

A. INTRODUCTION

An air quality analysis was prepared to estimate potential environmental impacts associated with the proposed Kingsbridge Armory retail development and rezoning. The analysis considers the effect of emissions of pollutants into the air.

The Shops at the Armory project is a proposed redevelopment of the Kingsbridge Armory, a historic landmark, with approximately 605,370 square feet of new uses and approximately 400 parking spaces. Air quality impacts from this type of development can be either direct or indirect. Direct impacts are impacts from air emissions generated by stationary sources at a development site, such as emissions from oil or gas-fired heating, ventilation and air conditioning (HVAC) systems, or emissions from parking garage ventilation (fan exhaust) systems. Indirect impacts occur from off-site sources, such as air emissions from changes to future traffic conditions (e.g., additional motor vehicles) due to the project.

The boilers associated with the proposed project's HVAC equipment are expected to burn natural gas. Therefore, a stationary source analysis was conducted to evaluate potential future pollutant concentrations with the proposed heat and hot water systems. The potential for indirect mobile source impacts (impacts from vehicular traffic) from the proposed project was also analyzed. In addition, because the proposed project would include an accessory parking garage, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the ventilation outlets with the proposed parking garage. On-street traffic concentrations near sidewalk receptors (locations of public access) were also taken into account, when calculating concentrations from the parking garage.

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, therefore there would be no indirect impacts from the proposed project. In addition, the proposed project's accessory parking facility 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.

Impacts from the proposed project's HVAC systems on nearby buildings in the area were also considered using a screening analysis. Based on the a stationary source screening analysis, there would be no potential significant adverse air quality impacts from the proposed heat and hot water systems of the proposed project.

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 (NO and NO₂, 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 (SO₂) 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 SO₂ 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 with and without the proposed project. A parking garage analysis was also conducted to evaluate future CO concentrations with the operation of the proposed parking garage.

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 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 U.S. 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, NO₂ (one component of NO_x) is also a regulated pollutant. Since NO₂ is mostly formed from the transformation of NO in the atmosphere, it is mostly of concern further downwind from large stationary point sources (including heat and hot water systems), and is not a local concern from mobile sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO₂ at

the source.) Potential impacts on local NO₂ concentrations from the fuel combustion for the proposed project's heat and hot water systems were evaluated.

LEAD

Airborne lead emissions are principally associated with industrial sources and motor vehicles that use gasoline containing lead additives. Most U.S. vehicles produced since 1975, and all produced after 1980, are designed to use unleaded fuel. As these newer vehicles have replaced the older ones, motor vehicle related lead emissions have decreased. As a result, ambient concentrations of lead have declined significantly. Nationally, the average measured atmospheric lead level in 1985 was only about one quarter the level in 1975.

In 1985, EPA announced new rules that drastically reduced the amount of lead permitted in leaded gasoline. The maximum allowable lead level in leaded gasoline was reduced from the previous limit of 1.1 to 0.5 grams per gallon effective July 1, 1985, and to 0.1 grams per gallon effective January 1, 1986. Monitoring results indicate that this action has been effective in significantly reducing atmospheric lead concentrations. 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 the 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 ($\mu\text{g}/\text{m}^3$).

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

RESPIRABLE PARTICULATE MATTER—PM₁₀ 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, home heating, and building heat and hot water systems), 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, or PM_{2.5}, and particles with an aerodynamic diameter of less than or equal to 10 micrometers, or PM₁₀, which includes the smaller 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 an exhaust pipe, stack, or vent) 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 number of project-generated vehicle trips from the proposed project is estimated to be greater than the New York City Department of Environmental Protection's (DEP's) current threshold for conducting a PM_{2.5} microscale mobile source analysis, which is 19 or more heavy-duty trucks trips per hour. Therefore, an analysis of potential impacts from mobile sources of PM was conducted to assess the worst case impacts on air quality from the traffic that would be generated by the proposed project.

SULFUR DIOXIDE

SO₂ emissions are primarily associated with the combustion of sulfur-containing fuels: oil and coal. Monitored SO₂ concentrations in New York City are below the 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 SO₂ are not significant and therefore, an analysis of SO₂ 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 analysis was performed to estimate the future levels of SO₂ 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, NO₂, ozone, respirable PM (both PM_{2.5} and PM₁₀), SO₂, 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 NO₂, ozone, lead, and PM, and there is no secondary standard for CO. The NAAQS are presented in **Table 15-1**. The NAAQS for CO, NO₂, and SO₂ 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), and ozone which correspond to federal standards that have since been revoked or replaced, and for beryllium, fluoride, and hydrogen sulfide (H₂S).

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 µg/m³ to 35 µg/m³ and retaining the level of the annual standard at 15 µg/m³. The PM₁₀ 24-hour average standard was retained and the annual average PM₁₀ standard was revoked. EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective in May 2008.

EPA lowered the primary and secondary standards for lead to 0.15 µg/m³, 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. The current lead NAAQS will remain in place for one year following the effective date of attainment designations for any new or revised NAAQS before being revoked, except in current non-attainment areas, where the existing NAAQS will not be revoked until the affected area submits, and EPA approves, an attainment demonstration for the revised lead NAAQS.

Air quality impacts from a proposed project must meet the NAAQS established below in **Table 15-1**, otherwise the project would be considered to have a potential significant adverse impact.

Table 15-1
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 ⁽⁵⁾	NA	0.15	NA	0.15
Nitrogen Dioxide (NO₂)				
Annual Average	0.053	100	0.053	100
Ozone (O₃)				
8-Hour Average ⁽²⁾	0.075	150	0.075	150
Respirable Particulate Matter (PM₁₀)				
24-Hour Average ⁽¹⁾	NA	150	NA	150
Fine Respirable Particulate Matter (PM_{2.5})				
Average of 3 Annual Means	NA	15	NA	15
24-Hour Average ^(3,4)	NA	35	NA	35
Sulfur Dioxide (SO₂)				
Annual Arithmetic Mean	0.03	80	NA	NA
Maximum 24-Hour Average ⁽¹⁾	0.14	365	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				
(1)	Not to be exceeded more than once a year.			
(2)	3-year average of the annual fourth highest daily maximum 8-hr average concentration. EPA has reduced these standards down from 0.08 ppm, effective May 27, 2008.			
(3)	Not to be exceeded by the annual 98th percentile when averaged over 3 years.			
(4)	EPA has lowered the NAAQS down from 65 µg/m ³ , effective December 18, 2006.			
(5)	EPA has lowered the NAAQS down from 1.5 µg/m ³ , effective January 12, 2009.			
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.				

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS (SIP)

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

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Plan (SIP), which delineates how a state plans to achieve air quality that meets the NAAQS under the deadlines established by the CAA.

In 2002, EPA re-designated New York City as in attainment for CO. The CAA requires that a maintenance plan ensure continued compliance with the CO NAAQS for former non-attainment areas. New York City is also 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 PM₁₀. On December 17, 2004, EPA took final action designating the five New York City counties, Nassau, Suffolk, Rockland, Westchester, and Orange counties as a PM_{2.5} non-attainment area under the CAA due to exceedance of the annual average standard. New York State has submitted a draft SIP to EPA, dated April 2008, designed to meet the annual average standard by April 8, 2010, which will be finalized after public review.

As described above, EPA has revised the 24-hour average PM_{2.5} standard. In December 2008 EPA designated the New York City Metropolitan Area as nonattainment with the 2006 24-hour PM_{2.5} NAAQS, effective in April 2009. The nonattainment area includes the same 10-county area EPA designated as nonattainment with the 1997 annual PM_{2.5} NAAQS. By April 2012 New York will be required to submit a SIP demonstrating attainment with the 2006 24-hour standard by 2014 (EPA may grant attainment date extensions for up to five additional years).

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe non-attainment area for ozone (1-hour average standard). In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. These SIP revisions included additional emission reductions that EPA requested to demonstrate attainment of the standard, and an update of the SIP estimates using the latest versions of the mobile source emissions model, MOBILE6.2, and the nonroad emissions model, NONROAD—which have been updated to reflect current knowledge of engine emissions and the latest mobile and nonroad engine emissions regulations.

On April 15, 2004, EPA designated these same counties as moderate non-attainment for the 8-hour average ozone standard which became effective as of June 15, 2004 (LOCMA was moved to the Poughkeepsie moderate non-attainment area for 8-hour ozone). EPA revoked the 1-hour standard on June 15, 2005; however, the specific control measures for the 1-hour standard included in the SIP are required to stay in place until the 8-hour standard is attained. The discretionary emissions reductions in the SIP would also remain but could be revised or dropped based on modeling. On February 8, 2008, the New York State Department of Environmental Conservation (DEC) submitted final revisions to a new SIP for ozone to EPA. DEC has determined that achieving attainment for ozone before 2012 is unlikely, and has therefore made a request for a voluntary reclassification of the New York nonattainment area as “serious”.

In March 2008 EPA strengthened the 8-hour ozone standards. EPA expects designations to take effect no later than March 2010 unless there is insufficient information to make these designation decisions. In that case, EPA will issue designations no later than March 2011. SIPs will be due three years after the final designations are made.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and the City *Environmental Quality Review (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 15-1**) 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 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.

INTERIM GUIDANCE CRITERIA REGARDING PM_{2.5} IMPACTS

DEC has published a policy to provide interim direction for evaluating PM_{2.5} impacts². This policy would apply only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM₁₀ 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 µg/m³ averaged annually or more than 5 µg/m³ 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.

Since the NYC metropolitan area does not meet (is in nonattainment) the PM_{2.5} 24-hour standard, New York is required to develop and implement a state implementation plan (SIP) showing how it will achieve the ambient air quality standard. To ensure the PM_{2.5} impacts are not significantly increased in the nonattainment area, the thresholds discussed below have been established and any concentrations above the thresholds would be considered to have a significant adverse impact. Therefore, NYC projects subject to the City Environmental Quality Review (CEQR) are required

¹ CEQR Technical Manual, section 222, 2001; and State Environmental Quality Review Act § 617.7

² CP33/Assessing and Mitigating Impacts of Fine Particulate Emissions, NYSDEC 12/29/2003.

to follow the DEP interim guidance for evaluating PM_{2.5} impacts. If the guidance thresholds are exceeded, the project would be considered significant and would trigger the requirement for an environmental impact statement (EIS).

DEP is currently recommending interim guidance criteria for evaluating the potential PM_{2.5} impacts for projects subject to CEQR. The interim guidance criteria currently employed by DEP for determination of potential significant adverse PM_{2.5} impacts under CEQR are as follows:

- 24-hour average PM_{2.5} concentration increments which are predicted to be greater than 5 $\mu\text{g}/\text{m}^3$ 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 which are predicted to be greater than 2 $\mu\text{g}/\text{m}^3$ but no greater than 5 $\mu\text{g}/\text{m}^3$ 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 which are predicted to be greater than 0.1 $\mu\text{g}/\text{m}^3$ 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 which are predicted to be greater than 0.3 $\mu\text{g}/\text{m}^3$ at a discrete receptor location (elevated or ground level).

Actions under CEQR predicted to increase PM_{2.5} concentrations by more than the DEP or DEC interim guidance criteria above will be considered to have a potential significant adverse impact. DEP recommends that actions subject to CEQR that fail the interim guidance criteria prepare an environmental impact statement (EIS) and examine potential measures to reduce or eliminate such potential significant adverse impacts.

The proposed project's annual emissions of PM₁₀ are estimated to be well below the 15-ton-per-year threshold under DEC's PM_{2.5} policy guidance, therefore the DEP interim guidance criteria has 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

The prediction of vehicle-generated CO emissions and their dispersion in an urban environment incorporates meteorological phenomena, traffic conditions, and physical configurations. 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 of these dispersion models predict conservatively high concentrations of pollutants, particularly under adverse meteorological conditions.

The mobile source analyses for the proposed project employ models approved by EPA that have 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 result from the proposed project. The assumptions used in the PM analysis were based on the latest PM_{2.5} draft interim guidance developed by DEP.

VEHICLE EMISSIONS DATA

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 DEC and DEP.

Vehicle classification data were based on field studies conducted for the proposed project. Appropriate credits were used to accurately reflect the New York State inspection and maintenance program, which requires inspections of automobiles and light trucks to determine if pollutant emissions from the vehicles' exhaust systems are below emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

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 fleet-wide breakdown.²

An ambient temperature of 43° F was used. The use of this temperature is recommended in the *CEQR Technical Manual* for the Borough of the Bronx and is consistent with current DEP guidance. Since ambient temperature mostly affects CO emissions, this temperature, calculated based on the latest guidance from EPA and DEC, represents the average temperature measured during the 10 highest 8-hour CO events measured at DEC monitoring stations.

Road Dust

The contribution of re-entrained road dust to PM₁₀ concentrations, as presented in the PM₁₀ SIP, is considered to be significant; therefore, the PM₁₀ emission estimates include both exhaust and re-entrained road dust. Road dust emission factors were calculated according to the latest

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

² 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).

procedure delineated by EPA.¹ For the PM_{2.5} microscale analyses fugitive road dust was calculated to be negligible (zero) based on the current EPA protocol for determining fugitive dust emissions from paved roads.

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 13, “Traffic and Parking”). Traffic data for the future without and with the proposed project were employed in the respective air quality modeling scenarios. The weekday evening (4:30 to 5:30 PM) and Saturday midday (1 to 2 PM) peak periods were analyzed. These time periods were selected for the mobile source analysis because they produce the maximum anticipated project-generated and future Build traffic and, therefore, have the greatest potential for significant air quality impacts.

For particulate matter, the projected weekday and weekend peak period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the existing condition and in the future without the proposed project, 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 MODELS FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets near the project site, resulting from vehicle emissions, were predicted using the CAL3QHC model Version 2.0.² 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 CAL3QHC modeling.

To determine motor vehicle generated PM concentrations adjacent to streets near the proposed project, the CAL3QHCR model was applied. This refined version of the model can utilize

¹ 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>, November 2006.

² *User's Guide to CAL3QHC, A Modeling Methodology for Predicted Pollutant Concentrations Near Roadway Intersections*, Office of Air Quality, Planning Standards, EPA, Research Triangle Park, North Carolina, Publication EPA-454/R-92-006.

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 2002-2006. 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 2013, the year by which the proposed project is expected to be completed. The future analysis was performed both without the proposed project (the No Build condition) and with the proposed project (the Build condition).

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.

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

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The 8-hour average background concentration used in the analysis was 2.2 ppm, which is based on the highest second-highest 8-hour measurements over the most recent three-year period for which complete monitoring data are available (2005-2007), utilizing measurements obtained at the Botanical Gardens monitoring station. The 1-hour CO background used in the analysis was 3.5 ppm.

The I.S. 52 monitoring station is the closest location to the proposed project where DEC collected PM₁₀ data in recent years. Therefore, a background value of 48 µg/m³ used in the analysis represents the maximum second-highest PM₁₀ 24-hour background concentration measured over the most recent period for which a complete data set is available (2003–2004 and 2007) at the I.S. 52 monitoring station.

MOBILE SOURCE ANALYSIS SITES

A total of three analysis sites were selected for microscale analysis (see **Table 15-2** and **Figure 15-1**). 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 the concentrations would be expected. Each of these intersections was analyzed for CO.

Table 15-2
Mobile Source Analysis Intersection Locations

Receptor Site	Location
1	Kingsbridge Road and University Avenue
2	Kingsbridge Road and Reservoir Avenue
3	W. Fordham Road and University Avenue

For the PM₁₀ and PM_{2.5} analyses, the Site 2 (Kingsbridge Road and Reservoir Avenue) intersection was analyzed. The Site 2 intersection was selected for particulate matter analysis as the location with the greatest potential to result in impacts on air quality, based on the review of overall project-generated traffic, project-generated truck traffic, and overall future traffic volumes in the 2013 analysis year.

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. Receptors were placed at sidewalk or roadside locations near intersections with continuous public access. 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 procedure for neighborhood-scale corridor PM_{2.5} modeling.

PARKING FACILITIES

The proposed project would result in the operation of a 400-space underground accessory parking garage located on the project site. The outlet air from the garage's ventilation systems could contain elevated levels of CO due to emissions from vehicular exhaust emissions in the garage. The ventilation air could potentially affect ambient levels of CO at locations near the outlet vents. An analysis of the emissions from the outlet vents and their dispersion in the

environment was performed, calculating pollutant levels in the surrounding area, using the methodology set forth in the *CEQR Technical Manual*.

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°F, as referenced in the *CEQR Technical Manual*. All arriving and departing vehicles were conservatively assumed to travel at an average speed of 5 miles per hour within the parking garages. In addition, all departing vehicles were assumed to idle for 1 minute before exiting. The concentration of CO within the garage was calculated assuming a minimum ventilation rate, based on New York City Building Code requirements, of 1 cubic foot per minute of fresh air per gross square foot of garage area. To determine compliance with the NAAQS, CO concentrations were predicted for the maximum 8-hour average period. (No exceedances of the 1-hour standard would occur and the 8-hour values are the most critical for impact assessment.)

To determine pollutant concentrations, the outlet vents were analyzed as a “virtual point source” using the methodology in EPA’s *Workbook of Atmospheric Dispersion Estimates, AP-26*. This methodology estimates CO concentrations at various distances from an outlet vent by assuming that the concentration in the garage is equal to the concentration leaving the vent, and determining the appropriate initial horizontal and vertical dispersion coefficients at the vent faces.

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 conservatively assumed to be operating in a “cold-start” mode, emitting higher levels of CO than arriving vehicles. Traffic data for the parking garage analysis were derived from the trip generation analysis described in Chapter 13, “Traffic and Parking”.

The air from the parking garage would be vented through two outlets at a height of approximately 50 feet. The vent face was modeled to directly discharge to West 195th Street. Receptors were placed along the sidewalks on both sides of the street (both near the vent and across the street) at a pedestrian height of 6 feet and at a distance 88 feet and 173 feet, respectively, from the vent. A persistence factor of 0.70, supplied by DEP, 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 and on-street CO concentrations were added to the modeling results to obtain the total ambient levels. The on-street CO concentration was determined using the methodology in Air Quality Appendix 1 of the *CEQR Technical Manual*, utilizing traffic volumes from a traffic survey conducted in the study area.

STATIONARY SOURCES

A stationary source analysis was conducted to evaluate potential impacts from the proposed project’s heating, ventilation, and air conditioning (HVAC) system. A screening analysis was performed using the methodology described in the *CEQR Technical Manual* for the analysis. 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 burned, the maximum development size, and the HVAC 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 proposed project would use natural gas exclusively in the HVAC system and the stack was assumed to be located near the edge of the building’s roof with flat rooftop louvers at a height of approximately 130 feet, the reasonable worst case development scenario (as per the *CEQR Technical Manual*).

E. EXISTING CONDITIONS

EXISTING MONITORED AIR QUALITY CONDITIONS

Monitored background concentrations of SO₂, NO₂, CO, ozone, lead, PM₁₀, and PM_{2.5} for the study area are shown in **Table 15-3**. These values are the most recent monitored data that have been made available by DEC. There were no monitored violations of NAAQS at these monitoring sites, with the exception of the maximum 24-hour PM_{2.5} concentration, which is above the recently revised NAAQS.

**Table 15-3
Representative Monitored Ambient Air Quality Data**

Pollutants	Location	Units	Period	Concentration	Exceeds Federal Standard?	
					Primary	Secondary
CO	Botanical Gardens	ppm	8-hour	1.9	N	N
			1-hour	2.7	N	N
SO ₂	IS 52	ppm	Annual	0.008	N	-
			24-hour	0.036	N	-
			3-hour	0.054	-	N
PM ₁₀	IS 52	µg/m ³	24-hour	48	N	N
PM _{2.5}	Botanical Gardens	µg/m ³	Annual	13.2	N	N
			24-hour	32.5	N	N
NO ₂	Botanical Gardens	ppm	Annual	0.024	N	N
Lead	JHS 126, Brooklyn	µg/m ³	3-month	0.02	N	-
Ozone (O ₃)	Botanical Gardens	ppm	8-hour	0.076	N	N

Source: DEC, 2006 New York State Ambient Air Quality Data.

CALCULATED EXISTING CO CONCENTRATIONS

As noted previously, receptors were modeled at multiple sidewalk locations next to the analyzed intersections. CO concentrations were calculated for each receptor location, at each intersection, and each peak period analyzed. **Table 15-4** shows the maximum calculated existing CO 8-hour average concentrations for all receptor sites for any of the time periods 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.

Table 15-4
Maximum Predicted Existing (2007) 8-Hour Average CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Kingsbridge Road and University Avenue	Weekday PM	3.5
2	Kingsbridge Road and Reservoir Avenue	Weekday PM	3.5
3	W. Fordham Road and University Avenue	Weekday PM	4.1
Note: 8-hour standard is 9 ppm.			

F. FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCE ANALYSIS

CO

CO concentrations without the proposed project were determined for the 2013 analysis year, using the methodology previously described. **Table 15-5** shows future maximum predicted 8-hour average CO concentrations at the analysis intersections without the proposed project (i.e., No Build values). The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed. As shown in **Table 15-5**, No Build values are predicted to be well below the national standard of 9 ppm.

Table 15-5
Maximum Predicted Future (2013) No Build 8-Hour Average CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Kingsbridge Road and University Avenue	Weekday PM	3.3
2	Kingsbridge Road and Reservoir Avenue	Weekday PM	3.3
3	W. Fordham Road and University Avenue	Weekday PM	4.2
Note: 8-hour standard is 9 ppm.			

PM

PM concentrations without the proposed project were determined for the 2013 analysis year using the methodology previously described. **Table 15-6** presents the future maximum predicted 24-hour average PM₁₀ concentrations at the intersection analyzed without the proposed project (i.e., No Build values). The value shown is the highest predicted concentration for the receptor locations analyzed and includes the ambient background concentration. Note that PM_{2.5} concentrations without the proposed project are not presented, since impacts are assessed on an incremental basis.

Table 15-6
Maximum Predicted Future (2013) No Build
24-Hour Average PM₁₀ Concentrations

Receptor Site	Location	24-Hour Concentration (µg/m ³)
2	Kingsbridge Road and Reservoir Avenue	63.0
Note: National Ambient Air Quality Standards—24-hour, 150 µg/m ³ .		

STATIONARY SOURCE ANALYSIS

Minimal growth and development within the project site and rezoning area would occur in the future without the proposed project. HVAC emissions in the No Build condition would likely be similar to existing conditions. Consequently, air quality as affected by local sources of emissions would be anticipated to be similar to existing conditions.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

MOBILE SOURCES ANALYSIS

CO

CO concentrations with the proposed project were determined for the 2013 analysis year at traffic intersections using the methodology previously described. **Table 15-7** shows the future maximum predicted 8-hour average CO concentration with the proposed project at the three intersections studied. (No 1-hour values are shown since no exceedances of the standard 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 for all receptors for any of the time periods analyzed. The results indicate that the proposed project would not result in any violations of the 8-hour CO standard. In addition, the incremental increase in 8-hour average CO concentrations would not result in a violation of the CEQR *de minimis* CO criteria. Therefore, the proposed project would not result in any significant CO air quality impacts.

Table 15-7
Maximum Predicted Future (2013) 8-Hour Average
No Build and Build CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)	
			No Build	Build
1	Kingsbridge Road and University Avenue	Weekday PM	3.3	3.9
2	Kingsbridge Road and Reservoir Avenue	Weekday PM	3.3	4.0
3	W. Fordham Road and University Avenue	Weekday PM	4.2	4.2
Note: 8-hour standard is 9 ppm.				

PM

PM concentrations with the proposed project were determined for the 2013 analysis year using the methodology previously described. **Table 15-8** shows the future maximum predicted 24-hour average PM₁₀ concentrations with the proposed project. The values shown are the highest predicted concentrations for all locations analyzed and include the ambient background concentrations. The results indicate that the proposed project would not result in any violations of the PM₁₀ standard or any significant adverse impacts on air quality.

Table 15-8
Maximum Predicted Future (2013) 24-Hour Average No Build and Build PM₁₀ Concentrations

Receptor Site	Location	24-Hour Concentration (µg/m ³)	
		No Build	Build
2	Kingsbridge Road and Reservoir Avenue	63.0	63.7
Note: National Ambient Air Quality Standards—24-hour, 150 µg/m ³ .			

Future 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 15-9** and **15-10**, respectively. The results show that the annual and daily (24-hour) PM_{2.5} increments are predicted to be well below the interim guidance criteria and, therefore, the proposed project would not result in significant PM_{2.5} impacts at the analyzed receptor locations.

Table 15-9
Maximum Predicted Future (2013) 24-Hour Average PM_{2.5} Concentrations

Receptor Site	Location	Increment
2	Kingsbridge Road and Reservoir Avenue	0.11
Note: PM _{2.5} interim guidance criteria—24-hour average, 2 µg/m ³ (5 µg/m ³ not-to-exceed value).		

Table 15-10
Maximum Predicted Future (2013) Annual Average PM_{2.5} Concentrations

Receptor Site	Location	Increment
2	Kingsbridge Road and Reservoir Avenue	0.01
Note: PM _{2.5} interim guidance criteria—annual (neighborhood scale), 0.1 µg/m ³ .		

PARKING FACILITIES

A screening analysis was performed to assess potential impacts from the underground accessory parking garage associated with the proposed project. Based on the methodology previously discussed, the maximum overall predicted future CO concentrations, including ambient background levels and potential contributions from nearby on-street traffic, at sidewalk receptor locations, would be 4.5 ppm and 2.9 ppm for the 1- and 8-hour periods, respectively. The maximum 1- and 8-hour contributions from the parking garage alone would be 0.6 ppm and 0.4 ppm, respectively. The values are the highest predicted concentrations for any time period analyzed. The maximum predicted CO

concentrations are well below the CO NAAQS; therefore, no significant adverse impacts from the proposed project's parking garage are expected.

STATIONARY SOURCE ANALYSIS

The primary stationary source of air pollutants associated with the proposed project would be emissions from the combustion of natural gas by HVAC equipment. The primary pollutant of concern when burning natural gas is nitrogen dioxide (NO₂).

The screening methodology in the *CEQR Technical Manual* was utilized for the proposed retail development in square feet. The total square footage used in the analysis was 897,860 ft². The stack was assumed to be placed at the edge of the Armory's roof for a reasonable worst case development analysis, with flat rooftop louvers at a height of approximately 130 feet.

There were no residential buildings of a similar or greater height within a distance of 400 feet, the maximum distance in the *CEQR Technical Manual*. Therefore, this distance was used in the analysis. Burning natural gas would not result in any significant source air quality impacts because the proposed project is below the maximum development size shown in Figure 3Q-10 of the *CEQR Technical Manual*. Therefore, the proposed project would not have any significant adverse stationary source air quality impacts from the proposed HVAC systems.

H. CONCLUSIONS

Based on the analyses conducted, the proposed project would not result in any significant adverse air quality impacts on sensitive uses in the surrounding community, and the proposed project would not be adversely affected by existing sources of air emissions in the study area, as described below.

The additional traffic that would be generated by the proposed project was found to not have the potential for significant adverse impacts on air quality. Maximum CO and PM₁₀ concentrations in the future with the proposed project would not result in violations of EPA air quality standards. It was also determined that the increase in CO impacts from the additional traffic that is predicted to occur as a result of the proposed project would not exceed the allowable levels stated in the *CEQR de minimis* criteria. Increases in PM_{2.5} concentrations would also not exceed the City's PM_{2.5} interim guidance criteria. In addition, the parking garage analysis determined that the ventilation of air from the parking facilities that would be constructed would not cause any significant adverse air quality impacts. Finally, the stationary source analyses determined that there would be no potential significant adverse air quality impacts from HVAC systems at the proposed development site. *