APPENDIX E

AIR QUALITY

This appendix contains background information that supplements the material in **Section 3.2**. This appendix consists of the following sections:

- E.1 Ambient Air Quality Standards – Discusses the current Ambient Air Quality Standards (National and State of Illinois) and changes in these standards since the O'Hare Modernization Environmental Impact Statement (EIS) and 2015 Re-Evaluation were published.
- E.2 Regional Air Quality/Meteorological Conditions – Provides an overview of air pollutant levels in the Chicago area and meteorological conditions that influence the formation and dispersion of the pollutants.
- E.3 Sources of Air Pollutant and Pollutant Precursor Emissions – Discusses the air pollutant and pollutant precursor sources for which emission estimates were prepared.
- E.4 Methodologies, Assumptions, and Data Descriptions – Documents the methods and various assumptions used to evaluate air quality conditions near O'Hare with the Existing Fly Quiet, Proposed Interim Fly Quiet, Revised Interim Fly Quiet 1, and Revised Interim Fly Quiet 2.
- E.5 Air Quality Analysis Results – Presents the results of the criteria pollutant emission inventories for the Existing Fly Quiet, Proposed Interim Fly Quiet, Revised Interim Fly Quiet 1, and Revised Interim Fly Quiet 2 and the results of a dispersion analysis that discloses changes in pollutant concentrations resulting from the Proposed Interim Fly Quiet, Revised Interim Fly Quiet 1, and Revised Interim Fly Quiet 2.
- E.6 Hazardous Air Pollutants (HAPs) – Discusses and presents emission inventories of HAPs for the Existing Fly Quiet, Proposed Interim Fly Quiet, Revised Interim Fly Quiet 1, and Revised Interim Fly Quiet 2.

The following attachment is also provided:

- Attachment E-1 – Provides documentation of the Chicago O'Hare International Airport Environmental Impact Statement Re-Evaluation Interim Fly Quiet Air Quality Analysis Methodology (dated April 11, 2018), which the United States Environmental Protection Agency (USEPA) reviewed and approved.[1]

The air quality analysis was assembled and analyzed, and is presented, in accordance with FAA's Order 1050.1F, Environmental Impacts: Policies and Procedures;[2] FAA's Order 5050.4B, NEPA Implementing Instructions for Airport Actions;[3] FAA's Aviation Emissions and Air Quality Handbook;[4] and other applicable guidance. Additionally, FAA provides guidance in the 1050.1F Desk Reference,[5] which

[1] Discussion by Amy Hanson, FAA with Mike Leslie, USEPA Region V on April 26, 2018.
[2] FAA, Order 1050.1F, Environmental Impacts: Policies and Procedures, July 16, 2015, https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.current/documentnumber/1050.1.
[3] FAA, NEPA Implementing Instructions for Airport Actions, April 2006, *https://www.faa.gov/airports/resources/publications/orders/environmental_5050_4/.*
[4] FAA, Aviation Emissions and Air Quality Handbook, *January 2015*, https://www.faa.gov/regulations_policies/policy_guidance/envir_policy/airquality_handbook/.
[5] FAA, An Environmental Desk Reference for Airport Actions, October 2007, *https://www.faa.gov/airports/environmental/environmental_desk_ref/.*

integrates the compliance with NEPA and applicable special purpose laws, including those pertaining to air quality.

E.1 AMBIENT AIR QUALITY STANDARDS

The Clean Air Act (CAA) requires the USEPA to establish National Ambient Air Quality Standards (NAAQS) for air pollutants considered harmful to the health of the public and the environment. Primary standards provide protection for public health, while secondary standards protect the public welfare (e.g., damage to buildings, vegetation, and visibility). There are NAAQS for six air pollutants, referred to as the "critieria" air pollutants. The six air pollutants are:

- Carbon monoxide (CO)
- Ozone (O_3)
- Sulfur dioxide (SO_2)
- Nitrogen dioxide (NO_2)
- Particulate matter (PM)
- Lead (Pb)

The size of the PM determines its potential to cause health problems. For this reason, the USEPA established NAAQS for particles of the following sizes:

- Less than or equal to 10 micrometers (coarse particulate matter, or PM_{10})
- Less than or equal to 2.5 micrometers (fine particulate matter, or $PM_{2.5}$)

The EIS was published in July 2005. The USEPA has made the following changes to the NAAQS, both before and since.

- June 15, 2005 – The one-hour O_3 standard was revoked.
- October 17, 2006 – The 24-hour standard for $PM_{2.5}$ was strengthened by reducing the standard from 65 micrograms per cubic meter ($\mu g/m^3$) to 35 $\mu g/m^3$. The annual standard for PM_{10} was revoked.
- March 27, 2008 – The eight-hour O_3 standard was reduced from 0.080 to 0.075 parts per million (ppm).
- October 15, 2008 – The Pb standard was revised to a rolling three-month average of 0.15 $\mu g/m^3$.
- February 9, 2010 – The one-hour NO_2 standard was established at 100 parts per billion (188 $\mu g/m^3$). The annual NO_2 standard remained at 53 parts per billion (100 $\mu g/m^3$).
- June 2, 2010 – The one-hour SO_2 standard was established at 75 parts per billion (196 $\mu g/m^3$) while the 24-hour and annual SO_2 standards were revoked. The three-hour SO_2 standard remained at 500 parts per billion (1,300 $\mu g/m^3$).
- December 14, 2012 – The annual $PM_{2.5}$ standard was lowered from 15.0 to 12.0 $\mu g/m^3$.
- October 1, 2015 – The eight-hour O_3 standard was further reduced from 0.075 to 0.070 ppm.

The current primary (human health) and secondary (public welfare) NAAQS, as adopted by the State of Illinois, are listed in **Table E-1**.

TABLE E-1
NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

		Primary Standards (Health Based)		Secondary Standards (Welfare Based)	
Pollutant	**Averaging Time**	**µg/m³**	**ppm**	**µg/m³**	**ppm**
CO	1-Hour[a]	40,000	35	-	-
	8-Hour[a]	10,000	9	-	-
O_3	8-Hour[b]	137	0.070	-	-
SO_2	1-Hour[c]	196	0.075	-	-
	3-Hour[a]	-	-	1,300	0.5
NO_2	1-Hour[d]	188	0.100	-	-
	Annual[e]	100	0.053	100	0.053
PM_{10}	24-Hour[f]	150	-	150	-
$PM_{2.5}$	24-Hour[g]	35	-	35	-
	Annual[h]	12.0	-	15.0	-
Pb	Quarterly Mean[i]	0.15	-	0.15	-

Notes: "-" = not applicable
µg/m³ - micrograms per cubic meter
ppm - parts per million
[a] Not to be exceeded more than once per year.
[b] Attained when the average of the annual fourth highest daily maximum 8-hour average is less than or equal to 0.070 ppm.
[c] Attained when the three-year average of the annual 99th percentile of the 1-hour daily maximum is less than or equal to 0.075 ppm.
[d] Attained when the three-year average of the annual 98th percentile of the 1-hour daily maximum is less than or equal to 0.10 ppm.
[e] Attained when the annual arithmetic mean concentration in a calendar year is less than or equal to 0.053 ppm, rounded to three decimal places.
[f] Attained when the expected number of days per calendar year with a 24-hour average concentration above 150 µgm³, is equal to or less than one.
[g] Attained when the 98th percentile 24-hour concentration average over three-years is less than or equal to 35 µgm³.
[h] Attained when the annual arithmetic mean concentration is less than or equal to 12.0 µg/m³ (revised on December 14, 2012) but the secondary standard retained the annual arithmetic mean concentration is less than or equal to 15.0 µg/m³.
[i] Maximum arithmetic mean averaged over a rolling three-month period.

Source: 40 CFR Part 50, National Primary and Secondary Ambient Air Quality Standards, https://www.epa.gov/criteria-air-pollutants/naaqs-table

The following is a brief summary of the potential health and welfare effects of each criteria air pollutant:

- CO – A colorless, odorless gas, CO is a product of incomplete combustion. At elevated concentrations, this pollutant can affect the cardiovascular and central nervous systems. CO is absorbed by the lungs and reacts with hemoglobin to reduce the oxygen-carrying capacity of the blood. At moderate concentrations, carbon monoxide has been shown to aggravate the symptoms of cardiovascular disease. It can also cause headaches and nausea, and in extremely high concentrations, lead to coma and death.
- O_3 – When volatile organic compounds (VOC) and nitrogen oxides (NO_x) accumulate in the atmosphere and are exposed to the ultraviolet component of sunlight, the pollutant O_3 is formed. O_3, a pulmonary irritant, affects the respiratory mucous membranes, other lung tissues, and respiratory functions. Exposure to O_3 at certain concentrations can result in symptoms such as tightness in the chest, coughing, and wheezing, and can trigger an attack (or exacerbate the symptoms) of asthma, bronchitis, and emphysema. Elevated concentrations of this pollutant also

interfere with a plant's ability to produce and store food, damage the leaves of trees, and reduce crop and forest yields. In Illinois, the O_3 season typically lasts from March 1 through October 31.[6]

- SO_2 – A colorless gas, SO_2 is formed when fuels containing sulfur compounds are combusted. SO_2 can cause irritation and inflammation of tissues with which it comes in contact. Inhaling elevated concentrations can irritate mucous membranes, cause bronchial damage, and exacerbate pre-existing respiratory diseases such as asthma, bronchitis, and emphysema. Sulfate particles are the major cause of reduced visibility in many areas of the United States. When combined with other substances in the air, this pollutant can fall to the earth as rain, fog, snow, or dry particles (commonly referred to as "acid rain"). SO_2 can also accelerate the decay of building materials and certain types of paint.
- NO_2 – When combustion temperatures are extremely high (as in aircraft engines, boilers, furnaces, or automobile engines), nitrogen gas from the atmosphere and from fuel combine with oxygen gas to form various oxides of nitrogen. Of these oxides of nitrogen, NO_2 is the most significant air pollutant. NO_2 is a lung irritant capable of producing pulmonary edema at high concentrations, and exposure to elevated concentrations can lead to respiratory illnesses such as bronchitis and pneumonia. Nitrate particles and NO_2 can also block the transmission of light, reducing visibility in urban areas.
- PM – Typical sources of PM are combustion of fossil fuels, industrial processes involving metals and fibers, fugitive dust from wind and mechanical erosion of soil, and photochemically produced particles (complex chain reactions between sunlight and gaseous pollutants). Particulates larger than 10 micrometers in diameter remain in the nose and throat and are readily expelled. PM_{10} or smaller can reach the air ducts (bronchi) and the air sacs (alveoli) of the lung. $PM_{2.5}$ or smaller have the best chance of reaching the lower respiratory tract. These particulates have been associated with an increase in respiratory diseases such as asthma, bronchitis, and emphysema; cardiopulmonary disease (heart attack); and cancer. PM is also a major cause of reduced visibility in parts of the United States.
- Pb – People and animals can be exposed to Pb by breathing or ingesting it in food, water, soil, or dust. Historically, the majority of Pb has come from the combustion of leaded fuels. However, the use of unleaded fuels since 1975 has reduced mobile source Pb emissions by more than 90 percent. Unlike unleaded automobile gasoline, aviation gasoline (commonly known as Avgas, or 100LL, for 100 octane low-lead) still contains Pb as an antiknock agent. Avgas is generally only used by general aviation aircraft with piston engines. As O'Hare's aircraft fleet contains few piston aircraft operations, the amount of O'Hare-related Pb emissions is minimal.

E.2 REGIONAL AIR QUALITY/METEOROLOGICAL CONDITIONS

This section discusses historic and current regulatory conditions in the Chicago area with respect to the CAA, measured levels of air pollutants in the area, and meteorological conditions that affect the production and dispersement of the pollutants.

[6] The ozone season previously ran from April through October. In 2017, however, the USEPA directed that the ozone season be expanded by one month.

E.2.1 Air Quality Conditions

In accordance with the CAA, all areas in the U.S. are designated, with respect to the NAAQS, as "attainment," "nonattainment," "maintenance," or "unclassifiable." The USEPA designates an area with air quality better than the NAAQS as attainment and an area with air pollutant levels worse than the NAAQS as nonattainment. Maintenance areas are areas that were historically designated as nonattainment, have been re-designated to attainment, and are given an additional designation of maintenance for a period of 20 years to ensure that the standard continues to be met. Areas may also be designated as unclassifiable if not enough data exists to form a basis of attainment status.

O'Hare is located within the Illinois counties of Cook and DuPage. These counties are presently designated attainment for NO_2, CO, SO_2, PM_{10}, and Pb and "moderately" nonattainment for the 2008 O_3 standard. The O_3 nonattainment area, referred to as "Chicago-Naperville, Illinois, Indiana, Wisconsin," encompasses three other counties and areas in two additional counties in Illinois, two counties in Indiana, and part of one county in Wisconsin. As stated previously, the USEPA revised the O_3 NAAQS in October 2015. On June 4, 2018, the USEPA published a final rule that also designates Cook and DuPage Counties "marginal" nonattainment for the 2015 O_3 standard.[7]

As stated previously, in December 2012, the USEPA revised the primary annual $PM_{2.5}$ standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$. Based on measured levels of $PM_{2.5}$ within the area, USEPA designated the area nonattainment for the pollutant in December 2014. However, through regularly scheduled technical audits, USEPA identified quality assurance/quality control issues with the weighing of the filters used to collect samples of $PM_{2.5}$ from some of the air quality monitoring locations. Following these audits, USEPA invalidated the $PM_{2.5}$ data from several monitoring sites used to assess compliance with the 2012 standard. As a result, USEPA designated the entire state of Illinois, plus two counties in Indiana associated with the Chicago, Illinois, area, as unclassifiable.

The Illinois EPA (IEPA) maintains a network of air quality monitors to assess compliance with the NAAQS and to evaluate the effect of air pollution control strategies. The maximum IEPA-measured pollutant concentrations of O_3 from 2014-16 within Cook and DuPage counties are presented in **Table E-2**. The number of days and the number of monitors during, and at, which the ozone, NO_x, and $PM_{2.5}$ standards were exceeded are also provided. As shown, the eight-hour ozone and annual $PM_{2.5}$ maximum IEPA-measured pollutant concentrations exceed the standards, which is consistant with the area's nonattainment status.

E.2.2 Meteorological Conditions

The NAAQS pertain to air pollutant levels in the lower part of the atmosphere (referred to as the planetary boundary layer). The planetary boundary layer is defined as "the region in which the atmosphere experiences surface effects through vertical exchanges of momentum, heat, and moisture."[8] In this atmospheric layer, the concentration of an air pollutant is based on the amount of pollutant emitted (or developed) and the degree to which the pollutant is diluted and dispersed.

In general, climatological conditions in Illinois are described as "continental," typical of the interior of a large landmass. The area experiences cold winters, warm summers, and frequent short fluctuations in temperature, humidity, cloudiness, and wind direction. Lake Michigan influences the climate of

[7] Additional Air Quality Designations for the 2015 Ozone National Ambient Air Quality Standards,83 FR 25776 (final rule June 4, 2018) (to be codified to 40 CFR 81).

[8] Panofsky H.A., Dutton J.A., 1984: Atmospheric turbulence, models and methods for engineering applications. John Wiley and Sons, New York.

northeastern Illinois and especially Chicago. The large mass of the lake tends to moderate temperatures, resulting in slightly cooler summers and warmer winters than areas located further inland.

TABLE E-2
MEASURED POLLUTANT CONCENTRATIONS

Pollutant	Averaging Time	Item	NAAQS Value	NAAQS Units	Highest Measured Level (a, b) 2014	2015	2016
CO	1-Hour	Measurement	35	ppm	1.57	1.30	1.22
	8-Hour	Measurement	9	ppm	0.90	0.80	0.76
O_3	8-Hour	Measurement	0.070	ppm	0.083	0.088	0.093
		Number of Days Greater than Standard			1	1	9
SO_2	1-Hour	Measurement	0.75	ppm	0.031	0.031	0.019
	3-Hour	Measurement	0.50	ppm	0.021	0.021	0.014
NO_2	1-Hour	Measurement	0.100	ppm	0.105	0.075	0.091
		Number of Monitors with Exceedances			1	0	0
	Annual	Measurement	0.053	ppm	0.021	0.018	0.017
PM_{10}	24-Hour	Measurement	150	µg/m3	99	146	
$PM_{2.5}$	24-Hour	Measurement	35	µg/m3	31.3	118	26.4
		Number of Monitors with Exceedances			0	12	0
	Annual	Measurement	12.0	µg/m3	12.2	12.5	9.4
		Number of Monitors with Exceedances			2	1	0
Pb	Quarterly Mean	Measurement	0.15	µg/m3	0.074	0.064	0.027

Notes: ppm= parts per million.
$\mu g/m^3$ = micrograms per cubic meter
NAAQS = National Ambient Air Quality Standards
(a) Data from all monitors within Cook and DuPage counties.
(b) The concentrations are the highest measured levels within the defined area. As such, the levels may/may not be directly comparable to the NAAQS with respect to number of exceedances because of the methodologies used to determine whether an exceedance has occurred.

Source: USEPA, Office of Air Quality Planning and Standards, *AIRData – Monitor Values Reports*, https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors and IEPA, *Annual Air Quality Reports*, http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index

The average annual temperature in Chicago is 51 degrees Fahrenheit. On a monthly basis, the average temperature ranges from 22 degrees (in January) to 74 degrees (in July). In the summer, the average possibility for sunshine ranges from 63 percent (in August) to 67 percent (in July), conditions favorable for the formation of O_3 (peak levels typically occur in hot, dry, and stagnant summertime conditions).

E.3 SOURCE OF AIR POLLUTANT AND POLLUTANT PRECURSOR EMISSIONS

The Proposed Interim Fly Quiet, through changes in runway use and taxi times, has the potential to affect levels of air pollutant and pollutant precursor emissions from the aircraft operating at O'Hare only during the nighttime hours (10:00:00 p.m. to 6:59:59 a.m.). The Proposed Interim Fly Quiet would not change the number of aircraft operations or passengers using the airport, the aircraft fleet mix, the use of ground support equipment, facilities on the ground, or surface transportation. Exhaust gases from aircraft engines are predominantly comprised of nitrogen, oxygen, and water vapor, compounds not normally considered air pollutants. To a lesser extent, aircraft also emit CO, NO_x, VOC, SOx, PM_{10}, and $PM_{2.5}$. The amount of pollutant emitted depends on factors such as engine type, aircraft type, and operational mode. The operational modes in the emissions estimates that comprise a landing-takeoff cycle (LTO) are termed descend below the [atmospheric] mixing height and climb below the [atmospheric] mixing height.[9] The Proposed Interim Fly Quiet would only affect the aircraft modes of descend/climb taxi (i.e., taxi-in and taxi-out, respectively).

The exhaust products of fuel combustion vary greatly depending on aircraft engine type, power setting, and period of operation. Additionally, air pollutants and pollutant precursors emitted by aircraft above the atmospheric mixing height have no measureable effect on polluant levels below the mixing height. CO and VOC are typically greatest in taxi/idle mode, while emissions of NO_x are greatest in take-off and climb-out modes.The same level of PM_{10} and $PM_{2.5}$ are typically emitted in the taxi/idle mode and take-off and climb-out modes.

E.4 METHODOLOGIES, ASSUMPTIONS, AND DATA DESCRIPTIONS

As stated previously, the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 would only affect aircraft-related emissions. More specifically, the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 would only affect two aircraft operational modes: descend taxi (i.e., taxi-in) and climb taxi (i.e., taxi-out) during nighttime. To evaluate the effect of these changes on local and regional air quality conditions, two types of air quality analyses were prepared:

- Emissions inventory,which documents the total emissions that would result from the airport operations associated with the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2
- Dispersion modeling, which evaluates the potential for the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 to cause or contribute to an exceedance of ambient air quality standards.

[9] For the purposes of the emissions inventory, a landing and take-off cycle is comprised of the following AEDT operational mode categories:

- *Descend Below Mixing Height*: The modes in this category are associated with an aircraft's arrival, beginning at the atmospheric mixing height and including descend emissions below 1,000 feet, the landing ground roll, and arrival taxi (i.e., taxi-in) emissions.
- *Climb Below Mixing Height:* The modes in this category are associated with an aircraft's departure, beginning with startup and including climb taxi (i.e.,taxi-out), takeoff ground roll, climb below 1,000 feet and climb to the atmospheric mixing height.

For the dispersion modeling, the incremental concentration is the difference between pollutant concentrations with the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 and the concentrations with the Existing Fly Quiet. The incremental concentrations represent project-related airport sources (i.e., nighttime aircraft activities). Background concentrations were used to represent non-Fly Quiet-related airport sources occuring during the same time period (i.e., ground support equipment and surface traffic that would not be affected by the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2) as well as non-airport sources (emissions sources beyond the airport boundary that are unrelated to the airport). For comparison to the NAAQS, the incremental concentration (i.e., project-related concentration) was added to the background concentration (i.e., non-project-related and non-airport-related concentrations). The incremental approach was reviewed and approved by USEPA.[10]

E.4.1 Emission Inventories

Emission inventories summarize the total quantity of each pollutant/pollutant precursor emitted within a defined project area. For this Re-Evaluation, annual aircraft emissions of CO, VOC, SO_x, NO_x, PM_{10}, $PM_{2.5}$, and SO_x, expressed in tons, were estimated. Pb emissions are not typically considered in emissions inventories for commercial service airports because these emissions result primarily from piston engine aircraft and the use of leaded aviation gasoline (Avgas, or 100LL), which typically represent a small share of operations and resources at a commercial service facility. Specifically, Avgas-fueled aircraft operations at O'Hare conducted by piston aircraft total less than one percent of total aircraft operations and would be expected to emit less than 0.1 tons of Pb per year. Thus, Pb emissions were not further evaluated in this Re-Evaluation.

Unlike the analysis presented in the EIS and the 2015 Re-Evaluation, this air quality analysis was performed with FAA's Aviation Environmental Design Tool (AEDT, Version 2d).[11] As of May 29, 2015, in conjunction with USEPA's approved dispersion model, the American Metereological Society/USEPA Regulatory Model (AERMOD 16216r),[12,13] the AEDT is required when preparing air emissions inventories and dispersion modeling for FAA-related actions.

The following section discusses the aircraft-specific data used in AEDT to calculate the emission inventories for the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2 and to derive the project-related concentrations resulting from the Proposed Interim Fly Quiet as well as Revised Interim Fly Quiet 1 and 2.

E.4.1.1 Aircraft Operations and Fleet Mix

The same aircraft operational level and aircraft fleet mix were used to prepare emissions data for the Existing Fly Quiet, Proposed Interim Fly Quiet (i.e., the Proposed Interim Fly Quiet will not induce or reduce total annual aircraft operations) and Revised Interim Fly Quiet 1 and 2. This data is provided in **Table E-3**. The aircraft fleet and number of annual operations presented in **Table E-3** are those that would occur during the nighttime hours (10:00 p.m. to 6:59 a.m.) only, as the Proposed Interim Fly Quiet would not change daytime aircraft operations.

[10] Discussion by Amy Hanson, FAA with Mike Leslie, USEPA Region V on April 26, 2018.
[11] FAA, Aviation Environmental Design Tool (AEDT) Users Guide, September 2017, https://aedt.faa.gov/.
[12] USEPA Preferred/Recommended Models, AERMOD Modeling System, https://www.epa.gov/scram/air-quality-dispersion-modeling-preferred-and-recommended-models.
[13] Title 40 CFR Part 51, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf.

TABLE E-3
AIRCRAFT OPERATIONS/FLEET MIX

Aircraft Code	Aircraft Type	Engine Type	Number of Annual Nighttime Arrivals	Number of Annual Nighttime Departures
A306	Airbus A300F4-600 Series	PW4158	659	220
A319	Airbus A319-100 Series	V2522-A5	462	362
A320	Airbus A320-200 Series	CFM56-5A3	75	220
A320	Airbus A320-200 Series	CFM56-5B4/P	220	220
A320	Airbus A320-200 Series	V2527-A5	976	1,628
A321	Airbus A321-200 Series	V2533-A5	5,338	2,315
A330	Airbus A330-300 Series	CF6-80E1A4	0	13
A333	Airbus A330-300 Series	CF6-80E1A4	0	220
A359	Airbus A350-900 series	Trent 772	0	439
B712	Boeing 717-200 Series	BR700-715C1-30	0	220
B737	Boeing 737-700 Series	CFM56-7B24	220	220
B738	Boeing 737-800 Series	CFM56-7B26	2,934	2,440
B738	Boeing 737-800 Series	CFM56-7B27	2,614	1,757
B739	Boeing 737-900-ER	CFM56-7B26	439	439
B739	Boeing 737-900-ER	CFM56-7B26E	2,637	879
B744	Boeing 747-400 Series	CF6-80C2B1F	0	13
B744	Boeing 747-400 Series Freighter	CF6-80C2B1F	0	220
B744	Boeing 747-400 Series Freighter	RB211-524G-T	439	0
B748	Boeing 747-800 Freighter	GENX-2B67	220	1,123
B752	Boeing 757-200 Series	RB211-535E4	1,318	232
B752	Boeing 757-200 Series Freighter	RB211-535E4	440	440
B762	Boeing 767-200 Series	JT9D-7R4D, -7R4D1	220	220
B763	Boeing 767-300 ER	CF6-80C2B6F	220	220
B763	Boeing 767-300 Series	CF6-80C2B6F	220	0
B772	Boeing 777-200-ER	PW4090	659	0
B772	Boeing 777-200-LR	GE90-110B1	659	737
B773	Boeing 777-300 ER	GE90-115B	220	0
B788	Boeing 787-8R	GENX-1B64	0	892
B789	Boeing 787-900 Dreamliner	GEnx-1B74/75/P1	0	13
DC10	Boeing DC-10-10 Series	CF6-6D	439	736
MD11	Boeing MD-11 Freighter	CF6-80C2D1F	220	220
MD82	Boeing MD-82	JT8D-219	220	13
MD88	Boeing MD-88	JT8D-219	659	362
CRJ2	Bombardier CRJ-200	CF34-3B	902	1,330
CRJ7	Bombardier CRJ-700	CF34-8C1	1,086	1,640
CRJ7	Bombardier CRJ-700	CF34-8C5	879	866
CRJ7	Bombardier CRJ-700	CF34-8C5B1	866	502

Aircraft Code	Aircraft Type	Engine Type	Number of Annual Nighttime Arrivals	Number of Annual Nighttime Departures
CRJ9	Bombardier CRJ-900	CF34-8C5B1	0	232
C208	Cessna 208 Caravan	PT6A-114A	220	0
E55P	Cessna 560 Citation V	PW530	0	220
C56X	Cessna 560 Citation XLS	JT15D-5, -5A, -5B	220	0
E145	Embraer ERJ145	AE3007A1	1,231	981
E145	Embraer ERJ145-XR	AE3007A1E	2,475	258
E170	Embraer ERJ170	CF34-8E5	724	1,368
E170	Embraer ERJ170	CF34-8E5A1	1,318	891
E190	Embraer ERJ190	CF34-10E5A1	65	220
E190	Embraer ERJ190	CF34-10E6	0	220
GLF5	Gulfstream V-SP	BR700-710A1-10	0	220
BE40	Raytheon Beechjet 400	JT15D-5, -5A, -5B	13	0
Total Nighttime Operations			**32,726**	**25,981**

Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

E.4.1.2 Emission Factors

FAA's AEDT contains a database of aircraft engine-specific emission factors based on engine make and model and the four engine operational modes (idle, take-off, climb-out, and approach.) AEDT also approximates emissions of VOC for aircraft that have International Civil Aviaiton Organization (ICAO)-certification on engine startup using a formula based on the rated thrust of an aircraft's engine.[14] The Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 would only affect aircraft operations within the taxi-in and taxi-out operating modes. The AEDT default emission factors for aircraft engines were used for the analysis presented in this Re-Evaluation.

E.4.1.3 Temporal Factors

Temporal factors were used to describe the relationship of one period of time to another (i.e., the relationship of activity during one hour to activity in a 24-hour period). In AEDT, temporal factors are applied to represent varying levels of activity as a fraction of a peak period. Using temporal factors gives the model the ability to more accurately reflect real world conditions.

To represent actual aircraft activity at the airport through the entire calendar year, quarter-hour-of-day, day-of-week, and month-of-year temporal factors (sometimes referred to as operational profiles) were developed. These factors are used by the AEDT in its dispersion mode to calculate hourly concentrations at receptor locations. **Tables E-4** and **Table E-5** provide the quarter-hour of day, day of week, and monthly temporal factors used in the air quality analysis. Temporal factors used in the analysis only represent nighttime (10:00 p.m. to 6:59 a.m.) activities. The quarter-hour of the day and monthly temporal factors were developed using data from the TAAM (Total Airspace and Airport Modeling) airfield simulation (see **Appendix A**). The day of week temporal factors were developed using FAA's Operations Network (OPSNET). The OPSNET is FAA's source of air traffic operations and delay data.

[14] *Aviation Environmental Design Tool (AEDT) Technical Manual*, Version 2d, September 2017.

During nighttime hours, departures tend to peak during the beginning of the nighttime (i.e., 10:00 p.m. for air carriers and 11:00 p.m. for cargo) and arrivals tend to peak at the end of the nighttime (i.e. 6:00 a.m. for cargo and 6:59 a.m. for air carriers). The same operational profiles were used for the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2. Based on the operational profiles, the peak of aircraft activity during the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 occurs on a Monday during October.

TABLE E-4
AIRCRAFT QUARTER-HOURLY OPERATIONAL PROFILES

Time Beginning	Time Ending	Departures			Arrivals		
		Air Carrier	GA	Cargo	Air Carrier	GA	Cargo
22:00	22:15	0.9848	0.0000	0.1086	0.3094	0.0000	0.0000
22:15	22:30	0.8923	0.0000	0.2568	0.3693	0.0000	0.0000
22:30	22:45	0.1388	0.0000	0.8518	0.1745	0.0000	0.0000
22:45	23:00	0.7106	0.6490	0.0211	0.0781	0.0000	0.0000
23:00	23:15	0.2820	0.3510	**1.0000**	0.1117	0.0000	0.0000
23:15	23:30	0.0000	0.0000	0.3695	0.1226	0.0000	0.8528
23:30	23:45	0.0000	0.0000	0.4782	0.4163	0.0000	0.6399
23:45	0:00	0.0463	0.0000	0.6305	0.1870	0.0000	0.7724
0:00	0.15	0.0669	0.0000	0.0000	0.2112	0.0000	0.1499
0.15	0:30	0.0032	0.0000	0.0000	0.1439	0.0000	0.2276
0:30	0:45	0.0774	0.0000	0.0000	0.0821	0.0000	0.0000
0:45	1:00	0.2734	0.0000	0.3695	0.0368	0.0000	0.0000
1:00	1:15	0.0662	0.0000	0.0000	0.0000	0.0000	0.0000
1:15	1:30	0.0040	0.0000	0.2609	0.0574	0.0000	0.0000
1:30	1:45	0.0000	0.0000	0.1086	0.0988	0.0000	0.0000
1:45	2:00	0.0000	0.0000	0.0000	0.0521	0.0000	0.0000
2:00	2:15	0.0702	0.0000	0.0000	0.0521	0.0000	0.0000
2:15	2:30	0.0000	0.0000	0.0000	0.0054	0.0000	0.0000
2:30	2:45	0.0000	0.0000	0.3485	0.0988	0.0000	0.0000
2:45	2:00	0.0000	0.0000	0.3695	0.0000	0.0000	0.0000
2:00	3:15	0.0000	0.0000	0.0211	0.0521	0.0000	0.0000
3:15	3:30	0.0000	0.0000	0.0000	0.0650	0.0000	0.0000
3:30	3:45	0.0000	0.0000	0.0000	0.0392	0.0000	0.1110
3:45	4:00	0.0000	0.0000	0.0000	0.0000	0.0000	0.3775

Time Beginning	Time Ending	Departures			Arrivals		
		Air Carrier	GA	Cargo	Air Carrier	GA	Cargo
4:00	4:15	0.0000	0.0000	0.0000	0.0000	0.0000	0.2880
4:15	4:30	0.0000	0.0000	0.0000	0.0521	0.0000	0.3560
4:30	4:45	0.0000	0.0000	0.0000	0.0183	0.0000	0.5274
4:45	5:00	0.0072	0.0000	0.0000	0.0698	0.0000	**1.0000**
5:00	5:15	0.1722	0.0000	0.0000	0.3492	0.0000	0.3817
5:15	5:30	0.1219	0.0000	0.0000	0.3414	0.0000	0.3733
5:30	5:45	0.1939	0.0000	0.0000	0.0024	0.0000	0.3601
5:45	6:00	0.1363	0.0000	0.3695	0.0604	0.0000	0.3601
6:00	6:15	0.6489	0.0000	0.0000	0.4102	0.0000	0.0174
6:15	6:30	**1.0000**	0.0000	0.0000	0.9468	0.0000	0.0000
6:30	6:45	0.6307	0.0000	0.0000	0.7479	**1.0000**	0.0000
6:45	6:59	0.5472	**1.0000**	0.1297	**1.0000**	0.0570	0.0000

BOLD values represent peak periods
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-5
AIRCRAFT DAILY AND MONTHLY OPERATIONAL PROFILES

Day	Operational Profile	Month	Operational Profile
Monday	**1.0000**	January	0.9048
Tuesday	0.9923	February	0.8024
Wednesday	0.9877	March	0.9623
Thursday	0.8098	April	0.8994
Friday	0.8190	May	0.9635
Saturday	0.6567	June	0
Sunday	0.9343	July	0
		August	0
		September	0.9594
		October	**1.0000**
		November	0.9302
		December	0.9364

BOLD values represent peak periods
Sources: FAA's Operations Network, Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

E.4.1.4 Time-in-Mode Data

AEDT contains emissions factors for the vast majority of U.S. aircraft by engine type and operational mode (e.g., take-off, climb-out, approach, and taxi/idle). Time-in-mode data is also used as input for the AEDT. As developed by TAAM and documented in **Appendix A**, the approach taxi (i.e., taxi-in) and climb-out taxi (i.e., taxi-out) ground travel times for the Existing Fly Quiet are 8.50 minutes and 12.92 minutes, respectively. As developed by the CDA and documented in **Appendix A**, the taxi-in and taxi-out ground travel times for the Proposed Interim Fly Quiet are 9.21 minutes and 13.04 minutes, respectively. Because of higher utilization of runways further from passenger terminals and cargo gates, the estimated aircraft taxi-in and taxi-out ground travel times for the Proposed Interim Fly Quiet are slightly greater than the taxi-in and taxi-out ground travel times for the Existing Fly Quiet. This slight increase in taxi times would be expected to result in a slight increase in total aircraft-related emissions.

As developed by the CDA and documented in **Appendix A**, the taxi-in and taxi-out ground travel times for the Revised Interim Fly Quiet 1 are 9.36 minutes and 13.02 minutes, respectively. Due to higher utilization of runways further from passenger terminals and cargo gates, the estimated aircraft taxi-in and taxi-out ground travel times for the Revised Interim Fly Quiet 1 are slightly greater than the taxi-in and taxi-out ground travel times for the Existing Fly Quiet. This slight increase in taxi times would be expected to result in a slight increase in total aircraft-related emissions.

As developed by the CDA and documented in **Appendix A**, the taxi-in and taxi-out ground travel times for the Revised Interim Fly Quiet 2 are 9.28 minutes and 13.02 minutes, respectively. Due to higher utilization of runways further from passenger terminals and cargo gates, the estimated aircraft taxi-in and taxi-out ground travel times for the Revised Interim Fly Quiet 2 are slightly greater than the taxi-in and taxi-out ground travel times for the Existing Fly Quiet. This slight increase in taxi times would be expected to result in a slight increase in total aircraft-related emissions.

E.4.1.5 Aircraft Assignments to Terminals and Taxiways

The TAAM output for the Existing Fly Quiet and additional information developed by the CDA for the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 (**Appendix A**) assigns aircraft to the appropriate terminal based on airline lease agreements, forecast gate use strategies, and known operations at O'Hare. The simulated taxiway assignments were based on the common and forecast routing paths that O'Hare ground traffic controllers are known to assign. Documentation for TAAM output for the Existing Fly Quiet provides further details regarding the taxiways used in the analysis. Furthermore, documentation by the CDA provides further details regarding the taxiways used in the analysis for the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2.

AEDT uses input data to develop an aircraft taxiway[15] and corresponding ground taxi durations. Each aircraft is assigned a terminal gate location to which the aircraft proceeds after landing and where servicing (e.g., baggage handling, fueling, catering, etc.) is conducted. The aircraft then departs from the same terminal gate for a takeoff runway end. Each aircraft is also assigned a runway end for arrival and departure in AEDT. The capacity of the airfield, which can affect emissions via ground delay, is defined as the highest number of hourly departures which can occur during the peak hour of arrivals and the highest number of hourly arrivals which can occur during the peak hour of departures.

Operating configurations specify the pattern of aircraft arrivals and departures on specific runways over the course of a year, depending on weather conditions and airfield capacity. Specifying

[15] A taxiway is an ordered list of instructions that specifies how to maneuver from a gate to a runway end (outbound) or from a runway exit to a gate (inbound).

configurations allows for aircraft to be assigned to runways based on aircraft weight, a similar method to that employed in an actual airport operating environment. For this Re-Evaluation, the west and east flow configurations were both included in the air quality analysis to account for weather conditions representing westerly and easterly wind directions to represent real-world conditions.

The assignments for taxiways, airfield capacity levels, and runway utilization were based on the TAAM results for the Existing Fly Quiet and information developed by the CDA for the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 (**Appendix A**). AEDT's Delay and Sequence Module takes into account aircraft operational schedules, runway configurations, and the delays associated with airport capacity (with respect to the ground movement of aircraft) to determine the ground taxi time.

E.4.1.6 Runway Use

When performing dispersion analysis, analysts must provide AEDT with runway use data. The runway use assignments for the analysis of the Existing Fly Quiet were obtained from TAAM; runway use assignments for the analysis of the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 were developed by the CDA. The data included percentages of departures and arrivals for each runway for each type of aircraft; this information was used to distribute landing-take-off cycles to each runway end. The west and east flow runway-use data for arrivals and departures, used in the analysis for the Existing Fly Quiet, is provided in **Table E-6** and **Table E-7**. The west and east flow runway use data for arrivals and departures, used in the analysis for the Proposed Interim Fly Quiet, is provided in **Table E-8** and **Table E-9**. The west and east flow runway use data for arrivals and departures, used in the analysis for the Revised Interim Fly Quiet 1, is provided in **Table E-10** and **Table E-11**. The west and east flow runway use data for arrivals and departures, used in the analysis for the Revised Interim Fly Quiet 2, are provided in **Table E-12** and **Table E-13, respectively**. As required by AEDT, the annual runway usage by aircraft size category (heavy, large, and small) and wind direction flow (west and east) are used for the air quality analysis (this requirement differs from AEDT's requirements for aircraft noise analysis).

TABLE E-6
RUNWAY USE – WEST FLOW – EXISTING FLY QUIET

	Percent Nighttime Runway Use						
	Arrivals				Departures		
Aircraft Size	28C	27L	27R	28R	22L	28R	28R(Int)
All Aircraft	12.64	64.20	14.33	8.83	23.21	58.63	18.16
Heavy	10.53	20.68	0.00	68.79	0.00	100.00	0.00
Large	13.16	71.72	15.12	0.00	29.27	47.83	22.90
Small	0.00	0.00	100.00	0.00	0.00	100.00	0.00

Note: 28R(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-7
RUNWAY USE – EAST FLOW – EXISTING FLY QUIET

	Percent Nighttime Runway Use							
	Arrivals					Departures		
Aircraft Size	**09L**	**09R**	**10L**	**10R**	**10C**	**09R**	**10L**	**10L(Int)**
All Aircraft	17.83	3.20	50.72	1.67	26.58	61.12	19.86	19.02
Heavy	0.00	6.12	93.88	0.00	0.00	7.70	85.95	6.35
Large	19.85	2.82	45.23	1.30	30.80	75.26	2.07	22.67
Small	53.75	0.00	0.00	38.74	7.51	100.00	0.00	0.00

Note: 10L(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-8
RUNWAY USE – WEST FLOW – PROPOSED INTERIM FLY QUIET

	Percent Nighttime Runway Use								
	Arrivals					Departures			
Aircraft Size	**22R**	**27L**	**27R**	**28C**	**28R**	**22L**	**28C**	**28R**	**28R(Int)**
All Aircraft	16.37	34.58	14.33	30.62	4.10	31.67	8.76	42.23	17.34
Heavy	18.77	5.79	0.00	56.76	18.68	9.37	20.73	69.90	0.00
Large	16.25	39.67	15.20	27.01	1.87	37.32	5.61	35.21	21.86
Small	0.00	0.00	100.00	0.00	0.00	20.92	22.56	56.52	0.00

Note: 28R(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-9
RUNWAY USE – EAST FLOW – PROPOSED INTERIM FLY QUIET

	Percent Nighttime Runway Use										
	Arrivals						Departures				
Aircraft Size	**09L**	**09R**	**10C**	**10L**	**10R**	**04R**	**09R**	**10C**	**10L**	**10L(Int)**	**04L**
All Aircraft	17.83	0.79	45.53	19.98	1.66	14.21	44.97	3.40	24.68	18.66	8.29
Heavy	0.00	0.29	37.79	38.02	0.01	23.89	6.21	8.70	74.51	5.49	5.09
Large	19.62	0.87	47.18	17.89	1.28	13.16	55.92	1.92	10.86	22.41	8.89
Small	53.75	0.00	7.51	0.00	38.74	0.00	13.33	5.18	20.71	0.00	60.78

Note: 10L(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Simulation Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-10
RUNWAY USE – WEST FLOW – REVISED INTERIM FLY QUIET 1

	Percent Nighttime Runway Use								
	Arrivals					Departures			
Aircraft Size	**22R**	**27L**	**27R**	**28C**	**28R**	**22L**	**28C**	**28R**	**28R(Int)**
All Aircraft	10.30	37.43	14.33	34.39	3.55	28.06	10.60	44.02	17.32
Heavy	11.95	8.36	0.00	64.08	15.61	5.98	22.88	71.14	0.00
Large	10.20	42.60	15.19	30.29	1.72	33.76	7.25	37.10	21.89
Small	0.00	0.00	100.00	0.00	0.00	14.05	30.89	55.06	0.00

Note: 28R(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Simulation Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-11
RUNWAY USE – EAST FLOW – REVISED INTERIM FLY QUIET 1

	Percent Nighttime Runway Use										
	Arrivals						Departures				
Aircraft Size	**09L**	**09R**	**10C**	**10L**	**10R**	**04R**	**09R**	**10C**	**10L**	**10L(Int)**	**04L**
All Aircraft	17.83	0.94	48.28	22.43	1.66	8.86	46.59	3.33	26.42	18.54	5.12
Heavy	0.00	0.46	43.46	41.34	0.01	14.73	6.02	8.38	77.04	5.36	3.20
Large	19.64	1.02	49.59	20.25	1.28	8.22	57.81	1.94	12.54	22.24	5.47
Small	53.75	0.00	7.51	0.00	38.74	0.00	20.12	4.64	33.85	0.00	41.39

Note: 10L(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-12
RUNWAY USE – WEST FLOW – REVISED INTERIM FLY QUIET 2

	Percent Nighttime Runway Use								
	Arrivals					Departures			
Aircraft Size	**22R**	**27L**	**27R**	**28C**	**28R**	**22L**	**28C**	**28R**	**28R(Int)**
All Aircraft	12.86	36.37	14.32	32.73	3.72	29.64	9.77	43.26	17.33
Heavy	14.78	7.21	0.00	61.10	16.91	7.44	21.91	70.65	0.00
Large	12.76	41.49	15.17	28.85	1.73	35.35	6.49	36.27	21.89
Small	0.00	0.00	100.00	0.00	0.00	17.26	27.51	55.23	0.00

Note: 28R(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

TABLE E-13
RUNWAY USE – EAST FLOW – REVISED INTERIM FLY QUIET 2

	Percent Nighttime Runway Use										
	Arrivals						Departures				
Aircraft Size	09L	09R	10C	10L	10R	04R	09R	10C	10L	10L(Int)	04L
All Aircraft	17.83	0.90	46.31	21.72	1.66	11.58	46.18	3.46	25.12	18.59	6.65
Heavy	0.00	0.40	39.28	40.92	0.01	19.39	6.34	8.56	75.49	5.45	4.16
Large	19.67	0.98	47.90	19.46	1.28	10.71	57.20	2.06	11.36	22.28	7.10
Small	53.75	0.00	7.51	0.00	38.74	0.00	17.46	5.59	25.97	0.00	50.98

Note: 10L(Int.) is the location of Intersection Departures for that runway.
Sources: Ricondo & Associates TAAM Results, June 2018, and The RCH Group and KB Environmental Sciences, Inc.

E.4.2 Dispersion Analysis

Dispersion is the process by which atmospheric pollutants disseminate due to wind and vertical stability. The base data for this type of analysis are emissions inventories (described previously). Dispersion models use these emissions to derive the concentration that would be experienced at specific locations at an airport and in its vicinity. Dispersion modeling uses hourly averaged meteorological data, terrain elevation data, and emissions and source release data to compute downwind pollutant concentrations over "averaging periods" ranging from one hour to one year.

To be consistent with the analysis performed for the EIS and the 2015 Re-Evaluation, the dispersion analyses for the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2 were designed to provide predicted levels of pollutants at expected worst-case locations (e.g., at the airport property line near the ends of runways) and on- and off-airport property at existing air quality sensitive sites (e.g., terminal curbsides).

The dispersion analysis was performed for CO, SO_2 (assuming full conversion of SO_x emissions to SO_2 emissions), PM_{10} and $PM_{2.5}$. Concentrations of NO_2 were also estimated using methods that convert the NO_x emissions estimated by the AEDT to concentrations of NO_2. Note that modeling to determine the effects of an individual project on regional levels of O_3 is not considered reasonable because the computer models used to assess this pollutant do not support comparisons between modeling results at specific locations and the NAAQS.

The dispersion model used in this analysis represents state-of-the-art modeling methodology and guidance at the time of this Re-Evaluation. Therefore, given the accuracy of the input data, its results offer the best available estimates with which to predict ambient concentrations. These models are not without limitations. Studies of model accuracy have consistently confirmed the following conclusions: (1) dispersion models are more reliable for predicting long-term concentrations than for estimating short-term concentrations at specific locations; and (2) dispersion models are reasonably reliable in predicting the magnitude of the highest concentrations occurring without respect to a specific time or location. For example, errors in highest-estimated concentrations of ±10 to 40 percent are found to be typical, i.e., certainly well within the often quoted "factor-of-two accuracy" for these models.[16]

[16] USEPA, 40 CFR Part 51. Requirements for Preparation, Adoption, and Submittal of State Implementation Plans (Guideline on Air Quality Models); Proposed Rule. Federal Register. 65(78): 21506-21546, April 21, 2000.

E.4.2.1 Dispersion Model and Options

The AERMOD is an atmospheric dispersion model that simulates point, area, volume, and line emissions sources. The model is capable of considering simple, intermediate, and complex terrain along with meteorological conditions and multiple receptor locations.[17,18] AERMODwas used for the modeling analysis of the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2. AERMOD is the appropriate model for this analysis based on the model's coverage of simple (i.e., flat), intermediate, and complex (i.e., above emission-source elevation) terrain. For this evaluation, the terrain was assumed to be flat.

The model also predicts both short-term (one to 24 hours) and long-term (annual) average concentrations. AERMOD was executed using the regulatory default options (stack-tip downwash, buoyancy-induced dispersion, final plume rise), default wind speed profile categories, default potential temperature gradients, and, with the exception of the NO_x to NO_2 analysis, no pollutant decay.

When executing the AERMOD, selection of appropriate dispersion coefficients depends on the land use within three kilometers (km) of a source. This land-use typing is based on a classification method defined by Auer,[19] using pertinent U.S. Geological Survey (USGS) 1:24,000 scale (7.5 minute) topographic maps of the area.

If the Auer land use types of heavy industrial, light-to-moderate industrial, commercial, and compact residential account for 50 percent or more of the total area, the USEPA Guideline on Air Quality Models[20] recommends using urban dispersion coefficients; otherwise, using the appropriate rural coefficients is advised. O'Hare is in an urban area; the immediate area, however, is characterized by large areas of pavement, low buildings, and open space. Consistent with the EIS and the 2015 Re-Evaluation and the criteria stated, therefore, rural dispersion coefficients were used for this analysis, which tends to be more conservative than the use of urban dispersion coefficients.

E.4.2.2 Emission Source Release Characteristics

Dispersion models require several types of data for each emissions source to simulate the characteristics of the release (i.e., movement) of pollutant and pollutant precursor emissions. For aircraft-related sources, AERMOD constructs area sources, which are used to model emissions from aircraft gate aprons (i.e., aircraft at startup) as well as aircraft taxiing, queuing, accelerating on the runway, and in the take-off, climb-out, and approach modes.

E.4.2.3 Meteorological Data

Lake Michigan influences the climate of Chicago and the rest of northeastern Illinois. The large thermal mass of the lake moderates temperatures, causing cooler summers and warmer winters. One major benefit is the cool lake breezes that provide relief from summer heat. The lake also tends to increase cloudiness in the area and suppress summer precipitation. Winter precipitation is enhanced by lake-effect snows that occur when winds blow from the north or northeast. These winds allow air to pass over the relatively warm lake, boosting storm system energy and water content, and leading to increased snowfall.[21]

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[17] USEPA Preferred/Recommended Models, AERMOD Modeling System, http://www.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod.

[18] Title 40 CFR Part 51, Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, http://www.epa.gov/ttn/scram/guidance/guide/appw_05.pdf.

[19] Auer, August H., 1978: *Correlation of Land Use and Cover with Meteorological Anomalies*. J. Appl. Meteor., 17, 636–643 http://journals.ametsoc.org/doi/pdf/10.1175/1520-0450%281978%29017%3C0636%3ACOLUAC%3E2.0.CO%3B2.

[20] Appendix W to Part 51 – Guideline on Air Quality Models, http://www.ecfr.gov/cgi-bin/text-idx?SID=e6a5b817b94abf58460f48c032d9a39c&node=40:2.0.1.1.2.23.11.5.37&rgn=div9.

[21] Climate of Illinois Narrative, http://www.sws.uiuc.edu/atmos/statecli/General/Illinois-climate-narrative.pdf.

The average annual maximum and minimum temperatures are 59 degrees Fahrenheit and 41 degrees Fahrenheit, respectively. The mean annual temperature is 51 degrees Fahrenheit. The annual precipitation is approximately 38 inches and the average annual wind speed is approximately 10 miles per hour.[22] The mixing height—the top of the unstable or neutral air near the ground—determines the limits of vertical transport and diffusion of pollutants. For this analysis, the site-specific mixing height of 2,510 feet was used, consistent with the EIS and the 2015 Re-Evaluation.

The AERMOD uses both surface data from O'Hare and upper-air meteorological conditions from Peoria, Illinois. The data used in the evaluation was obtained from the National Climatic Data Center. The dispersion modeling analysis used actual hour-of-day meteorological data collected at O'Hare by the National Weather Service for the most recent three-year period (2014 through 2016) for which data was available at the project initiation. **Figure E-1** displays the annual wind rose. The nighttime wind rose is provided in **Figure E-2**. As shown, the wind direction is predominately from the south-southwest-west with a low frequency of calm wind speed conditions (less than one percent), as shown in **Figure E-3,** which displays the annual wind speed distribution. The average annual wind speed is 10.4 miles per hour.

AERSURFACE, a tool that processes land cover data, was used to determine the surface characteristics utilized in AERMET, a meteorological data preprocessor for AERMOD. AERSURFACE was also used to assess the land use cover and determine the appropriate surface roughness length,[23] Bowen ratio,[24] and albedo[25] based on land use cover, soil moisture, and seasonal conditions. The appropriate surface roughness length, Bowen ratio, and albedo from AERSURFACE were 1.0, 1.625, and 0.2075, respectively, indicative of a land use containing urban features.[26]

AERMOD incorporates two options to address concerns regarding model performance under low wind-speed conditions. The LOWWIND1 option increases the minimum value of sigma-v (i.e., horizontal turbulence) from 0.2 to 0.5 m/s and "turns off" the horizontal meander component. The LOWWIND2 option increases the minimum value of sigma-v from 0.2 to 0.3 m/s and incorporates the meander component—with some adjustments to the algorithm—including an upper limit on the meander factor of 0.95. These low wind options can be used with the option to adjust the surface friction velocity u* (pronounced ustar) under low-wind/stable conditions. The LOWWIND2 and u* options were used in the dispersion analysis for this Re-Evaluation and in the 2015 Re-Evaluation.

A worst-case analysis was conducted to determine which year (of 2014, 2015, and 2016) could expect the greatest predicted concentrations of pollutants. Because it is anticipated that the predicted concentrations of NO_2 would be closest to the NAAQS, the analysis was performed for the Existing Fly Quiet and Proposed Interim Fly Quiet for the determination of the one-hour and annual NO_2 concentrations. The meteorological year resulting in the highest one-hour and annual NO_2 concentrations (i.e., 2014) was then used to evaluate all other pollutants/averaging periods.

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[22] https://www.usclimatedata.com/climate/chicago-o-hare-international-airport/illinois/united-states/usil0230.

[23] The roughness length is approximately one-tenth of the height of the surface roughness elements. For example, short grass of height 0.01m has a roughness length of approximately 0.001m. Surfaces are rougher if they have more protrusions. Forests have much larger roughness lengths than tundra, for example. Roughness length is an important concept in urban meteorology, as the building of tall structures, such as skyscrapers, affects roughness length and wind patterns.

[24] The Bowen ratio is used to describe the type of heat transfer in a water body. The Bowen ratio is the mathematical method generally used to calculate heat lost (or gained) in a substance; it is the ratio of energy fluxes from one state to another by sensible and latent heating, respectively.

[25] The ratio of reflected radiation from the surface to incident radiation on it, or reflecting power of a surface. Albedo values range from 0.1 for thick deciduous forests to 0.9 for fresh snow.

[26] AERMOD is more sensitive to surface roughness, which tends to be higher in urban environments due to greater obstructions and thus greater turbulence. Bowen ratio has little effect on the AERMOD results, while albedo can slightly affect the results. Higher surface roughness lengths may produce lower concentrations for surface-based emissions but higher concentrations for elevated emissions sources.

FIGURE E-1
ANNUAL WIND ROSE FOR O'HARE FROM 2014 THROUGH 2016

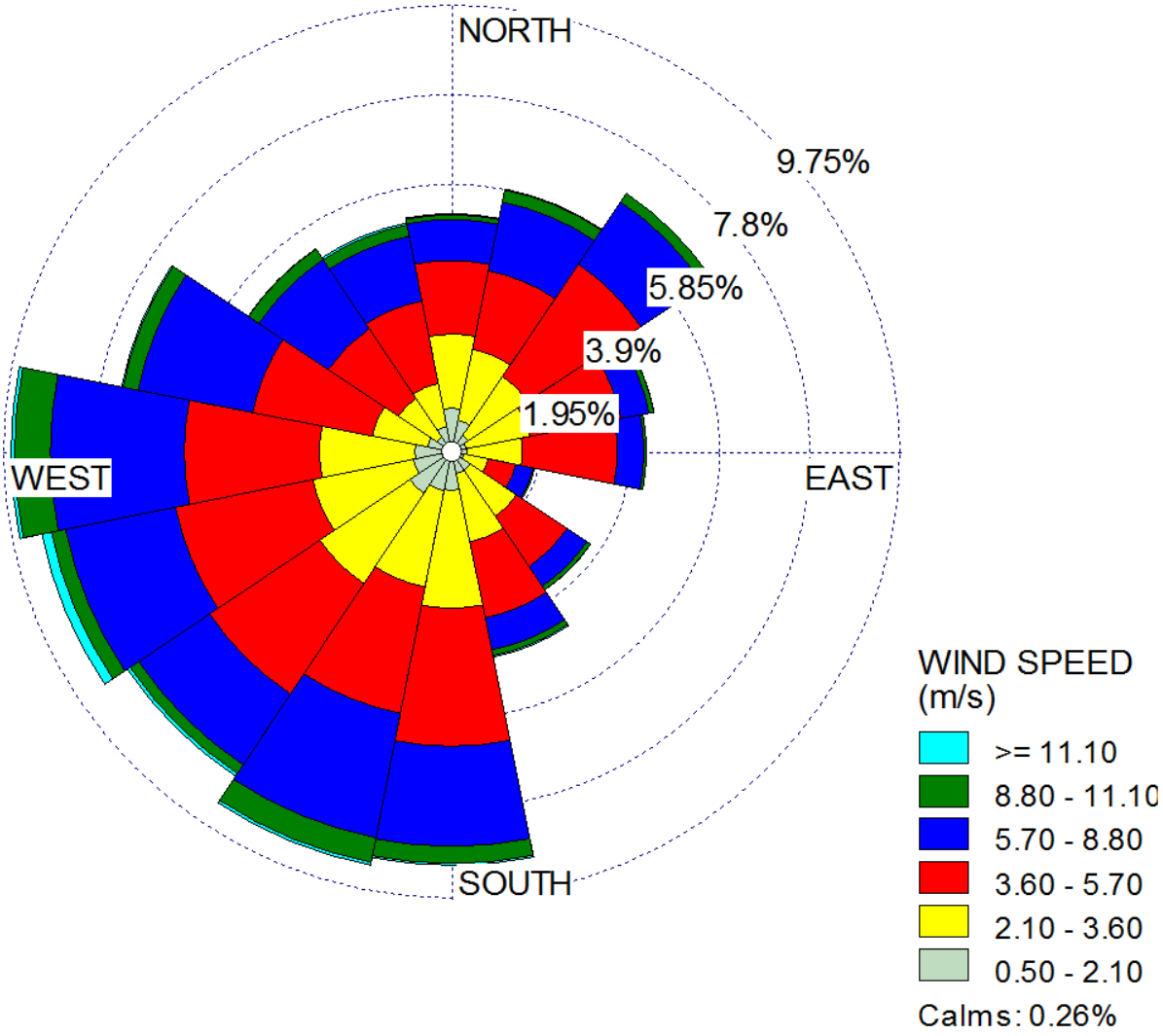


FIGURE E-2
NIGHTTIME WIND ROSE FOR O'HARE FROM 2014 THROUGH 2016

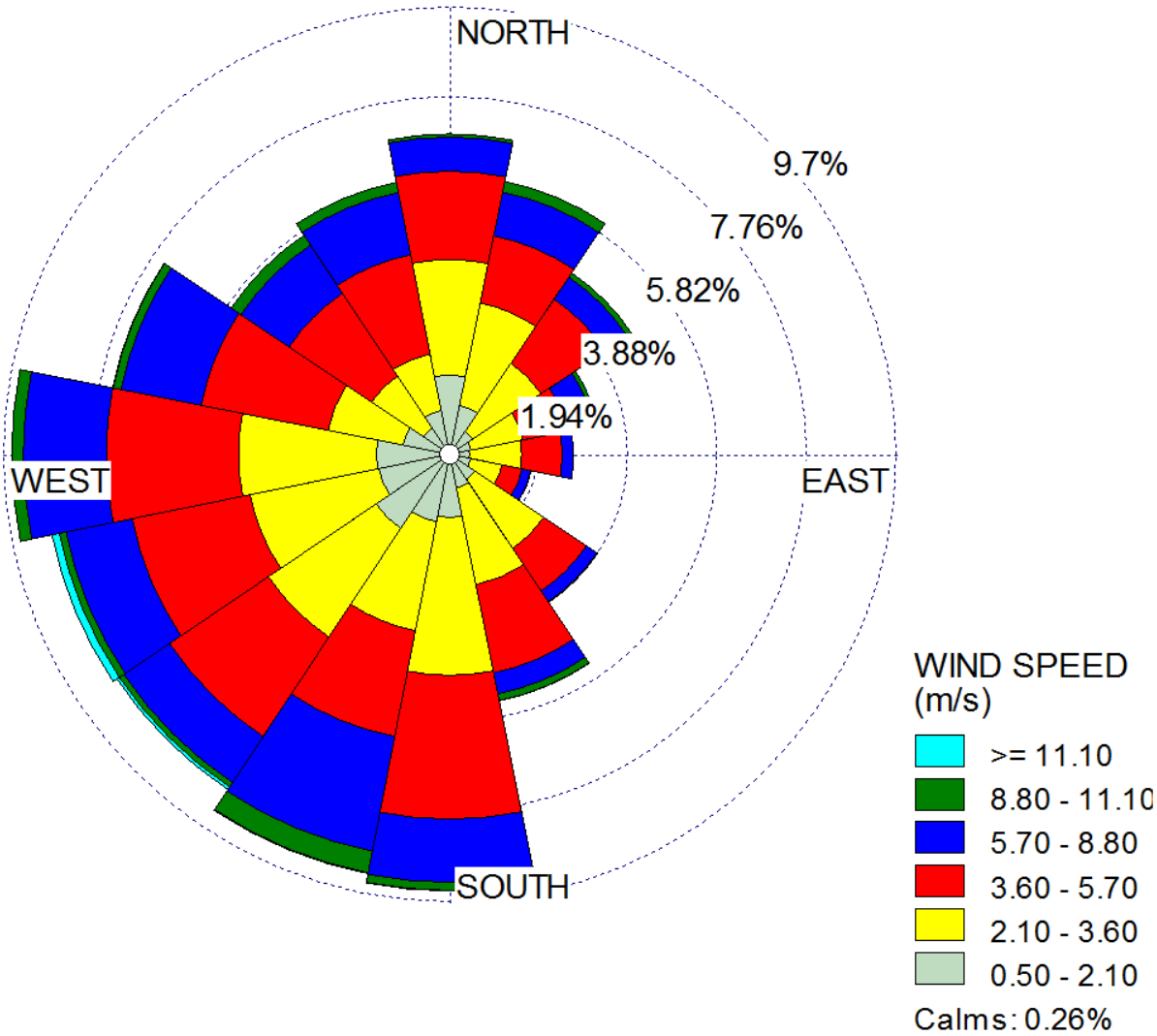
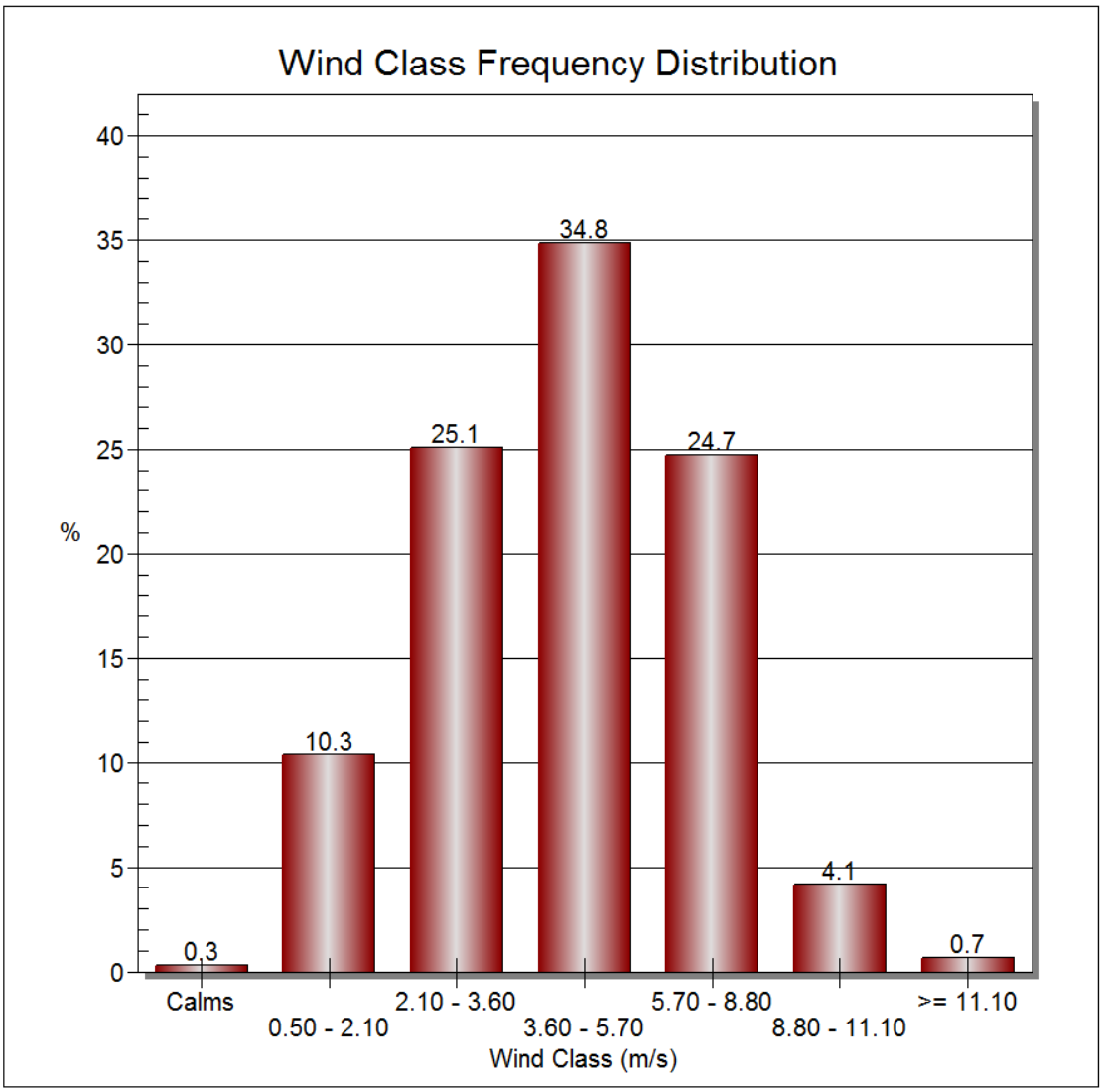


FIGURE E-3
WIND SPEED DISTRIBUTION FOR O'HARE FROM 2014 THROUGH 2016



E.4.2.4 Air Quality-Sensitive Receptors

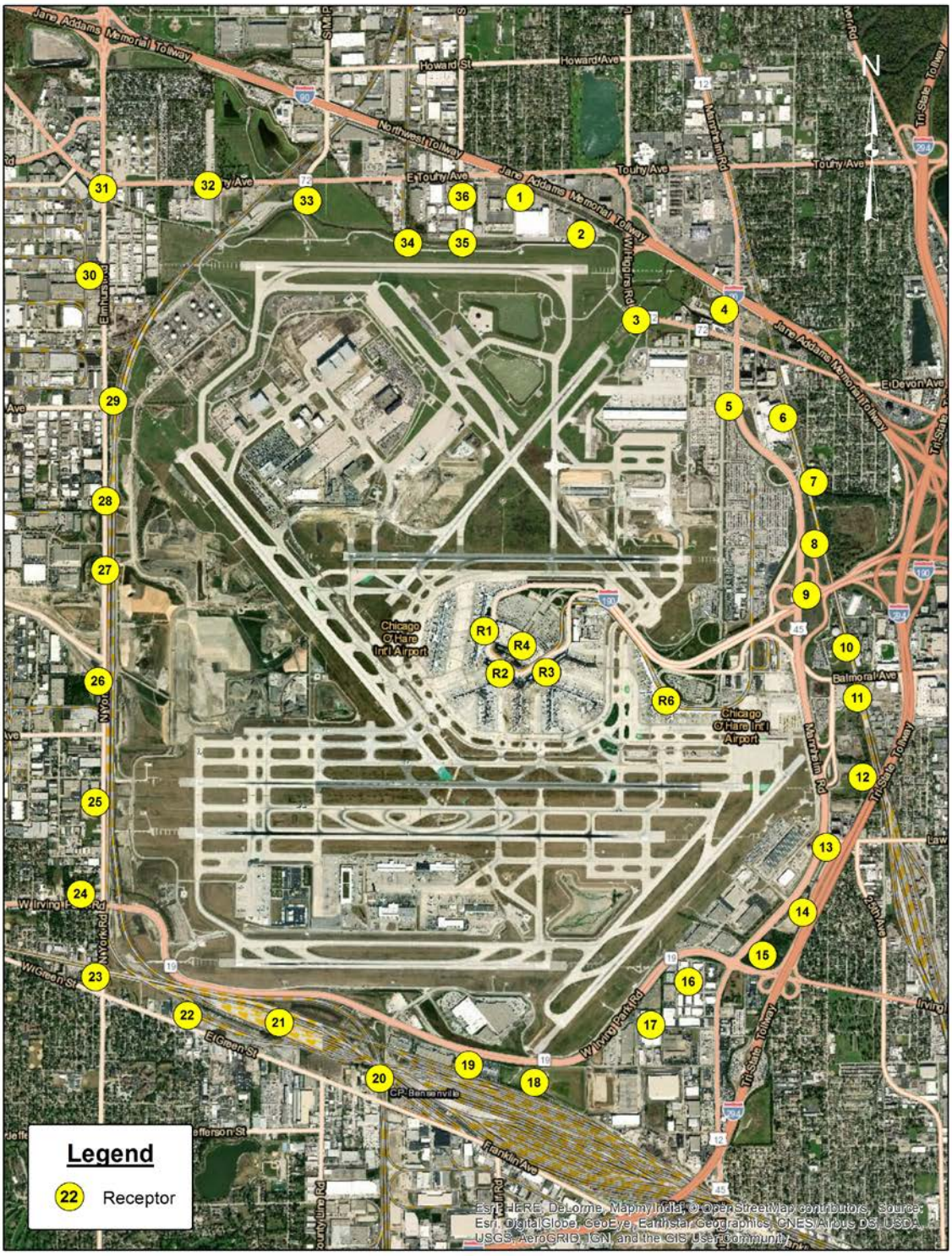
Pollutant concentrations were predicted at a number of publicly accessible locations to evaluate the maximum potential concentrations of pollutants. For the analysis of the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2, the same locations (i.e., receptors) evaluated in the EIS and the 2015 Re-evaluation were used. The evaluated receptors were located at the airport property line at approximate intervals of 10 degrees (i.e., predicted concentrations at approximately 36 receptors surrounding the airport). On-airport receptors included the curbsides at various terminals, the public and employee parking facilities, and other areas where the public has reasonable access. Additional discrete receptors were also analyzed. When placing discrete receptors, analysts considered locations to which the public has reasonable access, areas in which dominant emission sources would be in proximity (i.e., the distance between a source(s) and a receptor), model limitations, and professional judgment. The height of each receptor was assumed to be 1.8 meters above ground (breathing height), consistent with USEPA modelling guidance. **Table E-14** and **Figure E-4** provide a brief description of, and illustrate, the receptor locations evaluated in the dispersion modeling analysis.

TABLE E-14
RECEPTOR LOCATIONS

Receptor ID	Receptor Description	Receptor ID	Receptor Description
R01A	Terminal 1 Curbside (Lower)	15	Mannheim and Irving Park Intersection (145º)
R01B	Terminal 1 Curbside (Upper)	16	Property Line (155º - RW28L)
R02A	Terminal 2 Curbside (Lower)	17	Property Line (165º)
R02B	Terminal 2 Curbside (Upper)	18	Property Line (175º)
R03A	Terminal 3 Curbside (Lower)	19	Property Line (185º)
R03B	Terminal 3 Curbside (Upper)	20	Property Line (195º)
R05	Shuttle Bus Center Curbside	21	Property Line (205º)
R06A	Terminal 5 Curbside (Lower)	22	Property Line (215º)
R06B	Terminal 5 Curbside (Upper)	23	Property Line (225º - RW10R)
		24	York and Irving Park Intersection (235º)
1	Property Line (5º)	25	Property Line (245º -RW10L)
2	Property Line (15º)	26	Property Line (260º)
3	Property Line (25º - RW27R)	27	Property Line (275º - RW9R)
4	Mannheim and Higgins Intersection (35º)	28	Property Line (285º - RW9C)
5	Mannheim and Zemke Intersection (45º)	29	Property Line (300º - RW14R)
6	Property Line (55º)	30	Property Line (310º - RW9L)
7	Property Line (65º - RW27C)	31	Touhy and Elmhurst Intersection (315º)
8	Property Line (75º)	32	Property Line (325º)
9	Property Line (85º - RW27L)	33	Touhy and Mt. Prospect Intersection (335º)
10	Property Line (95º)	34	Property Line (345º)
11	Property Line (105º)	35	Property Line (355º)
12	Property Line (115º - RW28R)	36	Touhy and Wolf Intersection (355º)

Receptor ID	Receptor Description	Receptor ID	Receptor Description
13	Mannheim and Lawrence Intersection (125º) IEPA Monitoring Station (RW28C)	37	Thorndale and Arlington Heights Intersection
14	Property Line (135º)	38	Devon and Arlington Heights Intersection
Source: KB Environmental Science/RCH Group analysis and EIS, July 2005.			

FIGURE E-4
DISPERSION MODELING RECEPTOR LOCATIONS



Source: KB Environmental Science/RCH Group analysis

E.4.2.5 Background Concentrations

Before predicted and project-related pollutant concentrations derived from AEDT/AERMOD can be compared to the NAAQS, background concentrations are added to the model results. These concentrations represent emissions sources in the vicinity of the airport that are not part of the Proposed Interim Fly Quiet (i.e., aircraft operations in the daytime).

Background concentrations for NO_2 and $PM_{2.5}$ were derived from the Schiller Park monitoring station, located near the end of Runway 28R, east of the airport. Background concentrations for all other pollutants (which are not sampled at the Schiller Park monitoring station) were derived from the Northbrook monitoring station, located approximately 12 miles north-northeast of the airport. For the analysis of CO, three-hour SO_2, annual NO_2, and 24-hour PM_{10}, the background concentrations represent the highest (i.e., maximum) measured levels during 2014, 2015, and 2016. The background values for one-hour NO_2, one-hour SO_2, and 24-hour $PM_{2.5}$ are not the highest measured levels because the standards for these pollutants are based on 98th and 99th percentile values, respectively.

Using background concentrations from 2014, 2015, and 2016 results in conservatively high estimates of total pollutant concentrations due to a downward trend in regional pollutant concentrations in the area. The background concentrations for this Re-Evaluation are listed in **Table E-15**. As shown, the background concentrations for one-hour NO_2 and 24-hour/annual $PM_{2.5}$ represent more than 50 percent of the NAAQS for these pollutants and averaging periods.

TABLE E-15
BACKGROUND CONCENTRATIONS

Pollutant	Averaging Time	Station Selected	Year	Background Concentration	Percent of Standard
CO	1-hour	Northbrook	2016	1,394 µg/m^3 (1.22 ppm)	3
	8-hour	Northbrook	2016	867 µg/m^3 (0.78 ppm)	9
SO_2	1-hour	Northbrook	b	15.7 µg/m^3 (0.006 ppm)	8
	3-hour	Northbrook	2016	13.0 µg/m^3 (0.005 ppm)	1
NO_2	1-hour	Schiller Park	c	111 µg/m^3 (0.059 ppm)	59
	Annual	Schiller Park	d	34.3 µg/m^3 (0.018 ppm)	34
PM_{10}	24-hour	Northbrook	e	18.0 µg/m^3	12
$PM_{2.5}$	24-hour	Schiller Park	f	22.1 µg/m^3	63
	Annual	Schiller Park	g	11.0 µg/m^3	92

Notes: ppm - parts per million
µg/m^3 - micrograms per cubic meter
(a) Highest value for 2014, 2015, and 2016.
(b) Average of the 99th percentile values for 2014, 2015, and 2016.
(c) Average of the 98th percentile values for 2014, 2015, and 2016.
(d) Highest annual average for 2015 and 2016.
(e) Average of the annual values for 2014, 2015, and 2016.
(f) Average of the 98th percentile values for 2014, 2015, and 2016.
(g) Average of the annual values for 2014, 2015, and 2016.

Source: USEPA, Office of Air Quality Planning and Standards, *AIRData – Monitor Values Reports*, Acessed June 2018, https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors and IEPA, *Annual Air Quality Reports*, Accessed June 2018, http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index.

To account for the variance in background concentrations over time (i.e., hourly, daily, and monthly), temporal background concentrations for NO_2 were derived following USEPA guidance.[27] As shown in **Table E-16 and Figure E-5**, the derived one-hour NO_2 background concentrations vary by season and by time of day, with a tendency for higher concentrations during spring and fall and morning and evening periods. These temporal NO_2 background concentrations were used for the one-hour and annual NO_2 dispersion analysis.

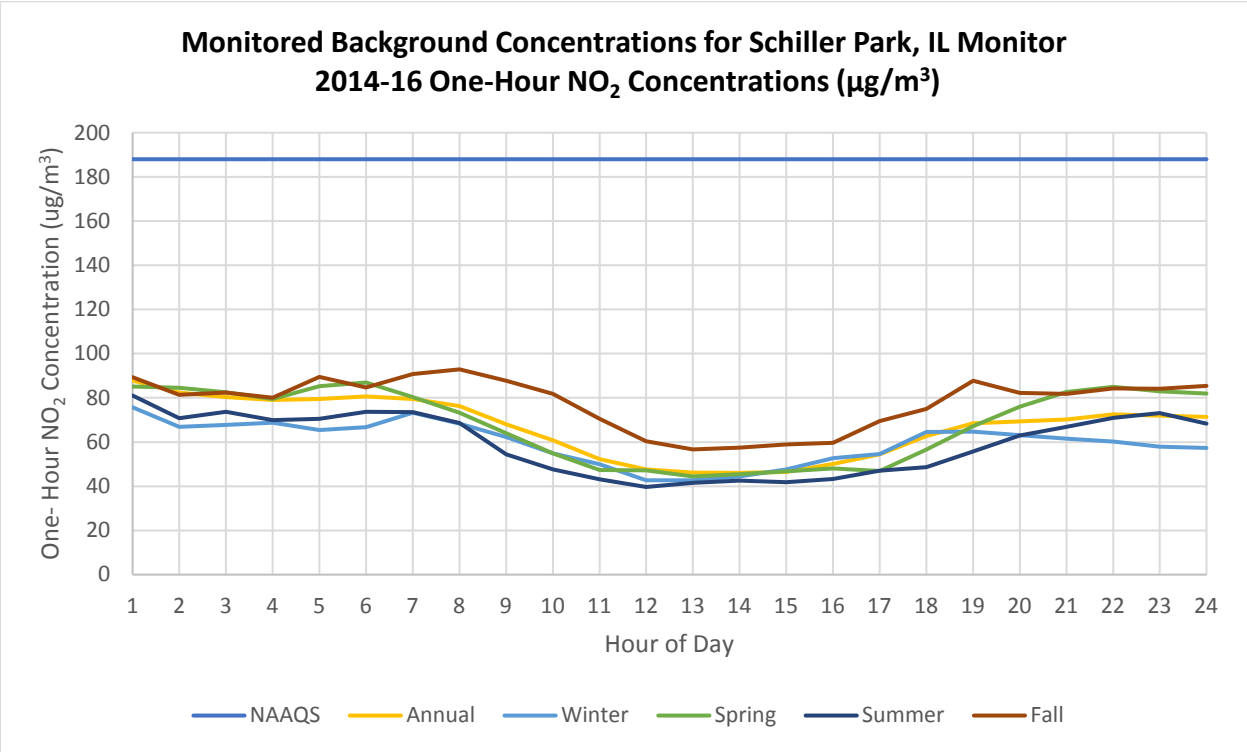
TABLE E-16
ONE-HOUR NO_2 TEMPORAL BACKGROUND CONCENTRATIONS ($\mu g/m^3$)

Hour	Winter	Spring	Summer	Fall	Annual
1	75.7	85.2	81.1	89.3	87.8
2	67.0	84.6	70.8	81.3	82.4
3	67.7	82.5	73.7	82.4	80.3
4	68.8	79.6	69.9	80.1	79.1
5	65.5	85.3	70.5	89.5	79.6
6	66.7	86.9	73.7	84.7	80.6
7	73.2	80.4	73.5	90.8	79.6
8	68.3	73.2	68.6	92.9	76.3
9	62.2	63.9	54.5	87.7	68.0
10	54.9	54.9	47.6	81.7	60.9
11	49.9	47.3	43.1	70.5	52.2
12	42.8	47.3	39.7	60.4	47.6
13	42.7	44.4	41.6	56.7	46.2
14	44.4	45.4	42.5	57.4	46.1
15	47.6	46.8	41.9	58.9	46.5
16	52.7	48.1	43.3	59.6	50.0
17	54.5	46.9	47.0	69.5	54.4
18	64.6	56.6	48.6	75.0	62.6
19	64.7	67.2	55.7	87.7	68.5
20	63.2	76.0	63.0	82.2	69.3
21	61.6	82.7	67.0	81.8	70.2
22	60.2	85.0	71.0	84.3	72.5
23	57.9	82.9	73.2	84.2	71.9
24	57.4	81.9	68.3	85.4	71.3

Notes: 98th percentile value for data for 2014 through 2016.
Source: USEPA, Office of Air Quality Planning and Standards, *AIRData – Monitor Values Reports*, Acessed June 2018, https://www.epa.gov/outdoor-air-quality-data/interactive-map-air-quality-monitors and IEPA, *Annual Air Quality Reports*, Accessed June 2018, http://www.epa.illinois.gov/topics/air-quality/air-quality-reports/index.

[27] Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, March 1, 2011 (https://www.epa.gov/sites/production/files/2015-07/documents/appwno2_2.pdf) and Clarification on the Use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard, September 30, 2014 (https://www3.epa.gov/scram001/guidance/clarification/NO2_Clarification_Memo-20140930.pdf).

FIGURE E-5
ONE-HOUR NO_2 BACKGROUND CONCENTRATIONS BY SEASON AND TIME OF DAY



E.4.2.6 One-Hour Nitrogen Dioxide to Nitrogen Oxides Ambient Ratio

Dispersion modeling results provide predicted concentrations of NO_x which, for comparison to the NAAQS, were converted to concentrations of NO_2. While AERMOD is generally considered a non-chemistry model, it offers three methods for modeling NO_2 formation from NO_x emissions: (i) the Ambient Ratio Method (ARM and ARM-2), (ii) the Ozone Limiting Method (OLM), and (iii) the Plume Volume Molar Ratio Method (PVMRM). Moreover, USEPA's Guideline on Air Quality Models[28] recommends a three-tiered screening approach to estimate ambient concentrations of NO_2:

- Tier 1 – Assumes complete (100 percent) conversion of all emitted NO_x to NO_2 based on application of an appropriate refined modeling technique under Section 4.2.2 of Appendix W (of the USEPA's Guideline) to estimate ambient NO_x concentrations.
- Tier 2 – Ambient Ratio Method (ARM/ARM-2), in which model-predicted NO_x concentrations are multiplied by a NO_2/NO_x ambient ratio derived from ambient monitoring data. The ARM multiplies Tier 1 results by an empirically-derived ambient NO_2/NO_x ratio, with 0.75 as the default ratio for annual impacts and 0.80 as the default ratio for one-hour impacts. Site-specific ambient NO_2/NO_x ratios derived from appropriate ambient monitoring data may also be considered as detailed screening methods on a case-by-case basis with proper justification. As of October 1, 2017, the USEPA does not accept the ARM. ARM-2 incorporates a variable ambient ratio—a function of

[28] Appendix W to Part 51 – Guideline on Air Quality Models, http://www.ecfr.gov/cgi-bin/text-idx?SID=e6a5b817b94abf58460f48c032d9a39c&node=40:2.0.1.1.2.23.11.5.37&rgn=div9.

model predicted one-hour NO_x concentration—based on an analysis of nationwide hourly ambient NO_x monitoring data from approximately 580 stations from 2001 through 2010. Therefore, the ARM-2 was used for the one-hour and annual concentrations.

- Tier 3 – Performs a detailed analysis on a case-by-case basis by employing the OLM or PVMRM. These methods require the most detailed analysis and produce the least conservative and presumably most representative results. Tier 3 requires information such as in-stack NO_2/NO_x ratio and ambient ozone concentrations.

For the 2015 Re-Evaluation, the Tier 2 (ARM/ARM-2), and Tier 3 (OLM and/or PVMRM) conversion approaches were evaluated to determine which was most suitable to derive one-hour NO_2 concentrations for comparison to the NAAQS. The predicted one-hour NO_2 concentrations from each method were then compared to ambient monitored data obtained from the Schiller Park monitoring station (located east of the airport) to select the most appropriate method to convert NO_x to NO_2. The evaluation found the ARM-2 to be the most appropriate method for estimating one-hour NO_2 concentration. Thus, the ARM-2 was also used for this Re-Evaluation, consistent with the 2015 Re-Evaluation.

The USEPA guidance recommends minimum and maximum NO_2/NOx ratios of 0.5 and 0.9, respectively. Non-default values can be used if technical justification—such as stack test results, manufacturer test data, or USEPA's In Stack Ratio database—is provided. Extensive emission testing has been conducted on a wide range of aircraft engines in the last decade. This research has shown the aircraft-related NO_2/NO_x emissions ratio to differ markedly from most other NO_x sources.[29] For aircraft, the NO_2 fraction of NO_x decreases with power, from more than 98 percent at the lowest power setting (four percent rated thrust or climb/descend taxi) to under 10 percent at higher power settings (65 to 100 percent rated thrust or climb/descend to 1,000 feet and to the atmospheric mixing height).[30] Overall, the amount of NO_x emissions from aircraft was assumed to be 3.3 kilogram (kg) per engine per LTO,[31] of which 0.8 kg is emitted in the form of NO_2.[32] **Table E-17** lists the NO_2 to NO_x ratios for each aircraft operating mode. Therefore, the dispersion modeling was performed using the minimum and maximum NO_2/NO_x ratios of 0.2 and 0.9, respectively, consistent with the 2015 Re-Evaluation.

[29] Wey, Chowen, Bruce Anderson, Changlie Wey, Richard Miake-Lye, Philip Whitefield, and Robert Howard. Overview on the Aircraft Particle Emissions Experiment (Apex). Journal of Propulsion and Power 23: (2007) 898-905.

[30] Wormhoudt, Joda, Scott Herndon, Paul Yelvington, Richard Miake-Lye, and Changlie Wey. Nitrogen Oxide (NO/NO2/HONO) Emissions Measurements in Aircraft Exhausts. Journal of Propulsion and Power 23: (2007) 906-11.

[31] An LTO is comprised of the AEDT mode categories 1) descend below the mixing height and 2) climb below the mixing height.

[32] Wood, Ezra, Scott Herndon, Michael Timko, Paul Yelvington, and Richard Miake-Lye. Speciation and Chemical Evolution of Nitrogen Oxides in Aircraft Exhaust Near Airports. Environmental Science & Technology, 2008, 42, 1884-1891.

TABLE E-17
NO_2 AND NO_X EMISSIONS FROM CFM56-3B1 ENGINE

Operating Mode	NO_2/NO_x Ratio	NO_2 Emissions	NO_x Emissions
Idle	0.914	0.53	0.58
Approach	0.155	0.08	0.49
Take-off	0.081	0.06	0.70
Climb-out	0.088	0.13	1.53
Source: Wood, Ezra, Scott Herndon, Michael Timko, Paul Yelvington, and Richard Miake-Lye. Speciation and Chemical Evolution of Nitrogen Oxides in Aircraft Exhaust Near Airports. Environmental Science & Technology, 2008, 42, 1884-1891.			

E.5 AIR QUALITY ANALYSIS RESULTS

The results of the two air quality evaluations—emissions inventories and dispersion analysis—performed for the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2 are presented in this section. As stated previously, the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 would only affect nighttime aircraft-related emissions within ground taxi time.

E.5.1 Emissions Inventories

The nighttime emissions inventories for the Existing Fly Quiet and Proposed Interim Fly Quiet are provided in **Table E-18**. As shown, emissions would increase slightly with the Proposed Interim Fly Quiet due to slightly higher aircraft ground travel time.

TABLE E-18
AIRCRAFT EMISSIONS – EXISTING FLY QUIET VS. PROPOSED INTERIM FLY QUIET

Program	Tons Emitted					
	Carbon Monoxide	Sulfur Oxides	Volatile Organic Compounds	Nitrogen Oxides	Particulate Matter 10 micrometers or less	Particulate Matter 2.5 micrometers or less
Existing Fly Quiet	260	32	35	425	2	2
Proposed Interim Fly Quiet	269	33	36	427	2	2
Difference	**9**	**1**	**1**	**2**	**<1**	**<1**
Values reflect rounding and represent the difference between Existing Fly Quiet and Proposed Interim Fly Quiet. Source: The RCH Group and KB Environmental Sciences, Inc.						

The nighttime emissions inventories for the Existing Fly Quiet and Revised Interim Fly Quiet 1 are provided in **Table E-19**. As shown, emissions would increase slightly with the Revised Interim Fly Quiet 1 due to slightly higher aircraft ground travel time.

TABLE E-19
AIRCRAFT EMISSIONS – EXISTING FLY QUIET VS. REVISED INTERIM FLY QUIET 1

	Tons Emitted					
Program	**Carbon Monoxide**	**Sulfur Oxides**	**Volatile Organic Compounds**	**Nitrogen Oxides**	**Particulate Matter 10 micrometers or less**	**Particulate Matter 2.5 micrometers or less**
Existing Fly Quiet	260	32	35	425	2	2
Revised Interim Fly Quiet 1	271	33	36	427	2	2
Difference	**11**	**1**	**1**	**2**	**<1**	**<1**

Values reflect rounding and represent the difference between Existing Fly Quiet and Revised Interim Fly Quiet 1.
Source: The RCH Group and KB Environmental Sciences, Inc.

The nighttime emissions inventories for the Existing Fly Quiet and Revised Interim Fly Quiet 2 are provided in **Table E-20**. As shown, emissions would increase slightly with the Revised Interim Fly Quiet 2 due to slightly higher aircraft ground travel time.

TABLE E-20
AIRCRAFT EMISSIONS – EXISTING FLY QUIET VS. REVISED INTERIM FLY QUIET 2

	Tons Emitted					
Program	**Carbon Monoxide**	**Sulfur Oxides**	**Volatile Organic Compounds**	**Nitrogen Oxides**	**Particulate Matter 10 micrometers or less**	**Particulate Matter 2.5 micrometers or less**
Existing Fly Quiet	260	32	35	425	2	2
Revised Interim Fly Quiet 2	270	33	36	427	2	2
Difference	**10**	**1**	**1**	**2**	**<1**	**<1**

Values reflect rounding and represent the difference between Existing Fly Quiet and Revised Interim Fly Quiet 2.
Source: The RCH Group and KB Environmental Sciences, Inc.

E.5.2 General Conformity Applicability Analysis

Section 176(c) of the CAA prohibits FAA from taking an action in a nonattainment area unless the emissions from the action conform to a State Implementation Plan (SIP). The Final OMP General Conformity Determination in the EIS concludes that since the OMP-related emissions were included in an approved SIP, the OMP conformed to a SIP. With regard to a re-evaluation of General Conformity, the CAA General Conformity Regulations (40 CFR Part 93) state the following (§93.157 Reevaluation of Conformity):

> (a) Once a conformity determination is completed by a Federal agency, that determination is not required to be re-evaluated if the agency has maintained a continuous program to implement the action; the determination has not lapsed as specified in paragraph (b) of this section; or any modification to the action does not result in an increase in emissions above the levels specified in §93.153(b). If a conformity determination is not required for the action at the time NEPA analysis is completed, the date of the finding of no significant impact (FONSI) for an Environmental Assessment, a record of decision (ROD) for an Environmental Impact Statement, or a categorical exclusion determination can be used as a substitute date for the conformity determination date.
>
> (b) The conformity status of a Federal action automatically lapses 5 years from the date a final conformity determination is reported under §93.155, unless the Federal action has been completed or a continuous program to implement the Federal action has commenced.
>
> (c) Ongoing Federal activities at a given site showing continuous progress are not new actions and do not require periodic re-determinations so long as such activities are within the scope of the final conformity determination reported under §93.155.
>
> (d) If the Federal agency originally determined through the applicability analysis that a conformity determination was not necessary because the emissions for the action were below the limits in §93.153(b) and changes to the action would result in the total emissions from the action being above the limits in §93.153(b), then the Federal agency must make a conformity determination.

According to Section 93.157(a), once a conformity determination is completed by a federal agency (as was done for the OMP), that determination is not required to be re-evaluated:

1. If the agency has maintained a continuous program to implement the action,
2. If the determination has not lapsed as specified in paragraph (b), or
3. If any modification to the action does not result in an increase in emissions above the de minimus thresholds in §93.153(b).

Relative to Section 93.157(b), other sections of this Re-Evaluation and the 2015 Re-Evaluation show that there has been continuous progress to implement the federal action (the OMP). The 2015 Re-Evaluation showed that the 2015 and 2020 conditions (interim conditions of the OMP) are a modified phasing of the same project noted in the EIS, as the Build Out remains the same, and per Section 93.157(b) periodic re-determinations are not required nor is a new determination required per Section 93.157(c). As such, a re-evaluation of the Final OMP General Conformity Determination is not required.

Relative to Section 93.157(c), the emissions inventories indicate that the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 would temporarily increase emissions. The EIS and ROD noted that the emissions from the OMP are within the approved SIP. As discussed in the 2015 Re-Evaluation and this Re-

Evaluation, total airport activity levels are substantially lower than were predicted and evaluated in the EIS (see 2015 Re-Evaluation Appendix B), of which VOC and NOx emissions were within the SIP. For these reasons, the Proposed Interim Fly Quiet emissions are within the scope of the Final OMP General Conformity Determination.

Relative to Section 93.157(d), given the passage of time, and the fact that development has not been completed in the same timeframe evaluated in the EIS, the lower emissions from lower activity levels would essentially offset the slight temporary increase in emissions with the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 and thus, the Proposed Interim Fly Quiet would continue to be in compliance with the SIP. As such, a re-evaluation of the Final OMP General Conformity Determination is not required.

Lastly, the O'Hare area is designated as nonattainment (marginal) for the 8-hour O_3 NAAQS. As such, a re-evaluation of the Final OMP General Conformity Determination would be required if there would be an increase in emissions of NOx or VOC, the precursors to O_3, of 100 or more tons (i.e., the de minimis level). As shown in **Tables E-18, E-19, and E-20**, the results of the emission inventories indicate that emissions of NOx and VOC would temporarily increase one and two tons, respectively, with the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 when compared to the Existing Fly Quiet. These increases are well below the de minimis threshold of 100 tons. As such, a re-evaluation of the Final OMP General Conformity Determination is not required.

E.5.3 Dispersion Analysis

As previously stated, pollutant concentrations were estimated for the following pollutants and averaging times: one- and eight-hour CO; one-hour and three-hour SO_2; one-hour and annual NO_2; 24-hour PM_{10}; and 24-hour and annual $PM_{2.5}$ to enable comparison to the NAAQS. For convenience in reviewing the data, the highest (i.e., maximum) short-term and annual project-related pollutant concentrations for the Proposed Interim Fly Quiet are provided in **Table E-21.** Concentrations for the entire receptor network are provided in **Table E-22**.

Project-related air quality impacts were determined based on the incremental change in concentrations of the evaluated pollutants (i.e., the difference in predicted concentrations with the Proposed Interim Fly Quiet and Revised Interim Fly Quiet 1 and 2 when compared to concentrations with the Existing Fly Quiet) and the background ambient monitoring data for the pollutants.

TABLE E-21
DISPERSION MODELING RESULTS – PROPOSED INTERIM FLY QUIET

	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
Factor	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
Predicted Incremental Concentration	569	73	84	<1	24	15	<1	<1	<1
Background Concentration	1,394	867	83	34	16	13	18	22	11
Total Concentration	1,963	940	167	35	40	28	18	22	11

Factor	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
Receptor ID	03	03	13	13	13	R02A	13	R02A	R06A
NAAQS	40,000	10,000	188	100	196	1,300	150	35	12
Exceeds NAAQS?	No	No	No	No	No	No	No	No	No

Values reflect rounding.
Values represent difference between Proposed Interim Fly Quiet and Existing Fly Quiet plus background concentration
Source: The RCH Group and KB Environmental Sciences, Inc.

TABLE E-22
DISPERSION MODELING RESULTS (BY RECEPTOR) – PROPOSED INTERIM FLY QUIET

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
1	1,705	920	107	34.3	22.4	16.6	18.0	22.1	11.0
2	1,693	903	115	34.4	25.5	18.5	18.1	22.1	11.0
3	**1,963**	**940**	135	34.4	31.1	24.6	18.0	22.2	11.0
4	1,897	918	138	34.4	27.4	19.5	18.0	22.1	11.0
5	1,828	921	134	34.4	26.2	21.5	18.0	22.1	11.0
6	1,683	930	126	34.4	26.2	23.3	18.0	22.1	11.0
7	1,620	898	131	34.3	27.7	23.3	18.0	22.2	11.0
8	1,680	898	129	34.3	27.2	20.9	18.0	22.2	11.0
9	1,690	905	136	34.3	25.9	17.4	18.1	22.2	11.0
10	1,622	897	145	34.4	25.2	16.8	18.1	22.2	11.0
11	1,637	897	135	34.3	28.4	17.7	18.0	22.2	11.0
12	1,715	907	143	34.5	37.0	26.4	18.1	22.2	11.0
13	1,695	907	**167**	**34.8**	**39.7**	25.6	**18.1**	22.2	11.0
14	1,641	894	150	34.6	30.8	23.1	18.1	22.2	11.0
15	1,625	906	140	34.6	31.4	21.1	18.0	22.2	11.0
16	1,730	919	127	34.7	30.1	23.8	18.1	22.2	11.0
17	1,773	923	121	34.5	27.2	17.5	18.1	22.2	11.0
18	1,616	911	111	34.4	30.0	18.7	18.1	22.2	11.0

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
19	1,657	923	110	34.4	28.9	17.5	18.1	22.1	11.0
20	1,761	923	110	34.4	26.2	18.4	18.1	22.2	11.0
21	1,670	931	117	34.4	29.0	21.4	18.1	22.2	11.0
22	1,789	931	115	34.4	34.3	19.3	18.0	22.2	11.0
23	1,557	900	108	34.4	27.3	17.8	18.0	22.2	11.0
24	1,668	901	102	34.3	24.2	16.3	18.0	22.1	11.0
25	1,557	888	126	34.4	22.4	17.2	18.0	22.1	11.0
26	1,576	895	111	34.4	23.6	18.8	18.0	22.1	11.0
27	1,592	894	114	34.3	22.5	16.6	18.0	22.2	11.0
28	1,512	884	109	34.3	21.4	15.0	18.0	22.1	11.0
29	1,494	884	105	34.3	19.2	14.5	18.0	22.1	11.0
30	1,465	878	96.0	34.3	18.1	14.2	18.0	22.1	11.0
31	1,493	876	96.7	34.3	18.6	14.4	18.0	22.1	11.0
32	1,524	884	104	34.3	22.9	16.5	18.0	22.1	11.0
33	1,539	892	106	34.3	24.0	16.9	18.0	22.1	11.0
34	1,516	896	107	34.3	21.6	15.6	18.0	22.1	11.0
35	1,581	897	104	34.3	22.8	16.2	18.0	22.1	11.0
36	1,551	901	104	34.3	20.6	16.2	18.0	22.1	11.0
37	1,456	877	92.9	34.3	17.0	13.8	18.0	22.1	11.0
38	1,451	874	92.9	34.3	18.0	15.0	18.0	22.1	11.0
R01A	1,738	916	133	34.2	33.5	23.5	18.1	22.2	11.0
R01B	1,694	914	129	34.2	32.9	22.6	18.1	22.2	11.0
R02A	1,765	915	131	34.2	35.1	**27.6**	18.1	**22.2**	11.0
R02B	1,745	910	127	34.2	33.1	26.4	18.0	22.2	11.0
R03A	1,740	911	128	34.1	34.4	22.3	18.0	22.2	11.0
R03B	1,714	907	127	34.2	31.6	21.3	18.0	22.2	11.0
R05	1,675	904	126	34.2	32.7	26.3	18.1	22.2	11.0
R06A	1,759	927	135	34.2	33.8	21.3	18.1	22.2	11.0
R06B	1,750	938	140	34.3	33.0	20.8	18.1	22.2	**11.0**

Values reflect rounding.
Values represent difference between Proposed Interim Fly Quiet and Existing Fly Quiet plus background concentration.
BOLD values represent maximum concentrations.
Source: The RCH Group and KB Environmental Sciences, Inc.

The highest (i.e., maximum) short-term and annual project-related pollutant concentrations are provided in **Table E-23**, while concentrations for the entire receptor network are provided in **Table E-24** for the Revised Interim Fly Quiet 1.

TABLE E-23
DISPERSION MODELING RESULTS – REVISED INTERIM FLY QUIET 1

Factor	Maximum Predicted Pollutant Concentrations (µg/m^3)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
Predicted Incremental Concentration	704	97	59	<1	25	16	<1	<1	<1
Background Concentration	1,394	867	85	34	16	13	18	22	11
Total Concentration	2,098	964	144	35	41	29	18	22	11
Receptor ID	04	R02A	13	16	13	13	R01A	R01A	R06B
NAAQS	40,000	10,000	188	100	196	1,300	150	35	12
Exceeds NAAQS	No	No	No	No	No	No	No	No	No

Values reflect rounding.
Values represent difference between Revised Interim Fly Quiet 1 and Existing Fly Quiet plus background concentration.
Source: The RCH Group and KB Environmental Sciences, Inc.

TABLE E-24
DISPERSION MODELING RESULTS (BY RECEPTOR) – REVISED INTERIM FLY QUIET 1

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m^3)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
1	1,537	895	105	34.3	23.2	16.5	18.0	22.1	11.0
2	1,580	902	113	34.4	29.5	19.1	18.0	22.2	11.0
3	1,837	934	123	34.4	31.8	19.6	18.1	22.2	11.0
4	**2,098**	956	125	34.3	28.3	18.4	18.1	22.2	11.0
5	1,784	927	122	34.3	31.8	19.2	18.1	22.2	11.0
6	1,791	927	117	34.3	28.0	18.8	18.1	22.2	11.0
7	1,851	931	122	34.2	27.1	18.3	18.0	22.2	11.0
8	1,709	921	129	34.2	26.3	17.7	18.0	22.1	11.0

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
9	1,727	920	134	34.1	24.9	16.2	18.1	22.2	11.0
10	1,691	911	141	34.3	24.7	17.3	18.1	22.2	11.0
11	1,788	924	136	34.3	25.9	19.4	18.1	22.2	11.0
12	1,667	906	131	34.4	34.7	25.3	18.1	22.2	11.0
13	1,744	921	**144**	34.6	**41.0**	**29.1**	18.1	22.2	11.0
14	1,653	912	143	34.6	36.2	23.2	18.1	22.1	11.0
15	1,690	907	142	34.7	30.0	20.7	18.0	22.2	11.0
16	1,615	910	134	**34.7**	33.8	19.1	18.1	22.2	11.0
17	1,645	907	118	34.5	27.4	18.6	18.1	22.2	11.0
18	1,647	904	113	34.4	25.1	18.6	18.1	22.2	11.0
19	1,612	907	121	34.4	25.6	19.5	18.1	22.2	11.0
20	1,598	896	121	34.4	26.0	19.0	18.1	22.1	11.0
21	1,664	909	115	34.3	26.4	26.8	18.0	22.2	11.0
22	1,589	895	109	34.3	31.1	23.5	18.1	22.2	11.0
23	1,656	900	102	34.3	27.2	19.7	18.1	22.1	11.0
24	1,721	908	102	34.3	24.5	16.1	18.0	22.1	11.0
25	1,619	894	128	34.4	22.0	20.7	18.0	22.1	11.0
26	1,549	886	120	34.4	35.4	22.3	18.0	22.2	11.0
27	1,601	904	118	34.3	24.6	16.0	18.0	22.1	11.0
28	1,574	891	117	34.3	22.1	15.1	18.0	22.1	11.0
29	1,552	880	105	34.3	19.7	15.0	18.0	22.1	11.0
30	1,490	877	101	34.3	18.3	14.3	18.0	22.1	11.0
31	1,485	878	97.6	34.3	18.0	14.6	18.0	22.1	11.0
32	1,467	877	101	34.3	20.3	15.9	18.0	22.1	11.0
33	1,457	878	100	34.3	25.3	16.7	18.0	22.1	11.0
34	1,526	885	106	34.3	23.6	16.2	18.0	22.1	11.0
35	1,611	897	107	34.3	23.3	16.8	18.0	22.2	11.0
36	1,558	895	105	34.3	22.4	16.7	18.0	22.2	11.0
37	1,432	873	92.9	34.3	16.7	13.5	18.0	22.1	11.0
38	1,431	874	92.9	34.3	17.6	14.2	18.0	22.1	11.0
R01A	1,736	926	128	34.1	38.3	24.4	**18.2**	**22.2**	11.0
R01B	1,690	927	126	34.1	35.9	24.8	18.2	22.2	11.0

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
R02A	2,040	**964**	129	34.2	39.6	24.2	18.1	22.2	11.0
R02B	2,029	960	127	34.2	37.1	23.0	18.1	22.2	11.0
R03A	2,026	954	130	34.1	34.2	20.2	18.1	22.2	11.0
R03B	2,006	951	130	34.1	31.9	19.3	18.1	22.2	11.0
R05	1,859	940	136	34.1	35.6	23.0	18.1	22.2	11.0
R06A	1,834	927	137	34.2	33.7	21.3	18.1	22.2	11.0
R06B	1,835	921	140	34.3	33.1	20.9	18.1	22.2	**11.0**

Values reflect rounding.
Values represent difference between Revised Interim Fly Quiet 1 and Existing Fly Quiet plus background concentration.
BOLD values represent maximum concentrations.
Source: The RCH Group and KB Environmental Sciences, Inc.

The highest (i.e., maximum) short-term and annual project-related pollutant concentrations are provided in **Table E-25**, while concentrations for the entire receptor network are provided in **Table E-26** for the Revised Interim Fly Quiet 2.

TABLE E-25
DISPERSION MODELING RESULTS – REVISED INTERIM FLY QUIET 2

Factor	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
Predicted Incremental Concentration	551	90	77	<1	30	13	<1	<1	<1
Background Concentration	1,394	867	86	34	16	13	18	22	11
Total Concentration	1,945	957	163	35	46	26	18	22	11
Receptor ID	R06B	R01A	12	13	R06B	12	R01A	12	R06B
NAAQS	40,000	10,000	188	100	196	1,300	150	35	12
Exceeds NAAQS	No	No	No	No	No	No	No	No	No

Values reflect rounding
Values represent difference between Revised Interim Fly Quiet 2 and Existing Fly Quiet plus background concentration
Source: The RCH Group and KB Environmental Sciences, Inc.

TABLE E-26
DISPERSION MODELING RESULTS (BY RECEPTOR) – REVISED INTERIM FLY QUIET 2

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m³)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
1	1,483	880	110	34.3	22.7	17.5	18.1	22.2	11.0
2	1,557	885	121	34.4	27.7	20.5	18.1	22.2	11.0
3	1,844	925	132	34.4	33.0	19.9	18.1	22.2	11.0
4	1,714	925	128	34.3	27.9	17.3	18.1	22.2	11.0
5	1,686	929	126	34.3	25.3	18.0	18.1	22.2	11.0
6	1,634	917	118	34.3	24.1	17.5	18.0	22.2	11.0
7	1,666	902	121	34.3	25.7	16.8	18.0	22.1	11.0
8	1,677	910	132	34.2	28.6	18.8	18.1	22.1	11.0
9	1,701	910	128	34.2	31.5	19.9	18.1	22.2	11.0
10	1,637	904	140	34.3	32.9	20.9	18.1	22.1	11.0
11	1,686	906	140	34.4	38.8	22.0	18.1	22.2	11.0
12	1,675	929	**163**	34.4	40.2	**26.0**	18.1	**22.3**	11.0
13	1,680	907	150	**34.7**	41.0	25.1	18.1	22.2	11.0
14	1,585	896	145	34.7	29.1	20.4	18.1	22.2	11.0
15	1,586	893	130	34.6	27.5	17.0	18.1	22.2	11.0
16	1,609	902	136	34.7	27.5	19.5	18.1	22.2	11.0
17	1,812	914	129	34.5	28.1	19.3	18.1	22.1	11.0
18	1,686	902	113	34.4	23.9	16.4	18.1	22.1	11.0
19	1,623	903	118	34.4	25.6	18.3	18.1	22.1	11.0
20	1,746	911	123	34.4	25.7	19.1	18.1	22.1	11.0
21	1,711	899	114	34.4	31.7	23.9	18.1	22.1	11.0
22	1,725	924	113	34.3	29.8	21.3	18.1	22.1	11.0
23	1,588	891	105	34.3	27.1	19.5	18.0	22.1	11.0
24	1,514	882	101	34.3	23.8	20.9	18.0	22.1	11.0
25	1,548	887	123	34.4	22.2	16.8	18.0	22.1	11.0
26	1,591	902	128	34.3	22.0	24.6	18.0	22.1	11.0
27	1,559	886	118	34.3	26.5	16.4	18.0	22.1	11.0
28	1,527	886	112	34.4	22.4	15.2	18.0	22.1	11.0
29	1,508	886	106	34.3	20.0	14.6	18.0	22.1	11.0
30	1,487	879	101	34.3	18.5	14.2	18.0	22.1	11.0
31	1,480	879	102	34.3	17.9	13.9	18.0	22.1	11.0
32	1,521	884	99.4	34.3	21.2	15.8	18.0	22.1	11.0
33	1,536	890	106	34.3	24.0	16.1	18.0	22.1	11.0
34	1,535	896	111	34.3	23.9	15.9	18.0	22.1	11.0
35	1,589	900	108	34.3	23.5	17.1	18.0	22.1	11.0

Receptor ID	Maximum Predicted Pollutant Concentrations (µg/m^3)								
	CO		NO_2		SO_2		PM_{10}	$PM_{2.5}$	
	One-Hour	Eight-Hour	One-Hour	Annual	One-Hour	Three-Hour	24-Hour	24-Hour	Annual
36	1,554	897	106	34.3	22.8	17.1	18.0	22.1	11.0
37	1,479	879	92.9	34.3	17.3	13.7	18.0	22.1	11.0
38	1,447	876	92.9	34.3	17.1	14.6	18.0	22.1	11.0
R01A	1,866	**957**	138	34.1	29.1	22.0	**18.2**	22.2	11.0
R01B	1,826	945	133	34.1	29.8	22.6	18.1	22.2	11.0
R02A	1,789	927	134	34.1	32.0	22.8	18.1	22.2	11.0
R02B	1,758	919	135	34.2	30.8	20.9	18.1	22.2	11.0
R03A	1,785	936	131	34.1	31.7	22.4	18.1	22.2	11.0
R03B	1,709	923	133	34.1	30.7	21.4	18.1	22.2	11.0
R05	1,751	925	135	34.1	30.9	21.6	18.1	22.2	11.0
R06A	1,823	941	145	34.2	36.7	21.7	18.1	22.2	11.0
R06B	**1,945**	955	146	34.2	**46.2**	23.3	18.1	22.2	**11.0**

Values reflect rounding.
Values represent difference between Revised Interim Fly Quiet 2 and Existing Fly Quiet plus background concentration.
BOLD values represent maximum concentrations.
Source: The RCH Group and KB Environmental Sciences, Inc.

E.6 HAZARDOUS AIR POLLUTANTS (HAPS)

HAPs (also known as air toxics) are gaseous organic and inorganic chemicals and particulate matter with known or suspected potential to cause cancer (carcinogenic) or other serious health effects (non-carcinogenic). They are commonly emitted by a wide range of airport and non-airport sources, including aircraft, ground support equipment, motor vehicles, home furnaces, evaporating fuel and paints, burning wood, carpets, dry cleaning of clothing, and industrial facilities.

HAPs have no NAAQS but are still regulated under the federal CAA because of their potentially adverse effects on human health and the environment. In most airport emission inventories, formaldehyde occurs in the greatest amounts, followed by acetaldehyde, acrolein, and 1,3-butadiene. Compounds such as benzene, ethylbenzene, naphthalene, toluene, hexane, styrene, and xylene also occur, but in far lesser amounts.

The USEPA and FAA developed organic gas speciation profiles and best practices for use in preparing HAP emission inventories of aircraft with turbofan, turbojet, and turboprop engines fueled with kerosene-based jet-A fuel. These profiles and guidance were developed in tandem by both agencies, taking into account the most recent data and information available.

> Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines.[33]
>
> The aircraft-related speciation profile developed from this initiative was used to update the organic gas profile for aircraft in the USEPA SPECIATE database—the agency's multi-sector repository for such data. In this application, a *speciation profile* is the amount of organic gases emitted based on the amount of VOC emitted by an emission source.

FAA also published a document providing an approach to, and technical guidance for, preparing speciated organic gas emissions inventories for airport sources.

> Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources.[34]
>
> This guidance is intended to help ensure that OG/HAPs emission inventories prepared in support of environmental documents prepared by, or on behalf of, the FAA under NEPA are done so consistently. Importantly, it points out that emission inventories of aviation-related organic gases, which include the organic gases identified by the USEPA to be HAP and the organic gases listed in the USEPA's Integrated Risk Information System, are not required by current USEPA regulations. However, in those cases where it is necessary to prepare such an aviation-related HAP emissions inventory, the inventory must be prepared following this guidance and using AEDT.

AEDT calculates HAP emissions based on the previously mentioned two documents. AEDT calculates emissions for approximately 400 different air toxics. Of these air toxics, 19 compounds are associated with aircraft actitives and are classified as HAPs by the USEPA.[35]

As with the criteria pollutants, HAP emissions for the Existing Fly Quiet, Proposed Interim Fly Quiet, and Revised Interim Fly Quiet 1 and 2 would be affected by nighttime aircraft operations within ground travel time.

[33] FAA and USEPA, Recommended Best Practice for Quantifying Speciated Organic Gas Emissions from Aircraft Equipped with Turbofan, Turbojet, and Turboprop Engines (Version 1.0), May 2009, http://www.epa.gov/nonroad/aviation/420r09901.pdf.

[34] FAA, Guidance for Quantifying Speciated Organic Gas Emissions from Airport Sources, Version 1, September 2, 2009, http://www.faa.gov/regulations_policies/policy_guidance/envir_policy/media/Guidance%20for%20Quantifying%20Speciated%20Organic%20Gas%20Emissions%20from%20Airport%20Sources.pdf.

[35] Agency of Toxic Substances and Disease Registry, https://www.atsdr.cdc.gov/substances/toxsubstance.asp?toxid=81.

E.6.1 HAPs of Interest

The 19 HAPs determined to be of interest are 1,3-butadiene, 2-methylnaphthalene, acetaldehyde, acetone, acrolein, benzaldehyde, benzene, ethylbenzene, formaldehyde, isopropyl benzene, methyl alcohol, naphthalene, n-heptane, phenol, propionaldehyde, styrene, toluene, m-xylenes, and o-xylenes. The HAP emission inventories for the Existing Fly Quiet and Proposed Interim Fly Quiet are provided in **Table E-27**. As shown, the HAPs with the greatest contribution to total project-related emissions are 1,3-butadiene, acetaldehyde, acrolein, and formaldehyde. As with criteria pollutants, the slight increase in HAP emissions is a result of slight increases in aircraft ground travel time.

TABLE E-27
HAP EMISSIONS – PROPOSED INTERIM FLY QUIET

Pollutants	Tons Emitted		
	Existing Fly Quiet	Proposed Interim Fly Quiet	Difference
1,3-Butadiene	0.60	0.61	0.01
2-Methylnaphthalene	0.07	0.07	<0.01
Acetaldehyde	1.51	1.55	0.03
Acetone	0.13	0.13	0.00
Acrolein	0.87	0.89	0.02
Benzaldehyde	0.17	0.17	<0.01
Benzene	0.60	0.61	0.01
Ethylbenzene	0.06	0.06	<0.01
Formaldehyde	4.36	4.46	0.09
Isopropyl benzene	<0.01	<0.01	<0.01
Methyl alcohol	0.64	0.65	0.01
Naphthalene	0.19	0.19	<0.01
N-Heptane	0.02	0.02	<0.01
Phenol	0.26	0.26	0.01
Propionaldehyde	0.26	0.26	0.01
Styrene	0.11	0.11	<0.01
Toluene	0.23	0.23	<0.01
m-Xylenes	0.10	0.10	<0.01
o-Xylenes	0.06	0.06	<0.01
Total	10.2	10.5	0.21

Values reflect rounding.
Source: The RCH Group and KB Environmental Sciences, Inc.

The HAP emissions inventories for the Existing Fly Quiet and Revised Interim Fly Quiet 1 are provided in **Table E-28**. As shown, the HAPs with the greatest contribution to total project-related emissions are 1,3-butadiene, acetaldehyde, acrolein, and formaldehyde. As with criteria pollutants, the slight increase in HAP emissions are a result of slight increases in aircraft ground travel time.

TABLE E-28
HAP EMISSIONS – REVISED INTERIM FLY QUIET 1

Pollutants	Tons Emitted		
	Existing Fly Quiet	Revised Interim Fly Quiet 1	Difference
1,3-Butadiene	0.60	0.61	0.01
2-Methylnaphthalene	0.07	0.07	<0.01
Acetaldehyde	1.51	1.54	0.03
Acetone	0.13	0.13	<0.01
Acrolein	0.87	0.89	0.02
Benzaldehyde	0.17	0.17	<0.01
Benzene	0.60	0.61	0.01
Ethylbenzene	0.06	0.06	<0.01
Formaldehyde	4.36	4.45	0.09
Isopropyl benzene	<0.01	<0.01	<0.01
Methyl alcohol	0.64	0.65	0.01
Naphthalene	0.19	0.20	<0.01
N-Heptane	0.02	0.02	<0.01
Phenol	0.26	0.26	0.01
Propionaldehyde	0.26	0.26	0.01
Styrene	0.11	0.11	<0.01
Toluene	0.23	0.23	<0.01
m-Xylenes	0.10	0.10	<0.01
o-Xylenes	0.06	0.06	<0.01
Total	10.2	10.4	0.20

Values reflect rounding.
Source: The RCH Group and KB Environmental Sciences, Inc.

The HAP emissions inventories for the Existing Fly Quiet and Revised Interim Fly Quiet 2 are provided in **Table E-29**. As shown, the HAPs with the greatest contribution to total project-related emissions are 1,3-butadiene, acetaldehyde, acrolein, and formaldehyde. As with criteria pollutants, the slight increase in HAP emissions are a result of slight increases in aircraft ground taxi time.

TABLE E-29
HAP EMISSIONS – REVISED INTERIM FLY QUIET 2

Pollutants	Tons Emitted		
	Existing Fly Quiet	Revised Interim Fly Quiet 2	Difference
1,3-Butadiene	0.60	0.61	0.01
2-Methylnaphthalene	0.07	0.07	<0.01
Acetaldehyde	1.51	1.54	0.03
Acetone	0.13	0.13	<0.01
Acrolein	0.87	0.88	0.01
Benzaldehyde	0.17	0.17	<0.01
Benzene	0.60	0.61	0.01
Ethylbenzene	0.06	0.06	<0.01
Formaldehyde	4.36	4.44	0.07
Isopropyl benzene	<0.01	<0.01	<0.01
Methyl alcohol	0.64	0.65	0.01
Naphthalene	0.19	0.20	<0.01
N-Heptane	0.02	0.02	<0.01
Phenol	0.26	0.26	<0.01
Propionaldehyde	0.26	0.26	<0.01
Styrene	0.11	0.11	<0.01
Toluene	0.23	0.23	<0.01
m-Xylenes	0.10	0.10	<0.01
o-Xylenes	0.06	0.06	<0.01
Total	10.2	10.4	0.17

Values reflect rounding.
Source: The RCH Group and KB Environmental Sciences, Inc.

A brief description of these compounds is provided within the following:

1,3-Butadiene

1,3-butadiene is a colorless gas. At room temperature, it has a gasoline-like odor. This pollutant is a byproduct of petroleum processing and is used in the production of synthetic rubber and plastics. It is also found in automobile exhaust, gasoline vapor, fossil fuel incineration products, and cigarette smoke. Most 1,3-butadiene is released into the air and humans are typically exposed to the pollutant via inhalation. Breathing very high levels of 1,3-butadiene, even for a short time, may cause central nervous system damage, blurred vision, nausea, fatigue, headache, decreased blood pressure and pulse rate, and unconsciousness. Breathing lower levels of this pollutant may cause irritation of the eyes, nose, and throat.

2-Methylnaphthalene

2-Methylnaphthalene is a naphthalene-related compound that enters the environment from the burning of fossil fuels and enters the body through the air breathed into the lungs. Exposure to a high concentration

may damage or destroy red blood cells which can then lead to hemolytic anemia. Anemia symptoms include fatigue, lack of appetite, and restlessness.

Acetaldehyde

Acetaldehyde is a colorless, volatile liquid with a characteristic pungent, fruity odor. Acetaldehyde is used primarily as a chemical intermediate in the production of acetic acid and as a synthetic flavoring agent. Acetaldehyde is released to the environment in vehicle exhaust and as a product of open burning of gas, fuel oil, and coal. Acute exposure to acetaldehyde can cause eye, nose, and throat irritation and subsequent inflammation of the eyes and coughing.

Acetone

Acetone is a manufactured chemical that is also found naturally in the environment. It is a colorless liquid with a distinct smell and taste. It evaporates easily, is flammable, and dissolves in water. Acetone is used to make plastic, fibers, drugs, and other chemicals. It occurs naturally in plants, trees, volcanic gases, forest fires, and as a product of the breakdown of body fat. It is present in vehicle exhaust, tobacco smoke, and landfill sites. Industrial processes contribute more acetone to the environment than natural processes. People begin to smell acetone in the air at 100 to 140 parts of acetone in a million parts of air, though some can smell it at much lower levels. Most people begin to detect the presence of acetone in water at 20 ppm. Acetone evaporates readily into the air and mixes well with water.

Acrolein

Acrolein is a clear or yellow liquid with a disagreeable odor. Acrolein is used as an intermediate in the production of acrylic acid, as well as a pesticide to control algae, weeds, bacteria, and mollusks. Small amounts of acrolein can be formed and emitted into the air when trees, tobacco, other plants, gasoline, and oil are burned. Acrolein may also be released into the environment in emissions and effluents from manufacturing and use facilities and in emissions from combustion. Exposure to high concentrations of acrolein may damage the lungs and could cause death. Breathing lower amounts may cause watery eyes, burning of the nose and throat, and decreased breathing rate.

Benzaldehyde

Benzaldehyde is a colorless liquid with a characteristic almond-like odor. The primary component of bitter almond oil, benzaldehyde can be extracted from a number of other natural sources. Synthetic benzaldehyde is the flavoring agent in imitation almond extract, which is used to flavor cakes and other baked goods.

Benzene

Benzene is a volatile, colorless, flammable liquid that has a sweet odor. It is a chemical intermediate in the synthesis of compounds such as plastics, resins, nylon, synthetic fibers, synthetic rubber, lubricants, dyes, detergents, drugs, and pesticides. Major sources of atmospheric releases include vehicle exhaust emissions, evaporative gasoline fumes, emissions from vehicle service stations, and industrial emissions. Other sources of atmospheric benzene include cigarette smoke and landfill emissions. Acute inhalation exposure to benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

Ethyl Benzene

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints. Ethylbenzene is used primarily to make styrene, another chemical. Other uses include as a solvent, in fuels, and to make other chemicals. You can smell ethylbenzene in the air at two parts of ethylbenzene per million parts of air (2 ppm). It evaporates at room temperature and burns easily. The median levels of ethylbenzene in air are 0.62 ppb in city and suburban locations.

Formaldehyde

At room temperature, formaldehyde is a colorless, flammable gas with a distinct, pungent smell. Formaldehyde is a product of incomplete combustion and is emitted into the air by burning wood, coal, kerosene, and natural gas, by automobiles, and by cigarettes; it is also a naturally occurring substance. Formaldehyde can be released to soil, water, and air by industrial sources and can off-gas from materials made with it. Humans can be exposed to formaldehyde through inhalation of contaminated air and smog. Low levels of formaldehyde can cause irritation of the eyes, nose, throat, and skin. Some epidemiological studies found an increased incidence of nose and throat cancer in exposed individuals, but other studies could not confirm this finding.

Isopropyl Benzene

Isopropyl benzene (cumene) is used in a variety of petroleum products and is released in to the environment via its evaporation and from the combustion of petroleum products. Acute (i.e., short term) inhalation exposure may cause headaches, dizziness, drowsiness, and unconsciousness.

Methyl Alcohol

Methyl alcohol, or methanol, is a colorless, flammable liquid used to manufacture formaldeyhde and acetic acid, in chemical synthesis, in antifreeze, and as a solvent. Ingestion of methanol is toxic and may cause blindness. Methyl Alcohol is used as a solvent and as an intermediate in chemical synthesis. It is a component of deicing mixtures and preservatives. It is the simplest alcohol, and is a light, volatile, colourless, flammable, poisonous liquid with a distinctive odor that is somewhat milder and sweeter than ethanol.

Naphthalene

Naphthalene is a white solid with the odor of mothballs or tar and is found naturally in fuels when they are burned. Burning tobacco or wood also produces naphthalene. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride plastics. Naphthalene is released into the air through the burning of tobacco, wood, oil, and coal. Exposure to large amounts of naphthalene may damage or destroy some red blood cells. This condition is called hemolytic anemia, with symptoms including fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin.

n-Heptane

In its liquid state, n-heptane is commercially available for use in paints and coatings. Exposure to vapors can cause loss of appetite, nausea, headaches, lightheadedness, dizziness, lack of coordination, and loss of consciousness. Long-term effects to the nervous system may result in reduced memory and concentration.

Phenol

Phenol is both a manufactured chemical and a natural substance. It is a colorless-to-white solid when pure. Phenol has a distinct sickeningly sweet and tarry odor. You can taste and smell phenol at levels lower than those that are associated with harmful effects. Phenol evaporates more slowly than water, and a moderate amount can form a solution with water. Phenol is used primarily in the production of phenolic resins and in the manufacture of nylon and other synthetic fibers. It is also used in slimicides (chemicals that kill bacteria and fungi in slimes), as a disinfectant and antiseptic, and in medicinal preparations such as mouthwash and sore throat lozenges.

Propionaldehyde

Propionaldehyde is a colorless liquid with a slightly irritating, fruity odor. It is principally used as a precursor to trimethylolethane through a condensation reaction with formaldehyde; this triol is an important intermediate in the production of alkyd resins. Other applications include reduction to propanol and oxidation to propionic acid.

Styrene

Styrene is primarily a synthetic chemical. It is a colorless liquid that evaporates easily and has a sweet smell. It often contains other chemicals that give it a sharp, unpleasant smell. It dissolves in some liquids but does not dissolve easily in water. It is used to make rubber, plastic, insulation, fiberglass, pipes, automobile parts, food containers, and carpet backing. Low levels of styrene also occur naturally in a variety of foods such as fruits, vegetables, nuts, beverages, and meats.

Toluene

Toluene is a colorless, clear liquid that occurs naturally in crude oil. It is also produced in the manufacturing of gasoline and other fuels from crude oil. Airport-related sources of toluene include aircraft, ground service equipment, motor vehicles, heating plants, and gasoline fuel storage tanks. Low to moderate levels of toluene can affect the nervous system and cause tiredness, confusion, weakness, memory loss, nausea, loss of appetite, and hearing and color vision loss. Inhaling high levels of toluene in a short time can make a person feel light-headed, dizzy, or sleepy, and can cause unconsciousness and death.

Xylenes

There are three forms of xylene, in which the methyl groups vary on the benzene ring: meta-xylene, ortho-xylene, and para-xylene (m-, o-, and p-xylene). Xylene is a colorless, sweet-smelling liquid that catches fire easily. It occurs naturally in petroleum and coal tar. It is one of the top 30 chemicals produced in the United States in terms of volume. Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a paint thinner, and in paints and varnishes. It is found in small amounts in aviation fuel and gasoline.

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ATTACHMENT E-1

CHICAGO O'HARE INTERNATIONAL AIRPORT ENVIRONMENTAL IMPACT STATEMENT RE-EVALUATION INTERIM FLY QUIET AIR QUALITY ANALYSIS METHODOLOGY MEMORANDUM

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KB Environmental Sciences

MEMO

Date: April 11, 2018

To: Diana Wasiuk (HMMH) and Amy Hanson, Federal Aviation Administration (FAA)

From: Carrol Fowler (KBE) and Mike Ratte (RCH Group)

Subject: Chicago O'Hare International Airport
Environmental Impact Statement Reevaluation
Interim Fly Quiet (IFQ) Air Quality Analysis Methodology

It is our understanding that the IFQ program would not change the number of aircraft operations, aircraft fleet mix, support equipment activities nor change surface traffic volumes or traffic operating conditions. However, the IFQ program would change aircraft taxi times and use of Chicago O'Hare International Airport's (O'Hare's) runways for certain nighttime operations. Because the change in the nighttime use of the airfield is expected to have a minimal impact on total air pollutant and pollutant precursor emissions as well as a minimal impact on ambient concentrations of the pollutants for which there are National Ambient Air Quality Standards (NAAQS), this Memorandum describes an alternative air quality analysis methodology that could be used to assess the impact of the IFQ program.

Typically, when a dispersion modeling analysis is performed to assess airport-related improvements, data for all of the airport emission sources, including those that would not be affected by the improvements, are considered in the preparation of an emissions inventory and in performing dispersion analysis (i.e., estimates of ambient concentrations). Then, to account for emission sources not associated with the airport, measured pollutant concentrations from a nearby monitoring station (referred to as background concentrations) are added to the predicted airport-related values.

In January of this year, the FAA issued a Finding of No Significant Impact (FONSI) and Record of Decision (ROD) for the proposed Landside Access Modernization Program (LAMP) Environmental Assessment (EA) for Los Angeles International Airport (LAX).[1,2] The air quality assessment that was performed for the LAMP used a simplified method of assessing the potential air quality impacts from the project improvements. Instead of modeling all sources of emissions within the airport property, only those sources for which emission levels/locations would change as a result of the project were included in the emissions inventory and dispersion analysis. For the LAMP, these project-related sources were motor vehicles and new stationary sources. Emissions from aircraft, auxiliary power units and ground support equipment were not modeled.

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[1] The cover of, and relevant pages from, the ROD are provided in **Attachment A** of this Memorandum.
[2] LAX is located within an area designated as a nonattainment area for the National Ambient Air Quality Standards for ozone and particulate matter less than or equal to 2.5 micrometers in diameter.

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727-578-5152

April 11, 2018
Page 2

The LAMP EA provides predicted concentrations of project-related emissions (again, motor vehicles and new stationary sources only) as well as background concentrations for each pollutant. The background concentrations of carbon monoxide (CO), nitrogen dioxide (NO_2), dioxide (SO_2), and particulate matter less than or equal to 10 micrometers in diameter (PM_{10}) were obtained from an air monitoring station located less than 0.5 miles from LAX's northernmost runway. The background concentration for particulate matter less than or equal to 2.5 micrometers in diameter ($PM_{2.5}$) was obtained from a monitoring station located more than 16 miles southeast of LAX. It should be noted that the same background concentrations were used to predict pollutant concentrations for three future years (2024, 2030 and 2035). No adjustments were made to the background concentrations to account for increases or decreases in emissions that would result from background sources of the pollutants (including growth in aircraft operations and/or changes in the aircraft fleet at LAX). [3]

Use of this simplified methodology would greatly reduce the previously proposed scope of services (i.e., level of effort) to assess the potential air quality impact of the IFQ program. For the IFQ program, emissions inventories and dispersion analysis would only be performed for aircraft and only for those nighttime hours and months in which the program would be implemented. For background concentrations we would propose, in coordination with the Illinois Environmental Protection Agency (IEPA), that measurements be obtained from the IEPA's monitors located in Schiller Park (immediately east of O'Hare) and Northbrook (a station from which background measurements were obtained for previous O'Hare-related air quality assessments). The estimated IFQ program-related concentrations (associated with nighttime changes to airfield activity) would be added to the background concentrations from these stations for direct comparison to the NAAQS.

With submittal of this memorandum, we request that the FAA provide judgement as to whether the simplified methodology described above would be acceptable for use in evaluating the potential air quality impact of the IFQ program at O'Hare.

[3] See **Attachment C** of this Memorandum.

ATTACHMENT A

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
WESTERN-PACIFIC REGION

FINDING OF NO SIGNIFICANT IMPACT AND RECORD OF DECISION

Proposed Landside Access Modernization Program

Los Angeles International Airport
Los Angeles, Los Angeles County, California

For further information

Victor Globa
U.S. Department of Transportation
Federal Aviation Administration
Western-Pacific Region
Los Angeles Airports District Office
15000 Aviation Boulevard
Lawndale, California 90261
310-725-3637

January 12, 2018

A. **Air Quality.** Sections 4.3 and 5.1 of the Final EA, state the analysis of air quality for the Proposed Action Alternative was guided by an Air Quality Protocol (see Appendix F) that was coordinated with the FAA, U.S. Environmental Protection Agency, Federal Highway Administration (FHA), California Air Resources Board (CARB), California Department of Transportation (Caltrans), Southern California Association of Governments (SCAG) and the South Coast Air Quality Management District (SCAQMD). The analysis outlined in the Air Quality Protocol was designed to meet the requirements of both the transportation and general conformity rules of the Clean Air Act of 1966, as amended. Both conformity rules apply to LAMP because the project includes both "transportation projects" as defined by regulation (see 40 C.F.R. §93101) and general federal actions as defined by regulation (see 40 C.F.R. §93.152). Section 4.3.2 of the Final EA states the Proposed Action Alternative would not affect aircraft operations at LAX. Sections 5.1.3 and 5.1.4 provide construction and operational emissions inventory for the Final EA. Table 5-2 provides the General Conformity *de minimis* thresholds. Table 5-3 shows the Proposed Action Alternative would exceed NO_x *de minimis* thresholds for construction air pollutant emissions for the years 2018-2022. Section 5.1.3.3 states that based on coordination with the SCAQMD, construction emissions for the Proposed Action Alternative are included in the State Implementation Plan (SIP) budget, the action would conform to the SIP that allows for attainment of the National Ambient Air Quality Standards (NAAQS) and impacts would not be significant when compared to the No Action Alternative. However, as noted above, because the construction emissions exceed the de minimis thresholds, the General Conformity Rule requires that a separate general conformity determination be made, which includes opportunity for public comment. Details regarding coordination with SCAQMD are in Appendix F, whereas, the Final General Conformity Determination for the Proposed Action Alternative can be found in Appendix O. Table 5-10 of the Final EA shows implementation of the Proposed Action Alternative would decrease operational emissions for all criteria pollutants in 2024, 2030, and 2035 when compared to the No Action Alternative. The reduction in operational emissions is due to the reduction in vehicle miles traveled associated with the Proposed Action Alternative improvements. Additionally, the reduced vehicle miles traveled would reduce hazardous air pollutant emissions.

ATTACHMENT B

F.1

Air Quality Protocol

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2.2.2 OPERATIONAL SOURCES

Operational emissions provide an indication of the changes in emissions that completing and operating the proposed Project would have when comparing operational emissions without the LAX Landside Access Modernization Program.

The FAA's Terminal Area Forecast for LAX, published in January 2016, forecasts demand for air travel in 2024, 2030, and 2035 at LAX. The forecast predicts an increase in total aircraft activity and total passenger activity at LAX. Implementation of the LAX Landside Access Modernization Program would not increase the number of flights or type of aircraft using the airfield because it only affects landside development and efficiency of the landside/roadway system. The LAX Landside Access Modernization Program would also not result in changes to air traffic flight patterns or aircraft taxi patterns. Finally, the LAX Landside Access Modernization Program would not change the number of passengers at LAX; it would only change how they access the airport and terminal facilities.

Therefore, changes in surface vehicle traffic patterns and trips that would occur because of the LAX Landside Access Modernization Program facilities, as well as emissions from new stationary facilities and energy demand for the proposed LAX Landside Access Modernization Program facilities, are the only operational sources that will be analyzed for impacts.

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2.3 Dispersion Analysis

Dispersion is the process by which atmospheric pollutants disseminate due to wind and vertical stability. Air dispersion modeling is used to predict ground-level ambient air concentrations of pollutants in the vicinity of known air emission sources. The results of a dispersion analysis are used to assess pollutant concentrations at or near an airport. The base data for the dispersion analysis are the emissions inventories described in Section 2.2.2 above, meteorological data that define the wind speeds and direction in the Project vicinity, and receptor locations where the ground level concentrations will be calculated.

Air dispersion modeling will be used to predict pollutant concentrations for operational sources for the 2015 existing condition, 2024, 2030, and 2035 Proposed Action and No Action conditions, as well as for any other action alternative carried forward for detailed consideration in the EA. Predicted concentrations resulting from the LAX Landside Access Modernization Program will be calculated for the following criteria pollutants: CO, NO_2, PM_{10}, $PM_{2.5}$, and SO_2. Project-related concentrations of CO, NO_2, and SO_2 will be added to the background concentrations for comparison to NAAQS. The background concentrations represent contributions from non-Project sources in the vicinity of the Airport. The modeled, project-related pollutant concentrations for PM_{10} and $PM_{2.5}$ will be directly compared to the Project only thresholds listed in Section 1.3.3.

ATTACHMENT C

DRAFT
ENVIRONMENTAL ASSESSMENT AND DRAFT GENERAL CONFORMITY DETERMINATION

Volume 1: Main Report
(Executive Summary – Chapter 9)

LOS ANGELES INTERNATIONAL AIRPORT (LAX)
LANDSIDE ACCESS MODERNIZATION PROGRAM

Los Angeles International Airport
Los Angeles, Los Angeles County, California

Prepared for:

LOS ANGELES WORLD AIRPORTS

U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION
As lead Federal Agency pursuant to the National Environmental Policy Act of 1969

Prepared by:

Ricondo and Associates, Inc.

August 2017

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

Responsible FAA Official **Date**

Page 5-15 of Volume 1

Table 5-7: 2024 Proposed Action Alternative Concentrations

POLLUTANT	AVERAGING PERIOD [1/]	INCREMENTAL PEAK ($\mu g/m^3$) [2/]	BACKGROUND ($\mu g/m^3$)	TOTAL ($\mu g/m^3$)	STANDARD ($\mu g/m^3$) [1/]	EXCEEDS STANDARD?
CO	1-hr CAAQS	82	3,565	3,647	23,000	No
CO	1-hr NAAQS	78	3,565	3,643	40,000	No
CO	8-hr CAAQS & NAAQS	37	2,778	2,815	10,000	No
NO_2	1-hr CAAQS	8	164	172	339	No
NO_2	1-hr NAAQS	6	116	122	188	No
NO_2	Annual CAAQS	1	23	24	57	No
NO_2	Annual NAAQS	1	23	24	100	No
SO_2	1-hr CAAQS	<1	39	39	655	No
SO_2	1-hr NAAQS	<1	16	16	196	No
SO_2	3-hr NAAQS	<1	39 [3/]	39	1,300	No
SO_2	24-hr CAAQS	<1	8	8	105	No
SO_2	Annual NAAQS	<1	3	3	80	No
PM_{10}	24-hr CAAQS	3.1	38.3	41.4	50	No
PM_{10}	24-hr NAAQS	2.8	35	37.8	150	No
PM_{10}	Annual CAAQS	1.5	22	23.5	20	**Yes**
$PM_{2.5}$	24-hr NAAQS	1.0	30	31.0	35	No
$PM_{2.5}$	Annual CAAQS & NAAQS	0.5	11.4	11.9	12	No

Page 5-16 of Volume 1

Table 5-8: 2030 Proposed Action Alternative Concentrations

POLLUTANT	AVERAGING PERIOD [1/]	INCREMENTAL PEAK ($\mu g/m^3$) [2/]	BACKGROUND ($\mu g/m^3$)	TOTAL ($\mu g/m^3$)	STANDARD ($\mu g/m^3$) [1/]	EXCEEDS STANDARD?
CO	1-hr CAAQS	68	3,565	3,633	23,000	No
CO	1-hr NAAQS	61	3,565	3,626	40,000	No
CO	8-hr CAAQS & NAAQS	31	2,778	2,809	10,000	No
NO_2	1-hr CAAQS	22	164	186	339	No
NO_2	1-hr NAAQS	19	116	135	188	No
NO_2	Annual CAAQS	7	23	30	57	No
NO_2	Annual NAAQS	7	23	30	100	No
SO_2	1-hr CAAQS	<1	39	39	655	No
SO_2	1-hr NAAQS	<1	16	16	196	No
SO_2	3-hr NAAQS	<1	39 [3/]	39	1,300	No
SO_2	24-hr CAAQS	<1	8	8	105	No
SO_2	Annual NAAQS	<1	3	3	80	No
PM_{10}	24-hr CAAQS	3.4	38.3	41.7	50	No
PM_{10}	24-hr NAAQS	3.1	35	38.1	150	No
PM_{10}	Annual CAAQS	1.5	22	23.5	20	**Yes**
$PM_{2.5}$	24-hr NAAQS	1.0	30	31.0	35	No
$PM_{2.5}$	Annual CAAQS & NAAQS	0.5	11.4	11.9	12	No

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Table 5-9: 2035 Proposed Action Alternative Concentrations

POLLUTANT	AVERAGING PERIOD [1/]	INCREMENTAL PEAK ($\mu g/m^3$) [2/]	BACKGROUND ($\mu g/m^3$)	TOTAL ($\mu g/m^3$)	STANDARD ($\mu g/m^3$) [1/]	EXCEEDS STANDARD?
CO	1-hr CAAQS	55	3,565	3,620	23,000	No
CO	1-hr NAAQS	49	3,565	3,614	40,000	No
CO	8-hr CAAQS & NAAQS	25	2,778	2,803	10,000	No
NO_2	1-hr CAAQS	22	164	186	339	No
NO_2	1-hr NAAQS	21	116	137	188	No
NO_2	Annual CAAQS	7	23	30	57	No
NO_2	Annual NAAQS	7	23	30	100	No
SO_2	1-hr CAAQS	<1	39	39	655	No
SO_2	1-hr NAAQS	<1	16	16	196	No
SO_2	3-hr NAAQS	<1	39 [3/]	39	1,300	No
SO_2	24-hr CAAQS	<1	8	8	105	No
SO_2	Annual NAAQS	<1	3	3	80	No
PM_{10}	24-hr CAAQS	3.4	38.3	41.7	50	No
PM_{10}	24-hr NAAQS	3.1	35	38.1	150	No
PM_{10}	Annual CAAQS	1.5	22	23.5	20	**Yes**
$PM_{2.5}$	24-hr NAAQS	1.0	30	31	35	No
$PM_{2.5}$	Annual CAAQS & NAAQS	0.5	11.4	11.9	12	No