a schedule file, which contains the scheduled pushback and landing times for every aircraft, it can be used by EDMS as the basis for sequence modeling, and also to determine the number of operations for each aircraft type. If no schedule file is available, EDMS can generate a “pseudo-schedule” from the annual operations and operational profiles, and use that as the basis for sequence modeling when that is selected.

1.3.2.6 Weather

The options for weather are *Use Annual Averages* and *Use Hourly Meteorological Data*. Regardless of that choice, the user can also set the mixing height to anything from 1,000 to 10,000 feet. The mixing height provides a vertical cutoff for EDMS's modeling of aircraft emissions. Hourly meteorological data must be processed through AERMET.

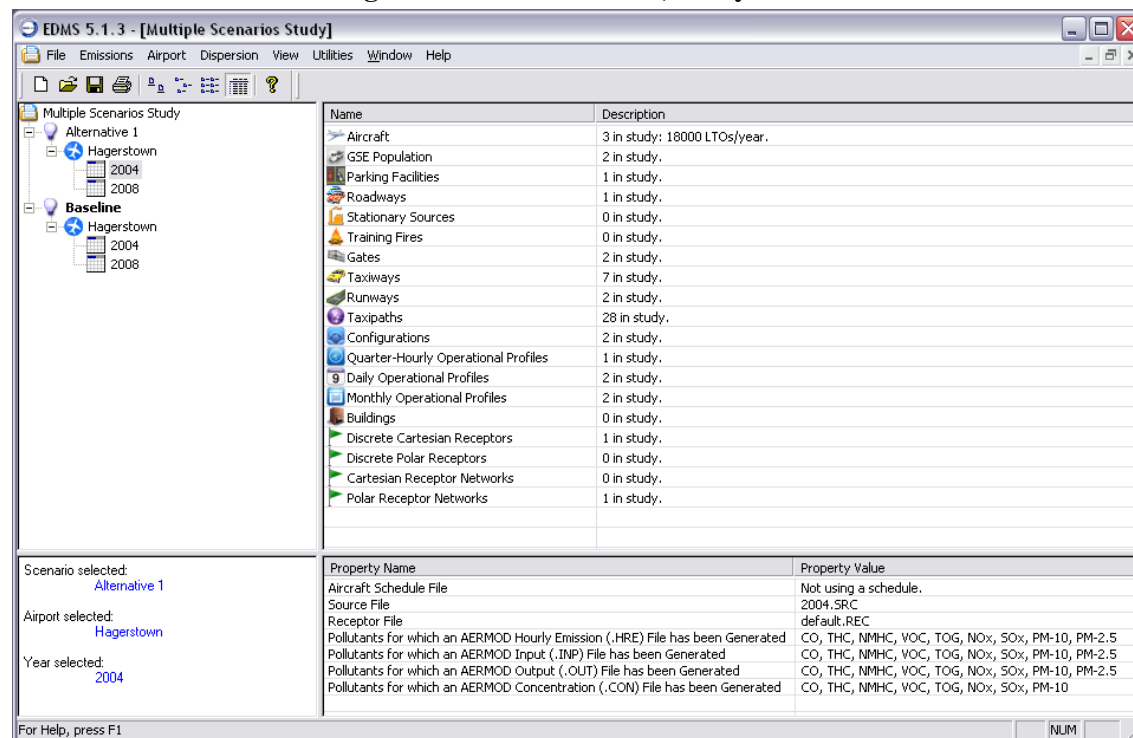
Hourly weather data is required for dispersion.

1.3.3 Structure of an EDMS Study

There are three independent aspects of an EDMS study: the scenarios, the airports and the years. Each study must have at least one scenario, one airport and one year defined. These are arranged in a hierarchical manner to facilitate the design, programming and maintenance of EDMS. Within the study the scenarios are given the highest rank, followed by the airports and finally the years.

As shown in Figure 1-3, in the upper-left pane of the study window is a tree showing the structure of the study. By clicking on a name or the preceding icon, the user can select what is currently active: the whole study, a particular scenario, a scenario-airport combination, or a scenario-airport-year combination. Selecting a lower-level item implicitly means that the higher-level items to which it pertains are also selected. For example, selecting a particular year would give access to the items associated to the airport, scenario and study above it in the tree, as well as all application level functionality. Right-clicking on a name will bring up a menu with some options germane to that item.

Figure 1-3: Main Window, Study Tree.



1.3.3.1 Application Level

User-created Aircraft, *User-created GSE* and *User-created APUs* are defined at the application level, that is, they can be created without having a study open, and once defined they are available to any study created under that installation of EDMS. This essentially permits the user to add custom extensions to the corresponding system tables.

1.3.3.2 Study Level

When the whole study is selected, then the user has access to features and data that apply to the whole study. Accessible features include the options under the *File* menu, *Update Emissions Inventory* under the *Emissions* menu, *Run AERMOD* under the *Dispersion* menu, all options under the *View* menu except the *Airport* option, all options under the *Utilities* menu except *Operational Profiles*, the *Window* menu and *Help* menu. *Update Emissions Inventory* and *Run AERMOD* are run for all scenarios-airport-year combinations where the data have changed since they were last run. Study properties are stored at this level.

1.3.3.3 Scenario Level

This level consists mainly of settings for modeling options such as the choices for the times in mode and taxi times. Users can create several scenarios, representing different modeling options for comparison.

There is no data at this level except the scenario properties, which were already accessible via the *Study Properties* → *Scenarios* → *Scenario Properties* dialog chain at the study level, and hence the available options are the same as on the Study Level. The right-click menu for the scenario name in the study tree provides another path to the same functionality. The scenario and airport are largely independent of each other within the study and only when both are selected does more functionality become available.

1.3.3.4 Airport Level

Only information entered on the *Airport Properties* dialog is tied to the particular airport, and applies across all scenarios for that airport in the study. All other data at this level are associated with the scenario and airport combination. The items that can be defined at this level include weather, gates, taxiways, runways, taxipaths, runway configurations, and the emissions sources that are included. The operational information for each source is not associated with this level, since it can change from year to year. All airport layout definitions such as runways apply to only the specific scenario and airport combination. To model variations in airport layout, the user can create multiple scenarios with one airport, or have multiple instances of the same airport under a single scenario, with a separate layout for each scenario-airport combination.

At the airport level more menu options are available; however there are instances where some portion of a dialog is disabled, because the information is specific to a particular year, primarily operational usage data. The menu items accessible at this level include the *Airport* menu, the *Airport* option under the *View* menu, and the *Operational Profiles* option of the *Utilities* menu.

1.3.3.5 Year Level

This level is the lowest and most detailed level, and contains information that varies for each year. Operational usage data (such as number of operations and the duration of each operation) for emissions sources is associated with this level, so it can only be entered when a particular

year is selected. At the year level there are no restrictions on menus or dialog due to the selected level.

1.3.4 Working with an EDMS Study

When setting up a study, it is usual for the user to first choose the study properties, and then define the airports to be used followed by the scenarios. However, if comparing different, but similar, airport layouts, say for instance because of a contemplated runway addition or extension, the user could first define all the airport features in the baseline scenario, and then use the duplicate scenario option (available by right-clicking the scenario name in the study tree), which will copy all of the already defined airport features, emissions sources and scenario options into a new scenario.

Study properties such as *Unit System* apply to the whole study. For example, selecting *Metric* units will cause all fields on all dialogs and views to display and/or accept metric units.

Under the scenario properties, *System Aircraft Times in Mode Basis* and *Taxi Time Modeling Options* alter the method used to compute those parameters within that scenario.

The selection of certain options within the study can also affect the availability of options in other parts of EDMS. The most significant of these restrictions are the enabling of dispersion and the selection of sequence modeling vs. using default taxi times, which are discussed below.

1.3.4.1 Dispersion Related Restrictions

Dispersion is enabled or disabled by checking or unchecking, respectively, the *Enable Dispersion Modeling* checkbox on the *Study Properties* dialog.

In order to perform dispersion modeling, EDMS has to know both when and where any emissions took place. This requires that performance-based aircraft modeling (for airborne movement) and sequence modeling (for taxiing) be used. So if dispersion is enabled, then on the *Scenario Properties* dialog, under *System Aircraft Times in Mode Basis*, *Performance Based* will be required while the *ICAO/USEPA Default Times in Mode* will be disabled, and under *Taxi Time Modeling Options*, *Sequence Modeling* will be required, while the *User-specified taxi times for each aircraft* option will be disabled. Consequently, requirements related to sequence modeling (described in the next section) will always be in effect when dispersion is enabled.

Buildings are not considered to have emissions, but can affect airflow for dispersion. So the *Buildings* option under the *Airport* menu is disabled when dispersion is not enabled. The *Dispersion* menu and the *Concentrations* option under the *View* menu are also available only when dispersion is enabled.

Dispersion also requires the use of hourly meteorological data. The *Weather* wizard, activated under the *Airport* menu, has options of *Use Annual Averages* and *Use Hourly Meteorological Data*. *Use Annual Averages* is disabled when dispersion is enabled.

1.3.4.2 Sequence Modeling Requirements

Sequence modeling is one of the *Taxi Time Modeling Options* on the *Scenario Properties* dialog, and is required for dispersion, but can also be used for emissions inventories if a detailed modeling of taxi emissions is desired. To use sequence modeling, the user must define the gates, taxiways, runways, taxipaths, and runway configurations for the airport. Default taxi times are not used with sequence modeling and that menu item is not available under the *Airport* menu.

If instead, *User-specified taxi times for each aircraft* has been selected, the airport features are not needed and the associated menu items under the *Airport* menu will be grayed out, but *Default Taxi Times* will be enabled.

1.3.5 EDMS Screen Layout

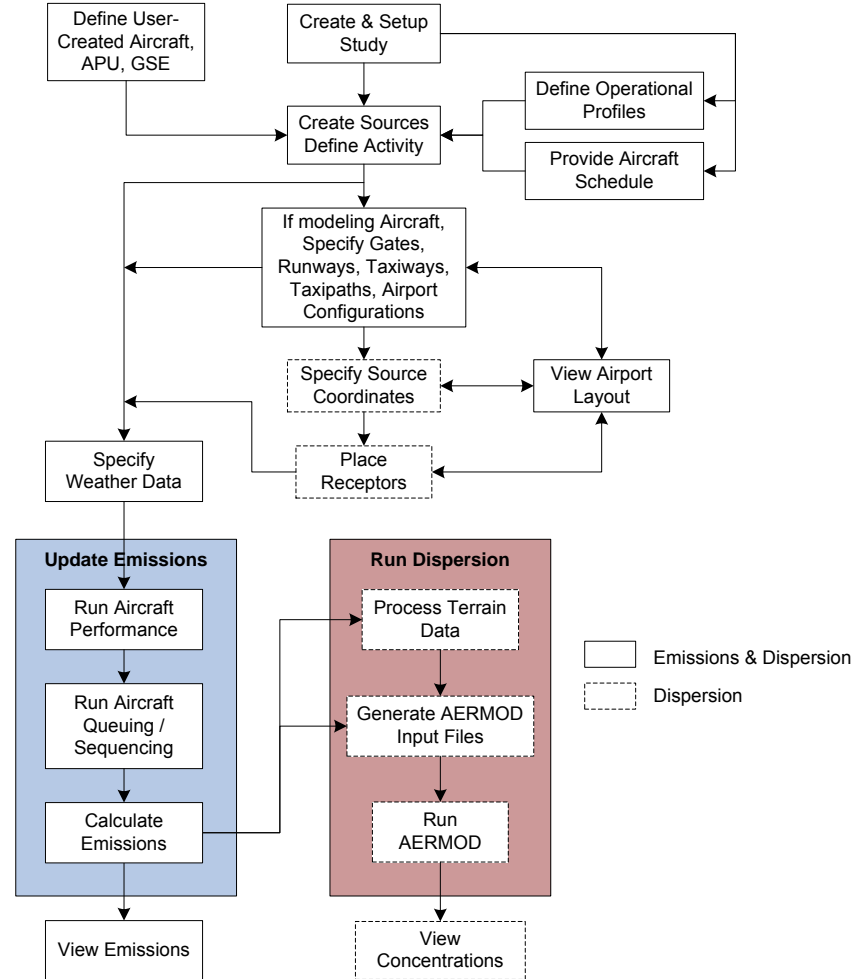
As shown in Figure 1-3, the main study window is divided into four panes.

1. The upper-left pane holds an interactive tree which depicts the study structure of scenarios, airports and years (described above) of the currently open study. Selecting a node in this tree updates the other three panes. The selected node also determines which dataset the dialog screens are currently editing. Right-clicking a node provides pertinent menu options.
2. The lower-left pane displays the scenario, airport, and year which are currently selected. These correspond to the node currently selected in the upper-left pane.
3. The upper-right pane lists the contents of the tree node selected in the upper-left pane. Double-clicking on a scenario, airport or year updates the currently selected node in the upper-left pane.
4. The lower-right pane lists the properties of the tree node selected in the upper-left pane. The information shown cannot be edited directly in the pane as it is displayed for user-reference only.

1.3.6 Functional Flow - Emissions

Overall, the fundamental usage of EDMS is to first perform an emissions inventory, after which the user can chose to continue to model the dispersion of the emitted pollutants calculated. As shown in Figure 1-4, to perform an emissions inventory the user would follow the following steps:

1. Set up the study by adding scenarios and airports, and choose which modeling options to use.
2. Define all emissions sources, including operational usage.
3. Define the airport layout if sequence modeling was selected.
4. Select a weather option: annual average or hourly (requires running AERMET).
5. Select *Update Emissions Inventory*.

Figure 1-4: EDMS Functional Flow

The simplest way to generate an emissions inventory and obtain a course estimate of the total annual emissions is to perform the first two steps, and use the ICAO/EPA default times in mode along with the default operational profiles, and the annual average weather from the EDMS airports database. Doing so would only consider the total number of operations for the entire year without regard to when those operations occurred.

If a more precise modeling of the aircraft taxi times using the Sequencing module is desired (required if dispersion will be performed), then the user must define the airport gates, taxiways, runways, taxipaths (how the taxiways and runways are used) and configurations (weather-dependent runway usage). The resulting emissions values can be viewed by selecting *Emissions Inventory* on the *View* menu. These results can be printed by selecting *Print* under the *File* menu while viewing the emissions inventory.

1.3.7 Functional Flow - Dispersion

To run a dispersion analysis, the user must first generate an emissions inventory while dispersion is enabled. Because of this, the methodology used for generating the emissions inventory is also the same one used to calculate the emissions for dispersion purposes. This inventory will take many times longer than the same one without dispersion enabled, because EDMS must generate (.HRE) files which contain all of the emissions broken into hourly bins by source and the (.SRC)

files that define all the sources. Also, enabling dispersion forces the selection of *Performance Based* times in mode, *Sequence Modeling* and hourly meteorological data.

In addition, to run dispersion the user must define receptors, which are points at which the concentration of pollutants will be computed.

Next, the user can optionally run AERMAP, which will adjust the elevations of all emissions sources and receptors to the terrain data supplied. This will override any user-defined elevations that had been entered.

Next, the user must specify the AERMOD run options and generate the AERMOD input (.INP) files.

And finally, the user runs AERMOD within the EDMS GUI to generate the concentrations at the receptors.

The resulting concentrations can be viewed by selecting *Concentrations* under the *View* menu. These results can be printed by selecting *Print* under the *File* menu while viewing the concentrations.

1.3.8 Features and Limitations

EDMS incorporates both EPA-approved emissions inventory methodologies and dispersion models to ensure that analyses performed with the application conform to EPA guidelines. Since EDMS is primarily used in the process of complying with EPA air quality requirements (e.g. through an environmental impact statement) it is imperative that the application uses the most current data available. For this reason, it is the FAA's intention for the database to contain a comprehensive list of aircraft engines, ground support equipment, aerospace ground equipment, auxiliary power units, vehicular, and stationary source emission factor data. However, there may be cases where the database does not contain a specific data element (e.g. a newly available emission factor). In these cases, EDMS tries to make allowances for the user to enter their own data and will perform parameter validation where possible. The pollutants currently included in the emissions inventory are CO₂, CO, THC, NMHC, VOC, TOG, NO_x, SO_x, PM_{2.5}, PM₁₀, and 394 speciated organic gases. CO₂ is calculated only for aircraft, and THC is calculated only for aircraft and APUs. Aircraft PM emissions are only available for aircraft with ICAO certified engines. EDMS does not compute PM emissions due to tire/brake wear. From the 394 speciated organic gases, 45 of them are considered to be Hazardous Air Pollutants (HAPs), while the other 349 are non-toxic compounds. Please refer to Appendix D for a more detailed list of the speciated organic gases by source.

EDMS performs dispersion analysis by generating input to EPA's AERMOD dispersion model, and provides an interface to the complex terrain module of AERMOD. To use this function, the user can run AERMAP (the AERMOD terrain pre-processor) as a part of EDMS. The pollutants currently included in EDMS for dispersion analysis are CO, THC, NMHC, VOC, TOG, NO_x, SO_x, PM_{2.5} and PM₁₀. Concentrations of the included pollutants are generated for comparison with all the Primary NAAQS and most of the Secondary NAAQS.

2 EMISSIONS CALCULATIONS

An emissions inventory is a summary of the total annual emissions of the modeled pollutants for the sources defined in a study. Depending on the purpose of the study, the emissions inventory may be an end in itself or an intermediate step towards performing a dispersion analysis.

2.1 Emission Inventory Pollutants

EDMS calculates emissions of the following pollutants:

1. **CO₂** (carbon dioxide) for aircraft only,
2. **CO** (carbon monoxide),
3. **THC** (total hydrocarbons) for aircraft and APUs only,
4. **NMHC** (non-methane hydrocarbons),
5. **VOC** (volatile organic compounds),
6. **TOG** (total organic compounds),
7. **NO_x** (nitrogen oxides),
8. **SO_x** (sulfur oxides),
9. **PM₁₀** (particulate matter, 10 microns)
10. **PM_{2.5}** (particulate matter, 2.5 microns), and
11. **394 Speciated Organic Gases**
 - a. 45 Hazardous Air Pollutants (HAPs)
 - b. 349 non-toxic compounds

Note: Aircraft PM emissions are only estimated for aircraft with ICAO certified engines using the FOA3/FOA3a methodology. EDMS does not compute PM emissions due to tire/brake wear.

2.1.1 OG Speciation Profiles

Speciation profiles (in the form of mass fractions of TOG) are used to estimate quantities of individual OGs based on estimates of the amount of mass OG. With respect to gas-phase OG, speciation profiles provide estimates of the quantity of an individual OG based on mass emissions of total HC (THC), non-methane HC (NMHC), total organic gases (TOG), and volatile organic compounds (VOC). Each of these “groups” of OG are discussed briefly below:

- **THC** – Organic compounds that comprise the OG species in exhaust, as measured by a flame ionization detector (FID) per the International Civil Aviation Organization’s (ICAO’s) Annex 16.² Notably, a FID does not measure all of the mass of oxygenated OGs. THC emissions are presented in terms of methane equivalency.
- **NMHC** - The most common OG is methane, a greenhouse gas that is sometimes excluded from the analysis of other VOCs. NMHC emissions are presented in terms of its own mass (NMHC as NMHC).
- **TOG** – As defined by CARB, TOGs are compounds of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. TOG includes all organic gas compounds emitted to the atmosphere, including the low

² ICAO’s Annex 16 addresses protection of the environment from the effect of aircraft noise and aircraft engine emissions.

reactivity compounds (e.g., methane, ethane, various chlorinated fluorocarbons, acetone, perchloroethylene, volatile methyl siloxanes, and oxygenated OGs). TOG emissions are presented in terms of its own mass (TOG as TOG).

- VOC – Defined as any compound of carbon that participates in atmospheric photochemical reactions, which is exhaust TOG corrected to exclude the mass of methane, ethane, and acetone and to fully account for the mass of formaldehyde and acetaldehyde [U.S. EPA 2007].³ VOC also excludes carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate. VOC emissions are presented in terms of its own mass (VOC as VOC).

2.1.2 Speciated Organic Gases

EDMS calculates emissions for 394 speciated organic gases. From the 394 speciated organic gases (OG), 45 are considered to be Hazardous Air Pollutants (HAPs) while the other 349 are non-toxic compounds.

2.1.2.1 Background Information

In 2003, the FAA Office of Environment and Energy (AEE) undertook an assessment of what was already known about speciated OG at airports, in general, and aircraft-related speciated OG. This initial body of work (referred to as the *FAA Resource Document for HAPs*) focused on HAPs and was prepared in response to the rising interest by various federal, state and local governmental agencies and the general public in connection with the emerging topic of these pollutants. The need for a more unified approach and technical guidelines for evaluating speciated OG emissions for airport-related sources was among the FAA's recommendations from this effort.

2.1.2.2 Additional FAA Guidelines and Other Resources

Documents, guidelines and resources developed by the FAA also give further support to the assessment of airport air quality issues and may be applicable to evaluations of airport-related speciated gas-phase OG. These documents include the FAA's *Airport Environmental Handbook*, *Air Quality Procedures for Civilian Airports and Air Force Bases* (and its Addendum). Abstracts of these materials are provided below.

- *FAA Resource Document for HAPs* [FAA, 2003]. This document provides a compilation of what was known about airport- and aircraft-related HAPs from the public materials that were available in the year 2003¹. Presented both as a narrative summary and assembled in an annotated bibliography, these materials cover a broad range of information related to this subject. Topics include HAP emission types and sources, agency regulations, air monitoring data and other supporting information.
- *NEPA Implementing Instructions for Airport Actions* (FAA Order 5050.4B) and *Environmental Impacts: Policies and Procedures* (FAA Order 1050.1E, Change 1) [FAA, 2006]. These two documents provide guidelines for the preparation of Environmental Assessments (EA), Environmental Impact Statements (EIS) and other similar reviews for airport projects or actions required under NEPA. Under the topic of air quality, these

³ Per the EPA definition of VOC at http://www.epa.gov/ttn/naaqs/ozone/ozonetech/def_voc.htm

guidelines address the criteria air pollutants and the federal CAA General Conformity Rule. The topic of HAPs is briefly addressed in Order 1050.1E and 5050.4B).

- *Air Quality Procedures for Civilian Airports and Air Force Bases* and its *Addendum* [FAA, 1997 and 2004]. Referred to as the “*Air Quality Handbook*”, this document provides guidance on conducting air quality impact assessments for airport projects and actions required under NEPA and the federal CAA. Contains comprehensive and detailed methodologies on preparing emission inventories and conducting dispersion modeling of airport-related criteria pollutants. Although HAPs are not specifically addressed, the technical guidance and procedures provided are applicable to the assessment of OG and PM: the two primary classes of HAPs.
- *Aircraft and Airport-Related Hazardous Air Pollutants: Research Needs and Analysis*, [Transportation Research Board, 2008]. Provides guidance on the most important projects to the airport community for ACRP consideration in the area of HAPs. This report examines the state of the latest research on aviation related HAP emissions and identified knowledge gaps that existing research has not yet bridged.
- *Recommended Best Practice For Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines*, [FAA and EPA, May, 2009]. This Recommended Best Practice was produced through an inter-agency partnership and provides an approach to, and technical support for, the quantification of organic gases from this source.
- *Guidance For Quantifying Speciated Organic Gas Emissions From Airport Sources*, [FAA, September, 2009]. This document provides an approach to, and technical guidance for, preparing speciated OG/HAP emission inventories in support of environmental documents prepared by, or on behalf of, the FAA under the National Environmental Policy Act (NEPA).

2.1.2.3 Considerations and Limitations Associated With the Evaluation of Airport-Related Speciated Organic Gases

- There are no Federal regulatory guidelines that specifically address any individual OG from airports - By definition, neither airports, in general (nor aircraft) are subject to the regulations of Section 112 (*Hazardous Air Pollutants*) of the CAA. Moreover, there are no regulatory guidelines on either the federal or state levels that identify when, or under what conditions, the evaluation of speciated OG (and in particular HAPs) from these sources is required nor do they define the type and extent of the analysis.
- Emission inventory results are estimates and are not directly comparable to regulatory standards or other acceptable criteria. – For disclosure and/or comparative purposes, an emission inventory provides a useful estimate of the quantity of a specific OG. However, by itself, the results of an emission inventory are not comparable to any enforceable measures of acceptability.

2.1.2.4 EPA-Identified HAPs and Toxic Compounds

Originally, under Section 112 (*Hazardous Air Pollutants*) of the federal CAA, the EPA classified 188 air pollutants as HAPs. The EPA later modified the list to identify only 187 HAPs (in 2005,

the EPA removed methyl ethyl ketone from the list). The OG species on the EPA's list include a wide variety of compounds for which there are no NAAQS.

The EPA also maintains a database of information regarding the human health effects that could result from exposure to various substances. The Integrated Risk Information System (IRIS) contains both descriptive and quantitative information regarding the cancer and non-cancer effects of certain compounds.

A list of the airport-related OG species that EPA identifies as HAPs and/or those included in the IRIS database is provided in Appendix D. This list also identifies the airport-related source(s) from which each OG species is emitted.

2.2 Data Input Overview

The *Study Properties* window allows the user to specify whether the current study will be used to generate only an emissions inventory (*Enable Dispersion Modeling* not checked), or an emissions inventory and a dispersion analysis (*Enable Dispersion Modeling* checked). If dispersion is not enabled, then only the inputs required for conducting an emissions inventory will be editable on each of the windows, but more modeling options will be available since there are fewer restrictions. On this same window is a function to generate emissions for speciated OGs (*Enable Speciated Organic Gas (OG) Emissions* checked).

To enter data for a specific type of source (e.g. aircraft, stationary sources, etc.), click on the scenario, airport, and year combination on the study tree view and select the appropriate source type from the *Emissions* menu. The menu options are described in more detail in (Chapter 6).

The parameter values for individual records are displayed by selecting the record in the *In Study* list box. These values may then be modified. Changes made to a record are remembered while accessing a different record, but changes are not applied unless the *Apply* button is pressed. Exiting a window without pressing *Apply* will result in all changes being discarded. Parameter validation is built into the interface, so in the event of an invalid entry, a pop-up window will be displayed that indicates the range of acceptable values.

Two similar parameters found in all of the emissions sources windows are *Yearly* and *Peak Quarter Hour* activity. For most emissions inventory cases, the analyst would obtain annual activity numbers. However, if the activity at the peak quarter hour is the only known variable then the user would create a set of operational profiles, under the *File* menu, that accurately represent the distribution of this activity over an entire year. Upon entering the value for *Peak Quarter Hour* and choosing the appropriate *Quarter Hourly*, *Daily*, and *Monthly* operational profiles, EDMS automatically computes a corresponding *Yearly* value. The following sections describe the emissions inputs required for aircraft activity, ground support equipment (GSE) populations, vehicles on roadways, vehicles in parking facilities, stationary sources, and training fires.

2.3 Aircraft Activity

Aircraft activity is specified by adding records in the *Aircraft Operations and Assignments* window found under the *Emissions* menu heading. To specify aircraft to be included in the study, choose an aircraft type and engine type from the *Available Aircraft/Engine* tree and *Add* it to the *In Study* list box.

EDMS models aircraft activity with 6 modes of operation corresponding to the following portions of a Landing-Takeoff (LTO) cycle. These modes of operation only apply to the aircraft main engines; APU emissions are calculated and presented separately.

1. Approach: The airborne segment of an aircraft's arrival extending from the start of the flight profile (or the mixing height, whichever is lower) to touchdown on the runway.
2. Taxi In: The landing ground roll segment (from touchdown to the runway exit) of an arriving aircraft, including reverse thrust, and the taxiing from the runway exit to a gate.
3. Startup: Aircraft main engine startup occurs at the gate. This methodology is only applied to aircraft with ICAO certified engines. All other aircraft will not have startup emissions. Aircraft main engine startup produces only THC, VOC, NMHC, and TOG emissions. A detailed speciated organic gases profile does not exist for main engine startup emissions.
4. Taxi Out: The taxiing from the gate to a runway end.
5. Takeoff: The portion from the start of the ground roll on the runway, through wheels off, and the airborne portion of the ascent up to cutback during which the aircraft operates at maximum thrust.
6. Climb Out: The portion from engine cutback to the end of the flight profile (or the mixing height, whichever is lower).

Each aircraft activity is expressed as an Arrival, a Departure, an LTO cycle, or a Touch and Go (TGO), and each type consists of different modes of operation. An Arrival consists of the Approach and Taxi In modes. A Departure consists of the Startup, Taxi Out, Takeoff, and Climb out modes. An LTO cycle consists of an Arrival and a Departure, and therefore consists of one of each of the six modes of operation. A TGO consists of the Approach mode, followed immediately by the Takeoff and Climb out modes. TGO operations are generally performed for training purposes, usually occur at military bases or smaller civilian airports, and generally have a flight profile that starts and ends at a much lower altitude than a regular LTO cycle.

EDMS offers two ways of calculating the amount of emissions released in the airborne segments and approach ground roll:

1. Using the International Civil Aviation Organization (ICAO) and Environmental Protection Agency (EPA) Times in Mode (TIM) found in a table, or
2. Using the aircraft performance module, which dynamically models the flight of the aircraft, based a flight profile using the methodology presented in the Society of Automotive Engineers (SAE) Aerospace Information Report (AIR) 1845.

The user selects the methodology, in the *Scenario Properties* window, to be applied to all aircraft in the system database.

NOTE: The dynamic aircraft performance-based modeling option should always be used in airport analyses conducted for FAA approval unless prior authorization is obtained from the FAA's Office of Environment and Energy.

The ICAO/EPA TIMs are based on broad aircraft categories and provide more generalized times spent in each of four modes: Approach, Idle, Takeoff, and Climb Out. The emissions determined from these four ICAO modes are allocated to the various EDMS modes of operation as follows:

the ICAO Approach, Takeoff, and Climb Out modes are allocated to the EDMS Approach, Takeoff, and Climb Out modes of operation, respectively, while the ICAO Idle mode is broken down into the EDMS Taxi In and Taxi Out modes of operation. The ICAO TIMs have no flight profiles associated with them, and they only determine the amount of time that an aircraft spends in each mode, not its position. Because there is no spatial information on the release of emissions when using the ICAO TIMs, this modeling option is not allowed when dispersion is enabled. Instead, use of the performance-based methodology is required when dispersion is enabled.

The dynamic aircraft performance module provides more precise and accurate modeling of aircraft performance by taking into account the aircraft type, engine, weight, approach angle to be flown (for arrivals), elevation and weather (atmospherics). Using hourly meteorological weather data, variations in the thrust used (and emissions released) for the same aircraft can be observed at different times of the day and at different airports due to the changing weather conditions. When user-created aircraft are added to a study, the user can enter aircraft-specific times for the takeoff, climb out, approach and landing idle modes or assign a flight profile from a similar aircraft in the system table.

For the EDMS Taxi In and Taxi Out modes of operation, the taxi times can either be user-specified or generated by the sequencing model. The latter is required when dispersion is enabled.

Mixing heights less than 1,000 feet are not allowed in EDMS. The default approach and climb out times in mode of both system aircraft using ICAO/EPA TIMs and user-created aircraft are based on a mixing height of 3,000 feet but are adjusted to reflect the user-specified local mixing height. When the mixing height in the *Weather* window is modified, the times-in-mode for all aircraft are automatically adjusted.

Mixing heights in EDMS are specified in terms of the runway elevation from which each aircraft departs/lands, so it is in terms of AGL (different runways can have different elevation). For dispersion, all sources are constructed based on AGL, either by user-specified source elevations or using terrain elevation (AERMAP).

Aircraft engines are the actual source of emissions for aircraft. EDMS treats each aircraft as a combination of a specific aircraft type and engine type. For each aircraft type there may be several different engine types available for use and emission factors may vary from engine to engine. Consequently, different aircraft may generate identical emissions because they are equipped with identical engines, or older aircraft may be outfitted with technologically newer engines and generate fewer emissions. Default engines (displayed in bold) represent an actual engine type which is the most common or the most widely used engine type for that particular aircraft type in the United States, Europe or worldwide fleet based on recent data extracted from the BACK aviation database. More information on the data used to determine the default engines is available from www.backaviation.com.

In each of the modes, the engines operate at correspondingly different power settings. The power settings determine the rate at which fuel is burned which, in turn, determines the quantity and nature of emissions released into the atmosphere.

For most engines the emission factor data was obtained from the ICAO Aircraft Engine Exhaust Databank, a publicly available database that can be downloaded from <http://www.caa.co.uk/default.aspx?catid=702>. The data is supplemented using data from QinetiQ (www.qinetiq.com), engine emissions data provided directly from the manufacturers and, for older aircraft, data contained in EPA's AP-42, Part II, Section 1.

2.3.1 Aircraft Operations & Schedule

Operational information for aircraft can be entered in one of two ways: (a) by specifying the number of annual operations or peak quarter-hour operations for each aircraft, along with operational profiles showing the relative activity by quarter-hour, day-of-the-week and month, or (b) by specifying a schedule of operations. In the first method, peak quarter-hour operations are converted into a pseudo-schedule using the selected operational profiles. From that point on, both methods are essentially the same.

2.3.2 Taxi Times and Sequence Modeling

In the *Scenario Properties* window, there are two options for determining the amount of time an aircraft spends taxiing: *User-specified taxi times for each aircraft* and *Sequence Modeling*. With user-specified taxi times, the user can define defaults for taxi in and taxi out times that apply to each aircraft added to the study. These taxi times can then be changed for each aircraft as desired. However, because these user-specified taxi times do not have any information on the location at which the taxiing occurs, this modeling option is not allowed when dispersion is enabled. Instead, the Sequence modeling option is required in order to provide the spatial taxiing information.

Sequence modeling in affect performs a simulation to dynamically determine the taxi times, and is required for dispersion, but can also be used for emissions inventories. To use sequence modeling, the user must define the gates, taxiways, runways, taxipaths, and runway configurations for the airport.

The Sequence module determines the active runway configuration that is used at each hour of the year based on meteorological information and the user-specified activation parameters in order to determine the associated airport capacity at each hour of the year. This airport capacity information along with demand information from the aircraft operational profiles or schedule is provided to the WWLMINET delay model to determine the airport throughput. EDMS then adjusts the estimated gate push-back time (for departures) and estimated touchdown time (for arrivals) into actual times that are possibly delayed.

The Sequencing module models the movement of aircraft along the taxiways (as prescribed by the taxipaths) between runways and gates for both arriving and departing aircraft. In addition, modeling of taxi queuing is then done for departing flights, but not arriving aircraft, which are assumed to have unimpeded taxi in to their gate. The departure aircraft are sequenced in the proper order to provide the duration that each aircraft spends on each taxiway segment. The aircraft form queues along the taxiways that feed into the corresponding runway-ends. This detailed modeling of the usage of individual taxiway segments during taxi in and taxi out provides a more realistic modeling of airside operations for both emissions inventory and dispersion purposes.

2.4 Ground Support Equipment (GSE) and Auxiliary Power Units (APUs)

Emissions are generated by ground support vehicles and auxiliary power units (APUs) while the aircraft is parked at the gate. The following sections cover Ground Support Equipment (GSE) and auxiliary power units (APUs). GSE can be modeled both by assignment to an aircraft and by population. GSE that are assigned to an aircraft will have their operations depend on the activity of that aircraft. GSE that are modeled as a population operate independently from aircraft

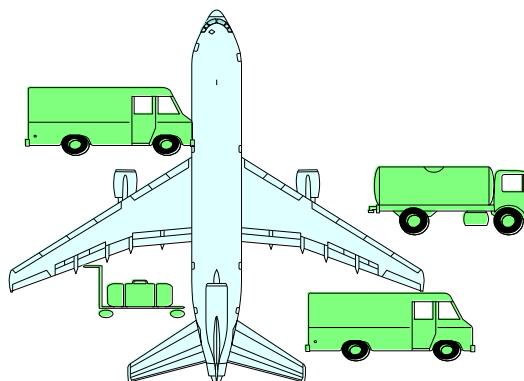
activity. Since APUs are onboard the aircraft, they are always modeled based on an aircraft's activity.

GSE emission factors used by EDMS are derived from EPA's NONROAD2005 model and are based on the following variables: fuel, brake horsepower and load factor. In addition, a deterioration factor is applied based on the age of the engine. GSE emission factors are given in grams per horsepower-hour. EDMS allows users to select the EPA-derived national fleet average age for a particular vehicle type, or to specify the exact age of an individual piece of equipment.

2.4.1 GSE Assigned to Aircraft

Upon arrival at a gate, aircraft are met by GSE to unload baggage and service the lavatory and cabin. While an aircraft is parked at a gate, mobile generators and air conditioning units may be in operation to provide electricity and conditioned air. Prior to aircraft departure, GSE are present to load baggage, food and fuel. When an aircraft departs from a gate, a tug may be used to push or tow the aircraft away from the gate and to the taxiway. Figure 2-1 depicts aircraft and GSE activity at the gate.

Figure 2-1. Aircraft with GSE.



GSE that are assigned to an aircraft are given times (minutes per arrival, minutes per departure) based upon the type of service. For example, a fuel truck servicing a large commercial aircraft will have a different operating time than the same fuel truck servicing a commuter aircraft. Tugs are generally used to move commercial aircraft away from the gates, but are typically not used by general aviation (GA) aircraft.

As system aircraft are added to the study, default GSE assignments are made for each newly added aircraft. Default assumptions are used in EDMS, but the user also has the flexibility to add and remove GSE to and from aircraft and modify the operating times as well as other parameters for assigned GSE. These default assignments are based upon several categories of aircraft types (e.g., wide body jets, cargo planes, commuter aircraft, general aviation, military jets, military transports, business jets, etc.).

If site-specific information is available for GSE (assignments and operational times), it is recommended that this data be used in place of the default values. If the aircraft type is removed from the study, all the GSE assigned to it will also be removed from the study. To modify the assignment and/or the operating times of these sources; select the *GSE & Gate Assignment* tab on the *Aircraft Operations & Assignments* window.

GSE emissions generated per LTO cycle (or arrival or departure) are the product of the emission factor, horsepower, load factor and operating time. For annual emissions this result is multiplied

by the number of yearly LTO cycles (or arrivals and departures) for the aircraft to which the equipment is assigned. GSE emissions are not calculated for TGO operations.

2.4.2 GSE Populations

For a population of GSE, the annual GSE emissions are the product of the emission factor for the given pollutant, horsepower, load factor, annual usage and population. The analyst can either select "*Use default age distribution*", which will cause GSE to be modeled with the national average GSE emission factors that were developed by the U.S. EPA using NONROAD2005, or can select "*Specify a specific age*", which will apply the NONROAD2005 emission factors for a specific vehicle. In the latter case, the fuel, the horsepower and the year of manufacture determine the zero-hour emission factor and the age and GSE type determine the deterioration to be applied.

2.4.3 Auxiliary Power Units (APU)

Auxiliary power units (APUs) are most often on-board generators that provide electrical power to the aircraft while its engines are shut down. Some pilots start the on-board APU while taxiing to the gate but, for the most part, it is started when the aircraft reaches the gate. The on-board APU is, in effect, a small jet engine and the calculations for the emissions generated by it are similar to that of an aircraft engine operating in one power setting only. The methodology for calculating emissions from APUs is adapted from the U.S. *EPA's Procedures for Emission Inventory Preparation, Volume IV*, Chapter 5, which can be found at www.epa.gov/otaq/invntory.htm. Like GSE, APU emissions generated per LTO cycle are the product of the emission factor and operating time, multiplied by the number of applicable aircraft LTO cycles. APU emissions for arrivals and departures are computed in a like manner, when those are treated separately. For the purpose of emissions calculations, APUs are assigned to the same category as GSE. External APUs used by an aircraft fall into the category of ground support equipment. In the absence of an APU or applicable GSE, a combination of 400 Hz electric power and preconditioned air (PCA) can be supplied to the aircraft using a fixed system at each gate to allow for normal operation. Fixed systems usually generate little or no emissions at the airport and are not included in EDMS. APU emissions are not calculated for TGO operations.

2.5 On-Road Vehicles

Motor vehicle activity on roadways is specified in the *Roadways* window under the *Emissions* menu heading. The *Traffic Volume (Yearly or Per Peak Quarter Hour)* refers to the number of vehicle traversals (one-way trips) on the roadway. The average speed (in mph) of vehicles traveling on the roadway (*Average Speed*) is one of the parameters necessary to determine a MOBILE 6.2 emission factor (grams/vehicle-mile) for the movement of the vehicles. The other three parameters are *Manufactured Year*, elevation (*Height*), and the average daily high and low temperatures, which come from the airport's weather data. Additionally, MOBILE 6.2 allows the user to choose between the default fleet mix and one of the 16 vehicle types. Selection of a specific vehicle type will cause EDMS to assume that the roadway is used only by vehicles of the specified type.

The *Roadway Length* field is used exclusively for emissions inventory purposes to determine the total amounts of pollutants generated by vehicles traveling the length of the roadway on their

way to and from the airport. Specify the total distance (in units set on the *Study Properties* window) a vehicle would be expected to travel along the selected roadway. For a dispersion analysis, the *Roadway Length* is computed from the coordinates of the points that define the roadway, and is not editable. Access to the roadway emission factors for the active record both for viewing and editing purposes are on the lower right corner of the window. The total emissions for a roadway are the product of the emission factors (given in grams per vehicle-mile), the annual *Traffic Volume*, and the *Roadway Length*.

Important: Unlike EDMS 4.x, EDMS 5 does NOT assume that vehicles travel “round-trip” (i.e. does not assume that each vehicle traverses a roadway once in each direction). So to indicate the round-trip passage of 100,000 vehicles, a yearly Traffic Volume of 200,000 should be entered.

Vehicular emission factors contained in EDMS are obtained from the EPA's MOBILE 6.2. To accommodate changing and/or varying regulations or the need for a more detailed analysis, the user has the option of entering their own vehicular emission factor data. Frequently, the user would obtain this emission factor data by running MOBILE with customized input.

Once the user has provided EDMS with the analysis year, temperature, elevation, vehicle speed and class, MOBILE will run using the default settings. The control flag settings used by EDMS for MOBILE 6.2 are summarized in (Table 2-1). *The EDMS Technical Manual* contains additional information about how EDMS models on-road vehicle emissions along with instructions on viewing the MOBILE input file generated by EDMS and the output received from MOBILE in return. Users should run MOBILE outside of EDMS, if they find that these defaults are not appropriate for their airport.

Table 2-1: MOBILE 6.2 Control Flag Settings.

Control Flag	Value(s)
Gasoline fuel Reid Vapor Pressure (RVP)	Adjusted to fit within the 7 to 9 psi range that is being used to model the default summer months.
Diesel Sulfur	500 ppm for study years prior to 2006 46 ppm for study years 2006 through 2009 11 ppm for study years 2010 and later
Minimum daily temperature	Average ambient temperature from the study setup screen – 10.35°F
Maximum daily temperature	Average ambient temperature from the study setup screen + 10.35°F
Calendar year	Study year from the study setup screen
Evaluation month	7 (July)
Roadway type	Arterial
Altitude	“1” if the airport elevation is less than 5,000 feet above sea level “2” otherwise
No Refueling	
Air Toxics	E200: 50 E300: 85

	GAS AROMATIC%: 25 GAS OLEFIN%: 15 GAS BENZENE%: 1.5 OXYGENATE: MTBE 0.00 0.0 ETBE 0.00 0.0 ETOH 10.0 1.0 TAME 0.00 0.0
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2.6 On-Road Vehicles in Parking Facilities

Motor vehicle activity in parking facilities is specified in the *Parking Facilities* window (under the *Emissions* menu heading). The *Number of Vehicles (Yearly or Per Peak Quarter Hour)* refers to the distinct number of individual vehicles using the parking facility. An entry and an exit of the parking facility with any idling and vehicle movement together, count as one operation. The average speed of vehicles traveling in the parking facility (*Speed*) is one of the parameters necessary to determine the emission factors for the movement of the vehicles using MOBILE 6.2. The three remaining parameters are, *Manufactured Year*, *Elevation*, and the average daily high and low temperatures, which come from the airport's weather data. MOBILE 6.2 does however allow the user to choose between the default fleet mix and one of the 16 vehicle types. Selection of a specific vehicle type will cause EDMS to assume that the parking facility is used only by vehicles of the specified type.

Note: In order to define a custom fleet mix of on-road vehicles, users must either run MOBILE outside of EDMS and import the resultant emission factors, or make a copy of the parking facility or roadway for each of the vehicle types.

Idle emission factors (grams/vehicle) are computed by extracting emission factors, as above, with a vehicle speed of 2.5 mph and multiplying these factors by the *Idle Time*. The input for the idle time is an estimate of the average time a vehicle spends idling between entry and exit. The input for *Distance Traveled* is an estimate for the average distance a vehicle travels between entry and exit. This field is used to modify the moving emission factors (grams/vehicle-mile). The moving emission factors and the idle emission factors are combined to produce a parking facility emission factor (grams/vehicle).

2.7 Stationary Sources

The EDMS database contains emission factors for several categories of stationary sources. Each broad category is further broken down into several specific types. The ten categories currently included are *Boiler/Space Heaters*, *Emergency Generators*, *Incinerators*, *Aircraft Engine Testing*, *Fuel Tanks*, *Surface Coating/Painting*, *Deicing Area*, *Solvent Degreasers*, *Sand/Salt Piles* and *Other*.

Users can specify the category specific (and in some cases type specific) emissions parameter values or use the default emissions parameter values. The specific methodologies for computing stationary source emission factors are presented in Appendix H of Air Quality Procedures for Civilian Airports and Air Force Bases (the Air Quality Handbook). The general methodology for calculating emissions from these sources considers the amount of fuel or substance consumed.

The *Stationary Sources* window under the *Emissions* menu heading is used to specify stationary source activity. After the selection of a *Category*, the first type is automatically selected from *Type* drop down menu and the *Emission Parameters* list is populated with the appropriate

parameters, including the emission factors. Typically the user will then select a *Type* that best matches the source that they wish to include in the study. The *Category* and *Type* fields are keys to retrieve default data from the database.

Based upon the nature of the fuel, the substance consumed, or throughput, emission factors are displayed either as *Kg/Metric Ton*, *Kg/Kiloliter*, *Kg/Thousand Cubic Meters*, *Kg/Hour* or *Kg/Test Cycle*. Emission factors and parameters may be modified if the user obtains site-specific data, but there is no validity checking performed to verify that the modified emission factors are actually valid for the selected *Category* and *Type*.

The *Yearly* and *Per Peak Quarter Hour* values specify the amount of time, fuel or substance consumed or throughput, and these are specified in *Metric Tons*, *Kiloliters*, *Thousands of Cubic Meters*, *Hours* or *Test Cycles* as appropriate. EDMS gives the user the flexibility to identify generic stationary sources. For miscellaneous stationary sources, the user has the option of choosing the *Other* category and entering their own emission factors in their choice of units. For such sources, the user is required to provide user-specified emission factors.

2.8 Training Fires

Training fire activity is specified by selecting the *Training Fires* window under the *Emissions* menu heading. Emission factor data for five fuels (*JP-4*, *JP-5*, *JP-8*, *Tekflame* and *Propane*) are stored in the EDMS database and may be selected from the *Fuel* drop down list. Training fire emission factors are specified in the system table FUEL_EF.dbf in kilograms of pollutant per gallon of fuel used; and hence, the training fire activity values are always entered in *Gallons of Fuel Used*. Training fire emission factors may be modified in the lower portion of the window under *Emission Factors*, however there they are displayed in grams of pollutant per gallon of fuel.

The *Training Fire* dialog shows only five emission factors, rather than eight. The emissions from VOC are used for to calculate NMHC, and TOG in the emissions inventory, and the PM10 emissions are used for both PM₁₀ and PM_{2.5}.

2.9 Emissions Inventory Output

The following sections describe the components of the emissions inventory, and the outputs available to the user. EDMS allows the analyst to view the emissions inventory on the window in an interactive manner, to print a formal emissions inventory report, or export the emissions inventory to a semicolon delimited text file. EDMS generates an emissions inventory for the following pollutants: CO₂, CO, THC, NMHC, VOC, TOG, NO_x, SO_x, PM_{2.5}, PM₁₀, and 394 speciated organic gases. CO₂ is calculated only for aircraft, and THC is calculated only for aircraft and APUs. Aircraft PM emissions are only available for aircraft with ICAO certified engines. From the 394 speciated organic gases 45 of them are considered to be Hazardous Air Pollutants (HAPs), while the rest 349 are non-toxic compounds. Please refer to Appendix D for a more detailed list of the speciated organic gases by source. The total fuel consumption is also calculated and displayed for the *Aircraft by Mode* and *Aircraft Summary*.

2.9.1 Emissions Inventory

An emissions inventory is a summary of the total pollutants generated by all active sources in the study. Using EDMS to perform an emissions inventory requires the user to identify the emission

sources, the annual activity for each of these sources and, in the case of user-defined sources, the emission factors. EDMS then calculates the total annual pollutant emissions for each of the identified sources and presents it in both a summarized report and a detailed report.

Important: To view speciated organic gases in the emissions inventory, the *Enable Speciated Organic Gas (OG) Emissions* checkbox in the *Study Properties* dialog must be checked.

2.9.2 View Emissions Inventory

The *View Emissions Inventory* window is displayed by selecting the appropriate option under the *View* menu heading. The initial display is the *Summary*, which shows total pollutant emissions by source category in tons, short tons, lbs, or kilograms per year as specified in the *Study Setup*. The units can be changed by selecting the desired unit from the *Units* drop down box. In addition, the analyst can view emissions for specific scenario, airport, and years by selecting the desired scenario-airport combination and the desired year from the *Scenario-airport* and *Year* drop-down boxes.

The source categories are: Aircraft (broken down by mode of operation), APU, GSE, Stationary Sources (including Training Fires), Vehicular sources (both Roadways and Parking Facilities), and the total of all categories. The analyst may also view total pollutant emissions by each source type by clicking on the appropriate buttons at the top of the view window.

The *Aircraft by Mode* display lists the total pollutants by the contributions of aircraft type in each mode of operation. The possible modes are Approach, Taxi In, Startup, Taxi Out, Takeoff and Climb Out. APU and Assigned GSE emissions may be viewed by pressing the *Aircraft/APU* button. The aircraft's Total emissions are the sum of all six modes due to the aircraft's activity. The Assigned GSE and APU totals are displayed separately. The *GSE Population* display shows the emissions for each item in the GSE population. The *Vehicular Sources* display lists the total emissions for each roadway and parking facility included in the study while the *Stationary Sources* display lists the total emissions for each stationary source or training fire specified in the study.

2.9.3 Export Emissions Inventory

To export the emissions inventory click the *Export* button in the *Emissions Inventory* window. EDMS will export the Scenario-Airport emissions inventory for the displayed source category, year and units selected, into a semicolon delimited text file. This process can be repeated to export the emissions for all source categories.

2.9.4 Print Emissions Report(s)

To print official reports of the emissions inventory choose *Print* from the *File* menu while the emissions view is selected. Aside from a difference in formatting, EDMS titles, and study information, the contents of the emissions inventory reports are exactly the same as described in *View Emissions Inventory*. Note: Due to the number of pollutants, this command will not print out the speciated OG's in an EDMS report, it only prints out the 10 main pollutants. To print the OGs the file should be exported and formatted to print outside of EDMS.

3 AIRPORT LAYOUT

The Airport Layout defines the physical “fixed” infrastructure components of the airport around and through which the airport sources operate. The airside network components include the runways, gates, and taxiways, and are optional for performing an emissions inventory, but are recommended if a precise calculation of inventory is desired, and are required for dispersion. Buildings have no affect on emissions, but affect the dispersion of point sources.

In EDMS, users also have the ability to graphically view the layout of the airport, and interact directly with the graphical airport view to place, move, and modify various sources.

3.1 Weather Data

The meteorological data settings can be found under the *Weather* option under the *Airport* main menu, and is specific to each scenario-airport combination. There are two settings available: 1) annual average weather values, and 2) hourly weather values. If dispersion is not enabled, then the user has the option of using either the annual averages or supplying his/her own hourly weather files for the emissions inventory. Hourly weather data supports the aircraft performance module and airport runway configurations to provide greater precision when performing an emissions inventory, but if it is not available, the airport’s annual average values will be used for all activities. If dispersion is enabled, then hourly weather data is required in order to provide the precision necessary for detailed emissions and support the AERMOD dispersion module.

The following weather parameters are used by EDMS:

1. Mixing Height
2. Temperature (ambient, daily high, daily low)
3. Relative humidity
4. Wind direction
5. Wind speed
6. Sea level pressure
7. Cloud ceiling height
8. Horizontal visibility

If hourly weather data is used, the user must supply surface data for each hour, as well as twice-daily upper-air observations, one of which must be an early morning sounding. Historical weather data are available for free from the EPA internet site (www.epa.gov) and other locations, such as www.webmet.com. Additionally, recent weather data are available from the National Climactic Data Center (NCDC) internet site (www.ncdc.noaa.gov) for a fee. The surface and upper-air observations are processed with the meteorological preprocessor, AERMET. The *AERMET Wizard*, initiated from the *Weather* dialog, steps the user through loading the two types of weather data and then merges them into a format that AERMOD can use. Three files are output from the *AERMET Wizard*:

1. The AERMOD surface file (.SFC)
2. The AERMOD profile file (.PFL)

3. The intermediate AERMET surface observation file (.MET)

The surface file and the profile file are used directly by AERMOD, and contain only the meteorological parameters needed for dispersion purposes. The third file, the AERMET surface observation file, is an intermediate output file by AERMET and retains all of the meteorological parameters originally contained in the user-supplied surface data file, which is used by EDMS directly to drive the aircraft performance and runway configurations.

Weather data must be provided in one of the formats listed in (Table 3-1); this may require converting the weather data into one of the formats listed. If weather for a specific location is not available, an appropriate substitution should be used.

Table 3-1. Acceptable Weather Data Formats

File Format	Use	Description Source
TD-3280	Surface	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
TD-3505	Surface	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
CD144	Surface	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
HUSWO	Surface	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
SCRAM	Surface	Environmental Protection Agency. www.epa.gov
SAMSON	Surface	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
TD-6201	Upper-Air	National Climactic Data Center (NCDC). www.ncdc.noaa.gov
Radiosonde Data of North America – FSL format	Upper-Air	National Climactic Data Center (NCDC). www.ncdc.noaa.gov

3.2 Airside Network Layout

The physical components that comprise the airside network include the runways, the gates, and the taxiways that link the two. In addition, taxipaths indicate the path through the taxiway network which an aircraft will take to go between a runway and gate, and runway configurations indicate the runways that will be active at a particular time of day based on weather conditions.

These elements are necessary in order to model the delay and sequencing of aircraft as they depart, and determine the amount of time each aircraft spends on each portion of the tarmac in order to more precisely allocate the emissions to those areas for dispersion purposes. These components are optional when only an emissions inventory is needed, but are required for dispersion, and are discussed further below.

3.2.1 Runways

Aircraft runways are defined using the *Runways* dialog found under the *Airport* menu heading. Runways are named based on their magnetic orientation. For example, runway 9-27 is a runway oriented east-west, with runway 9 defining aircraft moving west to east, and runway 27 defining aircraft moving east to west. The *Runways* dialog allows the user to create runways with distinct endpoints. This, in turn, allows the user to distinguish the direction of traffic on the runway when defining taxipaths on the *Taxipaths* dialog and runway usage percentages on the *Configurations* dialog.

3.2.2 Taxiways

Aircraft taxiways are defined through the *Taxiways* dialog found under the *Airport* menu heading. The coordinates of the taxiway identify a series of area sources for the placement of aircraft movement while the aircraft is taxiing to and from a gate or a runway. The default taxi speed for an aircraft in EDMS is 15 knots (27.78 kph, 17.26 mph).

3.2.3 Gates

A gate is a physical point of arrival and departure for an aircraft. The location of the gate can affect the overall annual emissions inventory by changing the distance (and the associated emissions) needing to be traversed between the gate and the runway. Gate locations are also used to determine the placement of the dispersion sources for GSEs and APUs.

3.2.4 Taxipaths

A taxipath is a series of taxiways connecting a gate to a runway end (for “outbound” taxipaths) or a runway exit to a gate (for “inbound” taxipaths). The sequencing model determines the time-location coordinates of an aircraft as it moves along the taxiways that its assigned taxipath comprises. These time-location coordinates are used to assign the aircraft’s emissions to the area sources that represent the taxiways.

3.2.5 Configurations

Airports operate under different configurations - the pattern of aircraft arrivals and departures on specific runways - over the course of a year depending on the weather, capacity, and noise abatement issues. Whereas it is impossible to account for all the various factors that might

influence the definition of configurations at specific airports, it has been determined that most often configurations are defined based on the wind parameters of direction and speed.

The *Configurations* dialog (under the *Airport* menu heading) provides a way for the analyst to dynamically assign aircraft to different runways at run-time based upon weather conditions, time of day, and aircraft weight category. Each configuration can have associated limits for any or all of the following activation parameters:

1. Wind direction
2. Wind speed
3. Hour of the day
4. Cloud ceiling
5. Horizontal visibility
6. Temperature

The active configuration can be determined based solely on those parameters, or the user can specify a distribution of percentage usage for the configurations, and EDMS will conform to that distribution, while trying to satisfy the activation parameters of the configurations as well as possible.

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3.4 Airport View

The *Airport* option, under the *View* menu, provides the user the capability to visualize their source and receptor placements in relation to each other. Runways are indicated by a thick gray line with a solid blue centerline, taxiways are identified by a thick, gray line, roadways are indicated by a solid red line and receptors are indicated by a flag pole. The ability to import an airport’s “wallpaper” is also provided. The wallpaper can be any bitmap image, and is typically the airport layout diagram or a map of the airport and the surrounding area.

The *Airport View* screen is a non-modal screen and hence the user may continue to add sources and receptors in dialogs and view their placement in the display upon closing each dialog. All sources can be dragged to their desired destination and modified from the *Airport View* by double-clicking the source and making changes through the sources dialog box. To further aid the user in verifying the coordinates and placement of components the position of the crossbar cursor, in the coordinate system, is displayed in the status bar at the bottom of the display screen, and a *Scale* is displayed in both the status bar and the legend. A limited zoom capability is also provided. (Section 6.6.3) provides detailed information on how to interact with the *Airport View*.

4 DISPERSION CALCULATIONS

EDMS generates input files for use with EPA's AERMOD dispersion model, its meteorological preprocessor, AERMET, and its terrain preprocessor, AERMAP. AERMOD is a steady-state plume model that assumes a Gaussian concentration distribution in both the horizontal and vertical directions in the stable boundary layer. In the convective boundary layer, dispersion is Gaussian in the horizontal direction, with the vertical direction being modeled by a bi-Gaussian probability density function. It is not the intent of this user manual to describe AERMOD or any of its associated preprocessors in detail. Detailed information about AERMOD is available from user guides and additional information contained on the EPA's internet site (www.epa.gov/scram001/dispersion_prefrec.htm#aermod). The purpose of this manual is to describe how EDMS is used to generate input files for AERMOD. The algorithms used by EDMS to generate the AERMOD input files are described in the *EDMS Technical Manual*.

4.1 Dispersed Pollutants

EDMS can calculate hourly emissions, and generate AERMOD input files for the following pollutants:

1. **CO** (carbon monoxide),
2. **THC** (total hydrocarbons) for aircraft and APUs only,
3. **NMHC** (non-methane hydrocarbons),
4. **VOC** (volatile organic compounds),
5. **TOG** (total organic compounds),
6. **NO_x** (nitrogen oxides),
7. **SO_x** (sulfur oxides),
8. **PM₁₀** (particulate matter, 10 microns), and
9. **PM_{2.5}** (particulate matter, 2.5 microns).

Note: Aircraft PM emissions are only estimated for aircraft with ICAO certified engines using the FOA3/FOA3a methodology. EDMS does not compute PM emissions due to tire/brake wear.

4.2 Inputs Required

The amount of data required to perform a dispersion analysis is significantly greater than the data necessary for just an emissions inventory. All of the inputs necessary for the emissions inventory are also necessary for dispersion modeling. In addition, some modeling options that are optional for just emissions inventory are required when dispersion is enabled, including:

1. Accurate operational profiles or a schedule (see Chapter 2),
2. Aircraft performance modeling (see Chapter 2),
3. Aircraft delay & sequencing modeling (see Chapter 2),
4. Hourly weather data (see Chapter 3), and
5. Placement of receptors.

An emissions inventory must first be generated before dispersion can be performed, since the set of emissions that are dispersed is the same as that produced from the annual inventory.

The dispersion algorithms use the selected operational profiles or aircraft schedule to vary the source activity based upon time. It is important that accurate profiles be developed to represent the variation of individual source activity as this can affect the outcome of dispersion significantly. Two similar parameters found in all of the emissions source screens are the values for *Yearly* and *Peak Quarter Hour* activity. The dispersion pre-processing routines use the *Peak Quarter Hour* value in the computation of an emission rate. If the *Yearly* activity were the only known variable then the user would use operational profiles to derive the *Peak Quarter Hour* value. Upon entering the value for *Yearly* activity and choosing the appropriate *Quarter Hourly*, *Daily*, and *Monthly* operational profiles the program will automatically compute the corresponding *Peak Quarter Hour* value. Even if the *Peak Quarter Hour* value is known, and entered directly, accurate operational profiles will still have to be defined and selected for each source in the study. AERMOD itself uses hourly time bins. The use of quarter hours is only to provide better fidelity from the aircraft sequence modeling.

Since EDMS is a model specifically developed for use at airports and air bases, there are several screens that relate directly to the placement of aircraft and other source activity and movement on the airport. Data input includes the creation and specification of runways, taxiways, buildings, and gates. These inputs are converted into a collection of appropriate sources for modeling dispersion in AERMOD.

4.2.1 Receptor Locations

The locations at which concentrations are estimated are known as receptors. EDMS allows the placement of receptors in the Cartesian or Polar coordinate system with the ability to also specify the height of the receptors. EDMS does not perform any checking on the reasonableness or accuracy of the placement of receptors; it is left to the users to verify this for themselves.

As a general rule, receptors should be located where the maximum total projected concentration is likely to occur and where the general public is likely to have access. General guidance is given in Volume 9 guidance (EPA, 1978b) for receptor placement:

- Places of expected maximum concentrations;
- Places where the general public has access over the time periods specified by the NAAQS; and
- Reasonableness.

Examples of reasonable receptor sites might be:

- Sidewalks to which the general public has access on a more-or-less continuous basis;
- On the property lines of all residences, hospitals, rest homes, schools, playgrounds, and the entrances and air intakes to all other buildings;
- Portions of a nearby parking lot to which pedestrians have continuous access.

Examples of unreasonable receptor sites might be:

- Median strips of roadways;
- On or close to an aircraft runway or taxiway;
- Within intersections or on crosswalks at intersections;
- Tunnel approaches;
- Within tollbooths; and

- A location far from the breathing height (1.8 m) at which the general public will not have access.

The *Receptors* dialog, found under the *Dispersion* menu heading, allows the user to place individual receptors or networks of receptors for concentration estimation. Dispersion calculations will include all receptors in the *In Study* list box. The EPA recommended height for receptor placement is breathing height (approximately 1.8 meters or 5.9 feet).

The *Receptor Networks* tabs on the *Receptors* dialog box allow the user to define two-dimensional grids of individual receptors over a rectangular region (Cartesian) or an annular sector (polar) of the airport or study area. Due to the increased computational time required for a large number of receptors, the primary use of grids has typically been in screening dispersion estimates.

4.2.2 Elevation

EDMS sources and airport layout components have an associated elevation field. The elevation acts as a base to which the release height for emissions is added to determine the initial vertical location of emissions. Running AERMAP supersedes the user-supplied elevations in the AERMOD input files with elevations from a Digital Elevation Model formatted file, but does not replace the user's elevation in the study data.

4.3 Dispersion Modeling Calculation

The intent of dispersion modeling is to assess the air pollutant concentrations at or near the airport or air base resulting from identified emissions sources. These pollutant concentrations are calculated to determine whether emissions from the site result in unacceptably high air pollution levels downwind by comparison with the National Ambient Air Quality Standards (NAAQS) or other relevant air quality standards. To perform dispersion modeling, EDMS requires the coordinates (in meters or feet relative to the user-specified origin) of each emissions source, the specification of an emissions rate (derived from emission factors) and its variation through time. For some sources, the release height, temperature and gas velocity are also required. The identification of spatial points in the coordinate system for concentration estimation (receptors), and the availability of weather data for individual hours are also required.

The basic Gaussian equation, a mathematical approximation that simulates the steady-state dispersion of pollutants from a continuous point source is given below.

Equation 4-1: Gaussian Approximation⁴

$$C(x, y, z, H) = \frac{Q}{2\pi\sigma_y\sigma_z u} \exp\left[-\frac{1}{2}\left(\frac{y}{\sigma_y}\right)^2\right] \left\{ \exp\left[-\frac{1}{2}\left(\frac{z-H}{\sigma_z}\right)^2\right] + \exp\left[-\frac{1}{2}\left(\frac{z+H}{\sigma_z}\right)^2\right] \right\}$$

where:

C = point concentration at receptor, in $\mu\text{g}/\text{m}^3$

⁴ Source: Air Quality Procedures for Civilian Airports and Air Force Bases, FAA/USAF, Washington, DC, 1997.

(x,y,z)	=	ground level coordinates of the receptor relative to the source and wind direction, in meters
H	=	effective release height of emissions, in meters (m)
Q	=	mass flow of a given pollutant from a source located at the origin, in $\mu\text{g/s}$
u	=	wind speed, in m/s
σ_y	=	standard deviation of plume concentration distribution in y plane, in m
σ_z	=	standard deviation of plume concentration distribution in z plane, in m

The results of the AERMOD dispersion calculations are the concentrations, given in micrograms per cubic meter ($\mu\text{g/m}^3$), at receptors for each hour. The following describes dispersion data inputs and outputs.

4.3.1 Point, Area and Volume Sources

Just as the emissions inventory breaks down airport operations into source categories, the same applies to dispersion calculations. For dispersion modeling purposes, each source category is assigned one of three source type categories: point, area or volume. EDMS uses all three source types in AERMOD.

Stationary sources such as power plants release pollutants into the atmosphere through a point source discharge mechanism such as a stack (training fires are also treated as point sources). The AERMOD point source module is used to model dispersion for all point sources in EDMS. Point source emission rates are generally given in grams per second (gm/sec).

Area sources are generally defined as an area with a uniform rate of emissions over the entire surface. Parking facilities are classified as area sources in the model. Airport parking facilities generate emissions due to on-road vehicles operations and vehicle idling. Area source emission rates are generally given in grams per second per square meter (gm/sec-m^2). In the case of a multi-level parking facility, area sources are stacked at a defined increment to characterize the structure.

Aircraft taxiing, aircraft queuing, aircraft accelerating on the runway, and on-road vehicle operations are considered to be a series of area sources, since their movement along a path approximates a line of continuous emissions. Similarly, aircraft after takeoff and during the landing approach are also represented as a series of area sources. The area source was selected, as opposed to using a series of volume sources based on recommendations from the American Meteorological Society/EPA Regulatory Model Improvement Committee (AERMIC).

In EDMS the activity at gates are considered to be volume sources when the emissions from Startup, GSE and APUs are estimated to originate from a single point of discharge, and area sources when multiple points are used to model the gate. The latter case is typically used when a terminal or part of a terminal is represented as an EDMS “gate.”

4.3.2 Aircraft

Aircraft activity is specified in the *Aircraft Operations and Assignments* dialog. The additional data required for dispersion analysis (other than operational profiles) are assigned in the

Performance and *GSE & Gate Assignment* tabs in the Aircraft Operations and Assignments dialog. The *Taxi Out* and *Taxi In Times in Mode* fields are not used in dispersion calculations; they are used solely for the emissions inventory. This permits users only interested in generating an emissions inventory to avoid having to define an airport layout. For dispersion, taxi in and out times (and their corresponding locations on the taxiway network) are determined from the delay and sequencing module. As discussed in (Chapter 2), aircraft have six modes of operation, and each mode is represented by AERMOD area sources as follows:

1. Approach: A vertical 2-dimensional grid of area sources extending along the runway center line starting at 1,000 ft down to the runway end representing the airborne approach path. The approach path from the mixing height to 1,000 ft is collapsed into a single horizontal row of area sources halfway between 1,000 ft and the mixing height.
2. Taxi In: The landing ground roll is attributed to the Runway source and the taxi in is attributed to the Taxiway sources.
3. Startup: Aircraft main engine startup occurs at the gate. This methodology is only applied to aircraft with ICAO certified engines. All other aircraft will not have startup emissions. Aircraft main engine startup produces only THC, VOC, NMHC, and TOG emissions. A detailed speciated organic gases profile does not exist for main engine startup emissions. The Startup emissions, and assigned GSE and APU are attributed to the Gate source.
4. Taxi Out: The Taxi Out is attributed to the Taxiways source.
5. Takeoff: The takeoff ground roll is attributed to the Runway sources, while the airborne portion is attributed to a vertical 2-dimensional grid of area sources extending along the runway center line starting at the runway end representing the airborne departure path, from the runway up to 1,000 ft. The departure path from 1,000 ft to the mixing height is collapsed into a single horizontal row of area sources halfway between 1,000 ft and the mixing height.
6. Climb Out: Uses the same vertical two-dimensional grid as the airborne Takeoff segments.

Because the vast majority of the dispersion concentrations are attributed to the emissions released by aircraft below 1,000 ft, the approach and departure spaces use a detailed vertical 2-dimensional grid below 1,000 ft. However, in order to improve the computer run time, aircraft sources between 1,000 feet and the mixing height are collapsed into the plane halfway between 1,000 feet and the mixing height.

4.3.3 Gates, GSE and APU

For the purposes of dispersion modeling, the emissions contributions due to aircraft main engine startup (contained in the aircraft Gate mode of operation), GSE, and APUs are localized at the gate to which the aircraft is assigned. The gate coordinates provide the spatial location in the coordinate system from which all these sources are considered to emanate. The dispersion from the sources at the gate is represented by a single volume source for each gate if only one point is specified to define the gate; otherwise an area source is used to represent the gate. For larger airports, many users represent a series of gates or part of a terminal as an individual gate in their EDMS study.

4.3.4 Runways

Runways determine the location at which aircraft will operate and release emissions during the ground roll for takeoff and landing. In addition, each runway end serves as the anchor point for the 2-dimensional vertical profile for the aircraft approach and takeoff grids from which emissions will be released for dispersion purposes as the aircraft approaches and takes off.

4.3.5 Taxiways

Taxiways determine the ground segments where the aircraft operates at idle thrust and releases emissions whilst taxiing between the gates and runways.

4.3.6 Parking Facilities

Parking lot and parking garage activity is specified in the *Parking Facilities*. The additional data required for dispersion analysis is found in the *Dispersion Parameters* box of the *Parking Facilities* dialog. The parking structure must be defined as a series of up to 20 points. The parking facility *Height* is specified to represent the height at which emissions are released. Each parking facility may also have up to 20 levels. Facilities with multiple parking levels are modeled using stacked area sources.

4.3.7 Roadways

Vehicle activity on roadways is specified in the *Roadways* dialog. The additional data required for dispersion analysis is found in the *Coordinates* box. Aside from the coordinates that define the path of the roadway, the *height and width* of the roadway must also be specified. These values correspond to the release height and width of the emissions and not the physical dimensions of the roadway. Roadways are modeled as a series of area sources by AERMOD.

4.3.8 Stationary Sources

The *Stationary Sources* dialog offers the capability of specifying the activity of several different categories of stationary sources for dispersion analysis. Performing a dispersion analysis requires the analyst to specify the dimensions of the stationary source. The additional data required for dispersion analysis is category dependent and is found in the lower left corner of the dialog. Users can specify the category-specific (and in some cases type-specific) emissions parameter values or use the default emissions parameter values. The specific methodologies for computing stationary source emission factors and the associated data requirements are presented in Appendix H of Air Quality Procedures for Civilian Airports and Air Force Bases (the Air Quality Handbook). The general methodology for calculating emissions from these sources considers the amount of fuel or substance consumed.

Users are permitted to select the type of AERMOD source (point, area, or volume) used to model each stationary source in the EDMS study to better characterize the sources at their airport. Default values are also provided for all source types.

4.3.9 Training Fires

Training fire data are used by EDMS in both emissions and dispersion analyses. For emissions purposes, calculations are based upon the amount of fuel burned, as well as the *Height, Temperature, Diameter, and Gas Velocity* of each fire. For dispersion analyses, training fire

emissions are treated as point sources by EDMS. Training fire emissions are located spatially within the airport using the (x, y) coordinates.

4.3.10 Buildings

Airport building sources affect the emitted point source plumes by essentially serving as obstacles to those sources, and therefore have a significant impact on concentrations resulting from stationary source emissions.

Important: Buildings have no effect on the concentrations estimated from volume and area sources such as aircraft, APU, GSE, roadways, and parking facilities.

4.4 Dispersion Data Output

Modeling concentrations is a three-step process in EDMS. First, the user must select the meteorological data to be used via the *AERMET Wizard*, which is started from the *Weather* dialog, which is opened from the *Airport* menu heading. EDMS includes the optional use of AERMAP, which is the terrain preprocessor of AERMOD. AERMAP creates source (.SRC) and receptor (.REC) files for inclusion in AERMOD dispersion analyses. Next, the user must *Generate AERMOD Input Files*, under the *Dispersion* menu heading. This step pre-processes the emissions for every source for every hour in the weather data. The user also has the opportunity to select different averaging periods as well as the desired pollutant at this time. Finally, the dispersion calculations may be run by selecting *Run AERMOD* under the *Dispersion* menu heading. To run AERMOD with the input files generated by EDMS on a different computer, the user can refer to the instructions in the *EDMS Technical Manual*. Step-by-step instructions for generating the AERMOD input files are provided in (Section 6.5.3).

As the dispersion algorithms execute, AERMOD displays its current status on the screen. Once AERMOD has finished, the AERMOD window will close and the user will be returned to EDMS. After AERMOD has run, EDMS will have created a directory for each scenario within the study directory. In each scenario directory there will be a directory for each airport. In each airport directory will be a file with the (.OUT) extension for each year and pollutant in the scenario-airport combination. These files contain both the list of inputs to AERMOD along with the concentrations for that scenario-airport-year-pollutant combination. These results can be viewed and printed in any text editor, but *TextPad* is recommended. Concentration (.CON) files can be viewed in the *Concentrations View*. Instructions for using the view concentrations option are provided in (Section 6.6.4).

Comments and Response to Comments Comment File G.8

This Supplemental Environmental Assessment (EA) was prepared in response to an order by the Ninth Circuit Court of Appeals remanding the Hillsboro Airport runway approval decision to the FAA for further consideration [655 F.3d 1120 (2011)]. The Court's mandate was narrowly drawn: FAA was instructed to "consider the environmental impact of increased demand resulting from the HIO expansion project, if any, pursuant to 40 CFR §1508.8(b)." The Court did not require FAA to examine any other issues. Although many comments received after release of the Draft Supplemental EA appear to fall outside the scope of the Ninth Circuit's remand order, a response is provided.

Appendix G contains each of the communications received during the public comment period. Please note that for those commenters that submitted extensive attachments, those attachments have been reviewed and retained by the FAA and Port of Portland. Those documents, which are not included herein, are noted in the responses and any party interested in obtaining copies of the attachments can contact the Port of Portland for an electronic copy. All documents and emails were forwarded to a central location to facilitate preparation of the responses.

Because of the size of the electronic files, the letters were separated into nine (9) files (i.e., Comment File G.1 through Comment File G.9). Comment identifiers (i.e., PQ#) begin with several letters that create a unique abbreviation of the commenter's name or organization, followed by a sequential number indicating the specific comment. These identifiers are found in the margin of the comment letter, and vertical red lines span the lines of the comment that correspond to the individual response. A comment identifier was placed in the right margin of the comment to indicate the corresponding response. Except in the case of the hearing transcript, responses follow the last page of the comment letter. In the case of the hearing transcript, the responses to all commenters follow the last page of the hearing transcript (found in Comment File G.1).

These include the following commenters:

Comment File G.1

4/17/2013	Andy Duyck	
4/19/2013	Bill Lennox	
4/18/2013	Pamela Treece - WEA letter	
4/19/2013 #2	Blaine C Ackley	
4/15/2013	Bryan/Robin Pietz	
Undated	Chris & Valeska Arnesen	
4/18/2013	Dale Feik	
4/7/2013	David Nardone	
4/15/2013	Fred Hostetler	
4/18/2013	Gary Warren	
3/25/2013	Greg Driscoll	
April 17, 2013 Public Hearing Transcript		
Wayne Vanderzanden		Miki Barnes
Dan Bloom		Jack Lettieri
Martin Granum		Renee Strong
Megan Granum		Bill Stone

Larry Altree
Blaine Ackley
Jim Lubischer
John Southgate
Ellen Sanders
Sharon Cornish
Vernon Mock
Ruth Warren
Brian Hannah

Larry Bird
Jim Lubischer
David Barnes
Miki Barnes
Ruth Warren
Brian Hannah
Miki Barnes
Vernon Mock

All Comments G.2

4/17/2013 Jim Lubischer

All Comments G.3

4/19/2013 Henry Oberhelman
4/17/2013 Howard Radin
4/17/2013 Justin St. Clair
4/18/2013 John Southgate
4/19/2013 Kimberly Culbertson
4/18/2013 Linda Barnfather
4/19/2013 Linda Beall
4/17/2013 G Lynn Hamm
May 12, 2013 (sic) Ruth Warren

Comments G.4

4/17/2013 Martin Donohoe
4/17/2013 Martin Granum
4/19/2013 Matthew Radin
4/17/2013 Mona Toms
4/12/2013 Nancy Monroe
4/19/2013 Patrick Conry
4/17/2013 Patrick Dunn
4/17/2013 Patrick Dunn, Constance Rosson
4/14/2013 Steve Gibson
4/12/2013 Walter Hellman

Comment File G.5

Undated Blaine C Ackley

Comment File G.6

4/19/2013 Sean Malone

Comment File G.7

4/15/2013 WB White
4/19/2013 Miki & David Barnes
4/19/2013 Miki Barnes, Oregon Aviation Watch

Comments G.8

Undated Analysis of the "General Aviation Survey Report Summary" by M. Barnes & J. Lubischer (GASR#)

Comments G.9

4/27/2013 Art and Joan Dummer
4/17/2013 OAW Testimony in response to the Hillsboro Airport Parallel Runway Draft Supplemental Environmental Assessment
4/17/2013 OAW Testimony (Barnes) Attach1 Williams

Analysis¹ of the

“General Aviation Survey Report Summary”

(Contained in the Draft Supplemental Environmental Assessment,
3-15-13, Hillsboro Airport Parallel Runway 12L/30R)

by Miki Barnes & James Lubischer, MD

(President and Vice-President of Oregon Aviation Watch, a 501(c)(3) non-profit
organization dedicated to reducing the adverse effects of aviation activity.)

The “Draft Supplemental Environmental Assessment” concludes, in part, that if the “Remand Forecasts” occur following construction of a parallel runway at HIO, emissions “would slightly increase...but remain well below the *de minimis* level.”² Put another way, the FAA and the Port of Portland purport that aircraft operations directly related to the construction of a new parallel runway (“induced operations”) may increase; but the increase in operations would be slight and the associated increase in toxic emissions would also be slight, will be *de minimis*, trifling, nothing to worry about, a level of risk that is too small to be concerned with, a risk that is negligible and too small to be of societal concern. GASR1

First, an increase in lead emissions from 0.8 tons per year to 0.9 tons per year³ is not trifling, not too small to worry about, not a negligible risk, not too small to be of societal concern. Lead is a potent neurotoxin. The Agency for Toxic Substances and Disease Registry lists 275 toxic substances on the “Substance Priority List”. Arsenic is number one on the list. Lead is number two.⁴ The Centers for Disease Control (CDC) has stated that “...no level of lead in a child’s blood can be specified as safe...”⁵ Furthermore, the CDC has stated⁶ that, “...because no level of lead in a child’s blood can be specified as safe, primary prevention must serve as the foundation of the effort [to prevent childhood lead poisoning]... Efforts to eliminate lead exposures through primary prevention have the greatest potential for success.” Primary prevention means not putting lead into our environment. Rather than increase the lead in our children’s environment we should be reducing the lead emitted from non-essential aircraft. Morally, any increase in lead cannot be considered *de minimis*. GASR2

Second, the Draft Supplemental Environmental Assessment’s conclusions regarding toxic emissions is directly founded on a faulty estimate of “induced operations.”⁷ “Based on the survey of aviation users it was estimated that 11,350 additional aircraft operations per year (see Table 3-2) could result from

¹ Italics have been added to this document for emphasis.

² Draft Supplemental Environmental Assessment, p35 “Air Quality”.

³ Draft Supplemental Environmental Assessment, p30, Table 6-3, year 2016.

⁴ See Exhibit “1”

⁵ “Preventing Lead Poisoning in Young Children”, A Statement by the Centers for Disease Control and Prevention, August 2005, U.S Department of Health and Human Services, Public Health Service, pg 3. [This document was submitted in toto at the public hearing on 4-17-13.]

⁶ “Preventing Lead Poisoning in Young Children”, A Statement by the Centers for Disease Control and Prevention, August 2005, U.S Department of Health and Human Services, Public Health Service, p1 & p3. [This document was submitted in toto at the public hearing on 4-17-13.]

⁷ “Induced” operations are operations that are directly attributable to construction of the new parallel runway.

GASR2

both a potential reallocation of demand in the region and the potential for growth exceeding the organic growth forecast in the Unconstrained Forecasts.”⁸ The 11,350 additional operations per year are included in the “Remand Forecasts.”⁹ The “estimated induced demand” of 11,350 operations is based on the General Aviation Survey (Survey) conducted by the Port of Portland and their “*independent research partner*” Riley Research Associates. The Survey (including the Report Summary), however, is fatally flawed. The “estimated induced operations” number of 11,350 is therefore without basis and the conclusions of the Draft Supplemental Environmental Assessment regarding toxic emissions are worthless.

This letter reviews some of the flaws of the Survey and the “General Aviation Survey Report Summary” (Report Summary). Flaws include the following:

GASR3

- 1) The Survey was designed by the vested parties.
- 2) The “Report Summary” includes responses that are not germane to runway use.
- 3) The Survey included student pilots.
- 4) The Survey did not capture the number of operations from the primary user of the airport, Hillsboro Aviation.
- 5) No HIO/TTD/PDX Contact conducts greater than 5% of their total operations as “touch and goes”, really?
The Report Summary notes there are no “HIO/TTD/PDX Contacts” (which includes Hillsboro Aviation) that conduct, at HIO, greater than 5% of their total operations as “touch and goes”.
- 6) Only 4 of the 15 “HIO/TTD/PDX Contacts” are appropriate participants for this survey.
- 7) The Remand Forecasts error in assuming that construction of a parallel runway will preclude use of the existing long runway by single-engine propeller operations.

1) **The Survey was designed by parties with a vested interest in the third runway.**

Facts: The Survey was designed by the Port of Portland and the Federal Aviation Administration (FAA).¹⁰ Riley Research Associates helped refine the questions¹¹. The preamble of the actual Survey¹² states,

“The Port of Portland owns and operates Hillsboro Airport (HIO), located in Washington County, Oregon. The Port and FAA are currently conducting an environmental review of proposed improvements at HIO, which would include (if approved) construction of a new 3,600 foot long, 60 foot wide, visual flight rules, parallel runway, primarily for small, single-engine propeller aircraft; associated taxiways; future helipad relocation; and associated infrastructure. The purpose of this questionnaire is to assist the FAA in evaluating the impact resulting from the HIO expansion project, and whether or not it changes the nature or magnitude of aviation demand at HIO...If you have any questions, you may contact *our independent research partner*, Riley Research...”

⁸ Draft Supplemental Environmental Assessment, p11.

⁹ The Ninth Circuit Court remanded the initial Environmental Assessment. The “Remand Forecasts” explore the effects on total airport operations that may not be included in the Unconstrained Forecasts.

¹⁰ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey, p1.

¹¹ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey, p1.

¹² Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey Report Summary “Appendix: Questionnaire”, which follows p50 of the Survey “Report Summary”.

GASR4

Comment: The Port and FAA (as well as most of the participants in the Survey) have a vested interest in construction of a new parallel runway at HIO. Relying on a survey designed by interested parties is improper. In this case, it is no secret that requiring an Environmental Impact Statement (EIS) would interfere with the construction of a new runway. Some of the participants in the Survey may have been influenced by the understanding that their answers could affect the estimate of “induced” operations. This could lead to understating possible expected increase use of a parallel runway in an effort to avoid an EIS. Therefore, any conclusions based upon a survey designed by interested parties, should be suspect, if not outright dismissed.

2) **The “Report Summary” includes responses that are not germane to runway use.**

Facts: The General Aviation Survey “Report Summary” states,

“Q1. At which area airport(s) do you currently base your aircraft (includes both fixed wing *and helicopters*)? (Multiple Responses)”¹³

“...(includes both fixed wing *and helicopters*)...”¹⁴

“Total forecast operations includes all activity using the runway system, *as well as helicopter training operations*”,¹⁵

The “Draft Supplemental Environmental Assessment” states,

GASR5

“Total aircraft operations include corporate and charter, general aviation, and military operations for fixed-wing aircraft *and helicopters*.”¹⁶

“Data represents total annual operations and not runway operations; total aircraft operations *includes the rotary wing aircraft operations* that are excluded in the runway operations numbers.”¹⁷

The General Aviation Survey “Report Summary” shows 270 “participants” having 68 “mean operations per month”.¹⁸

GASR6

Comment: As noted, the 270 “participants” had 68 mean operations per month, which gives a total of 220,320 HIO operations per year.¹⁹ Since total operations (which includes non-runway rotary operations) at HIO in 2011 were 214,243²⁰ it is evident that the Survey did not limit the operational numbers to relevant runway operations. From this and the quotes above it is evident that the Survey generated and the General Aviation Survey “Report Summary” included data / information for rotary

¹³ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p2.

¹⁴ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p20, following Q15 regarding an increase in operations)

¹⁵ Draft Supplemental Environmental Assessment, p 7, Table 3-1, footnote “c”.

¹⁶ Draft Supplemental Environmental Assessment, Appendix D, at D-10, see Note at Table D-4

¹⁷ Draft Supplemental Environmental Assessment, p10, Table 3-2 footnote.

¹⁸ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p8, top table.

¹⁹ 270 “participants” x 68 mean operations per month x 12 months = 220,320 HIO operations per year.

²⁰ Draft Supplemental Environmental Assessment, Appendix B, p3-2, Table 3-1.

GASR6

aircraft and rotary operators. Inclusion of non-runway helicopter operations and helicopter pilots is inappropriate in trying to estimate the “induced” demand for a third runway. Rotary aircraft only use a runway for “itinerant” operations. Almost all of the rotary operations at HIO are local operations and do not use a runway. Including non-runway rotary operation numbers and responses in the Survey is misleading, confusing and leads to obfuscation. Most importantly, by not instructing the “participants” that the questions apply only to runway use the Survey fails to provide an accurate picture which is needed to estimate an “induced” demand.

That the Port and the FAA understand runway operations do not include local rotary operations is evident in the footnote for Table 3-2²¹ and in Table 5-1²². Nevertheless the Survey’s questions are structured so that “non-runway” operations are included. Any conclusions based on the Survey should be dismissed for this reason.

3) The Survey included responses by student pilots.

GASR7

Facts: Survey participants included 323 “Pilots”²³ who were, (according to the Draft Supplemental Environmental Assessment and the General Aviation Survey Report Summary) “representative of general aviation pilots”²⁴ and were “registered pilots”.²⁵

In the General Aviation Survey “Report Summary” at page 23 a verbatim response from a participant to question “#Q1b” states “*in training*”; On page 24 a verbatim response states “*Student*” to question “#4b” which asked “other use” for the question “Which best describes your primary use of Hillsboro Airport?; On page 27 a verbatim response to question #11 states “*Training now, but on my way*”. On page D-3 of Appendix D to the Draft Supplemental Environmental Assessment is the statement, “...the difference is most likely related to duplication in responses by aviation *students*...”

Comment : The General Aviation Survey “Report Summary” states that the Survey was sent to pilots “representative of general aviation pilots” and the Draft Supplemental Environmental Assessment states that the Survey was sent to “registered pilots”. Neither the General Aviation Survey “Report Summary” nor the Draft Supplemental Environmental Assessment mentions that flight-training students are included in the Survey but it is evident that flight-training students were included. Inclusion of flight-training student responses in the General Aviation Survey “Report Summary” should disqualify any conclusions based on the General Aviation Survey “Report Summary” as their responses are not representative of Oregon general aviation registered pilots. Students cannot fly on their own (until their first “solo” flight), are unlikely to own aircraft, and the operations they conduct are controlled by their flight school. Furthermore, many of the students at HIO are likely to not live in the Metro area, many are likely not to live in Oregon and many do not even live in the United States.²⁶

²¹ Draft Supplemental Environmental Assessment, p10, Table 3-2 footnote.

²² Draft Supplemental Environmental Assessment, Appendix B, p 5-13.

²³ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, table at bottom, p1.

²⁴ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p1.

²⁵ Draft Supplemental Environmental Assessment, Appendix D, p D-1.

²⁶ See Exhibit “J”. Hillsboro Aviation states on their website that, “...we are one of the largest combined helicopter flight training and airplane flight training schools in the U.S. ...our school has trained thousands of pilots from over 75 countries, and our graduates fly for companies around the world...Organizations and pilots from all over the world choose our school...”

GASR7

Because the Survey contains inappropriate student responses it is impossible to accurately predict an “estimated induced demand” upon which to base an estimate of toxic emissions from a parallel runway. The conclusions regarding emissions found in the Draft Supplemental Environmental Assessment must therefore be rejected.

4) The Survey did not capture the number of operations from the primary user of the Hillsboro Airport, Hillsboro Aviation.

GASR8

Facts: The General Aviation Survey “Report Summary” table for question 5 (a) on page 8 includes information from 270 “Participants”. Of these, the 255 “Pilots” indicate they average 70 operations per month at Hillsboro Airport, which would be 214,200 operations per year.²⁷ The General Aviation Survey “Report Summary” table for question 5 (a) on page 8 also shows responses from 7 “HIO/TTD/PDX Contacts” who average 36 operations per month, which would be 252 operations per month or 3,024 per year.²⁸ According to the Air Traffic Activity Data System (ATADS), there were 214,243 operations at Hillsboro Airport in 2011.²⁹

Comment: The responses to question 5 (a) suggest that the 255 “Pilots” account for essentially all operations at HIO, while the “HIO/TTD/PDX Contacts” conduct just 3,024 operations per year. The “HIO/TTD/PDX Contacts” category includes Hillsboro Aviation.³⁰ It strains credulity that the pilots in the “Pilot” category account for essentially all of the operations at HIO and that the 7 “HIO/TTD/PDX Contacts” have only 3,024 operations per year.

Facts: Hillsboro Aviation states on their website that its “school division... is one of the largest combined helicopter and airplane flight training schools in the U.S. and one of the leading flight schools in the world. Our company flies in excess of 63,000 hours annually. We have trained students from over 75 countries, and our graduates fly for companies worldwide. The diversity of our operations and our experience are unparalleled.”³¹ “We have over 40 training airplanes, including models such as Cessna 152, Cessna 162, Cessna 172, Piper Seminole and Hawker Beechcraft King Air C90.”³² The president of Hillsboro Aviation stated in 2009, “We have become the largest flight training facility for both airplanes and helicopters on the pacific west coast...”³³

GASR9

Comment: That Hillsboro Aviation is a primary user of the Hillsboro Airport runways cannot be denied. Unfortunately, attempts to obtain exact operational counts or even estimates of Hillsboro Aviation operations have been fruitless. The Port of Portland replies they do not have this information³⁴ and they have given no estimates. The HIO Air Traffic Control Tower Manager replies they do not have this degree of detail for operations at HIO.³⁵ Hillsboro Aviation, citing proprietary reasons, has replied they will not release the number of their operations.³⁶

²⁷ (255 pilots)(70 operations/month/per pilot)(12 months/year) = 214,200 operations per year.

²⁸ (7 pilots)(36 operations/month/per pilot)(12 months/year) = 3,024 operations per year).

²⁹ Draft Supplemental Environmental Assessment, Appendix B, p3-2, Table 3-1.

³⁰ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p44.

³¹ See Exhibit E

³² See Exhibit C

³³ See Exhibit E, Letter to the Executive Director of the Port of Portland.

³⁴ See Exhibit G

³⁵ Personal communication.

³⁶ Personal communication.

Facts: The 10/09 Hillsboro Airport Parallel Runway 12L/30R “Draft Environmental Assessment at page 3-6 states, “Local operations (consisting largely of training activity) currently represent about 68 percent of total operations at HIO.”³⁷ “Itinerant” operations also include some flight-training operations.³⁸ On 8-25-06, then Director of Aviation for the Port of Portland Mary Maxwell stated, “We’re seeing a lot of development at that airport [HIO]. Next on our plans will be the development of a third runway, *which is primarily a shorter runway for training aircraft.*”³⁹

The following are “verbatim comments found in the General Aviation Survey Report Summary:

“Currently can experience horrible delays [at HIO], e.g. from *too many Hillsboro Aviation students.*”⁴⁰

“Increased safety by *separating training* from business aircraft operations.”⁴¹

“The airspace surrounding the airport is also very busy as it’s the host to *flight training operations...*”⁴²

“...and the *training* environment would be even better.”⁴³

“HIO already has a lot of traffic and *most of that traffic practice takeoff and landings.*”⁴⁴

“The biggest problem with HIO is the time it takes from engine-start to getting off the ground. *A training runway* would make it a lot easier to take off without delay.”⁴⁵

“I don’t like flying out to HIO because of *all the student traffic...* It seems that *Hillsboro is a pilot mill when it comes to cranking out overseas pilots...*”⁴⁶

“...due to frequent delays due to *all the student traffic.*”⁴⁷

“The *flight training operations* at HIO make it a little bit hectic...”⁴⁸

“I try to do so when there is less *flight instruction...*”⁴⁹

³⁷ See Exhibit B which is a copy of page 3-6 of the 10/09 Hillsboro Airport Parallel Runway 12L/30R “Draft Environmental Assessment.

³⁸ Personal communication (6-15-11) with Mr. Joseph Fiala, HIO Air Traffic Control Tower Manager

³⁹ See Exhibit D “A Conversation with Mary Maxwell, Director of Aviation for the Port of Portland.”

⁴⁰ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p27.

⁴¹ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p27.

⁴² Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p27.

⁴³ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p27.

⁴⁴ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p28.

⁴⁵ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p28.

⁴⁶ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p30.

⁴⁷ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p32.

⁴⁸ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p32.

⁴⁹ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p32.

GASR10

Comment: From the comments above it is apparent that flight training accounts for a lot of HIO runway use. Since “local operations (consisting largely of training activity) currently [2009] represent about 68 percent of total operations at HIO”⁵⁰ it is evident that a large amount, if not the majority, of operations at HIO are flight-training operations. The list of “HIO/TTD/PDX Contacts” at page 44 lists only two contacts who provide flight training, Gorge Winds Aviation (based at TTD⁵¹) and Hillsboro Aviation. Therefore, Hillsboro Aviation is the only flight training company at HIO included in the General Aviation Survey.

The survey is deficient in not searching for and identifying primary users of the HIO runways. The Port of Portland certainly knows that Hillsboro Aviation flight training constitutes a large number, if not the majority of operations at HIO. The Port could easily have structured their survey questionnaire to identify primary users of the HIO runway. The identification of primary users of the HIO runways is critical, as any “estimated induced demand” is likely to hinge on those particular users. Not ensuring that the primary users are included in the survey is a critical mistake and any conclusions based on this Survey are not valid.

Facts: The General Aviation Survey “Report Summary” table for question 5 (a) on page 8 lists only one⁵² “HIO/TTD/PDX Contact” who has “51+ operations / month”.

GASR11

Comment: Question #5 asked: “Approximately how many operations (landings and take-offs) per month do you average at: Hillsboro Airport?” (“5a”). The table, at page 8 of the Report Summary, summarizes the answers using ranges of responses and then giving a percentage of the respondents in each category.

It is unfortunate that the Report Summary did not give the actual number of operations for the one “HIO/TTD/PDX Contact” that responded and was in the “51+” category. Since this category is open ended, the response could have been 51 or the response could have been many thousands. But the table also gives us the mean operations per month for the “HIO/TTD/PDX Contacts” which was 36 operations / month. With this information we can see that the “HIO/TTD/PDX Contacts” account for but 252 operations per month, or only 3,024 operations per year. This is not credible. This number alone should have set off the alarm to the Port of Portland (and to the FAA and Riley Research Associates if they had been apprised of the fact that one company, Hillsboro Aviation, likely conducts the majority of operations at HIO). (Note on page 44 of the General Aviation Survey “Report Summary” that the “HIO/TTD/PDX Contacts” category includes Hillsboro Aviation - the flight training company which claims to be the largest flight training facility on the pacific west coast.⁵³)

In addition, using the information provided in this table for question #5 (a) this one “HIO/TTD/PDX Contact” averages at most 201 operations per month⁵⁴ or about 7 operations per day. Who is this

⁵⁰ See Exhibit B which is a copy of page 3-6 of the 10/09 Hillsboro Airport Parallel Runway 12L/30R “Draft Environmental Assessment.

⁵¹ See Exhibit “A”.

⁵² 14% of the 7 participants for this question = 1

⁵³ See Exhibit E, Letter to the Executive Director of the Port of Portland.

⁵⁴ To arrive at a maximum of 201 operations per month for the one “HIO/TTD/PDX Contact” who has “51+ operations / month” please note that the 7 “HIO/TTD/PDX Contacts” averaged 36 operations per month which would give a total of 252 operations per month (7 x 36). To calculate the maximum mean operations per month

GASR9

GASR12

“HIO/TTD/PDX Contact”? With such a low number of operations it certainly could not be Hillsboro Aviation. Where is the operations number for Hillsboro Aviation in this survey? This is a glaring deficiency. Hillsboro Aviation (HA) is almost certainly the primary user of HIO. This is no secret even though the Port of Portland is unable and Hillsboro Aviation is unwilling to give out the number of operations for HA despite repeated requests.

Facts: One verbatim comment from a “HIO/TTD/PDX Contact” states, “*My company does a large number of operations at the Hillsboro airport and the surrounding airports, but we do not count operations. Instead we count flight hours based from a particular location. Troutdale and Hillsboro airport towers would have more accurate information regarding our operation counts.*”⁵⁵ [Underline added for emphasis.]

GASR13

Comment: This comment could only have come from Gorge Winds Aviation or Hillsboro Aviation. They are the only two “HIO/TTD/PDX Contacts” who would count flight hours and who conduct operations at HIO and the “surrounding airports”.

Since Hillsboro Aviation accounts for perhaps 80-90% [my estimate] of operations at HIO the responses to question 5 don't lend credence to the survey. To realistically estimate “induced” operations from a third runway at the Hillsboro Airport it is imperative to consider how the number of operations could potentially change for the principal user of the airport, Hillsboro Aviation. The survey fails to do this. For this reason alone the survey cannot be relied upon to make any predictions of “induced” operations from construction of a parallel runway. [Even if the Port suggests that the operational numbers for Hillsboro Aviation were captured in the “Pilots” category, this would only underscore the poor design and interpretation of the Survey.]

To make an informed decision on the possible “induced” increase in operations from a parallel runway at HIO this information is critical as Hillsboro Aviation conducts the majority of operations at HIO. The possibility that Hillsboro Aviation will perhaps double in size is very real. The forecasts presented in the Draft Supplemental Environmental Assessment are based on airport service region, based aircraft forecasts, socioeconomic trends, price of aviation fuel but leave out a forecast that includes the possible expansion of the Hillsboro Aviation flight school. A flight school can double in a matter of months. Take, for example, the Sierra Academy of Aeronautics, a flight school based at Castle Airport, near Atwater, California. Last year Castle Airport had 67,271 operations. According to the Merced Sun-Star, “...that number is fast changing. Airport activity has taken off over the past several months because of the Sierra Academy of Aeronautics, which constitutes about 98 percent of traffic at

for the one HIO/TTD/PDX Contact who had 51+ mean operations per month, first the minimum number of mean operations for the other 6 HIO/TTD/PDX Contacts must be determined. 43%, or 3 “HIO/TTD/PDX Contacts” (43% x 7 = 3), indicate they had 1-5 operations per month so the minimum total operations per month for these 3 would be 3 x 1 operation = 3 operations per month; 14% (1) indicated they had 6-10 operations per month so the minimum for this “HIO/TTD/PDX Contact” was 1 x 6 operations = 6 operations per month; 29% (2) had 21-50 operations per month so the minimum total operations for these 2 would be 2 x 21 = 42 operations per month. So, combined these 6 “HIO/TTD/PDX Contacts” had at a minimum an average of 51 (3 + 6 + 42 = 51) mean operations per month. As noted previously the total operations per month for the 7 “HIO/TTD/PDX Contacts” is 252 (7 x 36 mean operations per month). Subtracting the 51 minimum mean operations per month (of the 6 “HIO/TTD/PDX Contacts” who averaged less than 51 operations per month) from the total of 252 gives 201 maximum mean operations per month for the one (and only) “HIO/TTD/PDX Contact” who had “51+ operations/month.

⁵⁵ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p43.

the airport. This year the airport anticipated recording more than 150,000 total operations after the flight school recently almost doubled in size. The academy now had 150 flight students up from 80 last year, as well as 40 employees, up from 20.”⁵⁶

5) No HIO/TTD/PDX Contact conducts greater than 5% of their total operations as “touch and goes”, really?

GASR14

Facts: Not one of the “HIO/TTD/PDX Contacts” that responded to question #6 responded they had over 5% of their total operations as “touch and goes” at HIO.⁵⁷

Comment: In other words, the Report Summary would have us believe there is not one “HIO/TTD/PDX Contact” that conducts greater than 5% of their total operations at HIO as “touch and go” operations. It is inconceivable that Hillsboro Aviation does not have more than 5% of their total operations as “touch and goes at HIO.

IF -- and this is a big if -- **IF** the responses to question #6 of the Survey truly reflect the touch-and-go operations at HIO then the maximum touch-and-goes for the highest using HIO/TTD/PDX Contact, would be 5%, assuming that at least one of these HIO/TTD/PDX Contacts is included in the 1-5% answer, which there must be (see “6” below). As shown previously, the results of the Survey indicate that the maximum mean operations per month by the highest HIO/TTD/PDX Contact is 201 mean operations per month. If this 201 was representative of their total operations then at a maximum of 5% the number of touch-and-go operations at HIO is 10 per month. This number is ludicrous. How can any credence be given to the Draft Supplemental Environmental Assessment conclusions when those conclusions are based on such a misleading survey? (Granted question #8 refers to 1-5% of their “total” operations, not just their operations at HIO, but even if this is taken into consideration the argument still stands.)

The misleading response to question #6 alone should disqualify any conclusions based on the Survey. Simply put, question #6 apparently did not include a response from Hillsboro Aviation and begs the question as to which questions Hillsboro Aviation did respond to and how forthcoming any responses were. Since Hillsboro Aviation is very likely the highest user of the HIO runways, not having their data voids any meaningful conclusions based on the Survey.

6) Only 4 of the 15 “HIO/TTD/PDX Contacts” are appropriate participants for this survey.

Facts: The General Aviation Survey included 14 participants in the “HIO/TTD/PDX Contacts” category.⁵⁸ (Global Aviation is listed with “2” [which would make 15 participants]). Responses to Survey question #1 list 71% [10] of the “HIO/TTD/PDX Contacts” as responding that they base aircraft at HIO.⁵⁹ Responses to survey question #5 list 7 of the “HIO/TTD/PDX Contacts” indicating that they conduct operations at HIO.⁶⁰

⁵⁶ See Exhibit “F”, Merced Sun-Star 3-29-13, front page.

⁵⁷ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p9, table at “a Hillsboro Airport (Categorized)”.

⁵⁸ Exhibit A and also Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p44.

⁵⁹ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p2.

⁶⁰ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p8

Comment: Only 4 of these 14 participants are appropriate to include in a survey which is trying to provide data with which to estimate “induced” demand from construction of a parallel runway at HIO. The 4 appropriate “HIO/TTD/PDX Contacts” are Global Aviation, Gorge Winds Aviation, Hillsboro Aviation, and Intel.

The other 10 participants are entities that do not conduct aviation operations. These 10 inappropriate participants include: one hotel (BHG Hotels in Hillsboro: probably Comfort Inns across from the airport), 2 car rental companies (Avis Car Rental, Hertz Corporation), an aviation centered school for 5-7th graders (Centers for Airway Science), Boeing, FAA Hillsboro Control Tower HIO, Horizon Airlines, Fliteline Condominium Hangar Owners, Tower Park Condo Hangar [This is more likely Tower Park Condo Association], and Storage Management Solutions (SMS) [This is more likely “Storage Management Systems”]. Please see Exhibit A for details.

The responses to question #1 suggest that there are 10 HIO/TTD/PDX Contacts who base their aircraft at HIO but there are only 4 Contacts from this category that are “eligible” to even answer this question. The responses to question #5 suggest that there are 7 HIO/TTD/PDX Contacts that they conduct operations at HIO but there are only 4 Contacts from this category that are even “eligible” to answer this question.

Including information submitted from these inappropriate participants is improper and muddies the data. Any conclusions based on the Survey are therefore based on information that, in part, is not representative of the possible users of a parallel runway.

Facts: The “participants” for question #4 include 15 from the “HIO/TTD/PDX Contact” category with 3 (20%) listing “Flight instruction” as their primary use of Hillsboro Airport.⁶¹

Comment: Only 2 of the HIO/TTD/PDX Contacts provide flight instruction (see Exhibit A) therefore the accuracy of the table for question #4 is suspect. This puts the Survey reliability in question, which puts the conclusions based on the Survey in question.

8) The Remand Forecasts error in assuming that construction of a parallel runway will preclude use of the existing long runway by single-engine propeller operations.

Facts: The Draft Supplemental Environmental Assessment states, “The Remand Forecasts incorporates the potential for additional activity related to changes in general aviation uses behavior as a result of the existence and availability of the new parallel runway at Hillsboro and the use of separate runways for single-engine propeller and jet aircraft operations.”⁶²

Comment: The assumption that a new parallel runway will result in separate runways being used by single-engine propeller and jet aircraft is wishful thinking and not supported by any facts. While jet aircraft may not be able to use the shorter parallel runway, it does not follow that a new parallel runway will result in small flight training aircraft only using a new parallel runway. To the contrary, it is almost a certainty that both runways will be used by Hillsboro Aviation flight training school as they expand their operations.

⁶¹ Draft Supplemental Environmental Assessment, Appendix D, General Aviation Survey “Report Summary”, p7.

⁶² Draft Supplemental Environmental Assessment, Appendix D, p D-1

GASR16

Both the Port of Portland and the FAA have verified that a new parallel runway will not proscribe training aircraft from using the existing runway:

In an email to Dr. Lubischer, Mr. Nagy, general aviation manager for the Port of Portland, has stated, "The allocation of flight operations between runways is subject to FAA control. We expect that flight training for smaller single engine aircraft will be predominately conducted on the new, shorter, parallel runway. *However, it will not be restricted to the new parallel runway exclusively.* There will be occasions where an aircraft will conduct some flight training from the existing runways, especially during those times when weather and wind conditions dictate the usage of the existing crosswind runway (Runway 2/20)."⁶³

In an email to Dr. Lubischer, Mr. Fiala, HIO Air Traffic Control Tower Manager, has stated, "*HIO would not prohibit any specific operation from using any runway specifically based on status (i.e. training, pleasure, charter, etc.). Operationally if an aircraft requires the use of the existing runway, we would honor that requirement. Emergencies, large aircraft, aircraft conducting IFR approaches, and such would more than likely be assigned the existing/longer runway.*"⁶⁴

SUMMARY

GASR16

The Ninth Circuit Court instructed the FAA "to consider the environmental impact of increased demand resulting from the HIO expansion project, if any, pursuant to 40 C.F.R." The Draft Supplemental Environment Assessment concludes that the "induced" demand could increase emissions "slightly" but emissions will still be "below *de minimus* levels". This conclusion is based on an "induced" demand of only 11,350 operations / year.

The estimated "induced" demand of 11,350 operations is based on data generated by the "General Aviation Survey". When carefully examined, the results of the survey, as summarized in the General Aviation Survey Report Summary, present a confusing picture for operations at HIO. Critical elements that should have been included are not evident nor do they seem to have even been considered.

The most important element missing from the survey is any inclusion or consideration of the operations contributed by "*one of the largest combined helicopter and airplane flight training schools in the U.S.*"⁶⁵, Hillsboro Aviation. The survey results would have one believe that Hillsboro Aviation conducts 7 operations per day. This is ridiculous. Hillsboro Aviation can conduct 7 flight-training operations within a span of 15 minutes on a good, or actually for those below a bad, day.

The toxic emissions, including lead, which will result from the expansion of the Hillsboro Aviation flight training school, will be significant, perhaps even doubling. The Draft Supplemental Environmental Assessment fails to consider this possibility. For this reason and the reasons stated above an Environmental Impact Statement is required to take a hard look at this possibility.

⁶³ See Exhibit G

⁶⁴ See Exhibit H

⁶⁵ See Exhibit J

J. Lubischer
4-19-13
SUBMITTED VIA email &
CERTIFIED MAIL / RETURN RECEIPT
REQUESTED ON 4-19-13
SER 102

Air Quality Planning

Portland Air Toxics Solutions Project Modeling Lead Data and the Hillsboro Airport



State of Oregon
Department of
Environmental
Quality

TO: RENEE DOWLIN
PORT OF PORTLAND
DRAFT SEA TESTIMONY
4-19-13

GASR17

I WOULD ALSO SUBMIT THIS INFORMATION WHICH SHOWS ODEQ'S INITIAL MODELING HAD LEAD CONCENTRATIONS > THAN BENCHMARK. ALSO, THIS SHOWS ODEQ BACKING OFF THEIR INITIAL ASSESSMENT AFTER CONTACT WITH THE PORT OF PORTLAND WHO COMMISSIONED THEIR OWN ANALYSIS & DETERMINED LEVELS WOULD BE BELOW BENCHMARK BECAUSE ESSENTIALLY THE LEAD DISTRIBUTION IN THEIR MODEL WAS AT HIGHER ALTITUDES ——— WHAT IS MISSING IS AN UNDERSTANDING THAT LEAD FALLS & IS NOT NECESSARILY BLOWN TO LOWER ALTITUDES AWAY FROM HILLSBORO.

J Lubischer
(LUBISCHER)

United States Government Accountability Office

GAO

Report to Congressional Requesters

July 2012

GENERAL AVIATION SECURITY

Weaknesses Exist in TSA's Process for Ensuring Foreign Flight Students Do Not Pose a Security Threat

4-19-13

TO: RENE DOWLIN
PORT OF PORTLAND
RE: DRAFT SEA TESTIMONY

GASR18

I WOULD LIKE TO SUBMIT THIS REPORT. THIS SHOWS THAT THERE ARE ~~MINIMAL~~ MINIMAL IF ANY SECURITY MEASURES REQUIRED FOR FLIGHT TRAINING COMPANIES SUCH AS THOSE WHO CONDUCT OPERATIONS AT H10. — THE DRAFT SEA DOES NOT CONSIDER THE ENVIRONMENTAL CONSEQUENCES OF A POTENTIAL TERRORIST AVAILING THEMSELVES OF THE MINIMAL, IF ANY, SECURITY MEASURES AT H10. **GAO** THIS IS ESPECIALLY IMPORTANT



Accountability * Integrity * Reliability

GAO-12-875

DUE TO THE CLOSE APPROXIMATION OF THE INTEL FACILITIES WHICH CONTAIN MANY HAZARDOUS CHEMICALS.

THANK YOU, J. Lubischer (LUBISCHER)

JAMES T. LUBISCHER, M.D.
PEDIATRICS
20110 S.W. ALEXANDER
ALOHA, OREGON 97006
TELEPHONE: (503) 649-5257

4-19-13

RENEE DOWLIN,
SENIOR ENVIRONMENTAL PLANNER
PORT OF PORTLAND

RE: DRAFT SEA

GASR19

PLEASE INCLUDE THE ACCOMPANYING ARTICLES IN MY TESTIMONY RELATED TO THE DRAFT SEA FOR A PARALLEL RUNWAY AT H10.

- ① "A GEOSPATIAL ANALYSIS OF THE EFFECTS OF AVIATION GASOLINE ON CHILDHOOD BLOOD LEVELS" (THIS SHOWS THAT LEAD LEVELS IN CHILDREN ARE HIGHER IF THEY LIVE IN PROXIMITY TO AN AIRPORT WHERE AVGAS IS USED) ^{BY MIRANDA ET AL}
- ② "A CONFIRMATION AND EXTENSION OF ASSOCIATION OF BLOOD LEAD WITH ADHD + ADHD SYMPTOM DOMAINS AT POPULATION-TYPICAL EXPOSURE LEVELS" BY MIGHT ET AL (THIS RESEARCH SHOWS THAT LEAD CONTRIBUTES TO ADHD AT VERY, VERY LOW BLOOD LEVELS, LEVELS LOWER THAN THE CDC'S CURRENT "REFERENCE VALUE" OF 5 µg/dL.)
- ③ "RECENT DEVELOPMENTS IN LOW LEVEL LEAD EXPOSURE + INTELLECTUAL IMPAIRMENT IN CHILDREN" BY KOLLER ET AL. (THIS ARTICLE CONCLUDES THAT WHILE LEAD CONTRIBUTES TO A LOWERING OF A CHILD'S COGNITIVE ABILITY AT VERY LOW LEVELS, THAT CONTRIBUTION IS SMALL BUT AT THE SAME TIME "EFFORTS MUST CONTINUE TO MINIMIZE CHILDHOOD EXPOSURE".)
- ④ "A RATIONALE FOR LOWERING THE BLOOD LEAD ACTION LEVEL FROM 10 TO 2 µg/dL" (THIS CONTAINS INFO ON THE ADVERSE EFFECTS OF LEAD IN CHILDREN)

THANK YOU,
J Lubischer

Responses to Analysis of the General Aviation Survey Report Summary by Miki Barnes and James Lubischer	
GASR1	<p>The original EA and the Supplemental EA use the term “de minimis” in the air quality section, as it is the specific term used in the Clean Air Act General Conformity regulations. The significance of this term relates to whether or not a conformity determination is required for federal actions occurring in a non-attainment/maintenance area.</p> <p>The Hillsboro Airport is located in an attainment area for lead. Even if the Hillsboro Airport area was designated as non-attainment for lead (meaning that measurements had identified violations of the NAAQS), project-related emissions would be evaluated against the de minimis threshold. To be de minimis, project emissions would need to be less than 25 tons per year: emissions below this level would be considered de-minimis [40CFR Part 93.153].</p> <p>As noted earlier, the project related emission would be highest if the Remand forecast were to occur. Under that scenario, the project would result in 0.1 ton of additional related emissions per year, relative to the Constrained Forecast. The USEPA considers emissions less than 25 tons to be de minimis [40CFR Part 93.153]. Because the additional emissions are well below the 25-ton threshold, under the General Conformity regulations, no further analysis would be required. For these reasons, the FAA concluded that there would be no significant risks to children’s health and welfare from project-related lead emissions.</p> <p>The USEPA has adopted National Ambient Air Quality Standards (NAAQS) for the criteria pollutants, including lead. These standards are set by USEPA and are designed to protect public health and welfare with an adequate margin of safety and with consideration given to sensitive populations. As noted by USEPA:</p> <p style="padding-left: 40px;">“The Clean Air Act, which was last amended in 1990, requires EPA to set National Ambient Air Quality Standards (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act identifies two types of National Ambient Air Quality Standards. Primary standards provide public health protection, including protecting the health of “sensitive” populations such as asthmatics, children and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings.” (http://www.epa.gov/air/criteria.html)</p> <p>Washington County has been designated by USEPA as attainment for all of the NAAQS and has no history of violating USEPA air quality standards. The area around Hillsboro Airport currently meets, and is expected to continue to meet, all of the NAAQS, including the lead NAAQS. In sum, the USEPA standards are designed to protect all populations, including children, with a margin of safety.</p>
GASR2	<p>The Court required the FAA to examine the possibility that the new runway might “induce” activity not otherwise accounted for in standard forecast methods, and suggested that a general aviation user survey might be an appropriate method. The Court questioned why the Port had not surveyed pilots during the Master Plan. To be responsive to the Court, FAA conducted a general aviation user survey. Primary data from all users—operators of helicopter and fixed-wing aircraft—was important to evaluating potential changes in future aviation activity of all general aviation users.</p> <p>Student pilots were not included in the mailing of the general aviation user survey unless they were already a registered pilot.</p> <p>The FAA Tower staff at Hillsboro is responsible for counting aircraft operations performed at Hillsboro Airport, both departures and arrivals, and recording operations by type (i.e., air</p>

	carrier, air taxi and commuter, general aviation, and military) in accordance with FAA Order JO7210.3X, <i>Facility Operation and Administration</i> , effective February 9, 2012. The FAA does not count operations by business or require individuals or businesses to submit that information.
GASR3	The Port of Portland retained two firms to assist with the preparation of the forecasts: LeighFisher Associates (who prepared the forecasts) and Riley Associates (who conducted the survey that supports the Remand Forecast). Neither firm has a vested interest in the proposed project, as neither firm is involved in design, construction, or operation of airport facilities.
GASR4	Neither the FAA nor the Port of Portland had communications with the survey respondents. The Port retained an independent survey company to administer the survey, and on-line participants were invited from a broad list of pilots and companies, and phone contacts were chosen at random to maximize the objectivity of the survey. See also responses GASR2 and GASR3.
GASR5	The Port retained an independent survey company to administer the survey, and on-line participants were invited from a broad list of pilots and companies, and phone contacts were chosen at random so as to maximize the objectivity of the survey. The FAA and the Port believe that the questions asked in the survey were appropriate to the information being sought for the Remand Forecast. The questions were designed to be clear and unbiased. For example, "Approximately how many operations (landings and take-offs) per month do you average..."
GASR6	The commenter appears to be questioning how the survey operations numbers added up. As is noted, a survey question requested the responder to identify the average number of operations they conducted at Hillsboro Airport per month, and then followed up with a second question about other airports in the region. This question received a response by 270 individuals, and they did note an average of 68 operations. While the survey could have been structured to ask pilots for their flight records in support of their answers, the Port anticipated that there would be few responses to such a request. Therefore, the official records of total activity at the Airport were used as the foundation of the Constrained and Unconstrained Forecast, rather than the memories of the individual survey respondents. The purpose of this question was to gauge whether or not the respondent (an existing HIO user or users of airports in the six county area) anticipated that their behavior would change with the availability of a new runway at Hillsboro Airport and the level of activity (relative to their current activity) that they thought the runway might enable. Helicopter activity at Hillsboro is germane to the capacity of the airfield. The Survey did not distinguish between runway operations and non-runway operations. Stratifying the response in that way was not important to purpose of the surveys, as the Court suggested that the Port should have originally considered surveying pilot opinion as to whether the new runway would change which airport the pilot would use. By including the helicopter responses where pilot opinion said that they would choose to operate at HIO with the new runway, a higher level of "induced activity" is reflected. While the responses by these users were small (less than 4%), the Port and FAA chose to be conservative in responding to the Court suggestion to conduct a survey.
GASR7	The survey did not ask the respondent if they were a student, as such a question was not germane as to whether the construction of the runway would affect their decision to

	operate at Hillsboro Airport. The purpose of the survey, in response to the Court comment, was to determine if pilots thought that they would change where they operate if a new runway was built at Hillsboro Airport.
GASR8	See also Response GASR6. The cited question requests the survey respondents to identify the average number of operations they conduct at Hillsboro Airport per month, and then follows with a second question about other airports in the region. The survey responses are documented in Appendix D. The official records of total activity at the Airport were used as the foundation of the Constrained and Unconstrained Forecast, rather than the memories of the individual survey respondents. The purpose of this question was to gauge whether or not the respondent (an existing user and users of airports in the six county area) anticipated that their behavior would change with the availability of a new runway at Hillsboro Airport and the level of activity (relative to their current activity) that they thought the runway might enable.
GASR9	<p>Mr. Lubischer and Ms. Barnes submitted in several letters requests that the Port of Portland report the number of operations by Hillsboro Aviation or other tenants at the Airport. The Port of Portland does not have the resources to collect information about specific general aviation operators at Hillsboro. The Port collects some data from aircraft operators that are required to pay landing fees by month; this information consists of total number of monthly operations by those operators. That information has been provided to various citizens upon their request. In other requests of many of these individuals, the Port has offered to assist these residents with collecting the data, but there would be a manpower cost for such data collection.</p> <p>It is important to note that the operations of all tenants at Hillsboro Airport are included in the FAA Tower counts and represent the total demand for general aviation and flight training services at the Airport. The FAA and Port do not believe that the information requested by commenters about flight training details or data about specific companies is necessary to prepare forecasts for this Supplemental Environmental Assessment. Background data on total flight training is available. For example, Table 3-5 presents data from the Hillsboro Tower on helicopter training operations. Table 5-1 presents forecasts of helicopter training operations. The data for training operations represent the historical and forecast demand, regardless of what company/FBO provides training services. The FBOs at HIO have been successful in growing their flight school operations because there is demand for flight training education, not simply because they expand their operations. Therefore, the detail on individual FBOs/flight schools is less important than understanding the overall demand trends for flight training. Even if the data for individual companies were available, forecasting operations by company would be speculative.</p> <p>Collecting such information would not facilitate an understanding of the activity characteristics of the Airport. It would also not affect the ability to predict project-related activity, such as directed by the Court case. As noted in Appendices B, C, and D, the approach to forecasting project-related activity is largely a function of demographic and economic activity. The Remand Forecast tested the opinion of pilots and was prepared solely in response to the court case. The Remand Forecast is conservative because it adds "induced" activity to the Unconstrained Forecast even though the FAA and Port believe that it is already included in the Unconstrained Forecast.</p>
GASR10	See also response GASR6. The FAA and the Port do not believe that the survey was "deficient." The survey had a very specific purpose: to pursue the Court's suggestion about surveying pilot opinion as to whether the availability of a new runway at Hillsboro Airport would influence a pilot's decision to operate at Hillsboro rather than another airport in the

	<p>region. Since existing operators are already in place at Hillsboro Airport, anticipated growth by these users is already reflected in the Constrained and Unconstrained Forecast. The survey supported the Remand Forecast that with the new runway, users at other locations would chose to relocate to Hillsboro Airport. Thus, the survey information was added to the Unconstrained Forecast.</p>
GASR11	<p>See also response GASR6. The cited question requests the respondent to identify the average number of operations they conduct at Hillsboro Airport per month, and then follows up with a second question about other airports in the region. The responses are documented in Appendix D. The official records of total activity at the Airport were used as the foundation of the Constrained and Unconstrained Forecast, rather than the memories of the respondents in this question. The purpose of this question was to gauge whether or not the respondent anticipated that their behavior would change with the availability of a new runway at Hillsboro Airport and the level of activity (relative to their current activity) that they thought the runway might enable.</p> <p>Collecting such information would not facilitate an understanding of the activity characteristics of the Airport. It would also not affect the ability to predict project-related activity, such as directed by the Court case. As noted in Appendices B, C, and D, the approach to forecasting project-related activity is largely a function of demographic and economic activity. The Remand Forecast tested the opinion of pilots and was prepared solely in response to the court case. The Remand Forecast is conservative because it adds "induced" activity to the Unconstrained Forecast even though the FAA and Port believe that it is already included in the Unconstrained Forecast.</p>
GASR12	<p>The survey respondent was not asked if they fly for a company or for personal reasons. Therefore, it is not possible to determine the identity of the respondent.</p>
GASR13	<p>Since Hillsboro Aviation is an existing airport user, growth in activity by Hillsboro Aviation with the proposed project was anticipated to be reflected in the Constrained and Unconstrained Forecasts. The purpose of the Remand Forecast and associated survey, were to identify users of other airports that might change the airport that they operate if a new runway were completed at the Airport. Therefore, taking a conservative approach, responses to the survey were added to the Unconstrained Forecast to develop the Remand Forecast.</p>
GSAR14	<p>See also response GASR6. The cited question requests the respondent to identify the average number of operations they conduct at Hillsboro Airport per month, and then follows up with a second question about other airports in the region. The responses are documented in Appendix D. The official records of total activity at the Airport were used as the foundation of the Constrained and Unconstrained Forecast, rather than the memories of the respondents in this question. The purpose of this question was to gauge whether or not the respondent anticipated that their behavior would change with the availability of a new runway at Hillsboro Airport and the level of activity (relative to their current activity) that they thought the runway might enable.</p> <p>Since Hillsboro Aviation is an existing airport user, growth in activity by Hillsboro Aviation with the proposed project was anticipated to be reflected in the Constrained and Unconstrained Forecasts. The purpose of the Remand Forecast and associated survey, were to identify users of other airports that might change the airport that they operate if a new runway were completed at the Airport. Therefore, taking a conservative approach, responses to the survey were added to the Unconstrained Forecast.</p>

GASR15	<p>The cited question requests the respondent to identify the average number of operations they conduct at Hillsboro Airport per month, and then follows up with a second question about other airports in the region. The responses are documented in Appendix D. Therefore, the official records of total activity at the Airport were used as the foundation of the Constrained and Unconstrained Forecast, rather than the memories of the respondents in this question. The purpose of this question was to gauge whether or not the respondent anticipated that their behavior would change with the availability of a new runway at Hillsboro Airport and the level of activity (relative to their current activity) that they thought the runway might enable as noted in response GSAR13 and GSAR14.</p>
GASR16	<p>Existing Runway 12/30, the Airport's longest runway, can accommodate all aircraft types at Hillsboro Airport. It is aligned with the prevailing winds, consistent the Port's noise abatement runway use preferences, and is therefore the most frequently used runway at Hillsboro Airport. Due to its length, Runway 2/20, the Airport's crosswind runway, is used primarily, but not exclusively, by smaller single and multi-engine propeller aircraft.</p> <p>A substantial proportion of the activity at Hillsboro Airport consists of pilot training. The Master Plan analysis determined that about 48% of total fixed-wing aircraft activity consists of touch-and-go operations. A touch-and-go consists of an aircraft landing and then rolling down the runway without coming to a full stop prior to taking off. One touch-and-go therefore counts as two operations, a landing and a takeoff. Touch-and-go operations are currently conducted on all runways at Hillsboro Airport.</p> <p>The proposed new parallel Runway 12L/30R would reduce traffic on the main runway by accommodating some of the operations that are currently conducted on the existing runway (Runway 12R/30L). This does not mean that all future operations at Hillsboro Airport will occur on the new runway. The new parallel runway is designed to accommodate the smaller, single engine propeller aircraft that require less runway length than the higher performance aircraft at the Airport. Consistent with the planned use of the runway, the FAA and Port anticipate that over 90% of the aircraft using the new runway will be single engine piston aircraft. The allocation of flight operations between runways is subject to FAA control. There will be some occasion where an aircraft will conduct some flight training from the existing runways, especially during those times when weather and wind conditions dictate the use of the existing crosswind runway.</p> <p>Estimates of current and future runway use used in the original EA were based on the analyses documented in the Hillsboro Airport Master Plan and were reviewed and approved by the Port's Noise Office and the FAA Hillsboro Airport Air Traffic Control Tower manager. Existing Runway 30L would continue to be the most frequently used runway for itinerant operations but the many of the touch-and-go operations, representing most of the local operations, would use the new runway.</p> <p>The purpose of the survey was to respond to the comment made by the Court in the Remand. See also response GASR2.</p>
GASR17	<p>The Port of Portland staff participate in regional activities sponsored by other agencies. As the region began to consider various toxic air pollutants, the Port became involved in the ODEQ Portland Air Toxics Solutions (OPATS) efforts. The Final Supplemental EA (Appendix F) includes a study prepared by the Port of Portland in response to the ODEQs initial evaluation of lead emissions performed in the fall of 2010. The Port of Portland was concerned that the methodology used by ODEQ to assess lead dispersion did not reflect aircraft flight and dispersion. ODEQ relied upon the CALPUFF model (developed by the California Air Resources Board for the dispersal of emissions from point sources) rather</p>

	<p>than FAA's EDMS/AERMOD model. AERMOD is the model recommended by EPA for near-field lead dispersion analysis and is most often used to assess dispersion over long distances, from tens to hundreds of kilometers. The FAA's model is appropriate in this context because it reflects use of a steady-state plume, which is believed to more accurately represent the emissions associated with aircraft. FAA requires the use of its EDMS model in air quality analyses developed for NEPA documents.</p> <p>The 2010 Port of Portland study considered 2007 activity levels (at 240,735 annual operations) and evaluated the lead emissions associated with aircraft that operate on AvGas (100LL). Several evaluations were conducted: 1) Use of EDMS, 2) a simplified AERMOD evaluation, and 3) two sensitivity analyses reflecting adjustments in the emission release height and inclusion of ground-based aircraft movement. Both maximum concentrations and average concentrations were identified.</p> <p>The highest concentration of lead emissions was found in the evaluation associated with the ground-based source sensitivity test. In this evaluation lead emissions were estimated to be 0.06567 $\mu\text{g}/\text{m}^3$, which is less than 50% of the lead NAAQS. It is important to note that the primary and secondary lead NAAQS are 0.15 $\mu\text{g}/\text{m}^3$ measured on a 3-month rolling average. The modeled concentration of 0.06567 $\mu\text{g}/\text{m}^3$ corresponds well to the emission inventory reported in the original EA at 0.622 tons of lead emitted per year. Thus, as the proposed project would result in either no increase in lead emissions, or an increase in lead emissions of 0.1 ton, relative to the No Action Alternative, a NAAQS violation as a result of project implementation is not expected.</p>
GASR18	<p>The continuing primary mission of the FAA is to ensure aviation safety and efficiency. Airports and aircraft operators must meet various safety certifications and operating requirements of the FAA. Hillsboro Airport is a safe airport that meets all FAA standards. While aircraft accidents are possible, it is not possible to predict the location and extent of accidents.</p> <p>The Department of Homeland Security (DHS), through the Transportation Security Administration (TSA), protects the nation's transportation systems to ensure freedom of movement for people and commerce. The Port of Portland and the operators at Hillsboro Airport comply with the national DHS security requirements.</p>
GASR19	<p>Mr. Lubischer submitted the following documents in support of the Analysis of the General Aviation Survey Report Summary:</p> <ul style="list-style-type: none"> • Exhibit A, HIO/TTD/PDX Contacts. • Exhibit B, section 3.1.3 from the HIO Environmental Assessment, page 3-6. • Exhibit C, Hillsboro Aviation Website printout. • Exhibit D, A conversation with Mary Maxwell, Director of Aviation, Daily Journal of Commerce; August 25, 2006. • Exhibit E, Letter to B. Wyatt (Port of Portland) from M. Lyons (Hillsboro Aviation); November 30, 2009. • Exhibit F, Solutions Eyed to Keep Castle Airport Tower Operating, Merced Sun. • Exhibit G, Email to J Lubischer from Steve Nagy (Port of Portland), 4-17-2013. • Exhibit H, Email to J Lubischer from James Fiala (FAA); 3-27-2013. • Exhibit I, ATSDR, Priority List of Hazardous Substances that will be the Subject of Toxicological Profiles. • Exhibit J, page from the Hillsboro Aviation web site, ACCSC.

- Environmental Health Perspectives, *A Geospatial Analysis of the Effects of Aviation Gasoline on Childhood Blood Lead Levels*; Marie Lynn Miranda; July 2011.
- NIH, *Confirmation and Extension of Associated Blood Lead with Attention-Deficit/Hyperactivity Disorder (ADHD) and ADHD Symptom Domains at Population-Typical Exposure Levels*; Joel Niggs; January 2010.
- Environmental Health Perspective, *Recent Developments in Low-Level Lead Exposure and Intellectual Impairment in Children*; Karin Kroller; June 2004.
- NIH, *A rationale for lowering the lead action level from 10 to 2 ug/dL*; Steven Gilbert; September, 2006.
- GAO, *Weaknesses Exist in the TSAs Process for Ensuing Foreign Flight Students do not Pose a Security Threat*; GAO 12-875; July 2012.
- ODEQ, *Air Quality Planning, Portland Air Toxics Solutions Project Modeled Lead Data and the Hillsboro Airport*.

CERTIFICATE OF SERVICE

I hereby certify that on November 4, 2014, I electronically filed the foregoing brief with the Clerk of the Court for the United States Court of Appeals for the Ninth Circuit by using the appellate CM/ECF system.

The participants in the case are registered CM/ECF users and service will be accomplished by the appellate CM/ECF system.

s/ Maggie B. Smith
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