

Date: February 18, 2016
To: Gil Grodzinsky, Georgia Environmental Protection Division (EPD)
From: Cristina Schoonard and Carrol Fowler
Subject: Hartsfield-Jackson Atlanta International Airport
Year 2014 and 2030 Emissions Inventory Data

As requested and discussed with the EPD and on behalf of the City of Atlanta Department of Aviation (DOA), a year 2030 criteria air pollutant, pollutant precursor, and hazardous air pollutant (HAP) emissions inventory was prepared for Hartsfield-Jackson Atlanta International Airport (ATL). The inventory was prepared for aircraft, auxiliary power units (APUs), and ground support equipment (GSE) for the following criteria pollutants/pollutant precursors:

- Carbon monoxide (CO)
- Nitrogen oxides (NO_x)
- Particulate matter 10 microns or less in diameter (PM₁₀) and 2.5 microns or less in size (PM_{2.5})
- Sulfur oxides (SO_x)
- Volatile organic compounds (VOC)

The individual HAPs that were inventoried are listed in the Excel spreadsheets that were submitted to the EPD in January.

Methodology

Although the Federal Aviation Administration (FAA) has sunset the model, the year 2030 emissions inventory was prepared using the FAA's Emissions and Dispersion Modeling System (EDMS). The EDMS was used instead of the FAA's current model, the Aviation Environmental Design Tool (AEDT) because estimates derived with both EDMS and AEDT indicate that the current version of AEDT (Version 2b) is lacking some key emission factor data. The following describes the assumptions and methodologies that were used to prepare the inventory using the EDMS.

Aircraft

By the year 2030, the DOA estimates that there will be 1,063,610 annual aircraft operations at ATL. The aircraft fleet mix (i.e., the type of aircraft and number of operations by aircraft type) were developed by Ricondo & Associates, Inc. using methodologies described in the DOA's Master Plan (March 2015).¹ The assignment of aircraft type/aircraft engine was made using data that was developed by KBE for the year 2014 emission inventory (submitted to the EPD in August of 2015). The number of year 2030 aircraft operations, by aircraft category (i.e., passenger, cargo, general aviation), aircraft type, and engine are provided in **Table 1**.

¹ <http://www.atlanta-airport.com/Airport/MasterPlan/documentation.html>

Table 1 Year 2030 Aircraft Fleet Mix and Annual Operations			
Aircraft Category	EDMS Aircraft	EDMS Engine	Number of Operations
Passenger – Air Carrier	Airbus 319/320	CFM56-5B4	224,110
	Boeing 717	BR700-715A1-30 Improved fuel injector	116,070
	Boeing 737-800/900	CFM56-7B26E	395,660
	Boeing 747, Airbus 380	RB211-524H	1,460
	Boeing 767-300	PW4060 Phase III	14,600
	Boeing 777/787	GE90-90B DAC I	51,830
	Bombardier CRJ-700	CF34-8C1	219,730
Cargo – Air Carrier	Airbus 330	PW4168A Floatwall	1,460
	Boeing 737F	CFM56-7B22	730
	Boeing 747-8F	GE9x-2B67 TAPS (11GE139)	730
	Boeing 747F	PW4056	6,570
	Boeing 757F	PW2040 (4PW073)	2,190
	Boeing 767F	CF6-80C2B6	2,920
	Boeing 777F	GE90-110B1	730
	Boeing MD-11 Freighter	CF6-80C2D1F	2,920
General Aviation (includes cargo-related operations)	Bombardier Global Express 5000	BR700-710A2-20	1,460
	Bombardier Learjet 45	TFE731-2-2B	1,460
	Cessna 172 Skyhawk	IO-320-D1AD	1,460
	Cessna 441 Conquest II	TPE331-10	1,460
	Cessna 500 Citation I	JT15D-1 series	1,460
	Cessna 525 CitationJet	JT15D-1 series	1,460
	Cessna 560 Citation XLS	JT15D-5, -5A, -5B	1,460
	Dassault Falcon 2000	PW308C	2,190
	de Havilland DHC-6-200 Twin Otter	PT6A-20	1,460
	Gulfstream IV-SP	TAY 611-8C	1,460
	Mitsubishi MU-300 Diamond	JT15D-4 series (1PW036)	1,460
	Piaggio P.180 Avanti	PT6A-66	1,460
	Raytheon Beech Baron 58	TIO-540-J2B2	1,460
	Raytheon Hawker 800	TFE731-3	1,460
Military	Raytheon Beech Baron 58	TIO-540-J2B2	730
Total			1,063,610

Ricondo and Associates, Inc. provided the taxi/delay times that were used in the analysis (26.6 minutes per landing-takeoff cycle (LTO)). Additional assumptions that were used in deriving the aircraft-related emissions inventory were:

- A default mixing height of 3,000 feet above ground level.
- Default aircraft trip (i.e., stage/weight) lengths.

As was requested by the EPD for the year 2014 inventory, the inventory results have been segregated by Standard Classification Code (SCC), for the aircraft groups defined in the National Emissions Inventory (e.g., commercial aircraft, general aviation aircraft/piston, general aviation aircraft/turbine) and, for those engines for which codes were available, by the aircraft type/engine codes provided by the U.S. Environmental Protection Agency (EPA).

APUs

For the year 2030 inventory, the EDMS default APU usage (run) times were assumed.

GSE

For the year 2030 inventory, the EDMS default GSE fleet and usage (run) times were assumed.

Annual Emissions Inventory Results

The year 2030 emission inventories for aircraft, APUs and GSE are presented in **Table 2**. As shown, these sources are estimated to emit approximately 8,639 tons of CO, 6,345 tons of NO_x, 112 tons of both PM₁₀ and PM_{2.5}, 645 tons of SO_x, and 914 tons of VOC.

Table 2						
2030 Annual Emissions Inventory (Tons)						
Source	CO	NO_x	PM₁₀	PM_{2.5}	SO_x	VOC
Aircraft						
<i>Startup</i>	-	-	-	-	-	190
<i>Taxi Out</i>	3,465	462	19	19	141	314
<i>Takeoff</i>	46	3,162	22	22	156	8
<i>Climb Out</i>	28	1,233	9	9	65	4
<i>Approach</i>	489	652	11	11	93	31
<i>Taxi In</i>	3,505	551	20	20	152	317
Total Aircraft	7,533	6,060	80	80	607	863
APU(s)	230	208	27	27	29	17
GSE	876	77	5	5	9	34
Total	8,639	6,345	112	112	645	914
Note: EDMS does not provide estimates of CO, NO _x , PM 10, PM 2.5, and SO _x emissions for aircraft startup.						

As was also requested by the EPD, emissions estimates were derived for a typical weekday in July for the years 2014 and 2030. These estimates were derived using operational data that was extracted from the DOA's Noise and Operations Monitoring System (NOMS). The NOMS data provided an estimate of the average number of operations that occur on a weekday in July (approximately 0.3% of annual emissions). The weekday emission estimates were also provided in a spreadsheet that was submitted to the EPD in January.

Subsequent to the submittal in January, the DOA requested that GSE-related emissions be segregated by fuel type (i.e., gas versus diesel). Because the EDMS does not readily provide this data, the segregated data was hand-calculated using ATL-specific operational data, emission factor data from the EDMS, and equipment-specific horsepower, operating times and load factors. The segregated GSE emissions data was provided to the EPD on February 9th. **Table 3** provides a summary of the GSE data.

Year	Table 3 2014 and 2030 GSE Emissions By Fuel Type (Tons)						
	Fuel Type	CO	NO _x	PM ₁₀	PM _{2.5}	SO _x	VOC
2014	Gas	2,165	116	3	3	7	61
	Diesel	45	135	6	6	0	15
	Total	2,210	251	9	9	7	76
2030	Gas	864	54	4	4	9	22
	Diesel	12	22	1	1	0	12
	Total	876	77	5	5	9	34

Comparison to Year 2014 Inventory

As shown in **Table 4**, aircraft and APU emissions, as well as total emissions, are forecast to increase in 2030 when compared to 2014. By comparison, with the exception of SO_x emissions, emissions attributable to GSE are forecast to decrease over this same time period. The increase in aircraft emissions from 2014 to 2030 is directly attributable to the forecast increase in operations at ATL. The decrease in GSE-related emissions from 2014 to 2030 is a direct result of the federally mandated reductions in emissions from nonroad diesel engines and the annual turnover/conversion of GSE nationally. The increase in GSE-related SO_x emissions is attributed to a slight increase in the emission factors within the EDMS for this equipment for the year 2030 when compared to the factors for the year 2014.

Year	Table 3 2014 and 2030 Annual Emissions Inventories (Tons)						
	Source	CO	NO _x	PM ₁₀	PM _{2.5}	SO _x	VOC
2014	Aircraft	5,561	4,630	71	71	554	617
	APU(s)	204	132	22	22	20	15
	GSE	2,210	251	9	9	7	76
	Total	7,975	5,013	103	102	581	708
2030	Aircraft	7,533	6,060	80	80	607	863
	APU(s)	230	208	27	27	29	17
	GSE	876	77	5	5	9	34
	Total	8,639	6,345	112	112	645	914
Difference	Aircraft	1,972	1,430	9	9	53	246
	APU(s)	26	76	5	5	9	2
	GSE	-1,334	-174	-4	-4	2	-42
	Total	664	1,332	9	10	64	206