Chapter 9: Air Quality

A. INTRODUCTION

As described in Chapter 1, "Project Description," the Kingsbridge Armory National Ice Center (KNIC) project is a proposed redevelopment of the Armory building (the "Armory")—a historic landmark that is substantially vacant—with approximately 795,000 gross square feet (gsf) of new uses, including approximately 457 parking spaces (the proposed project).

The potential for air quality impacts from the proposed project is examined in this chapter. 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-fired boiler systems. Indirect impacts are impacts that are caused by emissions from nearby existing sources or by emissions from on-road vehicle trips generated by a project or changes to future traffic conditions due to the project.

The maximum hourly incremental traffic from the proposed project would exceed the 2012 *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) screening threshold of 170 peak hour trips at certain nearby intersections in the study area, and the fine particulate matter ($PM_{2.5}$) emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, an analysis of emissions from project-generated traffic was performed. In addition, as the proposed project would include a below-grade parking garage, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the ventilation outlets for the proposed parking garage.

The proposed project would include fossil fuel-fired combustion equipment consisting of boiler installations for space heating, domestic hot water and desiccant heating, an emergency generator, and potentially gas-fired chillers and cogeneration plant. Therefore, a stationary source analysis was conducted to evaluate potential future pollutant concentrations from the proposed combustion systems.

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 parking facility would also not result in any significant adverse air quality impacts. Therefore, the proposed project would not have significant adverse impacts from mobile source emissions. Based on the stationary source analyses, there would be no potential significant adverse stationary source air quality impacts from pollutant emissions from fossil fuel-fired combustion systems.

Potential cumulative impacts from the proposed project's mobile and stationary sources were also evaluated. The results of the analysis determined that no significant adverse air quality impacts are predicted from the cumulative effects of the proposed project's emission sources.

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 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. These pollutants are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act (CAA), and are referred to as "criteria pollutants."

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 to evaluate future CO concentrations with and without the proposed project. In addition, an assessment of CO impacts from the proposed project's parking garage was conducted.

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. 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 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 proposed 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 boiler system were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the CAA. 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 VOC; 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. The proposed project is predicted to result in increases in $PM_{2.5}$ vehicle emissions that would exceed the screening thresholds defined in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, an analysis of potential impacts from PM was performed. In addition, an analysis of $PM_{2.5}$ emissions from the proposed project's stationary source combustion systems was performed.

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 do not exceed national standards. SO_2 is also of concern as a precursor to $PM_{2.5}$ and is regulated as a $PM_{2.5}$ precursor under the New Source Review permitting program for large sources. Due to the federal restrictions on the sulfur

content in diesel fuel for on-road and non-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant and, therefore, analysis of SO_2 from mobile and non-road sources was not warranted.

Natural gas would be burned in the proposed project's boiler installations, and ultra low sulfur diesel fuel would be used in the proposed emergency generator. The sulfur content in these fuels is negligible; therefore, no analysis was performed to estimate the future levels of SO_2 with the proposed project.

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, $PM_{2.5}$ (24-hour) and PM_{10}, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 9-1**. The NAAQS for CO, annual NO_2, and 3-hour 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. New York State also has standards for total suspended particulate matter (TSP), settleable particles, non-methane hydrocarbons (NMHC), 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the non-criteria pollutants beryllium, fluoride, and hydrogen sulfide (H_2S).

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 recently lowered the primary annual-average standard to 12 $\mu g/m^3$, effective March 2013.

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. EPA is also proposing a secondary ozone 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.

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.

Table 9-1
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	189	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	12	NA	15
24-Hour Average [7]	NA	35	NA	35
Sulfur Dioxide (SO_2) [8]				
1-Hour Average [9]	0.075	197	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.

Standards are defined in ppm. 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 lowered the primary annual standard from 15 µg/m^3, effective March 2013.

(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.

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

EPA established a 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 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 a non-attainment area (NAA) as a geographic region that has 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 CAA, 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 January 30, 2013, New York State requested that EPA approve its withdrawal of the 1995 SIP and redesignation request for the 1987 PM_{10} NAAQS, and that EPA make a clean data finding instead, based on data monitored from 2009-2011 indicating PM_{10} concentrations well below the 1987 NAAQS. Although not yet a redesignation to attainment status, this determination, if approved, would remove further requirements for related SIP submissions.

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 $PM_{2.5}$ NAA under the CAA due to exceedance of the annual average standard. EPA determined that the New York–Northern New Jersey–Long Island $PM_{2.5}$ NAA has attained the 1997 annual NAAQS, effective December 15, 2010. As stated earlier, EPA has recently lowered the annual average primary standard to 12 $\mu g/m^3$. EPA will make initial attainment designations by December 2014. Based on analysis of 2009-2011 monitoring data, it is likely that the region will be in attainment for the new standard.

In November 2009, EPA designated the New York City Metropolitan Area as non-attainment with the 2006 24-hour $PM_{2.5}$ NAAQS. The NAA includes the same 10-county area originally designated as non-attainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data, EPA determined that the area has attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions. New York State submitted a redesignation request and maintenance plan to EPA in February 2013.

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe NAA for ozone (1-hour average standard). On June 15, 2004, EPA designated these same counties as moderate non-attainment for the 8-hour average ozone standard. On February 8, 2008, the New York State Department of Environmental Conservation (DEC) 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 both the 1990 1-hour ozone NAAQS (0.12 ppm) and 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 NAA 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 1-hour SO_2 standard, replacing the former 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. EPA plans to make final attainment designations in June 2013.

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 9-1**) 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 NAAs, 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 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 concentrations are below 8.0 ppm.

[1] *CEQR Technical Manual,* Chapter 1, Section 222, January 2012 ; and State Environmental Quality Review Regulations, 6 NYCRR § 617.7

$PM_{2.5}$ DE MINIMISCRITERIA

The monitored background levels of $PM_{2.5}$ have gone down appreciably in recent years. Currently, New York City uses the following *de minimis* criteria for evaluating potential $PM_{2.5}$ impacts for projects subject to CEQR[2].

- Predicted increase of more than half the difference between the background concentration and the 24-hour standard; or
- Predicted annual average $PM_{2.5}$ concentration increments 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
- Predicted annual average $PM_{2.5}$ concentration increments greater than 0.3 $\mu g/m^3$ at a discrete or ground-level receptor location.

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

The above criteria have been used to evaluate the significance of predicted impacts of the proposed project on $PM_{2.5}$ concentrations and determine the need to minimize particulate matter emissions from the proposed project.

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

INTERSECTION ANALYSIS

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 $PM_{2.5}$ *de minimis* criteria.

[2] The *de minimis* criteria superseded the interim guidance criteria that were previously in effect.

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, MOVES.[3] 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 type and grade, 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 MOVES incorporate the most current guidance available from DEC.

Vehicle classification data were based on field 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.

County-specific hourly temperature and relative humidity data obtained from DEC were used.

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. $PM_{2.5}$ 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[4] 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 8, "Transportation"). Traffic data for the future No Build and Build conditions was employed in the respective air quality modeling scenarios. The Weekday MD (3:00 PM to 4:00 PM), Weekday PM (5:00 PM to 6:00 PM), Weekend Midday (MD) (2:30 PM to 3:30 PM) and Weekend PM (5:45 PM to 6:45 PM) peak periods were analyzed. These four periods include each of the peak events analyzed in the Transportation Chapter, and therefore represent the reasonable worst-case scenario for the mobile source analysis.

For particulate matter, off-peak traffic volumes in the future No Build and Build conditions were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations, and off-peak increments from the proposed project were determined by adjusting the peak period volumes by the 24-hour distribution of the parking garage arrivals and departures associated with the proposed project.

[3] EPA, Motor Vehicle Emission Simulator (MOVES), User Guide for MOVES2010b, June 2012.
[4] 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.

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.[5] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts 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[6], 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

[5] 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.

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

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.

ANALYSIS YEAR

The microscale analyses were performed for existing conditions and 2018, the year by which the proposed project is likely to be completed. The future analysis was performed with and without the proposed project.

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 9-2**. PM_{10} 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. These values were used as the background concentrations for the mobile source analysis. $PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ *de minimis* criteria. $PM_{2.5}$ 24-hour average background concentration of 28 $\mu g/m^3$ (based on the 2009 to 2011 average of 98th percentile concentrations) was used to establish the *de minimis* value, consistent with the background concentration provided for Morrisania in the *CEQR Technical Manual.*

Table 9-2
Maximum Background Pollutant Concentrations
For Mobile Source Sites ($\mu g/m^3$)

Pollutant	Average Period	Location	Concentration	NAAQS
CO	1-hour	Botanical Garden, Bronx	3.0 ppm	35 ppm
	8-hour		1.9 ppm	9 ppm
PM_{10}	24-hour	Morrisania, Bronx	37	150
$PM_{2.5}$	24-hour	Morrisania, Bronx	28	35

Notes: Consistent with the NAAQS, PM_{10} values are the highest of the latest available 3 years; CO is the highest of the latest 5 years.
Sources: New York State Air Quality Report Ambient Air Monitoring System, DEC, 2007–2011.

ANALYSIS SITES

Two analysis sites were selected for microscale analysis, at Kingsbridge Road and Reservoir Avenue and Kingsbridge Road and University Avenue. 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. The intersections were both analyzed for CO and PM.

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 GARAGE

The proposed project would include an accessory, below-grade parking facility with approximately 457 spaces. Emissions from vehicles using the parking facility could potentially affect ambient levels of pollutants at adjacent receptors. Since the parking facility would be used by automobiles, the primary pollutant of concern is CO. Because cold-starting automobiles leaving a parking facility would emit far higher levels of CO than vehicles entering a facility, the impact from a parking facility would be greatest during the periods with the largest number of departing vehicles. An analysis was performed using the methodology delineated in the 2012 *CEQR Technical Manual* to calculate pollutant levels.

Potential impacts from the proposed parking facility on CO concentrations were assessed at multiple receptor locations. The CO concentrations were determined for the time periods, when overall usage would be the greatest, considering the hours when the greatest number of vehicles would enter and exit the project site. Departing vehicles were assumed to be operating in a "cold-start" mode, emitting higher levels of CO than arriving vehicles. Emissions from vehicles entering, parking, and exiting the parking facility were estimated using the EPA MOVES mobile source emission model. All arriving and departing vehicles were conservatively assumed to travel at an average speed of 5 miles per hour within the parking facility. In addition, all departing vehicles were assumed to idle for 1 minute before exiting.

A "near" and "far" receptor was placed on the sidewalk adjacent to the parking garage and on the sidewalk directly opposite the parking facility. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 1- and 8-hour average periods. A persistence factor of 0.70 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 from the nearest DEC monitoring station were added to the modeling results to obtain the total ambient levels. The on-street CO concentration was determined using the methodology in the Air Quality Appendix of the *CEQR Technical Manual*, utilizing traffic volumes derived from the traffic study conducted in the area.

STATIONARY SOURCES

Stationary source analyses were conducted for the fossil fuel-fired combustion systems for the proposed project. The proposed project would include boiler installations for space heating, domestic hot water and desiccant heating which would fire natural gas. An emergency ultra low sulfur diesel-fueled generator with a capacity of 2 megawatts (MW) would be installed to serve the proposed project in the event of the loss of utility electrical power. In addition, the proposed project could include a natural gas-fired cogeneration plant, and/or gas engine chillers to make ice for the skating rinks. The maximum capacity of cogeneration plant is approximately 1 MW assuming gas engine chillers are utilized. A somewhat larger cogeneration plant would be feasible if electric chillers are used instead of gas engine chillers, but for the purpose of this analysis the gas engine chillers were assumed since it is more conservative.

The analysis of the proposed project's combustion systems was performed using the EPA/AMS AERMOD dispersion model.[7] 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 treatment of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of the interaction between the plume and terrain.

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 analyses of potential impacts from the exhaust stacks were made assuming stack tip downwash, urban dispersion and surface roughness length, with and without building downwash, and elimination of calms.

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 (BPIP) program for the PRIME model (BPIPRM) was used to determine the projected building dimensions for modeling with the building downwash algorithm enabled. The modeling of plume downwash accounts for all obstructions within a radius equal to five obstruction heights of the stack.

EPA has recently issued guidance for assessing 1-hour average NO_2 concentrations for compliance with NAAQS.[8] Background concentrations are currently monitored at several sites within New York City, which are used for reporting concentrations on a "community" scale. Because this data is compiled on a 1-hour average format, it can be used for comparison with the new 1-hour standards. Therefore, background 1-hour NO_2 concentrations currently measured at the community-scale monitors can be considered representative of background concentrations for purposes of assessing the impact of heat and hot water systems.

EPA's preferred regulatory stationary source model, AERMOD, is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standards. EPA has also developed guidance to estimate the transformation ratio of NO_2 to NO_x, applicable to heating and hot water systems, as discussed further below.

One-hour average NO_2 concentration increments associated with proposed project sources were estimated using AERMOD model. The results represent the 5-year average of the annual 98th percentile of the maximum daily 1-hour average, added to background concentrations.

Total 1-hour NO_2 concentrations were determined following methodologies that are accepted by the EPA. The methodology used to determine the compliance of the total 1-hour NO_2 concentrations from proposed sources with the 1-hour NO_2 NAAQS[9] was based on adding the

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[7] 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.

[8] 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.

[9] http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

hourly modeled concentrations from proposed developments to the 98th percentile background monitored concentrations averaged over the latest 3 years. This simplified approach is recognized as being conservative by EPA and the City.

NO_2 concentrations were estimated using NO_2 to NO_x ratios of 0.8 for the 1-hour concentration and 0.75 for the annual concentration, per EPA guidance.[10]

Although the proposed emergency generator would be used only for testing purposes outside of an actual emergency use, the short-term air quality impacts of the proposed generator were modeled (annual impacts are considered insignificant based on the anticipated usage). However, 1-hour NO_2 and 1-hour SO_2 concentrations from the emergency generator were not modeled based on guidance from EPA. According to the EPA guidance, the generators can be considered an "intermittent source," which would be operated on such a limited basis that it would not be considered to contribute significantly to the 1-hour daily maximum concentrations, due to the form of the 1-hour NO_2 and 1-hour SO_2 standards.

Discrete receptors (i.e., locations at which concentrations are calculated) were modeled along the façades of nearby buildings to represent operable window locations, intake vents, and otherwise accessible locations such as terraces. Rows of receptors were placed at spaced intervals on the nearby buildings at multiple elevations.

EMISSION RATES AND STACK PARAMETERS

Table 9-3 presents the emission rates and stack exhaust parameters used in the AERMOD analysis. Emission rates for the space and desiccant heating boiler installations were scaled for each month based on estimated monthly energy consumption. The emission rates shown in the table represent maximum emissions associated with the fuel during the month of January. Emission rates from the potential cogeneration system were based on the estimated maximum capacity. The emergency generator would be tested periodically for a short period to ensure its availability and reliability in the event of a sudden loss in utility electrical power. It would not be utilized in a peak load shaving program, minimizing the use of this equipment during non-emergency periods.

The reasonable worst-case short-term and annual scenario assumes continuous operation of the cogeneration plant for 8,760 hours per year at 100 percent load on natural gas. Emissions from the gas chiller plants were estimated based on annual energy consumption and assuming continuous operation for 8,760 hours per year. Overall, this is considered a conservative estimate since the cogeneration plant, if constructed as part of the proposed project, would reduce natural gas used to provide heating; however, since the potential for cogeneration is still under consideration, this potential energy recovery has not been accounted for in this analysis.

[10] 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 9-3
Emission Rates and Stack Parameters

Parameter	Space/ Desiccant Heating Boiler Systems	Domestic Hot Water Boilers	Emergency Generators	Cogeneration System	Gas-Fired Chillers
Stack Height (ft)	82	82	42	82	82
Stack Diameter (ft)	1.33(1)	0.5	2.5	1.0(2)	0.83
Exhaust Velocity (ft/s)	26.5	21.1	51.9	95.2	10.1
Exhaust Temperature (K)	337.6	333.2	673.3	553.2	449.8
NO_x Emission Rate (g/s)	0.0647	0.0037	(3)	0.046	0.0345
$PM_{2.5}$ Emission Rate (g/s)	0.0203	0.0011	0.0008	0.009	0.0013

Notes:
(1) Two 16" flue exhausts, however, modeled as one co-located equivalent exhaust stack (with 1.9 feet equivalent diameter).
(2) Five 12" flue exhausts, however, modeled as one co-located equivalent exhaust stack (with 2.2 feet equivalent diameter).
(3) Emergency Generator is an intermittent source, therefore, it was not modeled for 1-hour NO_2.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at LaGuardia Airport (2007–2011) and concurrent upper air data collected at Brookhaven, New York. The meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevation over the five-year period. These data were processed using the EPA AERMET program to develop data in a format which can be readily processed by the AERMOD model. The land uses around the site where meteorological surface data were available were classified using categories defined in digital United States Geological Survey (USGS) maps to determine surface parameters used by the AERMET program.

Receptor Locations

A comprehensive receptor network (i.e., locations with continuous public access) was developed for the modeling analyses. Discrete receptors were analyzed on nearby buildings, at operable windows, air intakes, and at publicly accessible ground-level locations.

Background Concentrations

To estimate the maximum expected total pollutant concentrations, the calculated impacts from the emission sources must be added to a background value that accounts for existing pollutant concentrations from other sources (see **Table 9-4**). The background levels are based on concentrations monitored at the nearest DEC ambient air monitoring stations over a recent five-year period for which data are available (2007-2011), with the exception of PM_{10}, which is based on three years of data (2009-2011), consistent with current DEP guidance. Consistent with the form of the standard, for the 1-hour NO_2 averaging period, the 3-year average of the annual 98th percentile daily maximum 1-hour average concentration was used. For the 24-hour PM_{10} concentration, the highest second-highest measured values over the specified period were used. The annual average background values are the highest measured average concentrations for these pollutants. The measured background concentration was added to the predicted contribution from the modeled source to determine the maximum predicted total pollutant concentration. It was conservatively assumed that the maximum background concentrations occur on all days.

Table 9-4
Maximum Background Pollutant Concentrations
For Stationary Source Analysis

Pollutant	Average Period	Location	Concentration (µg/m^3)	NAAQS (µg/^{m3})
NO_2	Annual	Botanical Garden, Bronx	46	100
	1-hour		122.3	189
PM_{10}	24-hour	Morrisania, Bronx	37	150
Source:	New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2007–2011.			

$PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ *de minimis* criteria. Therefore, a background concentration for $PM_{2.5}$ is not included.

E. EXISTING CONDITIONS

The most recent concentrations of all criteria pollutants at DEC air quality monitoring stations nearest to the proposed project are presented in **Table 9-5**. 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 9-5** are based on measurements obtained in 2011, the most recent year for which data are available; the background concentrations used in the mobile and stationary source analyses are obtained from several years of monitoring data and represent a conservative estimate of the highest background concentrations for future conditions.

Table 9-5
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Botanical Garden, Bronx	ppm	8-hour	1.7	9
			1-hour	3.0	35
SO_2	Botanical Garden, Bronx[1]	µg/m^3	3-hour	162	1,300
			1-hour	133.5	196
PM_{10}	Morrisania, Bronx	µg/m^3	24-hour	37	150
$PM_{2.5}$	Morrisania, Bronx[2]	µg/m^3	Annual	11.9	12
			24-hour	28	35
NO_2	Botanical Garden, Bronx[3]	µg/m^3	Annual	39.2	100
			1-hour	122.3	189
Lead	Morrisania, Bronx[4]	µg/m^3	3-month	0.008	0.15
Ozone	Botanical Garden, Bronx[5]	ppm	8-hour	0.072	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: DEC, New York State Ambient Air Quality Data.

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 9-6** shows the maximum modeled existing (2013) CO 8-hour

average concentration. (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.

Table 9-6
Modeled Existing 8-Hour Average CO Concentrations (2013)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Kingsbridge Road and Reservoir Avenue	Weekday MD	2.4
2	Kingsbridge Road and University Avenue	Weekday PM	2.3

Notes:
Eight-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 1.9 ppm.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCES

INTERSECTION ANALYSIS

CO concentrations in the No Build condition were determined for future 2018 conditions using the methodology previously described. **Table 9-7** shows future maximum predicted 8-hour average CO concentrations, including background concentrations, at the analysis intersections in the No Build condition. The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 9-7
Maximum Predicted Future (2018) 8-Hour Average Carbon Monoxide No Build Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Kingsbridge Road and Reservoir Avenue	Weekday MD	2.4
2	Kingsbridge Road and University Avenue	Weekday PM	2.3

Notes:
8-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 1.9 ppm.

As shown in **Table 9-7**, 2018 No-Build values are predicted to be well below the 8-hour CO standard of 9 ppm.

PM_{10} concentrations for the No Build condition were also determined using the methodology previously described. **Table 9-8** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2018 No Build condition. The values shown are the highest predicted concentrations for the receptor locations. Note that $PM_{2.5}$ concentrations for the No Build condition are not presented, since impacts are assessed on an incremental basis.

Table 9-8
No Build Condition Maximum Predicted 24-Hour Average PM_{10} Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration
1	Kingsbridge Road and Reservoir Avenue	46.9
2	Kingsbridge Road and University Avenue	47.9

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 37 .0 $\mu g/m^3$.

STATIONARY SOURCES

In the future without the proposed project, stationary source emissions would be similar to existing conditions.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

The following sections describe the results of the analyses performed to assess the potential impacts on the surrounding community from emissions associated with the proposed project.

MOBILE SOURCES

INTERSECTION ANALYSIS

CO concentrations for future conditions in the 2018 analysis year were predicted using the methodology previously described. **Table 9-9** shows the future maximum predicted 8-hour average CO concentrations at the intersection 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.

PM_{10} concentrations for the Build condition were also determined using the methodology previously described. **Table 9-10** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2018 Build condition. The values shown are the highest predicted concentrations for the receptor locations.

Table 9-9
Maximum Predicted 2018
CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)		
			No Action	Build	*De minimis*
1	Kingsbridge Road and Reservoir Avenue	Weekend PM	2.3	2.7	5.6
2	Kingsbridge Road and University Avenue	Weekend PM	2.2	2.7	5.6

Notes:
8-hour standard is 9 ppm.
Concentration includes a background concentration of 1.9 ppm.

Table 9-10
Maximum Predicted 24-Hour Average
PM_{10} Concentrations (µg/m^3)

Receptor Site	Location	Concentration	
		No Action	Build
1	Kingsbridge Road and Reservoir Avenue	46.9	48.6
2	Kingsbridge Road and University Avenue	47.9	50.3

Notes:
NAAQS—24-hour average 150 µg/m^3.
Concentration includes a background concentration of 37.0 µg/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 *de minimis* 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 9-11 and 9-12**, respectively. Note that $PM_{2.5}$ concentrations in the No Build condition are not presented, since impacts are assessed on an incremental basis.

Table 9-11
2018 Maximum Predicted 24-Hour Average
$PM_{2.5}$ Concentrations

Receptor Site	Location	Increment (µg/m^3)	*De Minimis* (µg/m^3)
1	Kingsbridge Road and Reservoir Avenue	0.98	3.5
2	Kingsbridge Road and University Avenue	1.30	3.5

Note:
$PM_{2.5}$ *de minimis* criteria — 24-hour average, not to exceed more than half the difference between the background concentration and the 24-hour standard of 35 µg/m^3.

Table 9-12
2018 Maximum Predicted Annual Average $PM_{2.5}$ Concentrations

Receptor Site	Location	Increment (µg/m^3)
1	Kingsbridge Road and Reservoir Avenue	0.065
2	Kingsbridge Road and University Avenue	0.094
Note: $PM_{2.5}$ *de minimis* criteria—annual (neighborhood scale), 0.1 µg/m^3.		

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

PARKING GARAGE

Based on the methodology previously described, the maximum predicted 8-hour average CO concentrations from the proposed parking facility were analyzed at the following locations, assuming a vent location on the façade of the proposed building: a near side sidewalk receptor on the same side of the street (82 feet) as the parking facility and a far side sidewalk receptor on the opposite side of the street (157 feet) from the parking facility. Pollutant levels were also predicted at the height of the vents at a distance of 15 feet, accounting for the minimum vent to window distance requirements specified by the New York City Mechanical Code.

The total CO concentrations include both background CO levels and contributions from traffic on adjacent roadways for the far side receptor only. The maximum predicted 8-hour average CO concentration of all the receptors modeled is 2.9 ppm on the building receptor. This value includes a predicted concentration of 1.0 ppm from the parking garage vent, and includes a background level of 1.9 ppm. The maximum predicted concentration is substantially below the applicable standard of 9 ppm. Therefore, the proposed parking garage would not result in any significant adverse air quality impacts.

STATIONARY SOURCES

An AERMOD modeling analysis was performed to determine potential impacts from the combustion sources associated with the proposed project. Maximum predicted concentrations were added to the design ambient background concentration and compared to the NAAQS.

The results of this analysis are presented in **Table 9-13** for NO_2 and PM_{10}. Concentrations from the proposed project are less than their respective NAAQS.

Table 9-13
Future (2018) Maximum Modeled Pollutant Concentration (in µg/m^3)

Pollutant	Averaging Period	Maximum Modeled Impact	Background	Total Concentration	NAAQS
NO_2	1-hour	16	122.3	138.3	189
	Annual	1.6	46	47.6	100
PM_{10}	24-hour	1.86	37	38.9	150

Maximum concentrations of $PM_{2.5}$ from the proposed project were also estimated. Impacts were compared to the City's *de minimis* criteria for $PM_{2.5}$. The maximum predicted 24-hour and localized annual average incremental $PM_{2.5}$ concentrations are presented in **Table 9-14**.

Table 9-14
Future (2018) Maximum Predicted $PM_{2.5}$ Concentrations (in µg/m^3)

Pollutant	Averaging Period	Maximum Concentration	*De Minimis*
$PM_{2.5}$	24-hour	1.86	3.5[(1)]
	Annual (discrete)	0.298	0.3
	Annual (neighborhood scale)	0.04	0.1

Note:
(1) $PM_{2.5}$ *de minimis* criteria — 24-hour average, not to exceed more than half the difference between the background concentration and the 24-hour standard of 35 µg/m^3.

As shown in **Table 9-14**, the maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable *de minimis* criteria . On an annual basis, the maximum projected $PM_{2.5}$ increments would be less than the applicable *de minimis* criterion of 0.3 µg/m^3 for local impacts and 0.1 for neighborhood scale impacts.

Therefore, the proposed project would not result in any significant adverse air quality impacts due to stationary sources.

CUMULATIVE IMPACTS

Since there are various source types (mobile and stationary sources) that may contribute to concentration increments concurrently, a cumulative assessment of all sources related to the proposed project was undertaken to determine the potential maximum effect of all sources combined.

Concentrations of pollutants from the proposed project's stationary sources near the mobile source analysis sites would be very low since the project's stationary sources are elevated sources located on the building rooftops and maximum concentrations occur at elevated receptors. The maximum predicted PM_{10} and $PM_{2.5}$ 24-hour average cumulative concentration from the mobile and stationary sources are presented in **Table 9-15**. As shown in **Table 9-15**, the maximum cumulative concentrations are well below the applicable *de minimis* criteria for $PM_{2.5}$ and NAAQS for PM_{10}. Therefore, no significant adverse air quality impacts are predicted from the cumulative effects of the proposed project's emission sources.

Table 9-15
Future (2018) Maximum Predicted Cumulative Concentrations (in µg/m^3)

Pollutant	Averaging Period	Cumulative Concentration	NAAQS/ *De Minimis*
PM_{10}	24-hour	49.9	150
$PM_{2.5}$	24-hour	2.41	3.5[(1)]

Note:
(1) $PM_{2.5}$ *de minimis* criteria — 24-hour average, not to exceed more than half the difference between the background concentration and the 24-hour standard of 35 µg/m^3.

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