Chapter 14: Air Quality

A. INTRODUCTION

The potential for air quality impacts from the proposed Seward Park Mixed-Use Development 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 exhaust from fossil fuel-fired heating and hot water systems. Indirect impacts are impacts that are caused by emissions from on-road vehicle trips generated by the proposed actions or other changes to future traffic conditions due to a project.

The reasonable worst-case development scenario (RWCDS) for the proposed actions would result in more than 170 peak hour vehicle trips at locations within the study area and would therefore exceed the *City Environmental Quality Review (CEQR) Technical Manual* (January 2012 edition) carbon monoxide (CO) screening threshold. In addition, the particulate matter emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual* would be exceeded in the 2022 analysis year. Therefore, a quantified assessment of the potential impacts on air quality from traffic generated by the proposed actions was conducted. The proposed actions would also include parking facilities and, therefore, an analysis was conducted to evaluate potential future CO concentrations in the vicinity of the proposed garage ventilation outlets.

The proposed actions could include natural gas burning heating and hot water systems. A refined stationary source analysis was conducted following the *CEQR Technical Manual* guidance to evaluate potential future pollutant concentrations with the heating and hot water systems.

PRINCIPAL CONCLUSIONS

As discussed below, the maximum predicted pollutant concentrations and concentration increments from mobile sources with the proposed actions would be below the corresponding guidance thresholds and ambient air quality standards. The proposed actions' parking facilities would also not result in any significant adverse air quality impacts. Based on a refined stationary source modeling analysis, there would be no potential for significant adverse air quality impacts from the heating and hot water systems for the proposed development. The only fossil fuel that would be used for heating and hot water systems at the development sites included in the proposed actions would be natural gas. This requirement will be included in the developers Request for Proposals (RFP). In addition, the RFP will specify stack placement requirements for Sites 5 and 9. The RFP requirements could be modified or eliminated in the future if additional air quality modeling shows that the requirements are not needed to meet national and local ambient air quality standards and thresholds. Future modeling could rely on information that is expected to become available as the design for the proposed sites progresses.

Therefore, there would be no potential for significant adverse impacts on air quality with the proposed actions.

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 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, 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 actions would result in changes in traffic patterns and an increase in traffic volume in the study area. In addition, new parking facilities are proposed. Therefore, a mobile source analysis was conducted at intersections in the study area that would result in a greatest change in traffic conditions, as well as for proposed parking facilities near which the greatest change in CO concentrations is expected.

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 development 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. A regional analysis of emissions of these pollutants from mobile sources associated with the proposed development 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 criteria 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.

In order to evaluate the effect of mobile source emissions due to the proposed development, predicted mobile source pollutant concentrations at affected roadways and intersections must be added to background concentrations. Community-scale monitors currently in operation can be used to represent background NO_2 conditions away from roadways, but there is substantial uncertainty regarding background concentrations at or near ground-level locations in close proximity to roadways. EPA estimates that concentrations near roadways may be anywhere from 30 to 100 percent higher than those measured at community-scale monitors. Furthermore, the existing EPA mobile source models are not capable of assessing the chemical transformation of emitted NO to NO_2 over relatively short distances (e.g., sidewalks, low-floor windows). In addition, existing EPA mobile source models are designed to provide only peak concentrations, which are not consistent with the statistical format of the 1-hour average NO_2 standard.

Given the current uncertainty regarding background concentrations at specific locations near roadways, and the lack of approved modeling protocols for the prediction of total maximum 1-hour daily 98th percentile NO_2 concentrations, as well as the lack of a benchmark for evaluating the significance of these incremental concentrations, no methodology exists that could provide reasonable predictions about concentrations from mobile sources due to the proposed development on the receptors at or near ground-level locations. The traffic associated with the proposed development is not expected to change NO_2 concentrations appreciably, since the vehicular traffic associated with the proposed development would be a small percentage of the total number of vehicles in the area. The amount of NO emitted that would rapidly transform to NO_2 in the immediate vicinity of roadways and intersections with traffic generated by the proposed development would be small. It is not known whether conditions in the future without the proposed actions will be within or in excess of the NAAQS in these near-road areas. Background concentrations are in fact expected to decrease over time and local sources would contribute an incremental amount of NO_2 to those background concentrations. The analysis limitations described above preclude the performance of an accurate quantitative assessment of the significance of the 1-hour NO_2 increments from the increase in traffic resulting from the proposed development.

Potential impacts on local NO_2 concentrations from the fuel combustion for the proposed development's heat and hot water boiler systems were evaluated following the *CEQR Technical Manual* and EPA guidance.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the Clean Air Act. No significant sources of lead are associated with the proposed development 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. 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 development would result in traffic exceeding the $PM_{2.5}$ vehicle emission screening analysis thresholds as defined in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, the potential impacts from vehicle $PM_{2.5}$ emissions were analyzed. The proposed development's heating and hot water systems would use exclusively natural gas for which NO_2 is the primary pollutant of concern as per the *CEQR Technical Manual*. Therefore, an analysis of PM emissions from heating and hot water systems is not warranted.

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 heat and hot water systems of the proposed development. The sulfur content of natural gas is negligible; therefore, an analysis for SO_2 from the heat and hot water systems was not warranted.

NONCRITERIA POLLUTANTS

In addition to the criteria pollutants discussed above, non-criteria pollutants may be of concern. Non-criteria pollutants are emitted by a wide range of man-made and naturally occurring sources. These pollutants are sometimes referred to as hazardous air pollutants (HAP) and when emitted from mobile sources, as Mobile Source Air Toxics (MSATs). Emissions of non-criteria pollutants from industries are regulated by EPA. No major sources of non-criteria pollutants will

be associated with the proposed actions; therefore an analysis of non-criteria pollutants was not warranted.

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 14-1**. 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 noncriteria pollutants beryllium, fluoride, and hydrogen sulfide (H_2S).

EPA revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008.

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

EPA established a 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.

Federal ambient air quality standards do not exist for noncriteria pollutants; however, the New York State Department of Environmental Conservation (NYSDEC) has issued standards for three noncriteria compounds. NYSDEC has also developed a guidance document DAR-1 (October 2010), which contains a compilation of annual and short term (1-hour) guideline concentrations for numerous other noncriteria compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure.

Table 14-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [1]	9	10,000	None	
1-Hour Average [1]	35	40,000		
Lead				
Rolling 3-Month Average [2]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [3]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [4]	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	NA	15	NA	15
24-Hour Average [5]	NA	35	NA	35
Sulfur Dioxide (SO_2) [6]				
1-Hour Average [7]	0.075	197	NA	NA
Maximum 3-Hour Average [1]	NA	NA	0.50	1,300

Notes:
ppm – parts per million (unit of measure for gases only)
µg/m^3 – micrograms per cubic meter (unit of measure for gases and particles, including lead)
NA – not applicable
All annual periods refer to calendar year.
Standards are defined in ppm. Approximately equivalent concentrations in µg/m3 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] Not to be exceeded by the annual 98th percentile when averaged over 3 years.
[6] EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.
[7] 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.

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

The CAA, as amended in 1990, defines non-attainment areas (NAAs) as geographic regions that have been designated as not meeting one or more of the NAAQS. When an area is designated as non-attainment by EPA, the state is required to develop and implement a State Implementation

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

In 2002, EPA re-designated New York City as in attainment for CO. The Clean Air Act requires that a maintenance plan ensure continued compliance with the CO NAAQS for former NAAs. 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 PM_{10}. On December 17, 2004, EPA took final action designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ NAA under the Clean Air Act due to exceedance of the annual average standard. Based on recent monitoring data (2007-2010), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. EPA has determined that the area has attained the 1997 $PM_{2.5}$ NAAQS, effective December 15, 2010.

In October 2009 EPA finalized the designation of the New York City Metropolitan Area as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS, effective in November 2009. The nonattainment area includes the same 10-county area originally designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2008-2010), 24-hour average concentrations of $PM_{2.5}$ in this area no longer exceed the annual standard. New York has submitted a "Clean Data" request to the USEPA. Any requirement to submit a SIP is stayed until EPA acts on New York's request.

The five New York City counties, Nassau, Rockland, Suffolk, Westchester, and Lower Orange County Metropolitan Area (LOCMA) counties had been designated as a severe NAA 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. On January 25, 2012, EPA proposed to determine that the New York Metropolitan Area (NYMA) has attained the standard. Although this is not yet a redesignation to attainment status, this determination would remove further requirements under the 1-hour standard.

On April 15, 2004, EPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard. On February 8, 2008, NYSDEC submitted final revisions to the SIP to EPA to address the 1997 8-hour ozone standard. On January 25, 2012, EPA proposed to determine that the NYMA has attained the 1997 8-hour ozone NAAQS (0.08 ppm).

In March 2008 EPA strengthened the 8–hour ozone standards. SIPs will be due three years after the final designations are made. On March 12, 2009, NYSDEC recommended that the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester be designated as a NAA for the 2008 ozone NAAQS (NY portion of the New York–Northern New Jersey–Long Island, NY-NJ-CT NAA). EPA has agreed, under consent decree, to promulgate area designations for the 2008 ground-level ozone NAAQS no later than May 31, 2012.

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" in January 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. Additional monitoring will be required. EPA plans to make final attainment designations in June 2012, based on 2008 to 2010 monitoring data and refined modeling. SIPs for nonattainment areas will be due by June 2014.

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 14-1**) would be deemed to have a potential significant adverse impact. Similarly, for non-criteria pollutants, a predicted exceedance of the DAR-1 guideline concentrations would be considered 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.

$PM_{2.5}$ INTERIM GUIDANCE CRITERIA

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts.[2] This policy applies only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the

[1] *CEQR Technical Manual*, Chapter 17, section 400, May 2010; and State Environmental Quality Review Regulations, 6 NYCRR § 617.7.

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

impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

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

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

The annual emissions of PM_{10} associated with the proposed development are estimated to be well below the 15-ton-per-year threshold under NYSDEC's $PM_{2.5}$ policy guidance. The above CEQR interim guidance criteria were used to evaluate the significance of predicted impacts of the proposed development on $PM_{2.5}$ concentrations and determine the need to minimize particulate matter emissions from the proposed development.

D. METHODOLOGY

MOBILE SOURCES

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

The mobile source analysis for the proposed actions employs 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 actions. The assumptions used in the analysis are based on the *CEQR Technical Manual* guidance.

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO, PM_{10}, and $PM_{2.5}$ engine emission factors were computed using the EPA mobile source emissions model, MOBILE6.2.[1] This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOBILE6.2 incorporate the most current guidance available from NYSDEC and the New York City Department of Environmental Protection (NYCDEP).

Vehicle classification data were based on field studies and data collected in the field. The general categories of vehicle types for specific roadways were further categorized into subcategories based on their prevalence within the fleet.[2] An ambient temperature of 50.0° Fahrenheit was used. The use of this temperature is recommended in the *CEQR Technical Manual* for Manhattan and is consistent with current NYCDEP guidance.

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 comply with emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

In accordance with the *CEQR Technical Manual* guidance, PM_{10} and $PM_{2.5}$ emission rates also include fugitive road dust in the analysis of local microscale impacts.[3] However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analysis, since NYCDEP considers it to have an insignificant contribution on that scale.

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 actions (see Chapter 13, "Transportation"). Traffic data for the future without and with the proposed actions were employed in the respective air quality modeling scenarios. The weekday, midday (1:00 PM to 2:00 PM), and evening (5:15 PM to 6:15 PM) peak hour traffic volumes

[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).

[3] 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, December 2003.

were analyzed. These time periods were selected for the mobile source analysis because they produce the maximum anticipated project-generated traffic and, therefore, have the greatest potential for significant air quality impacts.

For particulate matter, the peak midday and evening period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the future with and without the proposed actions were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations.

Dispersion Model for Microscale Analyses

Maximum CO concentrations adjacent to the analysis sites resulting from vehicular emissions were predicted using the CAL3QHC model Version 2.0.[1] 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_{10} and $PM_{2.5}$ concentrations on sidewalks near the project site, the CAL3QHCR model was applied. This is a refined version of the CAL3QHC model Version 2.0.[2] The CAL3QHCR model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHCR predicts emissions and dispersion of $PM_{2.5}$ 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 predict the number of idling vehicles. The CAL3QHCR model can utilize hourly traffic and meteorological data, and is therefore 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

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[1] 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.

[2] 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.

stability accounts for the effects of vertical mixing in the atmosphere. These factors, therefore, influence the concentration at a particular prediction location (receptor). 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 0.79 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.

Using the CAL3QHCR model, hourly concentrations were predicted based on hourly traffic data and five years (2005-2009) of monitored hourly meteorological data. The data consist of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

Analysis Year

The microscale analyses were performed for 2022, the year by which the proposed development would be constructed. The analysis was performed both without the proposed actions (the No Action condition) and with the proposed actions (the With Action 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 are added to modeling results to obtain total pollutant concentrations at an analysis site. The 1-hour and 8-hour CO background concentrations used in this analysis, which were based on the second-highest concentrations recorded at the DEC Queens College 2 monitoring station from 2006 to 2010, were 3.4 ppm and 2.0 ppm, respectively. The monitoring station at Queens College is the closest monitoring station to the project site that has available recorded data over a recent 5-year period.

The PM_{10} 24-hour background concentration of 52 $\mu g/m^3$ was based on the second-highest concentration, measured over the most recent three-year period for which complete data are available (2008–2010). The nearest NYSDEC monitoring site, at Division Street, was used. $PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ interim guidance criteria. Therefore, a background concentration for $PM_{2.5}$ is not included.

Analysis Sites

Two intersections near the project site were selected for microscale analysis (see **Table 14-2**). Consistent with the *CEQR Technical Manual,* these sites were selected because they are the locations in the study area where the projected number of vehicles generated due to the proposed actions would exceed the *CEQR Technical Manual* threshold of 170 vehicles. Site 1 also has the

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

highest level of project-generated traffic and, therefore, where the greatest air quality impacts and maximum changes in concentrations would be expected. The greatest number of overall project generated trips is expected during the weekday midday and PM peak periods. The potential impact from vehicle emissions of CO, PM_{10}, and $PM_{2.5}$ was analyzed for each of these intersections.

Table 14-2
Mobile Source Analysis Sites

Analysis Site	Location	Peak Periods Analyzed
1	Delancey Street at Norfolk Street	Midday and PM
2	Grand Street at Norfolk Street	Midday 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. Receptors were placed at sidewalk or roadside locations near intersections with continuous public access and at elevated residential locations. Receptors in the analysis model 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 *CEQR Technical Manual* procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

PARKING FACILITIES

The proposed actions would include a number of new accessory parking facilities on Sites 2–5, and they are assumed to be enclosed mechanically ventilated garages. Emissions from vehicles using the proposed garages could potentially affect ambient levels of CO in the immediate vicinity of the ventilation outlets. Projected parking facility capacity and the peak hour arrivals and departures were used to identify the parking facilities most likely to result in impacts on local air quality. The garages at Site 2 and the adjacent Site 3 were selected for the analysis. There are no mechanical designs for these proposed parking garages. Therefore, it was conservatively assumed that each of the proposed garages analyzed would have one vent that would exhaust air onto Norfolk Street, i.e., that the vents for the two garages analyzed would be facing each other, potentially affecting the same sidewalk receptors. Representative receptor locations on the proposed buildings were also modeled.

The analysis of emissions from the outlet vents and their dispersion was performed using the methodology set forth in the *CEQR Technical Manual*. The CO concentrations were determined for the time periods when overall garage usage would be the greatest, considering the hours when the greatest number of vehicles would exit the facility. Departing vehicles were assumed to be operating in a "cold-start" mode, emitting higher levels of CO than arriving vehicles. Traffic data for the parking garage analysis were based on analyses described in Chapter 13, "Transportation."

Emissions from vehicles entering, parking, and exiting the garages were estimated using the EPA MOBILE6.2 mobile source emission model and an ambient temperature of 50°F, as referenced in the *CEQR Technical Manual*. For all arriving and departing vehicles, an average speed of 5 miles per hour was conservatively assumed for travel within the parking garages. In

addition, all departing vehicles were assumed to idle for 1 minute before proceeding to the exit. The concentration of CO within the garages 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 and 1-hour averaging periods.

To determine pollutant concentrations, the outlet vents were analyzed as "virtual point sources" 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.

A persistence factor of 0.79 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 and concentrations from on-street traffic were added to the parking garage modeling results to obtain the total ambient CO levels.

STATIONARY SOURCES

HEATING AND HOT WATER SYSTEMS

Development pursuant to the proposed actions would use natural gas as fuel for heating and hot water systems, as will be required in the RFP. Per the guidance presented in the *CEQR Technical Manual* for natural gas burning sources, NO_2 was the only pollutant considered in the dispersion analysis. Future concentrations of 1-hour average and annual average NO_2 resulting from the proposed heating and hot water system emissions were predicted using the EPA/AMS AERMOD dispersion model.[1]

AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated 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

[1] EPA, AERMOD: Description Of Model Formulation, 454/R-03-004, September 2004; and

EPA, User's Guide for the AMS/EPA Regulatory Model AERMOD, 454/B-03-001, September 2004 and Addendum December 2006.

entrained in a recirculation region). The Building Profile Input Program (BPIP) program for the PRIME model (BPIPRM) was used to determine the projected dimensions of the proposed buildings 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.

The analysis was based on the maximum building envelopes for the nine development sites. The maximum building envelope is the three-dimensional space on the zoning lot within which a structure can be built, as permitted by applicable height, setback, and yard controls. The analysis was performed both with and without downwash in order to assess the worst-case impacts at elevated receptors close to the height of the sources, which would occur without downwash, as well as the worst-case impacts at lower elevations and ground level, which would occur with downwash.

For the analysis of the effect of the proposed development on 1-hour average NO_2 concentrations, the Plume Volume Molar Ratio Method (PVMRM) module was applied within AERMOD, following EPA's modeling guidance.[1] PVMRM analyzes chemical transformation of NO emitted from the stack to NO_2. The PVMRM module incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. Ozone concentrations were obtained from the NYSDEC Queens College monitoring station, which is the station with recent ozone data nearest to the project site. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust was assumed for the proposed development's heat and hot water systems. This ratio is appropriate for boilers per EPA guidance.[2]

Total hourly NO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the detailed hourly ambient NO_2 concentrations measured at the Queens College monitoring station for each corresponding hour. Then, the highest combined daily 1-hour NO_2 concentration was determined at each receptor location for each day. The 8th highest daily concentration (98th percentile) for each modeled year at any receptor was calculated by the model. The 5-year average of the 8th highest concentrations was then compared with the 1-hour NO_2 NAAQS standard.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at LaGuardia Airport (2006–2010) 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 that 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.

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

[2] MACTEC for Alaska Department of Environmental Conservation, Evaluation of Bias in AERMOD-PVMRM, June 2005 http://www.epa.gov/scram001/7thconf/aermod/pvmrm_bias_eval.pdf;
San Joaquin Valley, Recommended In-stack NO_2/NOx Ratios,
http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm.

Background Concentrations

As with mobile sources, to estimate the maximum expected pollutant concentration at a given location (receptor), the predicted impacts from stationary sources must be added to a background value that accounts for pollutant concentrations from other sources that are not directly accounted for in the model. The annual NO_2 background value used is 67.8 $\mu g/m^3$, based on the maximum annual average value measured at the Queens College 2 monitoring station, over the most recent five years for which hourly NO_2 data at that station were collected (2006-2010). For comparison with the 1-hour NO_2 standard, total hourly NO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the detailed hourly ambient NO_2 concentrations measured at the Queens College 2 monitoring station for each corresponding hour.

Receptor Placement

Discrete receptors (i.e., locations at which concentrations are calculated) were placed along the maximum building envelopes of the development sites (to approximate the facades of buildings constructed pursuant to the proposed actions) and on nearby buildings for the stationary source modeling analysis. The model receptor network consisted of operable windows, intake vents, and otherwise accessible locations such as terraces. Rows of receptors were placed in the model at spaced intervals at multiple elevations.

Emission Estimates and Stack Parameters

A project-specific heat and hot water system design is not available as this Draft Generic Environmental Impact Statement (DGEIS) analyzes a RWCDS and not a specific building design or program. Therefore, fuel consumption was estimated based on procedures outlined in the *CEQR Technical Manual*. Emission rates for the heating and hot water systems for the development sites were projected using the proposed development size (square feet) by use, fuel consumption rates provided in the *CEQR Technical Manual* and EPA's *Compilation of Air Pollutant Emission Factors (AP-42)*[1] for combustion of natural gas. Typical stack parameters for exhaust velocity, diameter, and temperature were determined based on expected heat and hot water systems ratings associated with the calculated fuel usage rates. Emission rates and stack parameters are provided in **Table 14-3**.

[1] EPA, Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, http://www.epa.gov/ttn/chief/ap42.

Table 14-3
Emission Rates and Stack Parameters for Proposed Sites

Site No.	Total Residential (gsf)	Total Commercial (gsf)	Fuel Consumption (Mcf/year)	Annual NO_x (g/s)	Short Term NO_x (g/s)	Stack diameter (m)	Stack Velocity (m/s)	Stack Height (m)
1	74,951	65,731	7.36	1.06E-02	3.86E-02	0.3048	7.8	57.9
2	97,450	257,750	17.35	2.50E-02	9.11E-02	0.4572	7.2	96.0
3	168,239	86,019	13.73	1.97E-02	7.21E-02	0.4572	7.2	57.9
4	256,663	89,688	19.07	2.74E-02	1.00E-01	0.4572	7.2	88.4
5	229,603	81,855	17.13	2.46E-02	8.99E-02	0.4572	7.2	57.9
6	88,101	33,925	6.69	9.62E-03	3.51E-02	0.3048	7.8	57.9
8	37,862	8,790	2.61	3.76E-03	1.37E-02	0.3048	7.8	25.3
9	75,361	18,807	5.26	7.56E-03	2.76E-02	0.3048	7.8	37.5
10	20,402	6,240	1.48	2.12E-03	7.75E-03	0.3048	7.8	25.3

Notes:
The uses modeled as residential include residents and hotel uses. The uses modeled as commercial include retail, office, public market, and community facility.
Site 7 is not included as no new development is proposed on that site.
The exhaust temperature modeled for all proposed sites is 307.8 ºF.

E. EXISTING CONDITIONS

Representative criteria pollutant concentrations measured in recent years at NYSDEC air quality monitoring stations nearest to the project site are presented in **Table 14-4**. The values presented are consistent with the NAAQS format. For example, the 8-hour ozone concentration shown is the 3-year average of the 4th highest daily maximum 8-hour average concentrations. The concentrations were obtained from the 2010 New York State Ambient Air Quality Report, the most recent report available. As shown in **Table 14-4**, the recently monitored levels did not exceed the NAAQS.

Table 14-4
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Queens College 2, Queens	ppm	8-hour	1.7	9
			1-hour	3.4	35
SO_2	Queens College 2, Queens[1]	µg/m^3	3-hour	65	1,300
			1-hour	78.2	196
PM_{10}	Division Street, Manhattan	µg/m^3	24-hour	43	150
$PM_{2.5}$	Division Street, Manhattan	µg/m^3	Annual	10.9	15
			24-hour	28	35
NO_2	Queens College 2, Queens[2]	µg/m^3	Annual	67.7	100
			1-hour	129.8	188
Lead	J.H.S. 126, Brooklyn	µg/m^3	3-month	0.019	0.15
Ozone	Queens College 2, Queens	ppm	8-hour	0.074	0.075

Notes:
(1) The 1-hour value is based on a three-year average (2008-2010) of the 99th percentile of daily maximum 1-hour average concentrations.
(2) The 1-hour value is based on a three-year average (2008-2010) of the 98th percentile of daily maximum 1-hour average concentrations.
Source: NYSDEC, New York State Ambient Air Quality Report (2008-2010).

F. THE FUTURE WITHOUT THE PROPOSED ACTIONS

MOBILE SOURCES

CARBON MONOXIDE

CO concentrations without the proposed actions were determined for the 2022 With Action year using the methodology previously described. **Table 14-5** shows future maximum predicted 8-hour average CO concentrations, including background concentrations, at the analyzed intersections in 2022 without the proposed actions. The values shown are the highest predicted concentrations at any receptor location for each of the time periods analyzed.

As shown in **Table 14-5**, 2022 CO concentrations without the proposed actions are predicted to be well below the 8-hour CO standard of 9 ppm.

Table 14-5
Future (2022) Maximum Predicted 8-Hour Average
CO Concentrations Without the Proposed Actions (ppm)

Receptor Site	Location	Time Period	8-Hour Concentration
1	Delancey Street at Norfolk Street	PM	4.5
2	Grand Street at Norfolk Street	PM	2.5
Note: 8-hour standard (NAAQS) is 9 ppm.			

PARTICULATE MATTER

PM_{10} concentrations without the proposed actions were determined for the 2022 With Action year using the methodology previously described. **Table 14-6** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2022 without the proposed actions. The values shown are the highest predicted concentrations for the receptor locations.

Table 14-6
Future (2022) Maximum Predicted 24-Hour Average
PM_{10} Concentrations Without the Proposed Actions ($\mu g/m^3$)

Receptor Site	Location	Concentration
1	Delancey Street at Norfolk Street	90.1
2	Grand Street at Norfolk Street	57.5
Note: NAAQS—24-hour average 150 $\mu g/m^3$.		

STATIONARY SOURCES

Without the proposed actions, there would be no new buildings constructed by 2022 on the project site.

Stationary source emissions from existing sources in the area would decrease with the phased implementation of State and local laws to restrict the use of No. 6 and No. 4 fuel oil for heating, and lower the sulfur content of No. 2 fuel oil. With the implementation of New York State and

New York City regulations that would require the use of cleaner fuels for heat and hot water, an overall improvement in air quality is anticipated.

G. PROBABLE IMPACTS OF THE PROPOSED ACTIONS

MOBILE SOURCES

CARBON MONOXIDE

CO concentrations with the proposed actions were determined for the 2022 With Action year using the methodology previously described. **Table 14-7** shows the future maximum predicted 8-hour average CO concentrations with and without the proposed actions at the intersections analyzed. (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 represent the highest predicted concentrations for any of the receptors analyzed and include the 8-hour CO ambient background concentration.

The results indicate that the proposed actions would not result in any violations of the 8-hour CO standard. In addition, the increments in 8-hour average CO concentrations are small and consequently would not exceed the *de minimis* CO criteria. (The *de minimis* criteria are described above in Section C, "Air Quality Regulations, Standards, and Benchmarks.")

Table 14-7
Future (2022) Maximum Predicted 8-Hour Average CO Concentrations With and Without the Proposed Actions (ppm)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)			
			Without the Project	With the Project	Increment	*De Minimis*
1	Delancey Street at Norfolk Street	PM	4.5	4.7	0.2	2.3
2	Grand Street at Norfolk Street	PM	2.5	2.7	0.2	3.3
Notes: 8-hour standard (NAAQS) is 9 ppm.						

PARTICULATE MATTER

Using the methodology previously described, PM_{10} concentrations with and without the proposed actions were determined for the 2022 With Action year. The values shown in **Table 14-8** are the highest predicted concentrations for all receptors analyzed and include the PM_{10} ambient background concentration. The results indicate that the vehicle trips generated by the proposed actions would not result in PM_{10} concentrations that would exceed the NAAQS.

Table 14-8
Future (2022) Maximum Predicted 24-Hour Average PM_{10} Concentrations With and Without the Proposed Actions ($\mu g/m^3$)

Receptor Site	Location	No Build	Build
1	Delancey Street at Norfolk Street	90.1	91.5
2	Grand Street at Norfolk Street	57.5	58.3
Note: The National Ambient Air Quality Standard for PM_{10} is 150 $\mu g/m^3$, for a 24-hour average.			

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 actions. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Table 14-9** and **Table 14-10**, respectively. $PM_{2.5}$ concentrations without the proposed actions are not presented, since impacts are assessed on an incremental basis.

Table 14-9
Maximum Predicted 24-Hour Average $PM_{2.5}$ Increments ($\mu g/m^3$)

Receptor Site	Location	Increment
1	Delancey Street at Norfolk Street	0.4
2	Grand Street at Norfolk Street	0.2
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, 2 $\mu g/m^3$ (5 $\mu g/m^3$ not-to-exceed value).		

Table 14-10
Maximum Predicted Annual Average $PM_{2.5}$ Increments ($\mu g/m^3$)

Receptor Site	Location	Increment
1	Delancey Street at Norfolk Street	0.005
2	Grand Street at Norfolk Street	0.004
Note: $PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 $\mu g/m^3$.		

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

PARKING GARAGES

The CO levels from the proposed parking garages were predicted using the methodology set forth in the *CEQR Technical Manual*. Based on the projected parking demand developed for the proposed actions, the number of vehicles entering and exiting the garages would be greatest during the weekday PM (5 PM to 6 PM) and Saturday (4 PM to 5 PM) peak hours. Over the peak weekday 8-hours of garage usage, 12 PM to 8 PM, an average of 47 vehicles per hour would enter the proposed garage at Site 2, while an average of 52 vehicles per hour would exit. Over the same 8-hours, an average of 16 vehicles per hour would enter the proposed garage at Site 3, while an average of 17 vehicles per hour would exit. To account for emissions from local on-street traffic, the With Action weekday PM peak hour traffic (1,032 vehicles) and With Action Saturday peak hour traffic (953 vehicles) along Norfolk Street, between Broome and Delancey Streets, were included in the analysis. The *CEQR Technical Manual* methodology was used to calculate concentrations.

The vent for each of the garages was modeled at a height of 10 feet above ground level, along Norfolk Street, between Broome and Delancey Streets. Pollutant levels were 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. Receptors (locations where CO levels were predicted) were also modeled along the Norfolk Street sidewalks.

The maximum predicted CO concentration from a single garage, with ambient background, and on-street traffic levels would be 6.4 ppm for the 1-hour period, and 3.8 ppm for the 8-hour

period. The maximum 1- and 8-hour contributions from the parking garage alone would be 2.6 ppm and 1.4 ppm, respectively. The maximum 1- and 8-hour contributions from on-street traffic would be 0.5 ppm for the 1-hour period, and 0.4 ppm for the 8-hour period. Maximum potential cumulative impacts from the two garages would be 6.6 ppm for the 1-hour period, and 3.9 ppm for the 8-hour period. These maximum predicted CO levels would be in compliance with the applicable CO federal ambient air quality standards and the CO *de minimis* criteria. As these results show, the proposed parking garages would not result in any significant adverse air quality impacts based on the RWCDS assumptions regarding the locations of the garage exhaust vents. Therefore, there would be no potential for significant adverse impacts on air quality with parking garage mechanical designs and exhaust locations that comply with applicable codes.

There would be no potential for significant adverse impacts from any mobile source emissions generated by the proposed actions. The proposed actions would not affect regional traffic or air quality and, therefore, the proposed actions would be consistent with the State Implementation Plan for each pollutant of concern.

STATIONARY SOURCES

A detailed dispersion analysis was performed to assess the potential for air quality impacts from the emissions from the heat and hot water systems at the development sites using the AERMOD model. This analysis determined the need for stack restrictions on Sites 9 and 5 as described below. Therefore, the following requirements will be specified in the RFP:

- Natural gas shall be used for fossil-fuel fired heating and hot water equipment on all of the proposed development sites.
- To preclude the potential for air quality impacts from natural gas-fired heating and hot water systems of a new building on Site 5, the stack(s) shall be located at the highest rooftop of the building and at least 90 feet away from the lot line facing Broome Street.
- To preclude the potential for air quality impacts on existing and proposed buildings on the same block as Site 9, stack(s) associated with natural gas-fired heat and hot water systems for the building on Site 9 shall be located at the highest rooftop of the building and at least 70 feet away from any building of a similar of greater height.
- In lieu of the requirements described above, an analysis demonstrating that national and local ambient air quality standards and thresholds would be met using an alternative stack configuration and/or a different fuel type may be performed. Such an analysis could consider information regarding emissions from the heating and hot water systems, emission controls, and projected heat and hot water demand specific to the proposed development. It is expected that such site specific information would become available as the design of the proposed sites progresses.

With the above requirements in place, the calculated concentrations for NO_2 are presented in **Table 14-11**, along with the relevant background concentrations, the total potential concentrations, and the applicable ambient standards. The annual average NO_2 impacts from the proposed development were conservatively calculated assuming that all of the NO emitted by the heat and hot water systems of the proposed development was fully transformed to NO_2 (100 percent conversion). The highest annual average concentration at any receptor over the 5-year modeling period is reported in **Table 14-11**. For the analysis of 1-hour impacts, the PVMRM module was applied and hourly background NO_2 data were added within the model. The highest combined daily 1-hour NO_2 concentration was determined at each receptor location for each day.

The 8th highest (98th percentile) of the daily 1-hour maximum concentration for each modeled year was then calculated within the model. The 98th percentile concentrations were averaged over five years at each receptor, in accordance with EPA guidance for addressing the NO_2 1-hour standard and the maximum 5-year average value at any receptor is reported in **Table 14-11**.

Table 14-11
Potential Future NO_2 Concentrations
From the Heat and Hot Water Systems ($\mu g/m^3$)

Pollutant	Averaging Period	Project Increment	Background Concentration	Total Concentration	NAAQS
NO_2	Annual [1]	2.2	67.7	71	100
	1-hour [2]	N/A	N/A	132	188

Notes:
[1] Total hourly NO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the hourly ambient NO_2 concentrations for each corresponding hour. The total 1-hour concentration reported is the five-year average of the annual 98th percentile of the highest combined daily 1-hour NO_2 concentrations, in accordance with EPA guidance.
[2] The annual modeled NO_2 concentration was conservatively reported to be equal to the NO_x concentration. The increment presented is the highest concentration at any receptor over the five years modeled (2006-2010).

As shown in **Table 14-11**, the maximum potential increase in concentrations associated with the proposed development's heat and hot water systems when added to background concentrations would be less than the NAAQS. Therefore, the proposed development's heat and hot water systems would not have the potential for significant adverse impacts on air quality.

With the use of natural gas for fossil fuel-fired heating systems and the required locations of exhaust stacks for proposed buildings on Site 9 and Site 5, there would be no potential for significant adverse impacts on air quality from the proposed actions. These requirements would be included in the developers RFP. ✷