ATTACHMENT D

Air Quality Technical Memorandum

KB Environmental Sciences, Inc.

April 5, 2013

Short Environmental Assessment Form
for Hotel Development at Baltimore/Washington
International Thurgood Marshall Airport

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ATTACHMENT D
Air Quality Technical Memorandum

This attachment contains background, data, assumptions, and methodology associated with the air quality analysis.

Federal Aviation Administration (FAA) Order 5050.4B[1] provides the basis for delineating the scope of the FAA's assessment of air quality impacts under National Environmental Policy Act (NEPA) and the *Clean Air Act* (CAA), and contains guiding criteria for determining the extent of air quality analysis. Additionally, FAA Order 1050.1E[2], Change 1, directs agency personnel to ensure that an air quality assessment prepared under NEPA includes an analysis and summary conclusions of the Proposed Action's impacts on air quality and, when a NEPA analysis is needed, an assessment of the Proposed Action is required to evaluate the impact on the National Ambient Air Quality Standards (NAAQS).

The CAA requires the United States Environmental Protection Agency (EPA) to establish, and periodically review, NAAQS to protect public health, welfare and the environment. NAAQS have been established for the following seven air pollutants (known as criteria pollutants): ozone (O_3),[3] carbon monoxide (CO), nitrogen dioxide (NO_2), sulfur dioxide (SO_2), particulate matter equal to or less than 10 micrometers (coarse particulates or PM_{10}), particulate matter equal to or less than 2.5 micrometers (fine particulates or $PM_{2.5}$), and lead (Pb).

1 Regulatory Context

Under the CAA, EPA's responsibilities include the approval of State Implementation Plans (SIP), regional emission budgets, in designated nonattainment and maintenance areas and establishment of emission standards for stationary and mobile sources of air pollution (i.e., motor vehicles, construction vehicles, etc.). Areas possessing outdoor pollutant concentrations in excess of the NAAQS are considered "nonattainment"; areas with concentrations within the NAAQS are considered "attainment". In addition, some areas are considered as "maintenance areas." Maintenance areas are those areas that were classified as nonattainment, but have demonstrated that they have sufficient controls in place to meet the NAAQS.

Under the CAA, federal agencies (such as the FAA) must make a determination of conformity with the applicable SIP, before taking any action on a proposed action (e.g., setting aside money, granting a permit, etc.). The EPA has published a rule (referred to as the General Conformity Rule) that indicates

1 Federal Aviation Administration, Order 5050.4B, National Environmental Policy (NEPA) Implementing Instructions for Airport Actions, April 26, 2006.

2 Federal Aviation Administration, Order 1050.1E, Environmental Impacts: Policies and Procedures, May 20, 2006.

3 Emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOC) are the two primary precursors to ozone (O_3) formation.

how most federal agencies are to make such a determination. A formal conformity determination must be performed when the emissions caused by a federal action (the "net" emissions when Proposed Action emissions are compared to No Action emissions) equal or exceed what are known as *de minimis* levels. If emissions are below the *de minimis* levels, it can be presumed that a proposed action conforms to the CAA.

Anne Arundel County in Maryland (including the area surrounding BWI Marshall) is presently designated by the EPA as nonattainment for the pollutants O_3 and $PM_{2.5}$. [4] Therefore, emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOC) – the two primary precursors to O_3 formation – as well as $PM_{2.5}$ are the focus of this air quality analysis.

Therefore, the EPA's General Conformity Rule applies to the Proposed Action and an air quality analysis must be prepared. For this Proposed Action, the applicable *de minimis* thresholds are 100 tons per year of VOC, NO_x, and $PM_{2.5}$. For completeness, emissions of CO, SO_2, and PM_{10} are also included.

In Maryland, the responsibility of enforcing the NAAQS falls upon the Maryland Department of Environment (MDE). Pursuant to this responsibility, the MDE prepares a SIP, regional emissions budget, for nonattainment areas under its jurisdiction, by which air quality goals and standards can be met.

2 Ambient Monitoring Data

The MDE maintains an air quality monitoring network composed of approximately 25 pollutant and meteorological monitoring stations throughout Maryland. The air quality monitoring stations nearest to BWI Marshall are within Anne Arundel County (Public Works Building), Prince George's County (Howard University), and Baltimore City (Old Town Fire Station). The nearest monitoring station that collects data for CO and O_3 is located at Howard University in Beltsville, approximately 14 miles southwest of BWI Marshall. The nearest monitoring station that collects data for NO_2 is located at the Old Town Fire Station in Baltimore, approximately nine miles to the north of BWI Marshall. The nearest monitoring station that collects data for PM_{10} and $PM_{2.5}$ is located at the Anne Arundel County Public Works Building, approximately 1.25 miles to the east of Runway 28 at BWI Marshall. **Table 1.1** includes the ambient pollutant levels monitored at these stations for the years 2010 through 2012.

The concentrations of CO, NO_2, and PM_{10} are well below the NAAQS. The $PM_{2.5}$ monitoring data reveal concentrations in violation of the NAAQS in 2005 but were not sufficiently high to violate the standard in the past three years. Additionally, the O_3 concentrations have consistently exceeded the 8-hour O_3 NAAQS since 2005, including the three year period of 2010 through 2012 (average concentration of 0.086 micrograms per cubic meter or $\mu g/m^3$). However, this is likely a regional occurrence with elevated O_3 concentrations occurring throughout Maryland.

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4 The CO maintenance designation (which means the area has remedied past violation of the NAAQS for this pollutant for the Baltimore City Center does not apply to the area surrounding BWI Marshall.

Table 1.1

Ambient Monitoring Data

Monitoring Station	Pollutant	Averaging Period	NAAQS	2010	2011	2012
Howard University	CO	1-hour	35 ppm	1.5	1.8	1.4
		8-hour	9 ppm	1.0	1.1	1.2
	Ozone	8-hour	0.075 ppm	0.085	0.083	0.091
Public Works Building	PM_{10}	24-hour	150 μg/m^3	47	34	28
	$PM_{2.5}$	Annual	15 μg/m^3	11.1	10.7	9.74
		24-hour	35 μg/m^3	27.5	24.7	23.4
Old Town Fire Station	NO_2	Annual	53 ppb	0.032	NA	0.031
		1-hour	75 ppb	0.061	NA	0.055

Source: *United States Environmental Protection Agency AIRData – Monitor Values Reports,* accessed January 23, 2013.
Note: ppm = parts per million, ppb = parts per billion, and μg/m^3 = micrograms per cubic meter.

3 Construction Emissions

Construction emissions were estimated using the EPA Motor Vehicle Emissions Simulator (MOVES version 2010b)[5] motor vehicle emission factor model, NONROAD (Version 2008a)[6] emission factor model, and other appropriate guidelines. Construction-related emissions are primarily associated with the exhaust from heavy equipment (i.e., cranes, backhoes, bulldozers, graders, rollers, etc.), delivery and haul trucks (i.e., cement trucks, dump trucks, etc.), and construction worker vehicles getting to and from the site; and with fugitive dust from site preparation, land clearing, material handling, equipment movement on unpaved areas, and demolition activities. These emissions are temporary in nature and generally confined to the construction site and the access/egress roadways.

The construction activities are anticipated to occur from January of 2014 through March of 2015. Typical construction is anticipated to occur six days per week and 10 hours per day.[7] The equipment activity levels associated with the Proposed Action were estimated based on the expected construction schedule and manpower. A usage factor accounting for the percentage of daily operation and a load factor accounting for the average throttle setting relative to full throttle rating were used and based on data within the NONROAD model. For example, a usage factor of 0.75 equates to six hours of operation (based on an eight hour work day) and a load factor of 0.62 equates to 62 percent of full throttle rating during operation. Concrete, dump, and haul trucks are assumed to travel a roundtrip distance of 20 miles.

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5 United States Environmental Protection Agency, *Motor Vehicle Emissions Simulator (MOVES) User Guide for MOVES2010b*, June 2012.

6 United States Environmental Protection Agency, *User's Guide for the Final NONROAD2005 Model*, December 2005 and *EPA NONROAD Model Updates for 2008*, April 2009.

7 Terminal Area Hotel Planning Considerations, May 25, 2012.

Emissions from construction activities were estimated based on the projected construction activity schedule, the number of vehicles/pieces of equipment, the types of equipment/type of fuel used, vehicle/equipment utilization rates (including load factor or usage factor), the equipment size (horsepower), and the year in which construction occurs. A total of nearly 20 different types of standard construction equipment/vehicles were used as a basis of the construction activities required. **Table 1.2** presents the construction schedule showing the types of construction equipment and the estimated hours of operation.

Table 1.2

Construction Equipment Hours of Operation

Construction Equipment	2014	2015
Truck with Crane	3,120	600
Aerial Lift	960	60
Crane 150 ton	960	60
Finisher	1,140	120
Concrete Pump	1,140	-
Compactor	2,280	-
Paver	-	360
Roller	300	540
Paint Striper	-	120
Loader	720	-
Hammer	180	-
Grader	120	180
Dozer	120	180
Excavator	180	-
Backhoes	180	-
Compressor	180	-
Welders	360	-
Crew Truck	360	240
Dump Truck	900	480
Flatbed Truck	-	120
Fuel Truck	3,120	600
Low Boys	360	-
Pickup	7,680	1,800
Ready Mix Trucks	7,980	-
SUV	3,120	600

Source: Terminal Area Hotel Planning Considerations, May 25, 2012.

The horsepower assigned to the equipment type was based on the most frequently utilized equipment within Anne Arundel County as derived from the NONROAD model. For the off-road equipment SO_2

and particulate matter emission factors, a diesel sulfur content of 15 parts per million (ultra-low sulfur diesel fuel) was assumed, based on EPA mandated regulations. Emission factors for each equipment type were applied to the anticipated equipment work output (horsepower-hours of expected equipment use). **Table 1.3** presents the construction equipment data such as horsepower, load factor, and usage factor.

Table 1.3

Construction Equipment Data

Construction Equipment	Horsepower	Load Factor	Usage Factor	NONROAD Description
Truck with Crane	100	0.43	0.48	Diesel - Cranes
Aerial Lift	75	0.21	0.18	Diesel - Aerial Lifts
Crane 150 ton	300	0.43	0.48	Diesel - Cranes
Finisher	25	0.59	0.27	Diesel - Surfacing Equipment
Concrete Pump	11	0.43	0.19	Diesel - Pumps
Compactor	6	0.43	0.23	Diesel - Plate Compactors
Paver	175	0.59	0.39	Diesel - Pavers
Roller	100	0.59	0.37	Diesel - Rollers
Paint Striper	600	0.59	0.44	Diesel - Scrapers
Loader	175	0.59	0.37	Diesel - Rubber Tire Loaders
Hammer	175	0.43	0.22	Diesel - Bore/Drill Rigs
Grader	300	0.59	0.46	Diesel - Graders
Dozer	175	0.59	0.45	Diesel - Crawler Tractor/Dozers
Excavator	175	0.59	0.53	Diesel - Excavators
Backhoes	100	0.21	0.55	Diesel -
Compressor	100	0.43	0.39	Diesel - Air Compressors
Welders	50	0.21	0.31	Diesel - Welders

Source: United States Environmental Protection Agency NONROAD2008a, 2009 and United States Environmental Protection Agency *Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling*, 2008.

Because the age of the equipment is entirely dependent on the preferences of the contractor, a conservative estimate of average equipment age was applied. For example, although newer Tier III and IV equipment less than six years old may be used, the construction emissions inventory utilized Tier I and II equipment for a portion of the fleet. However, Tier III and IV may be incorporated in greater quantities depending on the contractor's fleet.

The following equations were used to obtain emission estimates for off-road construction equipment:

*Equipment Emission Rate (tons/year) = Full Throttle Emission Factor (grams/hp-hour) * size (hp) * # hours per year * Load Factor * Usage Factor * (1 pound/453.59 grams) * (1 ton/2,000 pounds)*

Tables 1.4 and 1.5 present the construction equipment emission factors (grams per horsepower-hour) for 2014 and 2015, respectively.

Table 1.4

Construction Equipment Emission Factors (grams/hp-hour) for 2014

Construction Equipment	CO	NOx	PM10	PM2.5	SO2	VOC
Truck with Crane	1.93	3.37	0.30	0.29	0.01	0.30
Aerial Lift	5.71	6.02	0.84	0.81	0.01	1.24
Crane 150 ton	0.56	2.63	0.12	0.11	0.01	0.22
Finisher	2.62	4.46	0.36	0.35	0.01	0.49
Concrete Pump	4.53	5.25	0.54	0.52	0.01	0.77
Compactor	4.49	4.95	0.50	0.49	0.01	0.72
Paver	1.04	2.63	0.25	0.24	0.01	0.23
Roller	2.91	3.27	0.39	0.38	0.01	0.30
Paint Striper	1.15	2.94	0.17	0.16	0.01	0.19
Loader	1.08	2.77	0.25	0.24	0.01	0.24
Hammer	1.43	4.84	0.29	0.29	0.01	0.41
Grader	0.73	2.17	0.15	0.14	0.01	0.19
Dozer	1.00	2.43	0.24	0.23	0.01	0.22
Excavator	0.95	2.21	0.23	0.23	0.01	0.20
Backhoes	6.13	5.14	0.91	0.89	0.01	1.09
Compressor	2.04	3.70	0.33	0.32	0.01	0.35
Welders	5.18	5.43	0.81	0.79	0.01	1.32

Source: United States Environmental Protection Agency NONROAD2008a, 2009.

Table 1.5

Construction Equipment Emission Factors (grams/hp-hour) for 2015

Construction Equipment	CO	NOx	PM10	PM2.5	SO2	VOC
Truck with Crane	1.73	2.95	0.26	0.25	<0.01	0.27
Aerial Lift	5.38	5.79	0.78	0.76	<0.01	1.16
Crane 150 ton	0.49	2.27	0.10	0.10	<0.01	0.20
Finisher	2.51	4.46	0.36	0.35	<0.01	0.48
Concrete Pump	4.51	5.08	0.51	0.50	<0.01	0.74
Compactor	4.47	4.81	0.48	0.46	<0.01	0.69
Paver	0.92	2.26	0.22	0.21	<0.01	0.21
Roller	2.59	2.85	0.34	0.33	<0.01	0.27
Paint Striper	1.03	2.60	0.15	0.15	<0.01	0.18
Loader	0.96	2.40	0.23	0.22	<0.01	0.22
Hammer	1.31	4.51	0.27	0.27	<0.01	0.38
Grader	0.62	1.84	0.12	0.12	<0.01	0.18
Dozer	0.87	2.04	0.21	0.20	<0.01	0.20
Excavator	0.80	1.84	0.19	0.19	<0.01	0.19

Backhoes	5.70	4.75	0.84	0.82	<0.01	0.99
Compressor	1.86	3.32	0.30	0.29	<0.01	0.32
Welders	4.62	5.20	0.73	0.71	<0.01	1.16

Source: United States Environmental Protection Agency NONROAD2008a, 2009.

The construction worker vehicle and haul truck emissions were based on estimated manpower needs, the number of trips/shifts, and the estimated trip distance. Instead of hours of operation, as with construction equipment, vehicle emissions were based on an average speed of 30 miles per hour and the following average travel distances for on-road construction vehicles operating as a result of the construction activities:

- 20 miles round trip per day – Workers' passenger cars used for commuting, and
- 20 miles round trip per day – Haul/concrete trucks.

The following equations were used to obtain emission estimates for on-road vehicles (haul trucks and construction worker vehicles):

*Delivery/Haul Truck Emission Rate (tons/year) = Emission Factor (grams/mile) * # hours per year * 30 miles per hour * (1 pound/453.59 grams) * (1 ton/2,000 pounds)*

*Construction Worker vehicle Emission Rate (tons/year) = Emission Factor (grams/mile) * # of employees * 20 miles per trip * # of shifts per year * (1 pound/453.59 grams) * (1 ton/2,000 pounds)*

Tables 1.6 and 1.7 present the on-road vehicles emission factors (grams per mile) for construction worker vehicles and haul trucks, respectively during the construction period. MOVES model input parameters were selected based on guidance and data provided by the MDE.[8] MOVES was developed based on specific information (vehicle/fuel mix, fuel specifications, inspection/maintenance program, etc.) related to the Anne Arundel County area.

8 Email from Mohamed Khan, Maryland Department of the Environment to Paul Sanford, KBE, December 4, 2012, regarding MOVES data files.

Table 1.6

Passenger Car and Truck Emission Factors (grams/mile)

Pollutant	Emission Factor
Carbon Monoxide (CO)	1.48
Nitrogen Oxides (NO_x)	0.28
Particulate Matter 10 micrometers (PM_{10})	0.03
Particulate Matter 2.5 micrometers ($PM_{2.5}$)	0.01
Sulfur Dioxide (SO_2)	<0.01
Volatile Organic Compounds (VOC)	0.03

Source: United States Environmental Protection Agency MOVES2010b, 2011.

Table 1.7

Haul Trucks Emission Factors (grams/mile)

Pollutant	Emission Factor
Carbon Monoxide (CO)	3.04
Nitrogen Oxides (NO_x)	2.24
Particulate Matter 10 micrometers (PM_{10})	0.15
Particulate Matter 2.5 micrometers ($PM_{2.5}$)	0.10
Sulfur Dioxide (SO_2)	<0.01
Volatile Organic Compounds (VOC)	0.14

Source: United States Environmental Protection Agency MOVES2010b, 2011.

Additionally, the construction emissions inventory for fugitive dust sources was calculated using emission factors within EPA's *Compilation of Air Pollutant Emission Factors* (AP-42, Volume I, Fifth Edition). Fugitive dust emissions result from the following activities: grading, moving soil, and excavating, loading/unloading of trucks, movement of trucks on unpaved surfaces, and wind erosion of stockpiles. A fugitive dust emission factor of 10 pounds per day per acre disturbed was used. For the purpose of the analysis and based on plans for the proposed improvements, a disturbed acreage of 6.2 acres was used. Based on EPA's AP-42 (Section 13.2.3 *Heavy Equipment Operations*), $PM_{2.5}$ emissions were assumed to be 10 percent of PM_{10} emissions. Erosion control measures and water application programs were taken into consideration to minimize fugitive dust emissions. Based on EPA's AP-42, a dust control efficiency of 75 percent due to daily watering and other measures was used.

Evaporative VOC emissions associated with the application of hot mix asphalt on areas requiring paving was estimated based on an emission factor of 0.053 tons of VOC per acre of asphalt material laid, following methodology outlined by the National Association of Clean Air Agencies. For the purpose of the analysis and based on plans for the proposed improvements, pavement acreage of 3.1 acres was used.

Although construction emissions associated with the Proposed Action are considered to be *de minimis* under the General Conformity Rule and are temporary in duration (i.e., 15 months), these emissions can be further reduced by employing the following measures and by incorporating the provisions of FAA

Advisory Circular 150/5370 – 10E, Standards for Specifying Construction of Airports. Emission reduction measures related to fugitive dust and combustion exhaust include:

- Reduction of exposed erodible surface area through appropriate materials and equipment staging procedures;
- Cover of exposed surface areas with pavement or vegetation in an expeditious manner;
- Reduction of equipment idling times;
- Ensure contractor knowledge of appropriate fugitive dust and equipment exhaust controls;
- Soil and stock-pile stabilization via cover or periodic watering;
- Use of low- or zero-emissions equipment;
- Use of covered haul trucks and conveyors during materials transportation;
- Reduction of electrical generator usage, wherever possible; and
- Suspension of construction activities during high-wind conditions.

4 Operational Emissions

The EPA MOVES emissions model was used to determine emission factors (see **Table 1.8**) for motor vehicles along roadways for the operational emissions inventory during the existing and future years. MOVES input files and model input parameters were selected based on guidance from the MDE. PM_{10} and $PM_{2.5}$ emission factors include exhaust as well as brake and tire wear. The Proposed Action would generate 70 peak hour inbound trips and 60 peak hour outbound trips or 830 daily inbound trips and 820 daily outbound trips. Operational emissions were based on a round trip distance of 20 miles.

Table 1.8

Composite Emission Factors (grams/mile)

Pollutant	2012	2015	2020
Carbon Monoxide (CO)	1.58	1.37	1.24
Nitrogen Oxides (NO_x)	0.58	0.38	0.26
Particulate Matter 10 micrometers (PM_{10})	0.05	0.04	0.03
Particulate Matter 2.5 micrometers ($PM_{2.5}$)	0.03	0.02	0.02
Sulfur Dioxide (SO_2)	<0.01	<0.01	<0.01
Volatile Organic Compounds (VOC)	0.04	0.03	0.02

Source: United States Environmental Protection Agency MOVES2010b, 2011.

5 Intersection Analysis

The Proposed Action would generate 70 peak hour inbound trips and 60 peak hour outbound trips or 830 daily inbound trips and 820 daily outbound trips.[9] The EPA identifies CO[10], PM_{10}, and $PM_{2.5}$[11] as the primary pollutants of concern when assessing potential air quality impacts from motor vehicle exhaust. Increased concentrations of CO, PM_{10}, and $PM_{2.5}$ can be expected in places where large numbers of motor vehicles (especially diesel vehicles for PM_{10} and $PM_{2.5}$) are present including crowded intersections where traffic delays are common during peak (traffic) hour periods.

The intersection air quality analysis was conducted in accordance with the criteria established by the EPA's Project-Level Conformity and Hot-Spot Analyses[12]. A hot-spot analysis is required only for locations which are nonattainment or maintenance for CO, PM_{10}, and/or $PM_{2.5}$. As previously stated, the area surrounding BWI Marshall is in attainment for CO and PM_{10} and nonattainment for $PM_{2.5}$.

For CO, intersections that are at Level-of-Service (LOS) D, E, or F or that will deteriorate to LOS D, E, or F with the Proposed Action are to be evaluated. For PM_{10} and $PM_{2.5}$, intersections that are at LOS D, E, or F with a significant number of diesel vehicles or intersections that will deteriorate to LOS D, E, or F with a significant number of diesel vehicles with the Proposed Action are to be evaluated.

Two project intersections would be LOS D, E, or F with the Proposed Action and thus, would be candidates for detailed evaluation. Of note, these two project intersections LOS would not deteriorate as a result of the project (i.e., the LOS would be the same with or without the Proposed Action). **Table 1.9** presents the LOS for the future No Action and Proposed Action.

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9 Baltimore/Washington International Thurgood Marshall Airport, Hotel Environmental Review: Traffic Study, Ricondo and Associates, January 2013.

10 CO is a non-reactive pollutant that is a product of incomplete combustion. At high concentrations, CO reduces the oxygen-carrying capacity of the blood and can cause headaches, dizziness, unconsciousness and even death. Ambient CO concentrations usually follow the spatial and temporal distributions of vehicular traffic and are also influenced by meteorological factors such as wind speed and atmospheric mixing. Under inversion and/or stagnant wind conditions, high mobile CO concentrations may exist at sensitive receptors located near roadways.

11 Particulate matter comprises very small particles of dirt, dust, soot, or liquid droplets called aerosols. Particulate matter is formed as an exhaust product in the internal combustion engine or can be generated from the breakdown and dispersion of other solid materials (e.g., fugitive dust). Particulate matter can be inhaled deep into the lungs and cause adverse health effects. Some sources of particulate matter, such as demolition and construction activities, are more local in nature, while others such as vehicular traffic have a more regional effect.

12 United States Environmental Protection Agency**,** Transportation Conformity Guidance for Quantitative Hot-spot Analyses in $PM_{2.5}$ and PM_{10} Nonattainment and Maintenance Areas, March 2006; Using MOVES in Project-Level Carbon Monoxide Analyses, December 2010; and Guideline for Modeling Carbon Monoxide from Roadway Intersections, November 1992.

Table 1.9

Intersection Level of Service

Intersection	Peak Hour	2015 No Action	2015 Proposed Action	2015 No Action	2015 Proposed Action
1	AM	B	B	B	B
	PM	D	D	E	E
2	AM	B	B	C	C
	PM	A	A	B	B
3	AM	A	A	B	B
	PM	C	C	D	D

Source: Baltimore/Washington International Thurgood Marshall Airport, Hotel Environmental Review: Traffic Study, Ricondo and Associates, January 2013

Secondly, a significant number of diesel vehicles would not be associated with the Proposed Action (i.e., less than two percent of the project-related volume or 16 daily trips; primarily due to deliveries). Lastly, although the region is nonattainment for $PM_{2.5}$, the nearest ambient monitor to the Proposed Action (see **Table 1.1**) shows $PM_{2.5}$ concentrations are well below the NAAQS. Therefore, given the CO attainment status and the small percentage of diesel vehicle resulting from the Proposed Action, an intersection air quality analysis is not required for CO, PM_{10}, and $PM_{2.5}$. However, for informational purposes only, a CO intersection analysis was completed.

The CAL3QHC screening dispersion model was used for the CO analysis. CAL3QHC (version 04244) is an EPA-approved micro-scale atmospheric dispersion model that combines roadway design and operational parameters, motor vehicle emission factors and meteorological conditions to predict pollution concentrations at specified receptor locations along roadways, interchanges, or intersections.[13] The dispersion modeling analysis at roadway intersections was prepared for the following scenarios: the future No Action and Proposed Action during 2015 and 2020.

Approach speeds to signalized intersections were assumed to be 20 mph in all cases to ensure conservative estimates. Traffic emissions were associated with running vehicles along the roadway and idling vehicles at the intersection based on the MOVES emissions model. For the CO analysis, the following worst-case meteorological conditions and input parameters were used:

- Stability Class: D (neutral atmosphere)
- Wind Speed: 1 meter per second (m/s)
- Wind Directions: 360° in 10° increments, then refined to 1° increments
- Mixing Height: 1,000 meters (m)
- Surface Roughness: 175 centimeters (cm)
- Saturation Flow Rate: 1,800 vehicles per hour (vehicles per hour)

[13] User's Guide to CAL3QHC Version 2: A Modeling Methodology for Predicting Pollutant Concentration near Roadway Intersections, EPA-454/R-92-006, United States Environmental Protection Agency, Research Triangle Park, NC, November 1992.

CO concentrations were estimated for a 1-hour averaging period and adjusted to an 8-hour averaging period based on a persistence factor of 0.7. The two intersections at the I-195/MD-170 interchange are limited access; therefore, receptors were placed at the nearest locations where the general public would have access, which included parking lots and trails. For the Aviation Boulevard/Elm Road intersection, receptors were located at the corners of each intersection and at distances of 25, 50, and 100 meters from the intersection corner along both the approach and departure lane for a total of 28 receptors at the intersection. The receptors were also placed approximately three meters from the edge of the roadways since this is where the maximum concentrations are expected to occur and also where the public has access. Link lengths were limited to approximately 300 meters and included thru lanes, queue lanes, for the appropriate turning movements. Data such as approach volumes, signal timing cycle, and queue delay, was based on the project traffic study and the Highway Capacity Model (HCM) output.[14]

Emissions factors were obtained from MOVES model based upon model input parameters were selected based on guidance and data provided by the MDE. MOVES emission factors were developed based on specific information (vehicle/fuel mix, fuel specifications, inspection/maintenance program, etc.) related to the Anne Arundel County area.

For this analysis, future year traffic volumes at three signalized intersections (**Figure 1.1**) were evaluated. A total of three signalized intersections were examined, as listed within the following:

1. I-195/MD-170 Interchange (South Intersection)
2. I-195/MD-170 Interchange (North Intersection)
3. Aviation Blvd and Elm Road

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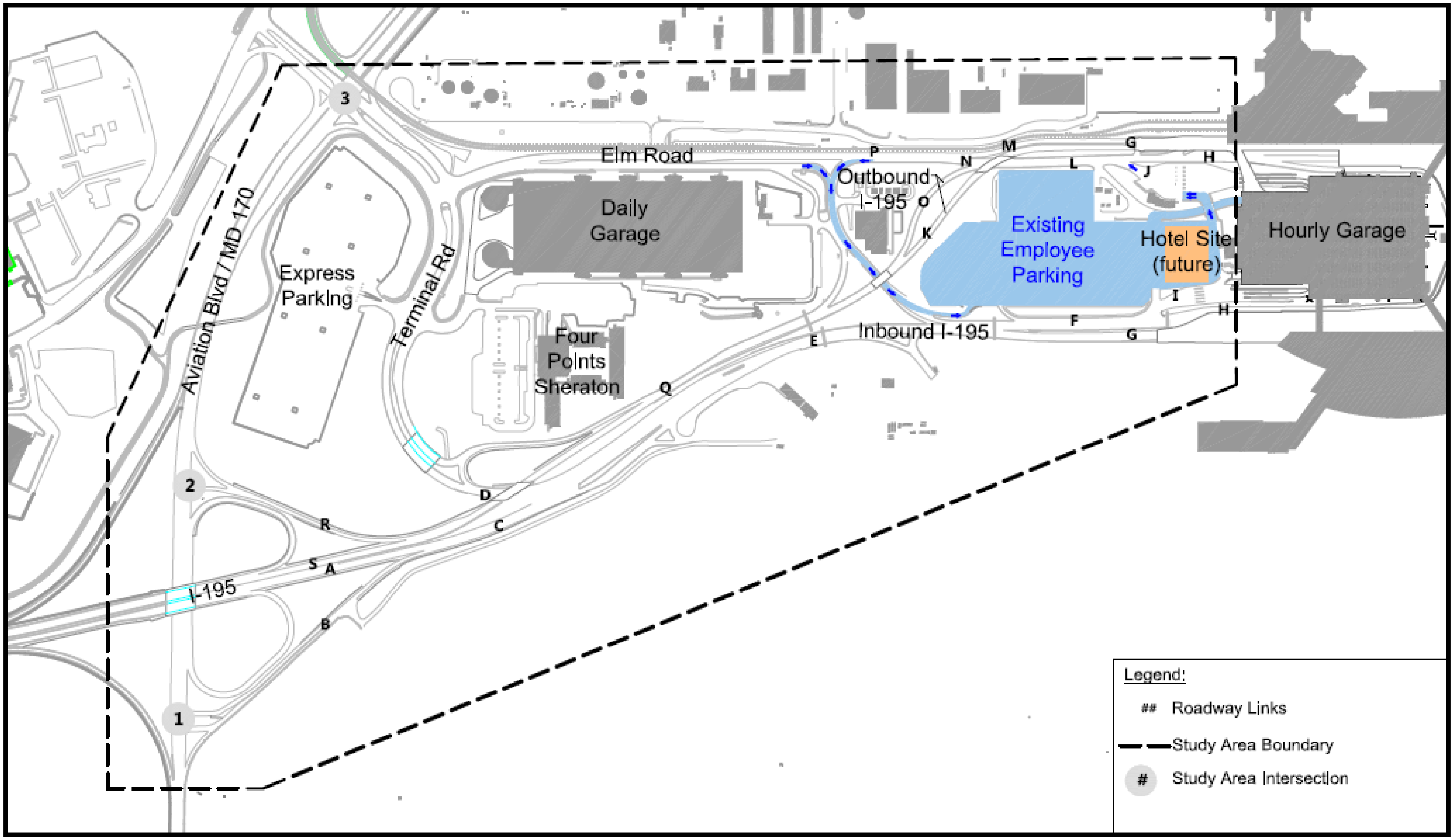
[14] Baltimore/Washington International Thurgood Marshall Airport, Hotel Environmental Review: Traffic Study, Ricondo and Associates, January 2013.

Figure 1.1 Project Intersections



Source: Baltimore/Washington International Thurgood Marshall Airport, Hotel Environmental Review: Traffic Study, Ricondo and Associates, January 2013.

Background concentrations representing other local sources were determined based on nearby ambient air monitoring stations data. The nearest monitoring station that collects data for CO is located at Howard University in Beltsville, approximately 14 miles southwest of BWI Marshall. The project concentrations plus background concentrations were compared to NAAQS. A background concentration for CO of 1.8 and 1.2 ppm for 1-hour and 8-hour averaging periods, respectively, was used.

6 Climate Change

Research has shown there is a direct correlation between fuel combustion and greenhouse gas (GHG) emissions. In terms of United States (U.S.) contributions, the U.S. General Accounting Office (GAO) reports that "domestic aviation contributes about three percent of total carbon dioxide emissions, according to EPA data," compared with other industrial sources, including the remainder of the transportation sector (20 percent) and power generation (41 percent) (GAO, 2009).[15] The International Civil Aviation Organization estimates that GHG emissions from aircraft account for approximately three percent of all anthropogenic GHG emissions globally (Melrose, 2010).[16] Climate change due to GHG emissions is a global phenomenon, so the affected environment is the global climate.[17]

The scientific community is continuing efforts to better understand the impact of aviation emissions on the global atmosphere. The FAA is leading and participating in a number of initiatives intended to clarify the role that commercial aviation plays in GHG emissions and climate. The FAA, with support from the U.S. Global Change Research Program and its participating federal agencies (e.g., National Aeronautics and Space Administration, National Oceanic and Atmospheric Administration, EPA, and U.S. Department of Energy), has developed the Aviation Climate Change Research Initiative in an effort to advance scientific understanding of regional and global climate impacts of aircraft emissions. FAA also funds the Partnership for Air Transportation Noise and Emissions Reduction Center of Excellence research initiative to quantify the effects of aircraft exhaust and contrails on global and U.S. climate and atmospheric composition. Similar research topics are being examined at the international level by the International Civil Aviation Organization (Maurice, 2007).[18]

Although there are no federal standards for aviation-related GHG emissions, it is well established that GHG emissions can affect climate. The Council on Environmental Quality (CEQ) has indicated that

15 Aviation and Climate Change. GAO Report to Congressional Committees, (2009). http://www.gao.gov/new.items/d09554.pdf.

16 Alan MeIrose, "European ATM and Climate Adaptation: A Scoping Study," in ICAO Environmental Report. (2010).

17 As explained by the United States Environmental Protection Agency, "greenhouse gases, once emitted, become well mixed in the atmosphere, meaning U.S. emissions can affect not only the U.S. population and environment but other regions of the world as well; likewise, emissions in other countries can affect the United States." Climate Change Division, Office of Atmospheric Programs, United States Environmental Protection Agency, Technical Support Document for Endangerment and Cause or Contribute Findings for Greenhouse Gases under Section 202(a) of the Clean Air Act 2-3 (2009), available at http://epa.gov/climatechange/endangerment.html.

18 Lourdes Q. Maurice and David S. Lee. Chapter 5: Aviation Impacts on Climate. Final Report of the Intemational Civil Aviation Organization (lCAO) Committee on Aviation and Environmental Protection (CAEP) Workshop. October 29th_ November 2nd 2007, Montreal. http://www.icao.int/icaonetlcnfrstlCAEP/CAEP SG_20082/docs/Caep8_SG2_ WPI0.pdf.

climate should be considered in NEPA analyses.[19] The FAA has also prepared guidance on how to address GHG emissions and climate change within NEPA evaluations.[20] As noted by CEQ, "it is not currently useful for the NEPA analysis to attempt to link specific climatological changes, or the environmental impacts thereof, to the particular project or emissions, as such direct linkage is difficult to isolate and to understand" (CEQ, 2010).[21]

The cumulative impact of this Proposed Action on the global climate when added to other past, present, and reasonably foreseeable future actions is not currently scientifically predictable. Aviation has been calculated to contribute approximately three percent of global carbon dioxide (CO_2) emissions; this contribution may grow to five percent by 2050. Actions are underway within the U.S. and by other nations to reduce aviation's contribution through such measures as new aircraft technologies to reduce emissions and improve fuel efficiency, renewable alternative fuels with lower carbon footprints, more efficient air traffic management, market-based measures and environmental regulations including an aircraft CO_2 standard. The U.S. has ambitious goals to achieve carbon-neutral growth for aviation by 2020 compared to a 2005 baseline, and to gain absolute reductions in GHG emissions by 2050. At present, there are no calculations of the extent to which measures individually or cumulatively may affect aviation's CO_2 emissions. Moreover, there are large uncertainties regarding aviation's impact on climate.

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19 Federal Aviation Administration, NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emission, CEQ (January 12, 2012). http://www.faa.gov/about/office_org/headquarters_offices/apl/environ_policy_guidance/guidance/media/NEPA_GHG_Guidance_Final.pdf.

20 See Massachusetts v. E.P.A., 549 U.S. 497, 508-10, 521-23 (2007).

21 Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, CEQ (2010). http://ceq.hss.doe.gov/nepa/regs/Consideration_of_Effects_of_GHG_Draft_NEPA_Guidance_FINAL_02182010.pdf.