Appendix D

Air Quality

A. PROCEDURES AND ASSUMPTIONS FOR THE STATIONARY SOURCE ANALYSIS

INTRODUCTION

As described in Chapter 14 of the Environmental Impact Statement (EIS) for the proposed project, a detailed stationary source analysis was conducted using the Environmental Protection Agency (EPA) AERMOD dispersion model. The analysis was conducted to assess potential air quality impacts due to the proposed project from heating, ventilation and air conditioning (HVAC) systems on receptor locations. Presented below is a description of the procedures used in the modeling and the assumptions and data used. A more general description of the stationary source analyses performed, as well as the results obtained, is presented in the EIS.

EMERGENCY GENERATOR

As presented in the EIS, an emergency generator rated at approximately 2 megawatts (MW) would be installed to serve the arena block in the event of the loss of electrical power to the project site. The air quality analysis presented in the EIS included the emissions from the emergency generator.

Short-term emissions rates were calculated based on emission factors obtained from various sources, including vendor data and equipment specifications for nitrogen oxides (NO_x), sulfur dioxide (SO_2) and carbon monoxide (CO) emissions, and the *EPA Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources* for PM_{10} and $PM_{2.5}$. PM_{10} and $PM_{2.5}$ emissions include both the filterable and condensable fractions. To estimate annual emissions, the emergency generator would operate (other than due to a loss of utility electric power) approximately 26 hours per year (based on 30 minutes of operation per week for testing to ensure reliability and availability). No. 2 fuel oil with a maximum sulfur content of 0.2 percent sulfur would be utilized.

For each pollutant averaging period of 24 hours or less, the short-term emission rates were adjusted based on the ratio of the total daily operation (30 minutes) to the duration of the averaging period. For the annual average pollutant concentrations, the short-term emission rates were adjusted based on the ratio of the total annual equipment hours of operation (30 minutes x 52 weeks per year, or 26 hours per year) to the total hours in a year (8,760 hours).

Table D-1 presents the maximum short-term and annual emission rates for the emergency generator, and the stack parameters used in the air quality analysis.

Table D-1
Emergency Generator Emission Rates and Stack Parameters

Stack Parameters	Value
Stack Height, feet	520.5
Stack Diameter, feet	1
Stack Exit Velocity, feet/sec	323.3
Stack Exit Temperature, ºF	770
Emissions, lbs/hour	**Value**
NO_xAnnual	0.0020
SO_2 Short-term	0.68/0.085 (1)
SO_2 Annual	0.00023
$PM_{10}/PM_{2.5}$ Short-term	0.0067
$PM_{10}/PM_{2.5}$ Annual	0.000018
CO Short-term	0.96/0.12 (2)

Notes:
(1) The first value was used to calculate 3-hour impacts, and the second value was used to calculate 24-hour impacts.
(2) The first value was used to calculate 1-hour impacts, and the second value was used to calculate 8-hour impacts.

The EIS presents emission data and stack parameters for the proposed project's HVAC systems.

MODELING APPROACH

As described in the EIS, modeling was performed with the AERMOD model using five years of meteorology. For determining annual average impacts, the AERMOD model was run for each of the five years, however, for the short-term impacts, a combined five year set of meteorology was used and the highest overall impacts were extracted. As per the *CEQR Technical Manual*, modeling was performed both with and without building downwash to determine impacts under worst-case conditions. Buildings which could potentially cause wake effects due to building downwash were surveyed using Graphical Information Systems (GIS) and Sanborn Maps, as well as information on proposed developments in the project study area. EPA's Building Profile Input Program (BPIP) program, which is described in the *User's Guide to the Building Profile Input Program*, EPA, Research Triangle Park, North Carolina, was used to determine the projected building dimensions for the AERMOD modeling with the building downwash algorithm enabled. For both the with and without downwash cases, the proposed project was modeled at 25 percent, 50 percent, 75 percent and 100 percent operating capacity to simulate a full range of potential operations.

A comprehensive receptor network (i.e., off-site locations with continuous public access) was developed for the modeling analyses. The receptor network included regularly spaced ground-level receptors and numerous discrete receptors on nearby sensitive uses and tall buildings. Receptors were placed on nearby existing and proposed buildings which could potentially be affected by the proposed project, as well as the project itself.

To examine impacts at ground level, the receptor network included a 2 kilometer by 2 kilometer (km) Cartesian grid with a grid spacing of 100 meters (m), centered on the project site. Additional receptors were placed at sidewalk locations around the project site in order to predict

pollutant concentrations at locations where the contribution from project-generated traffic to air quality would be greatest. Ground level locations were modeled as flagpole receptors set at pedestrian height, consistent with guidance criteria in the *City Environmental Quality Review (CEQR) Technical Manual*.

Receptors representing buildings or other occupied sensitive locations were modeled at various flagpole elevations to represent operable windows, ventilation intakes, etc. A general elevated receptor network was created at a five-story elevation to represent typical low-rise building construction in all directions around the project site, out to a distance of approximately 2 km (with a total of 1,113 receptors). Individual existing and proposed buildings around the project site that were taller than 5 stories were modeled with additional receptors. A total of 132 off-site buildings were modeled out to a distance of approximately ¾-mile from the project site (with a total of 489 receptors). In addition, a total of 2,440 receptors were placed at elevated locations on the proposed project's buildings. Receptors were placed at various building elevations on all façades to ensure that potential worst-case project-on-project impacts would be identified.

Since the receptors used in the modeling included locations on the proposed project itself, additional modeling and post-processing of the model output was necessary to exclude certain receptors when determining maximum pollutant concentrations on the proposed project. This is appropriate since the AERMOD model assumes the stack plume travels directly towards the elevated receptor, which is unrealistic because the stack plume would be greatly influenced by the project building's own roof structure. To analyze pollutant concentrations at elevated receptors on project buildings, source groups were created consisting of all of the proposed project's sources except within each source group, one building's source(s) was excluded. For example, to examine impacts from the proposed project on Building 6, a source group was created which contained all of the proposed project's stationary sources except the boiler source for Building 6. Next, the model output file created with each source group was reviewed. Receptors at the building for which the source was excluded were reviewed to determine the maximum overall concentration, and receptors at other locations were ignored. For example, the output file for the source group containing all sources except Building 6 examined the receptors at Building 6, and ignored all other receptors. This process was performed for each of the project buildings which are proposed to have an HVAC system. For buildings on the project site that would not have an HVAC system, but rather would be served by the central boiler plant (i.e., Building 1, 2 and 3), the maximum pollutant concentrations were determined by modeling all of the proposed project's sources, as with off-site receptors.

The maximum predicted concentrations were obtained from the plot files and were added to the background concentrations to estimate the ambient air quality at potential elevated receptor locations near the project site. The results of this analysis are presented in Chapter 14 of the EIS.

B. EFFECTS OF TRAFFIC MITIGATION MEASURES ON AIR QUALITY

Chapter 14, "Air Quality," showed the maximum predicted CO and particulate matter (PM_{10} and $PM_{2.5}$) concentrations for the proposed project, and concludes that the proposed project would not result in any significant adverse air quality impacts. Therefore, no air quality mitigation is required. This section considers the effects on air quality of the proposed project with implementation of the traffic mitigation measures discussed in Chapter 19, "Mitigation," discussed above.

The tables presented below illustrate the effect that proposed traffic mitigation measures, developed as part of the proposed project's traffic analysis (see Chapter 14, "Traffic and Parking"), would have on maximum predicted pollutant concentrations with the proposed project. Tables D-2, D-3 and D-4 summarize the maximum CO and PM_{10} 24-hour and annual build and build with mitigation concentrations for the 2010 analysis year, respectively. Tables D-5 and D-6 summarize the maximum predicted 24-hour and annual average $PM_{2.5}$ concentrations with the proposed project for the 2010 analysis year, respectively, as well as the maximum predicted incremental impacts. Tables D-7, D-8 and D-9 summarize the maximum CO and PM_{10} 24-hour and annual build and build with mitigation concentrations for the 2016 analysis year, respectively. Tables D-10 and D-11 summarize the maximum predicted 24-hour and annual average $PM_{2.5}$ concentrations with the proposed project for the 2016 analysis year, respectively, as well as the maximum predicted incremental impacts.

The values shown are the highest predicted concentrations for the analyzed receptor locations. The results shows that the with the proposed traffic mitigation measures, future concentrations of pollutants with the proposed project would be below the National Ambient Air Quality Standards (NAAQS) and would not result in any significant adverse air quality impacts using the *de minimis* criteria for CO impacts and the $PM_{2.5}$ interim guidance criteria.

Table D-2
Future (2010) Maximum Predicted 8-Hour Average Carbon Monoxide Build and Build with Mitigation Concentrations (parts per million)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm) [1]	
			Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avnue/4th Avenue	Weekday PM	6.0	5.9
2	Atlantic Avenue and 6th Avenue	Weekday PM	4.0	4.1
		Weekend Post-game	4.1	4.0
3	Atlantic Avenue and Carlton Avenue	Weekday PM	4.0	4.1
		Weekend Post-game	4.1	4.0
4	Atlantic Avenue and Vanderbilt Avenue	Weekday PM	5.3	5.6
		Weekend Post-game	5.0	4.7
5	Dean Street and 6th Avenue	Weekend Post-game	3.7	3.6
6	Dean Street and Vanderbilt Avenue	Weekday PM	3.4 [2]	3.6 [2]
		Weekend Post-game	3.7 [2]	3.6 [2]
7	Tillary Street and Flatbush Avenue	Weekday PM	5.8	5.7

Notes:
[1] 8-hour standard is 9 ppm.
[2] Includes the CO contribution from the proposed temporary parking facility at Block 1129.

Table D-3
Future (2010) Maximum Predicted 24-Hour Average PM_{10} Build and Build with Mitigation Concentrations

Receptor Site	Location	24-Hour Concentration ($\mu g/m^3$)[1]	
		Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	61.79	62.77
5	Dean Street and 6th Avenue	63.92	64.36

Note: [1] National Ambient Air Quality Standards—24-hour, 150 $\mu g/m^3$.

Table D-4
Future (2010) Maximum Predicted Annual Average PM_{10} Build and Build with Mitigation Concentrations ($\mu g/m^3$)

Receptor Site	Location	Annual Concentration ($\mu g/m^3$)[1]	
		Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	25.41	25.88
5	Dean Street and 6th Avenue	24.70	25.04

Note: [1] National Ambient Air Quality Standards—annual average, 50 $\mu g/m^3$.

Table D-5
Future (2010) Maximum Predicted 24-Hour Average $PM_{2.5}$ Build and Build with Mitigation Concentrations

Receptor Site	Location	24-Hour Concentration ($\mu g/m^3$)					
		Without Mitigation			With Mitigation		
		No Build	Build	Increment	No Build	Build	Increment
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	41.86	41.93	0.08	41.86	42.03	0.17
5	Dean Street and 6th Avenue	41.34	42.26	0.92	41.34	42.34	1.00

Notes:
National Ambient Air Quality Standards—24-hour, 65 $\mu g/m^3$. EPA has proposed revisions to the NAAQS for PM which include lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$
$PM_{2.5}$ interim guidance criteria—annual average (neighborhood scale), 0.1 $\mu g/m^3$.
Differences between No Build and Build are due to rounding.

Table D-6
Future (2010) Maximum Predicted Annual Average $PM_{2.5}$ Build and Build with Mitigation Concentrations

Receptor Site	Location	Annual Concentration (µg/m³)					
		Without Mitigation			With Mitigation		
		No Build	Build	Increment	No Build	Build	Increment
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	15.52	15.54	0.02	15.52	15.56	0.04
5	Dean Street and 6th Avenue	15.32	15.34	0.02	15.32	15.34	0.03

Notes:
National Ambient Air Quality Standards—annual, 15 µg/m³.
$PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 µg/m³.
Differences between No Build and Build are due to rounding.

Table D-7
Future (2016) Maximum Predicted 8-Hour Average Carbon Monoxide Build and Build with Mitigation Concentrations (parts per million)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm) (1)	
			Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avnue/4th Avenue	Weekday PM	5.8	5.8
2	Atlantic Avenue and 6th Avenue	Weekday PM	4.1	4.0
		Weekend Post-game	4.1	4.1
3	Atlantic Avenue and Carlton Avenue	Weekday PM	4.2	4.2
		Weekend Post-game	4.0	4.0
4	Atlantic Avenue and Vanderbilt Avenue	Weekday PM	5.4	5.4
		Weekend Post-game	4.8	4.4
5	Dean Street and 6th Avenue	Weekend Post-game	3.8	3.6
6	Dean Street and Vanderbilt Avenue	Weekday PM	3.3	3.3
		Weekend Post-game	3.4	3.5
7	Tillary Street and Flatbush Avenue	Weekday PM	5.9	5.7

Note:
[1] 8-hour standard is 9 ppm.

Table D-8
Future (2016) Maximum Predicted 24-Hour Average PM_{10} Build and Build with Mitigation Concentrations

Receptor Site	Location	24-Hour Concentration ($\mu g/m^3$)[1]	
		Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	62.80	63.87
5	Dean Street and 6th Avenue	65.25	65.79

Note: [1] National Ambient Air Quality Standards—24-hour, 150 $\mu g/m^3$.

Table D-9
Future (2016) Maximum Predicted Annual Average PM_{10} Build and Build with Mitigation Concentrations ($\mu g/m^3$)

Receptor Site	Location	Annual Concentration ($\mu g/m^3$)[1]	
		Build	Build with Mitigation
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	25.81	26.31
5	Dean Street and 6th Avenue	25.03	25.33

Note: [1] National Ambient Air Quality Standards—annual average, 50 $\mu g/m^3$.

TableD-10
Future (2016) Maximum Predicted 24-Hour Average $PM_{2.5}$ Build and Build with Mitigation Concentrations

Receptor Site	Location	24-Hour Concentration ($\mu g/m^3$)					
		Without Mitigation			With Mitigation		
		No Build	Build	Increment	No Build	Build	Increment
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	41.75	41.84	0.08	41.75	41.92	0.16
5	Dean Street and 6th Avenue	41.36	42.15	0.79	41.36	42.21	0.85

Notes:
National Ambient Air Quality Standards—24-hour, 65 $\mu g/m^3$. EPA has proposed revisions to the NAAQS for PM which include lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$
$PM_{2.5}$ interim guidance criteria—annual average (neighborhood scale), 0.1 $\mu g/m^3$.
Differences between No Build and Build are due to rounding.

Table D-11
Future (2016) Maximum Predicted Annual Average
$PM_{2.5}$ Build and Build with Mitigation Concentrations

Receptor Site	Location	Annual Concentration (µg/m³)					
		Without Mitigation			With Mitigation		
		No Build	Build	Increment	No Build	Build	Increment
1	Atlantic Avenue/Flatbush Avenue/4th Avenue	15.50	15.52	0.02	15.50	15.54	0.04
5	Dean Street and 6th Avenue	15.32	15.34	0.02	15.32	15.34	0.03

Notes:
National Ambient Air Quality Standards—annual, 15 µg/m³.
$PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 µg/m³.
Differences between No Build and Build are due to rounding.

✷