Chapter 11: Air Quality

A. INTRODUCTION

Under the 2012 *City Environmental Quality Review (CEQR) Technical Manual* guidelines, air quality impacts can be either direct or indirect. Direct impacts result from emissions generated by stationary sources at a development site, such as emissions from on-site fuel combustion for heat and hot water systems, or emissions from parking garage ventilation systems. Indirect impacts are caused by emissions from nearby existing stationary sources (impacts on the proposed project) or by emissions from on-road vehicle trips generated by a project or other changes to future traffic conditions due to a project.

The USTA Billie Jean King National Tennis Center (NTC) Strategic Vision (the proposed project) would result in a series of improvements on the project site, as described in Chapter 1, "Project Description." The potential for air quality impacts from the proposed improvements and expansion to the NTC, located in Flushing Meadows Corona Park in Queens, is examined in this chapter.

The maximum hourly incremental traffic from the proposed project would exceed the *CEQR Technical Manual* carbon monoxide screening threshold of 170 peak hour trips at nearby intersections in the study area. In addition, the particulate matter emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual* would be exceeded. Therefore, the potential for mobile source impacts from the proposed project was analyzed.

The proposed project would include construction of two new stadiums to replace the existing Louis Armstrong Stadium (Stadium 2) in the same location, and Grandstand Stadium (Stadium 3), in a new location at the southwest corner of the NTC site. The proposed project would include natural gas fired heating, ventilation and air conditioning (HVAC) systems. Therefore, a stationary source analysis was conducted to evaluate potential future pollutant concentrations from these systems.

The proposed project would include the construction of two accessory parking garages for staff and event-related uses. Therefore, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the proposed accessory parking garages.

PRINCIPAL CONCLUSIONS

As discussed below, the maximum predicted pollutant concentrations and concentration increments from mobile sources with the proposed project would be below the corresponding guidance thresholds and ambient air quality standards. The project's accessory parking facilities would also not result in any significant adverse air quality impacts. Thus, the proposed project would not have significant adverse impacts from mobile source emissions.

Based on a stationary source screening analysis, there would be no potential significant adverse air quality impacts from pollutant emissions associated with the proposed project's heat and hot water systems.

B. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of carbon monoxide (CO) are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and sources utilizing non-road diesel such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas which does not persist in the atmosphere, CO concentrations can vary greatly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

The proposed project would result in changes in traffic patterns and an increase in traffic volume in the study area. Therefore, a mobile source analysis was conducted at critical intersections in the study area to evaluate future CO concentrations in the No-Action and With Action conditions. A parking garage analysis was also conducted to evaluate future CO concentrations with the operation of the proposed parking garages.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone during the two-week US Open. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions; the change in regional mobile source emissions of these pollutants would be related to the total vehicle miles traveled added or subtracted on various roadway types throughout the New York metropolitan area, which is designated as a moderate non-attainment area for ozone by the United States Environmental Protection Agency (EPA).

The proposed project would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels is predicted. An analysis of project-related emissions of these pollutants from mobile sources was therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and not a local concern from mobile sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source.) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant.

Potential impacts on local NO_2 concentrations from the fuel combustion for the proposed project's HVAC systems were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Effective January 1, 1996, the Clean Air Act (CAA) banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, concluding a 25-year effort to phase out lead in gasoline. Even at locations in the New York City area where traffic volumes are very high, atmospheric lead concentrations are far below the 3-month average national standard of 0.15 micrograms per cubic meter ($\mu g/m^3$).

No significant sources of lead are associated with the proposed project and, therefore, analysis was not warranted.

RESPIRABLE PARTICULATE MATTER—PM_{10} AND $PM_{2.5}$

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of naturally occurring VOCs; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and from forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic and some likely carcinogenic compounds.

As described below, PM is regulated in two size categories: particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$), and particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}, which includes $PM_{2.5}$). $PM_{2.5}$ has the ability to reach the lower regions of the respiratory tract, delivering with it other compounds that adsorb to the surfaces of the particles, and is also extremely persistent in the atmosphere. $PM_{2.5}$ is mainly derived from combustion material that has volatilized and then condensed to form

primary PM (often soon after the release from a source exhaust) or from precursor gases reacting in the atmosphere to form secondary PM.

Diesel-powered vehicles, especially heavy duty trucks and buses, are a significant source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel powered vehicles.

An analysis was conducted to assess the worst case PM impacts due to the increased traffic associated with the proposed project.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Monitored SO_2 concentrations in New York City are lower than the current national standards. Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant and therefore, an analysis of SO_2 from mobile sources was not warranted.

As part of the proposed project, natural gas would be burned in the proposed HVAC systems. The sulfur content of natural gas is negligible; therefore, no SO_2 analysis was performed for these systems. However, a central power generation plant utilizing diesel fuel-fired reciprocating engines could be utilized; therefore, potential SO_2 impacts were analyzed for this source.

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 11-1**. The NAAQS for CO, annual NO_2, and SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked. EPA also proposed lowering the primary annual-average standard to within the range 12-13 $\mu g/m^3$. A final decision on this standard is expected by December 14, 2012.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060 to 0.070 ppm.

Table 11-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [1]	9	10,000	None	
1-Hour Average [1]	35	40,000		
Lead				
Rolling 3-Month Average [2]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [3]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [4,5]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [1]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean [6]	NA	15	NA	15
24-Hour Average [7]	NA	35	NA	35
Sulfur Dioxide (SO_2) [8]				
1-Hour Average [9]	0.075	196	NA	NA
Maximum 3-Hour Average [1]	NA	NA	0.50	1,300

Notes:

ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable

All annual periods refer to calendar year.

PM concentrations (including lead) are in µg/m^3 since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m^3 are presented.

(1) Not to be exceeded more than once a year.

(2) EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.

(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.

(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.

(5) EPA has proposed lowering this standard further to within the range 0.060-0.070 ppm, and adding a secondary standard measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on this standard has been postponed but is expected to occur in 2013.

(6) EPA has proposed lowering the primary standard to within the range 12-13 µg/m^3. A final decision on this standard is expected by December 14, 2012.

(7) Not to be exceeded by the annual 98th percentile when averaged over 3 years.

(8) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.

(9) 3-year average of the annual 99th percentile daily maximum 1-hr average concentration. Effective August 23, 2010.

Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

EPA lowered the primary and secondary standards for lead to 0.15 $\mu g/m^3$, effective January 12, 2009. EPA revised the averaging time to a rolling 3-month average and the form of the standard to not-to-exceed across a 3-year span.

EPA established a new 1-hour average NO_2 standard of 0.100 ppm, effective April 12, 2010, in addition to the annual standard. The statistical form is the 3-year average of the 98th percentile of daily maximum 1-hour average concentration in a year.

EPA established a new 1-hour average SO_2 standard of 0.075 ppm, replacing the 24-hour and annual primary standards, effective August 23, 2010. The statistical form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

The CAA, as amended in 1990, defines non-attainment areas (NAA) as geographic regions that have been designated as not meeting one or more of the NAAQS. When an area is designated as non-attainment by EPA, the state is required to develop and implement a State Implementation Plan (SIP), which delineates how a state plans to achieve air quality that meets the NAAQS under the deadlines established by the Clean Air Act, followed by a plan for maintaining attainment status once the area is in attainment.

In 2002, EPA re-designated New York City as in attainment for CO. Under the resulting maintenance plan, New York City is committed to implementing site-specific control measures throughout the City to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period.

Manhattan has been designated as a moderate NAA for PM_{10}. On December 17, 2004, EPA took final action designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ non-attainment area under the Clean Air Act due to exceedance of the annual average standard. Based on recent monitoring data (2006-2009), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. EPA has determined that the area has attained the 1997 annual $PM_{2.5}$ NAAQS, effective December 15, 2010.

As described above, EPA has revised the 24-hour average $PM_{2.5}$ standard. In October 2009, EPA finalized the designation of the New York City Metropolitan Area as non-attainment with the 2006 24-hour $PM_{2.5}$ NAAQS, effective in November 2009. The non-attainment area includes the same 10-county area originally designated as non-attainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2007-2009), 24-hour average concentrations of $PM_{2.5}$ in this area no longer exceed the standard. New York has submitted a "Clean Data" request to the EPA. Any requirement to submit a SIP is stayed until EPA acts on New York's request.

New York City, Nassau, Rockland, Suffolk, Westchester, and Lower Orange County Metropolitan Area (LOCMA) counties had been designated as a severe non-attainment area for ozone (1-hour average standard, 0.12 ppm). On June 18, 2012, EPA determined that the New York–New Jersey–Long Island NAA has attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements under the 1-hour standard.

Effective June 15, 2004, EPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard (LOCMA was moved to the Poughkeepsie moderate non-

attainment area for 8-hour ozone). On February 8, 2008, the New York State Department of Environmental Conservation (NYSDEC) submitted final revisions to the SIP to EPA to address the 1997 8-hour ozone standard. On June 18, 2012, EPA determined that the New York–New Jersey–Long Island NAA has attained the 1997 8-hour ozone NAAQS (0.08 ppm). Although not yet a redesignation to attainment status, this determination removes further requirements under the 8-hour standard.

In March 2008, EPA strengthened the 8–hour ozone standards. EPA designated the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester (NY portion of the New York–Northern New Jersey–Long Island, NY-NJ-CT NAA) as a marginal non-attainment area for the 2008 ozone NAAQS, effective July 20, 2012. SIPs are due in 2015.

New York City is currently in attainment of the annual-average NO_2 standard. EPA has designated the entire state of New York as "unclassifiable/attainment" for the new 1-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the 1-hour standard, areas will be reclassified once three years of monitoring data are available (2016 or 2017).

EPA has established a new 1-hour SO_2 standard, replacing the 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. EPA plans to make final attainment designations in 2013. SIPs for non-attainment areas will be due in 2015.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and the *CEQR Technical Manual* state that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large, or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 11-1**) would be deemed to have a potential significant adverse impact. In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

DE MINIMIS CRITERIA REGARDING CO IMPACTS

New York City has developed *de minimis* criteria to assess the significance of the increase in CO concentrations that would result from the impact of proposed projects or actions on mobile sources, as set forth in the *CEQR Technical Manual*. These criteria set the minimum change in CO concentration that defines a significant environmental impact. Significant increases of CO concentrations in New York City are defined as: (1) an increase of 0.5 ppm or more in the maximum 8-hour average CO concentration at a location where the predicted No-Action

[1] *CEQR Technical Manual*, Chapter 17, section 410, Jan 2012 (Rev. 6/18/12); and State Environmental Quality Review Regulations, 6 NYCRR § 617.7

condition 8-hour concentration is equal to or between 8 and 9 ppm; or (2) an increase of more than half the difference between baseline (i.e., No-Action) concentrations and the 8-hour standard, when No-Action conditions concentrations are below 8.0 ppm.

$PM_{2.5}$ INTERIM GUIDANCE CRITERIA

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts[1]. This policy would apply only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

In addition, New York City uses interim guidance criteria for evaluating the potential $PM_{2.5}$ impacts for projects subject to CEQR. The interim guidance criteria currently employed for determination of potential significant adverse $PM_{2.5}$ impacts under CEQR are as follows:

- 24-hour average $PM_{2.5}$ concentration increments that are predicted to be greater than 5 $\mu g/m^3$ at a discrete receptor location would be considered a significant adverse impact on air quality under operational conditions (i.e., a permanent condition predicted to exist for many years regardless of the frequency of occurrence);
- 24-hour average $PM_{2.5}$ concentration increments that are predicted to be greater than 2 $\mu g/m^3$ but no greater than 5 $\mu g/m^3$ would be considered a significant adverse impact on air quality based on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations;
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.1 $\mu g/m^3$ at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.3 $\mu g/m^3$ at a discrete receptor location (elevated or ground level).

Actions under CEQR predicted to increase $PM_{2.5}$ concentrations by more than the interim guidance criteria above will be considered to have a potential significant adverse impact.

The proposed project's stationary source annual emissions of PM_{10} are anticipated to be well below the 15-ton-per-year threshold under NYSDEC's $PM_{2.5}$ policy guidance. The above CEQR interim guidance criteria have been used to evaluate the significance of predicted $PM_{2.5}$ impacts of the proposed project associated with mobile source emissions.

[1] CP33/Assessing and Mitigating Impacts of Fine Particulate Emissions, NYSDEC 12/29/2003.

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

The prediction of vehicle-generated emissions and their dispersion in an urban environment incorporates meteorological phenomena, traffic conditions, and physical configuration. Air pollutant dispersion models mathematically simulate how traffic, meteorology, and physical configuration combine to affect pollutant concentrations. The mathematical expressions and formulations contained in the various models attempt to describe an extremely complex physical phenomenon as closely as possible. However, because all models contain simplifications and approximations of actual conditions and interactions, and since it is necessary to predict the reasonable worst-case condition, most dispersion analyses predict conservatively high concentrations of pollutants, particularly under adverse meteorological conditions.

The mobile source analyses for the proposed project employ a model approved by EPA that has been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the proposed project. The assumptions used in the PM analysis were based on the City's $PM_{2.5}$ interim guidance criteria.

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, MOBILE6.2[1]. This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOBILE6.2 incorporate the most current guidance available from NYSDEC and the New York City Department of Environmental Protection (DEP).

Vehicle classification data were based on field studies and data obtained from other traffic studies. Appropriate credits were used to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system are lower than emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

[1] EPA, User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, EPA420-R-03-010, August 2003.

All taxis were assumed to be in hot stabilized mode (i.e., excluding any start emissions). The general categories of vehicle types for specific roadways were further categorized into subcategories based on their relative breakdown within the fleet.[1]

An ambient temperature of 43.0° Fahrenheit was used, as referenced in the *CEQR Technical Manual*.

Road Dust

The contribution of re-entrained road dust to PM_{10} concentrations, as presented in the PM_{10} SIP, is considered to be significant; therefore, the PM_{10} estimates include both exhaust and road dust. In accordance with the $PM_{2.5}$ interim guidance criteria methodology, $PM_{2.5}$ emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analyses, since DEP considers it to have an insignificant contribution on that scale. Road dust emission factors were calculated according to the latest procedure delineated by EPA[2] and the *CEQR Technical Manual*.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the proposed project (see Chapter 10, "Transportation"). Traffic data for the future No-Action and With Action conditions was employed in the respective air quality modeling scenarios. The weekday evening (6 to 7 PM) peak period was analyzed. This time period was selected for the mobile source analysis because it would produce the maximum anticipated project-generated traffic and therefore have the greatest potential for significant air quality impacts. The scenario would represent the conflict date scenario that includes the New York Mets home game situation.

For particulate matter, the peak evening period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the existing condition, future No-Action condition, and off-peak increments from the proposed project, were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations. For annual impacts, average weekday and weekend 24-hour distributions were used to more accurately simulate traffic patterns over longer periods.

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets within the surrounding area, resulting from vehicle emissions, were predicted using the CAL3QHC model Version 2.0.[3] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts

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[1] The MOBILE6.2 emissions model utilizes 28 vehicle categories by size and fuel. Traffic counts and predictions are based on broader size categories, and then broken down according to the fleet-wide distribution of subcategories and fuel types (diesel, gasoline, or alternative).

[2] EPA, Compilations of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42, January 2011.

[3] EPA, User's Guide to CAL3QHC, A Modeling Methodology for Predicted Pollutant Concentrations Near Roadway Intersections, Office of Air Quality, Planning Standards, Research Triangle Park, North Carolina, EPA-454/R-92-006.

emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to accurately predict the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first level of CAL3QHC modeling.

To determine motor vehicle generated PM concentrations adjacent to streets within the traffic study area, the CAL3QHCR model was applied. This refined version of the model can utilize hourly traffic and meteorology data, and is therefore more appropriate for calculating 24-hour and annual average concentrations.

METEOROLOGY

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the direction in which pollutants are dispersed, and atmospheric stability accounts for the effects of vertical mixing in the atmosphere. These factors, therefore, influence the concentration at a particular prediction location (receptor).

Tier I Analyses—CAL3QHC

In applying the CAL3QHC model, the wind angle was varied to determine the wind direction resulting in the maximum concentrations at each receptor.

Following the EPA guidelines[1], CAL3QHC computations were performed using a wind speed of 1 meter per second, and the neutral stability class D. The 8-hour average CO concentrations were estimated by multiplying the predicted 1-hour average CO concentrations by a factor of 0.70 to account for persistence of meteorological conditions and fluctuations in traffic volumes. A surface roughness of 3.21 meters was chosen. At each receptor location, concentrations were calculated for all wind directions, and the highest predicted concentration was reported, regardless of frequency of occurrence. These assumptions ensured that worst-case meteorology was used to estimate impacts.

Tier II Analyses—CAL3QHCR

A Tier II analysis performed with the CAL3QHCR model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consists of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York for the period of 2007-2011. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

[1] *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, EPA Office of Air Quality Planning and Standards, Publication EPA-454/R-92-005.

ANALYSIS YEAR

The microscale analyses were performed for existing conditions and 2019, the year by which the proposed project is likely to be completed. The future analysis was performed both in No-Action and With Action conditions.

BACKGROUND CONCENTRATIONS

Background concentrations are those pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations must be added to modeling results to obtain total pollutant concentrations at an analysis site.

The background concentrations for the area of the project are presented in **Table 11-2**. PM backgrounds are the highest measured concentrations from the latest available three years of monitored data (2009–2011), consistent with the NAAQS. All other pollutants are based on the latest available five years of monitored data (2007–2011). Consistent with the NAAQS for each pollutant, for averaging periods shorter than a year, the second highest value is used, aside from $PM_{2.5}$, which is the 98th percentile. These values were used as the background concentrations for the mobile source analysis.

Table 11-2
Maximum Background Pollutant Concentrations (µg/m^3)

Pollutant	Average Period	Location	Concentration	NAAQS
CO	1-hour	Queens College, Queens	3.4 ppm	35 ppm
	8-hour		2.0 ppm	9 ppm
PM_{10}	24-hour	Queens College, Queens	50	150
$PM_{2.5}$	24-hour	Queens College, Queens	26	35
	Annual		10	15

Sources: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2007–2011.

Notes: Consistent with the NAAQS, PM values are the highest of the latest available 3 years; all other pollutants are the highest of the latest 5 years. Consistent with the NAAQS for each pollutant, for averaging periods shorter than a year the second highest value is used, aside from $PM_{2.5}$ which is the 98th percentile.

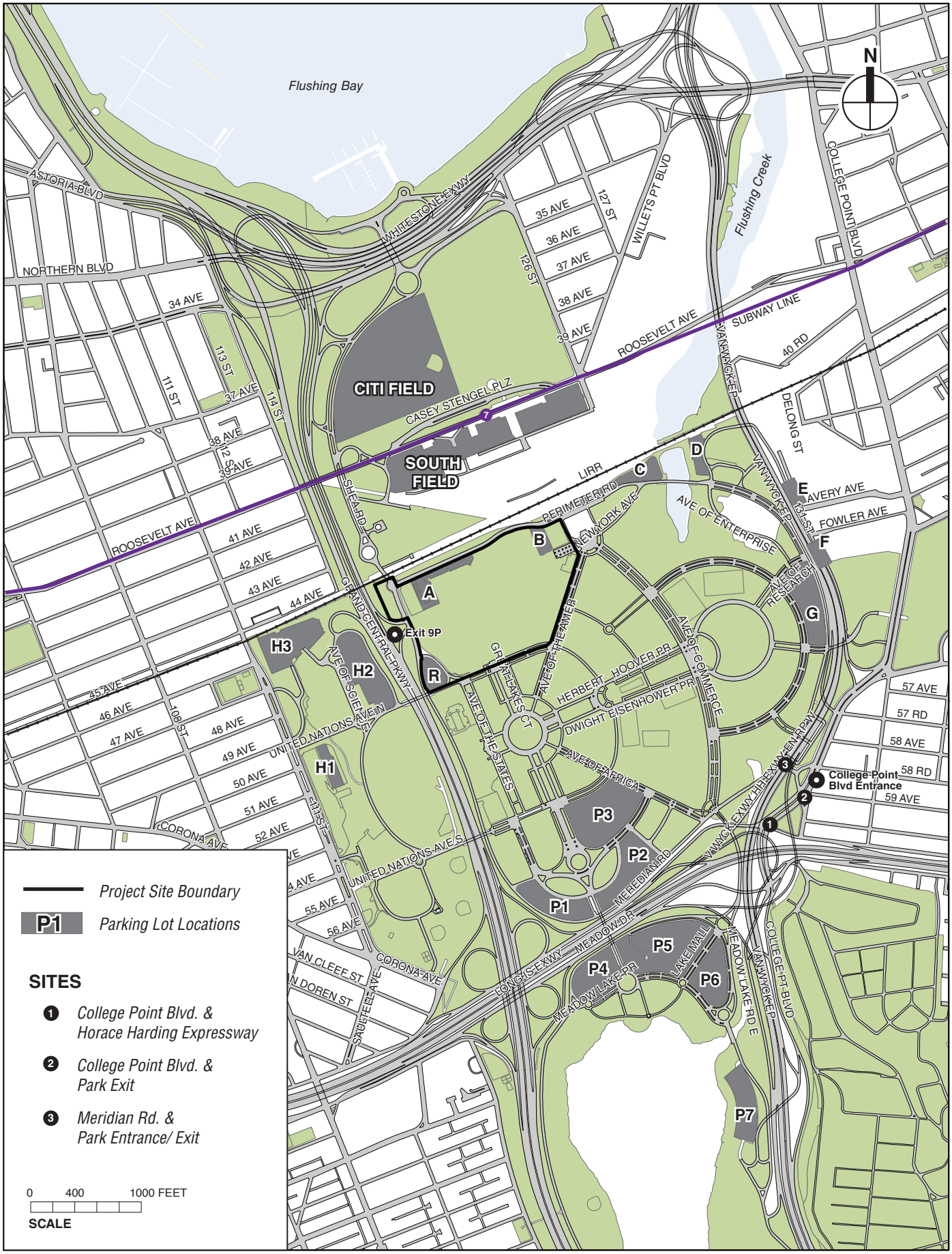
ANALYSIS SITES

A total of three analysis sites were selected for microscale analysis (see **Table 11-3 and Figure 11-1**). These sites were selected because they are the locations in the study area where the largest levels of project-generated traffic are expected, and, therefore, where the greatest air quality impacts and maximum changes in concentrations would be expected. Each of these intersections was analyzed for CO and PM.

Table 11-3
Mobile Source Analysis Sites

Analysis Site	Location
1	College Point Blvd. & Horace Harding Expy.
2	College Point Blvd & Park Exit
3	Park Entrance/Exit & Meridian Rd

12.14.12



Mobile Source Analysis Sites

Figure 11-1

RECEPTOR PLACEMENT

Multiple receptors (i.e., precise locations at which concentrations are predicted) were modeled at each of the selected sites; receptors were placed along the approach and departure links at spaced intervals. Ground level receptors were placed at sidewalk or roadside locations near intersections with continuous public access, at a pedestrian height of 1.8 meters. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters, from the nearest moving lane at each analysis location, based on the DEP guidance for neighborhood-scale corridor $PM_{2.5}$ modeling.

PARKING FACILITIES

The proposed project would result in the construction of two new aboveground naturally ventilated parking garages that would accommodate 423 and 270 spaces. These garages would replace existing surface lots that currently are able to accommodate 200 and 104 spaces, respectively. Emissions from vehicles using the parking garages could potentially affect ambient levels of CO in the project study area.

An analysis was performed using the methodology set forth in the *CEQR Technical Manual*, applying modeling techniques and calculating pollutant levels at various distances from the larger of the two parking garages, located on Lot A. Emissions from vehicles entering, parking, and exiting the garage were estimated using the EPA MOBILE6.2 mobile source emission model and an ambient temperature of 43.0°F, as referenced in the *CEQR Technical Manual*. For all arriving and departing vehicles, an average speed of 5 miles per hour was conservatively assumed for travel within the parking garages. In addition, all departing vehicles were assumed to idle in the parking space for 1 minute before proceeding to the exit. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 1-hour and 8-hour averaging periods.

To determine pollutant levels from each level of the modeled parking facility, the analysis was based on a correction factor for an elevated point source using the methodology in EPA's *Workbook of Atmospheric Dispersion Estimates, AP-26*. This methodology estimates CO concentrations by determining the appropriate height correction factor for each level, based on the difference between pedestrian height and the respective parking level elevation. Total ambient levels at each receptor location are then calculated by adding together contributions from each level of the facility and ambient background levels.

The CO concentrations were determined for the time periods when overall garage usage would be the greatest, considering the hours when the greatest number of vehicles would exit the facility. Departing vehicles were assumed to be operating in a "cold-start" mode, emitting higher levels of CO than arriving "hot-stabilized" vehicles. Maximum emissions would result in the highest CO levels and the greatest potential impacts. Traffic data for the parking garage analysis was derived from a parking lot utilization survey performed for one of the existing lots, during non-event conditions, which is when overall garage activity would be highest due to parking turn over from employee parking. Maximum parking garage impacts would be located more than 3,000 feet from the analyzed mobile source intersections. Additionally, maximum parking garage and mobile source impacts would occur in different seasons. Therefore, potential cumulative impacts from parking garages and on-street traffic would be negligible.

The emissions from the larger proposed parking garage was modeled to directly discharge to Meridian Road located to the north of the garage, and "near" and "far" receptors were placed

along the sidewalks at a pedestrian height of 6 feet and at a distance 6 feet and 47 feet, respectively, from the parking garage. A persistence factor of 0.70, as referenced in the *CEQR Technical Manual*, was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period.

Background CO concentrations were added to the modeling results to obtain the total ambient levels.

STATIONARY SOURCES

EMERGENCY GENERATORS

Backup battery power packs or a low power emergency diesel-fueled generator would be installed at each of the two new stadiums to serve in the event of the loss of utility electrical power. In the case that diesel-fueled emergency generators are implemented, the generator units would be tested periodically for a short period to ensure their availability and reliability in the event of a sudden loss in utility electrical power. Additionally, testing would only be conducted during non-event conditions. The generator would not be utilized in a peak load shaving program, minimizing the use of this equipment during non-emergency periods. Emergency generators are exempt from NYSDEC air permitting requirements, but would require a permit or registration issued by DEP, depending on the generator capacity. The emergency generators would be installed and operated in accordance with DEP requirements, as well as other applicable codes and standards. Potential air quality impacts from the emergency generator would be insignificant, since it would be used only for testing purposes outside of an actual emergency use.

HEAT AND HOT WATER SYSTEMS ANALYSIS

Screening Analysis

A stationary source analysis was conducted to evaluate potential impacts from the proposed project's heat and hot water systems. Since the proposed project would not result in any major stationary source emissions, a screening analysis was initially conducted; this procedure evaluates whether or not a refined analysis using dispersion modeling is necessary.

The proposed project would include natural gas fired heat and hot water. The methodology described in the *CEQR Technical Manual* was used for the analysis of the heating and hot water systems and considered impacts on sensitive uses (both existing residential development as well as other residential developments under construction). The *CEQR* methodology determines the threshold of development size below which the action would not have a significant adverse impact. The screening procedures utilize information regarding the type of fuel to be used, the maximum development size, and the boiler exhaust stack height to evaluate whether a significant adverse impact is likely. Based on the distance from the development to the nearest building of similar or greater height, if the maximum development size is greater than the threshold size in the *CEQR Technical Manual*, there is the potential for significant air quality impacts, and a refined dispersion modeling analysis would be required. Otherwise, the source passes the screening analysis, and no further analysis is required.

The project site was evaluated and any nearby projected residential development of similar or greater height was analyzed as a potential receptor. The maximum development floor area of the proposed project's building were used as input for the screening analysis, and that the stacks

would be located three feet above roof height (as per the *CEQR Technical Manual*). If the source did not pass any of the screening analyses (oil or gas) using the *CEQR Technical Manual* procedures, a refined dispersion model would be applied.

Dispersion Modeling

Since the screening analysis of potential air quality impacts from the proposed project's stationary source emissions resulted in potential exceedance at the administrative and retail building, a refined dispersion modeling analysis was performed. This potential impact was re-evaluated using the EPA/AMS AERMOD dispersion model.[1] AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions.

The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability to calculate pollutant concentrations at locations where the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. The analysis of potential impacts from exhaust stacks was performed assuming stack tip downwash where appropriate, urban dispersion and surface roughness length, with and without building downwash, and elimination of calms. Hourly meteorological data measured at the LaGuardia Airport station during the years 2007 through 2011 were employed in this analysis.

The AERMOD model also incorporates the algorithms from the PRIME model, which is designed to predict impacts in the "cavity region" (i.e., the area around a structure which, under certain conditions, may affect an exhaust plume, causing a portion of the plume to become entrained in a recirculation region). The Building Profile Input Program for the PRIME model (BPIPRM) was used to determine the projected building dimensions modeling with the building downwash algorithm enabled. The modeling of downwash from sources accounts for all obstructions within a radius equal to five obstruction heights of the stack.

Receptor Placement

Elevated receptors were placed along the top of the proposed Louis Armstrong Stadium at a height of 85 feet. Additionally, lower receptors were placed within the stadium seating area near the façade adjacent to the administrative/retail building.

Emission Estimates and Stack Parameters

In order to assess worst case concentrations, multiple stack locations were run at varying distances to the façade of the Louis Armstrong Stadium adjacent to the administrative and retail building. The stack locations run began at distances of 6 feet, 15 feet, and every 15 feet until a distance of 60 feet based on the minimum distance determined by the screening method mentioned above. **Table 11-4** presents the emission rates and stack parameters used in the modeling analysis.

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[1] EPA, *AERMOD: Description Of Model Formulation*, 454/R-03-004, September 2004; and EPA, *User's Guide for the AMS/EPA Regulatory Model AERMOD*, 454/B-03-001, September 2004 and Addendum December 2006.

Table 11-4
Adminstrtive and Retail Building HVAC Emission Rates and Stack Parameters

Parameter	Value
Stack Parameters	
Stack Height (ft)	28
Stack Diameter (ft) (1)	1.0
Exhaust Exit Velocity (ft/s) (1)	25.6
Exhaust Temperature (°F) (1)	300
Emission Rates (g/s)	
NO_x	0.025
$PM_{2.5}$	0.00187
SO_2	0.000147
CO	0.021

Notes:
1. The stack diameter, exhaust velocity, and exhaust temperature were based on NYCDEP Boiler Permit Database.

Sources: AP-42

NO_2 concentrations from the administrative/retail HVAC systems were estimated using NO_2 to NO_x ratio of 0.8 for the maximum 1-hour concentration. The 0.8 ratio used for the maximum 1-hour concentration is the recommended default ambient ratio per EPA's guidance memo providing additional clarification regarding application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS.[1]

Background Concentrations

As with the mobile source analysis, the predicted impacts from stationary sources analyzed must be added to a background value that accounts for existing pollutant concentrations from sources that are not directly accounted for in the model to estimate the maximum expected pollutant concentration at a given location (receptor). All background concentrations used in the stationary source analysis are based on data collected at the DEC Queens College 2 monitoring station from 2007 to 2011. The annual NO_2 background is based on the maximum annual average value measured over the five years. The 1-hour CO, 8-hour CO, and 3-hour SO_2 background levels are based on maximum second-highest concentrations recorded over the five year period. The 24-hour average PM_{10} background concentration is based on the maximum second-highest 24-hour average concentration measured over the most recent 3-year period for which monitoring data are available (2009-2011). The 1-hour average SO_2 concentration is based on the 3-year average of the annual 99th percentile of the daily maximum 1-hour SO_2 concentrations, and the NO_2 1-hour average background concentrations is based on the 3-year average of the annual 98th percentile of the daily maximum 1-hour NO_2 concentrations, consistent with the form of the NAAQS.

[1] EPA, Memorandum, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, March 1, 2011.

Table 11-5
Maximum Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1 hour	Queens College 2, Queens	126	188
	Annual		54.5	100
SO_2	1 hour	Queens College 2, Queens	78.6	196
PM_{10}	24 Hour	Queens College 2, Queens	50	150
Sources: 2007-2011 Annual New York State Air Quality Report Ambient Air Monitoring System, NYSDEC				

CENTRAL CHILLER PLANT

To meet electrical power needs during peak demand conditions, the proposed project may include additional reciprocating engines that would serve a central chiller plant. The plant would utilize generators that would be temporarily in use for the US Open. These generators would be fueled with natural gas (if available) or ultra-low sulfur diesel, and have advanced controls to minimize pollutant emissions. They would also comply with applicable environmental standards for such equipment. ~~Due to insufficient natural gas availability, it is assumed that the engines would use diesel fuel.~~ The plant would have a maximum capacity of up to 8 megawatts and would be operated only during the US Open.

The plant would be located to north of the project site—north of Meridian Road, east of Arthur Ashe Stadium (Stadium 1), and west of Louis Armstrong Stadium (Stadium 2). This would be approximately 350 feet from areas that would be accessible to the public.

Federal regulations for generator engines[1] phase-in Tier 4 exhaust emission standards beginning in the 2011 model year and will be completed by the 2015 model year. The Tier 4 exhaust emission standards present significant reductions of NO_x and PM (CO emissions limits remain unchanged) compared to the Tier 2-3 stage. It was assumed that Tier 4 engines would be readily available and utilized in the operation of the central chiller plant by the 2019 Build Year.

The NO_2 and SO_2 1-hour analyses were evaluated using the EPA/AMS AERMOD dispersion model and background concentrations mentioned above.

Receptor Placement

A network of ground level discrete receptors (i.e., locations at which concentrations are calculated) were modeled along the public accessible walkways within the project site at a pedestrian height of 1.8 m.

Emission Estimates and Stack Parameters

Table 11-6 presents the emission rates and stack parameters used in the modeling analysis. Since use would be limited to operation during the US Open, engine generator emissions were modeled as occurring only during the months of August and September.

[1] *Protection of Environment* 40 CFR 1039.101. July 2005.

Table 11-6
Central Chiller Plant Emission Rates and Stack Parameters

Parameter	Value
Stack Parameters	
Stack Height (ft)	20
Stack Diameter (ft) (1)	1.3
Exhaust Flowrate (cfm) (1)	70,400
Exhaust Temperature (°F) (1)	800
Emission Rates (g/s) (2)	
NO_x	1.489
$PM_{2.5}$	0.0667
SO_2	0.00755(3)
CO	7.778

Notes:
1. The stack diameter, exhaust velocity, and exhaust temperature were based on vender data for similar size systems.
2. The emission rates are based on emissions standards set out in the Standards of Performance for New Stationary Sources.
3. The SO_2 emission rate for fuel oil assumes the use of ultra low sulfur diesel with a maximum sulfur content of 15 parts per million.

Sources: 40 CFR §1039.101

Similar to the HVAC analysis described above, NO_2 concentrations from the proposed plant were estimated using NO_2 to NO_x ratio of 0.8 for the maximum 1-hour concentration. The 0.8 ratio used for the maximum 1-hour concentration is the recommended default ambient ratio per EPA's guidance memo providing additional clarification regarding application of Appendix W Modeling Guidance for the 1-hour NO_2 NAAQS.[1]

E. EXISTING CONDITIONS

The most recent concentrations of all criteria pollutants at NYSDEC air quality monitoring stations nearest to the proposed project are presented in **Table 11-7**. As shown, the recently monitored levels did not exceed the NAAQS. It should be noted that these values are somewhat different from the background concentrations used in the mobile source analyses. For most pollutants, the concentrations presented in **Table 11-7** are based on measurements obtained in 2011, the most recent year for which data are available; the background concentrations are obtained from several years of monitoring data and represent a conservative estimate of the highest background concentrations for future conditions.

MODELED CO CONCENTRATIONS FOR EXISTING TRAFFIC CONDITIONS

As noted previously, receptors were placed at multiple sidewalk locations next to the intersections selected for the analysis. **Table 11-8** shows the maximum modeled existing (2011) CO 8-hour average concentrations for each peak period analyzed. (No 1-hour values are shown since predicted values are much lower than the 1-hour standard of 35 ppm.) At all receptor sites, the maximum predicted 8-hour average concentrations are well below the national standard of 9 ppm.

[1] EPA, Memorandum, "Additional Clarification Regarding Application of Appendix W Modeling Guidance for the 1-hour NO_2 National Ambient Air Quality Standard, March 1, 2011.

Table 11-7
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Queens College 2, Queens	ppm	8-hour	1.8	9
			1-hour	2.1	35
SO_2	Queens College 2, Queens[1]	µg/m^3	3-hour	81.5	1,300
			1-hour	78.6	196
PM_{10}	Queens College 2, Queens	µg/m^3	24-hour	47	150
$PM_{2.5}$	Queens College 2, Queens[2]	µg/m^3	Annual	9.9	15
			24-hour	26	35
NO_2	Queens College 2, Queens[3]	µg/m^3	Annual	38.7	100
			1-hour	126	188
Lead	Morrisania, Bronx[4]	µg/m^3	3-month	0.008	0.15
Ozone	Queens College 2, Queens[5]	ppm	8-hour	0.075	0.075

Notes:
(1) The 1-hour value is based on a three-year average (2009-2011) of the 99th percentile of daily maximum 1-hour average concentrations. EPA replaced the 24-hr and the annual standards with the 1-hour standard.
(2) Annual value is based on a three-year average (2009-2011) of annual concentrations. The 24-hour value is based on the 3-year average of the 98th percentile of 24-hour average concentrations.
(3) The 1-hour value is based on a three-year average (2009-2011) of the 98th percentile of daily maximum 1-hour average concentrations.
(4) Based on the highest quarterly average concentration measured in 2011.
(5) Based on the 3-year average (2009-2011) of the 4th highest daily maximum 8-hour average concentrations.
Source: NYSDEC, New York State Ambient Air Quality Data.

Table 11-8
Modeled Existing 8-Hour Average CO Concentrations (2011)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	College Point Blvd. & Horace Harding Expy.	PM	4.7
2	College Point Blvd & Park Exit	PM	4.2
3	Park Entrance/Exit & Meridian Rd	PM	3.5

Notes:
8-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 2.0 ppm.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCES

ON-STREET SOURCES

CO concentrations in the No-Action condition were determined for future 2019 conditions using the methodology previously described. **Table 11-9** shows future maximum predicted 8-hour

average CO concentrations, including background concentrations, at the analysis intersections in the No-Action condition. The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 11-9
Maximum Predicted Future (2019) 8-Hour Average Carbon Monoxide No-Action Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	College Point Blvd. & Horace Harding Expy.	1	4.3
2	College Point Blvd & Park Exit	2	3.8
3	Park Entrance/Exit & Meridian Rd	3	3.3

Notes:
8-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 2.0 ppm.

As shown in **Table 11-9**, 2019 No-Action values are predicted to be well below the 8-hour CO standard of 9 ppm, and lower than predicted existing average concentrations (shown in **Table 11-8**). The predicted decrease in CO concentrations would result from the increasing proportion of newer vehicles with more effective pollution controls as well as the continuing benefits of the New York State I&M Program.

PM_{10} concentrations for the No-Action condition were also determined using the methodology previously described. **Table 11-10** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2019 No-Action condition. The values shown are the highest predicted concentrations for the receptor locations. Note that $PM_{2.5}$ concentrations for the No-Action condition are not presented, since impacts are assessed on an incremental basis.

Table 11-10
No-Action Condition Maximum Predicted 24-Hour Average PM_{10} Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration
1	College Point Blvd. & Horace Harding Expy.	83.82
2	College Point Blvd & Park Exit	70.32
3	Park Entrance/Exit & Meridian Rd	69.18

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 50 .0 $\mu g/m^3$.

STATIONARY SOURCES

In the future without the proposed project, HVAC emissions would similar to existing conditions.

G. THE FUTURE WITH THE PROPOSED PROJECT

MOBILE SOURCES

ON-STREET SOURCES

CO concentrations for future 2019 No-Action and With Action conditions were predicted using the methodology previously described. **Table 11-11** shows the future maximum predicted 8-hour average CO concentrations at the three intersections studied. (No 1-hour values are shown, since no exceedances of the NAAQS would occur and the *de minimis* criteria are only applicable to 8-hour concentrations; therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentrations. The results indicate that the proposed project would not result in any violations of the 8-hour CO standard. In addition, the incremental increases in 8-hour average CO concentrations are very small, and consequently would not result in a violation of the CEQR *de minimis* CO criteria. Therefore, the proposed project mobile source CO emissions would not result in a significant adverse impact on air quality.

Table 11-11
Maximum Predicted 2019
CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)		De minimis
			No Action	With Action	
1	College Point Blvd. & Horace Harding Expy.	PM	4.3	4.5	6.7
2	College Point Blvd & Park Exit	PM	3.8	3.9	6.4
3	Park Entrance/Exit & Meridian Rd	PM	3.3	3.6	6.1

Notes:
8-hour standard is 9 ppm.
Concentration includes a background concentration of 2.0 ppm.

PM_{10} concentrations for the With Action condition were also determined using the methodology previously described. **Table 11-12** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2019 With Action condition. The values shown are the highest predicted concentrations for the receptor locations.

Table 11-12
No-Action Condition Maximum Predicted 24-Hour Average
PM_{10} Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration	
		No Action	With Action
1	College Point Blvd. & Horace Harding Expy.	83.82	84.61
2	College Point Blvd & Park Exit	70.32	71.41
3	Park Entrance/Exit & Meridian Rd	69.18	71.78

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 50.0 $\mu g/m^3$.

Using the methodology previously described, maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared to the interim guidance criteria that would determine the potential significance of any impacts from the proposed project. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Tables 11-13 and 11-14**, respectively. Note that $PM_{2.5}$ concentrations in the No-Action condition are not presented, since impacts are assessed on an incremental basis.

Table 11-13
2019 Maximum Predicted 24-Hour Average
$PM_{2.5}$ Concentration

Location	Increment ($\mu g/m^3$)
College Point Blvd. & Horace Harding Expy.	0.32
College Point Blvd & Park Exit	0.46
Park Entrance/Exit & Meridian Rd	0.66
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, 2 $\mu g/m^3$ (5 $\mu g/m^3$ not-to-exceed value).	

Table 11-14
2019 Maximum Predicted Annual Average
$PM_{2.5}$ Concentration

Location	Increment ($\mu g/m^3$)
College Point Blvd. & Horace Harding Expy.	0.09
College Point Blvd & Park Exit	0.08
Park Entrance/Exit & Meridian Rd	0.06
Note: $PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 $\mu g/m^3$.	

The results show that the annual and daily (24-hour) $PM_{2.5}$ increments are predicted to be below the interim guidance criteria. Therefore, there would be no potential for significant adverse impacts on air quality from vehicle trips generated by the proposed project.

PARKING FACILITIES

The CO levels from the proposed parking garages were predicted using the methodology set forth in the *CEQR Technical Manual*. The proposed parking garages would replace existing surface parking lots. A conservative, worst-case peak period was considered in the analysis of the 1-hour average CO concentrations. A persistence factor of 0.70, as referenced in the *CEQR Technical Manual*, was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. Pollutant levels were predicted at a pedestrian height of 6 feet. Receptors (locations where CO levels were predicted) were modeled on Meridian Road locations near the proposed entrance of the larger garage.

The maximum predicted CO concentration, with ambient background, would be 3.7 ppm for the 1-hour period and 2.2 ppm for the 8-hour period. The maximum 1- and 8-hour contributions from the parking garage alone would be 0.3 ppm and 0.2 ppm, respectively. These maximum predicted CO levels are below the CO NAAQS and the City's CO *de minimis* criteria. As these results show, the proposed parking garages would not result in a significant adverse air quality impact.

STATIONARY SOURCES

HEAT AND HOT WATER SYSTEMS ANALYSIS

Screening Analysis

A screening analysis was performed to assess the potential for air quality impacts from the HVAC systems for the proposed Louis Armstrong Stadium (Stadium 2), Grandstand (Stadium 3) Stadium, and the administrative and retail building.

The analysis for the stadiums was based on the total proposed enclosed or conditioned floor areas of 80,000 and 31,000 gross square feet, respectively, with an exhaust height of approximately 88 and 58 feet, respectively (3 feet above the appropriate stadium building's rooftop). Based on this height, the nearest building of a similar or greater height was determined to be Arthur Ashe Stadium (Stadium 1) for each stadium. It was determined that there was a distance of 85 feet between the new Stadium 2 and Arthur Ashe Stadium, and a distance of 300 feet between the new Stadium 3 and Arthur Ashe Stadium; therefore, these distances were used for the analysis in accordance with the guidance provided in the *CEQR Technical Manual*.

The use of natural gas for the heat and hot water systems for each of the proposed stadiums would not result in a significant adverse impact on air quality because for both of the stadiums analyzed, the respective gross square footage would be below the maximum permitted size shown in Figure 17-8 in the Air Quality Appendix of the *CEQR Technical Manual*.

Dispersion Modeling

The initial screening analysis for the administrative/retail building which would be located adjacent to the proposed Lois Armstrong Stadium used a total proposed enclosed area of 80,000 gross square feet and an exhaust height of approximately 28 feet. Based on the guidance provided in the *CEQR Technical Manual* a minimum distance between the exhaust stack and the adjacent stadium was determined to be 62 feet. Therefore, an analysis was performed with multiple stack locations ranging from 6 feet to 60 feet using the AERMOD model to evaluate potential impacts of PM_{10}, 1-hour NO_2 and 1-hour SO_2. The maximum predicted concentrations for any distance analyzed were added to the maximum 1-hour, 24-hour, and annual ambient background concentration and compared to the NAAQS. The results of this analysis are presented in **Table 11-15**.

Table 11-15
Maximum Modeled NO_2, SO_2 and PM_{10} Concentrations from Proposed Administrative/Retail Building (in µg/m^3)

Pollutant	Averaging Period	Maximum Modeled Impact	Modeled Setback (ft)	Background[(1)]	Total Concentration	NAAQS / Threshold
NO_2	1-hour	48.58 [(2)]	60	126	174.58	188
	Annual	0.1	60	54.5	54.6	100
SO_2	1-hour	0.51	60	78.6	79.11	196
PM_{10}	24-hour	2.07	45	50	52.07	150

Notes:
(1) Background concentrations for NO_2 1-hour and SO_2 1-hour, which are the maximum daily 98th percentile and 99th percentile, respectively, background concentrations, averaged over three years, in accordance with the form of the standards.
(2) Includes a 1-hour conversion ratio of NO_2 to NO_x of 80 percent.

As shown in **Table 11-15**, the predicted 1-hour NO_2, SO_2 and PM_{10} concentrations are less than their respective NAAQS. As shown in the table, the predicted pollutant concentrations for each of the pollutant time averaging periods shown are below their respective standards.

The air quality modeling analysis also determined the highest predicted increase in annual average $PM_{2.5}$ concentrations (see **Table 11-16**). As shown in Table 11-16, the maximum projected $PM_{2.5}$ increments from the proposed project would be less than the applicable interim guidance criterion of 0.3 µg/m^3 for local impacts and 0.1 for neighborhood scale impacts.

Table 11-16
Maximum Modeled $PM_{2.5}$ Concentrations from Proposed Administrative/Retail Building (in µg/m^3)

Averaging Period	Maximum Modeled Impact	Modeled Setback (ft)	NAAQS / Threshold
24-hour	2.07	45	5/2[(1)]
Annual	0.01	60	0.3/0.1 [(2)]

Notes:
(1) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 µg/m^3 (5 µg/m^3 not to exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.
(2) Annual $PM_{2.5}$ interim guidance criterion, > 0.3 µg/m^3 at any discrete receptor location for localized impacts and >0.1 µg/m^3 averaged over a 1km by 1km ground level receptor grid for neighborhood-scale impacts.

The air quality modeling analysis also determined the highest predicted increase in 24-hour average $PM_{2.5}$ concentrations. The 24-hour average $PM_{2.5}$ concentration increments with the proposed project were compared to the 24-hour average interim guidance criterion of 2 µg/m^3 for discrete receptor locations (see Section C., *Air Quality Standards, Regulations Benchmarks* for a description of the City's $PM_{2.5}$ interim guidance criteria). The assessment examined the magnitude, duration, frequency, and extent of the increments at locations where exposure above the 2 µg/m^3 threshold averaged over a 24-hour period could occur.

Table 11-17 presents a summary of the frequency, magnitude and extent of predicted $PM_{2.5}$ concentration increments at receptor locations which exceed 2 µg/m^3 (there are no receptor locations where the maximum predicted incremental concentrations of $PM_{2.5}$ would exceed 5 µg/m^3). The results presented in **Table 11-17** represent the maximum incremental concentrations of $PM_{2.5}$ for a period of five years (2007 to 2011).

Table 11-17
Magnitude, Frequency and Extent of 24-hour $PM_{2.5}$ Impacts > 2 µg/m^3 From the Administrative/Retail Building's HVAC System

Year	Frequency	Extent of Impacted Receptors (Number of Receptors)	Max Conc. (µg/m^3)	2nd Max Conc. (µg/m^3)
2007	0	0	<2	<2
2008	0	0	<2	<2
2009	0	0	<2	<2
2010	1	2	**2.08**	2.04
2011	0	0	<2	<2

Notes:
(1) Maximum predicated 24-hour average concentration increment shown in bold. Represents the maximum predicted 24-hour concentration over a five year period (2007-2011).

At receptors where the maximum 24-hour average concentration were predicted to be greater than 2 µg/m^3, the maximum annual frequency of concentrations greater than 2 µg/m^3 was once per year, with the average frequency of once per year or less, over five years.

Overall, the magnitude, extent, and frequency of 24-hour average $PM_{2.5}$ concentrations above 2.0 µg/m^3 are low. Therefore, it would not result in a significant impact based on the City's interim guidance criteria. Overall, the proposed project's HVAC systems would not result in any significant adverse air quality impacts.

CENTRAL CHILLER PLANT ANALYSIS

An analysis was performed using the AERMOD model to evaluate potential impacts of PM2.5, 1-hour NO2 and 1-hour SO2 from operation of a conceptual central chiller plant for the proposed project. The maximum predicted concentrations from the modeling analysis were added to the maximum 1-hour, 24-hour, and annual ambient background concentration and compared to the NAAQS. The results of this analysis are presented in **Table 11-18**.

Table 11-18
Maximum Modeled Chiller Plant Pollutant Concentration (in µg/m^3)

Pollutant	Averaging Period	Maximum Modeled Impact	Background[(1)]	Total Concentration	NAAQS / Threshold
NO_2	1-hour	43.59 [(2)]	126	169.59	188
	Annual	1.3	54.5	55.8	100
SO_2	1-hour	0.32	78.6	78.92	196
$PM_{2.5}$	24-hour	1.8	N/A	N/A	5/2[(3)]
	Annual	0.06	N/A	N/A	0.3/0.1 [(4)]
PM_{10}	24-hour	1.8	50	51.8	150

Notes:
(1) Background concentrations for NO_2 1-hour and SO_2 1-hour, which are the maximum daily 98th percentile and 99th percentile, respectively, background concentrations, averaged over three years, in accordance with the form of the standards.
(2) Includes a 1-hour conversion ratio of NO_2 to NOx of 80 percent.
(3) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 µg/m^3 (5 µg/m^3 not to exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.
(4) Annual $PM_{2.5}$ interim guidance criterion, > 0.3 µg/m^3 at any discrete receptor location for localized impacts and >0.1 µg/m^3 averaged over a 1km by 1km ground level receptor grid for neighborhood-scale impacts.

As shown in **Table 11-18**, the predicted 1-hour NO_2 and SO_2 concentrations are less than their respective NAAQS, and the maximum incremental concentrations of $PM_{2.5}$ are below the City's interim guidance criteria. In addition, since the maximum annual average impact at a discrete receptor was predicted to be 0.06 µg/m^3, neighborhood-scale impacts would not exceed the City's interim guidance criterion of 0.1 µg/m^3. Based on the AERMOD analysis, there would be no potential significant adverse stationary source air quality impacts from the proposed project.✷