Chapter 5: Air Quality

A. INTRODUCTION

The potential for air quality impacts from the proposed actions is examined in this chapter.

As discussed in Chapter 8, "Mitigation," with implementation of the proposed traffic mitigation measures, the proposed actions would not significantly alter traffic conditions. The maximum hourly incremental traffic from the proposed actions would not exceed the 2014 *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) screening threshold of 170 auto trips for peak hour trips at nearby intersections in the study area, nor would it exceed the particulate matter (PM) emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. In terms of emissions of NO_2 from mobile sources, the increases in NO_2 concentrations are primarily due to relatively small increases in the number of vehicles (as compared to existing or No-Action traffic in the study area). This increase would not be expected to significantly affect levels of NO_2 experienced near roadways without the proposed project. Therefore, the changes in traffic introduced by the proposed actions would not have the potential to significantly change air quality conditions, and a quantified assessment of emissions from project generated traffic is not warranted.

The proposed actions would increase the overall number of parking spaces provided on the project site by 239 spaces (from an existing 1,414 spaces to the proposed 1,653 spaces); therefore, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the surface parking lot.

The proposed actions would include fuel fired heating systems. Therefore, a stationary source analysis was conducted to evaluate potential future pollutant concentrations with the proposed systems.

PRINCIPAL CONCLUSIONS

This chapter examined the potential effect of the proposed parking expansion and fuel fired heating systems associated with the proposed project. The analysis for the parking expansion and heating systems determined that there would not be any potential significant adverse air quality impacts from the proposed actions. Since the proposed project would not exceed thresholds for mobile source analyses, no mobile source analysis is required, and the proposed project would not have any significant impact on air quality from mobile sources. Overall, the project would not have any significant adverse impact on air quality.

B. POLLUTANTS FOR ANALYSIS

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. 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 some sources utilizing non-road diesel such as large international marine engines. On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs. Ambient concentrations of CO, PM, NO_2, SO_2, ozone, and lead are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act (CAA), and are referred to as 'criteria pollutants'; emissions of VOCs, NO_x, and other precursors to criteria pollutants are also regulated by EPA.

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. CO concentrations can diminish rapidly 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 analyzed on a local, or microscale basis.

The proposed actions are not expected to significantly alter traffic conditions. Since the proposed actions would result in fewer new peak hour vehicle trips than the *CEQR Technical Manual* screening threshold of 170 trips at nearby intersections in the study area, a quantified assessment of mobile source CO emissions is not warranted. However, an analysis was conducted to evaluate future CO concentrations from the proposed expansion of the surface parking lot.

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.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and is not a local concern from mobile sources. (NO_x emissions from fuel combustion are typically greater than 90 percent NO with the remaining fraction primarily NO_2 at the source.[1]) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources

[1] EPA. Compilation of Air Pollutant Emission Factors, AP-42. Fifth Edition, Volume I: *Stationary Point and Area Sources*, Section 1.3, Table 1.3-1.

such as mobile sources become of greater concern for this pollutant. Potential impacts on local NO_2 concentrations from the on-site fuel combustion for the proposed project's heating system were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the CAA and therefore, lead is not a pollutant of concern for the proposed actions. Therefore, an analysis of this pollutant was not warranted.

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

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

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

All gasoline-powered and diesel-powered vehicles, especially heavy duty trucks and buses operating on diesel fuel, 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 gasoline and diesel powered vehicles. The proposed actions would not result in any significant increases in truck traffic near the development site or in the region, nor other potentially significant increase in $PM_{2.5}$ vehicle emissions as defined in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, an analysis of potential impacts from PM was not warranted.

The proposed actions' heating systems would result in emissions of PM; therefore, potential 24-hour and annual incremental impacts of $PM_{2.5}$ from the fossil fuel-fired HVAC systems were evaluated using a microscale analysis. PM emissions from the proposed parking lot were also evaluated.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). 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 sources was not warranted.

As part of the proposed project, oil would be combusted in the proposed residential development's heating systems. A worst-case analysis of future levels of SO_2 with the proposed project was performed, assuming the use of No. 2 oil.

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary standards are generally either the same as the secondary standards or more restrictive. The NAAQS are presented in **Table 5-1**. 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 particles, settleable particles, non-methane hydrocarbons, 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.

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked. EPA later lowered the primary annual $PM_{2.5}$ average standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008, and the previous 1997 ozone standard was fully revoked effective April 1, 2015. Effective December 2015, EPA further reduced the 2008 ozone NAAQS, lowering the primary and secondary NAAQS from the current 0.075 ppm to 0.070. EPA expects to issue final area designations by October 1, 2017; those designations likely would be based on 2014-2016 air quality data.

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

EPA established a 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.

Table 5-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average	9 (1)	10,000	None	
1-Hour Average	35 (1)	40,000		
Lead				
Rolling 3-Month Average (2)	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average (3)	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average (4,5)	0.070	140	0.070	140
Respirable Particulate Matter (PM_{10})				
24-Hour Average (1)	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean (6)	NA	12	NA	15
24-Hour Average (7)	NA	35	NA	35
Sulfur Dioxide (SO_2) (8)				
1-Hour Average(9)	0.075	196	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/m^3 are presented.

1. Not to be exceeded more than once a year.
2. EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.
3. 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
4. 3-year average of the annual fourth highest daily maximum 8-hr average concentration.
5. EPA has lowered the NAAQS down from 0.075 ppm, effective December 2015.
6. 3-year average of annual mean. EPA has lowered the primary standard from 15 µg/m^3, effective March 2013.
7. Not to be exceeded by the annual 98th percentile when averaged over 3 years.
8. EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.
9. 3-year average of the annual 99th percentile daily maximum 1-hr average concentration.

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

EPA also 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. In January 2017, New York State recommended that EPA designate the entire State of New York, with the exception of Seneca, St. Lawrence, and Tompkins counties as in attainment for this standard; the remaining counties will be designated upon the completion of required monitoring by December 31, 2020.

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

In 2002, EPA re-designated New York City as in attainment for CO. Under the resulting maintenance plans, New York City is committed to implementing site-specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period. The second CO maintenance plan for the region was approved by EPA on May 30th, 2014.

Manhattan, which had been designated as a moderate NAA for PM_{10}, was reclassified by EPA as in attainment on July 29, 2015.

The five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties had been designated as a $PM_{2.5}$ NAA (New York Portion of the New York–Northern New Jersey–Long Island, NY–NJ–CT NAA) since 2004 under the CAA due to exceedance of the 1997 annual average standard, and were also nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS since November 2009. The area was redesignated as in attainment for that standard effective April 18, 2014, and is now under a maintenance plan. As stated above, EPA lowered the annual average primary standard to 12 $\mu g/m^3$ effective March 2013. EPA designated the area as in attainment for the new 12 $\mu g/m^3$ NAAQS effective April 15, 2015.

Effective June 15, 2004, EPA designated Nassau, Rockland, Suffolk, Westchester, and the five New York City counties (NY portion of the New York–Northern New Jersey–Long Island, NY-NJ-CT, NAA) as moderate non-attainment for the 1997 8-hour average ozone standard. In March 2008 EPA strengthened the 8–hour ozone standards. EPA designated the New York–Northern New Jersey–Long Island, NY-NJ-CT NAA as a marginal NAA for the 2008 ozone NAAQS, effective July 20, 2012. On April 11, 2016, as requested by New York State EPA reclassified the area as a moderate NAA. New York State has begun submitting SIP documents in December 2014. The state is expected to be able to meet its SIP obligations for both the 1997 and 2008 standards by satisfying the requirements for a moderate area attainment plan for the 2008 ozone NAAQS.

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" of the 1-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the 1-hour standard, areas will be reclassified once three years of monitoring data are available (likely 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. Draft attainment designations were published by EPA in February 2013, indicating that EPA is deferring action to designate areas in New York State and expects to proceed with designations once additional data are gathered.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and the 2014 *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.[2] 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 5-1**) 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.

CO DE MINIMIS CRITERIA

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.

$PM_{2.5}$ DE MINIMIS CRITERIA

For projects subject to CEQR, the *de minimis* criteria currently employed for determination of potential significant adverse $PM_{2.5}$ impacts are as follows:

- Predicted increase of more than half the difference between the background concentration and the 24-hour standard;
- 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

[2] New York City. *CEQR Technical Manual*. Chapter 1, section 222. March 2014; and New York State Environmental Quality Review Regulations, 6 NYCRR § 617.7

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 or ground level receptor location.

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

The above *de minimis* criteria have been used to evaluate the significance of predicted impacts of the proposed project on $PM_{2.5}$ concentrations.

D. METHODOLOGY

PARKING FACILITIES

The proposed actions would increase the overall number of surface parking spaces provided on the project site by 239 spaces to the proposed 1,653 spaces. Approximately 225 of the 1,653 spaces would be provided as part of a new parking deck located at the second level of the proposed Building F, partially above the contemplated grocery store use and partially above the at-grade parking in the rear of Building F located at the southeast corner of the project site. Emissions from vehicles using the parking lot could potentially affect ambient levels of pollutants in the immediate vicinity. Therefore, an analysis was performed using the methodology delineated in the *CEQR Technical Manual* to calculate levels for the pollutants of concern (CO and PM).

Potential impacts from the parking lot on CO and PM concentrations were assessed at multiple receptor locations. The concentrations were determined for the time periods defined by the CO and PM NAAQS—annual and 24-hours for PM and peak 1 and 8 hours for CO when overall lot usage would be the greatest, considering the hours when the greatest number of vehicles would enter and exit the project site. Additionally, the potential impacts from the two-level naturally ventilated parking structure near Building F were also analyzed. Emissions from vehicles entering, parking, and exiting the parking lot were estimated using the EPA MOVES mobile source emission model. All arriving and departing vehicles were conservatively assumed to travel at an average speed of 5 miles per hour within the parking lot. In addition, all departing vehicles were assumed to idle for 1 minute before exiting.

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

A "near" and "far" receptor (i.e., precise location at which concentrations are evaluated) was placed on the sidewalk adjacent to the parking lot and on the sidewalk directly opposite the parking lot along Ebbitts Street. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 1- and 8-hour average periods, and PM concentrations were determined for the maximum 24-hour and annual average period. A persistence factor of 0.70 was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. A factor of 0.6 was

used to obtain 24-hour average concentrations and a factor of 0.1 was used to obtain annual average concentrations from the peak one hour concentrations, following USEPA guidance.[3]

Background CO and PM_{10} concentrations from the nearest NYSDEC monitoring station with available data were added to the modeling results to obtain the total ambient levels. The on-street pollutant concentrations were determined using the methodology in the Air Quality Appendix of the *CEQR Technical Manual*, utilizing traffic volumes derived from the traffic study conducted in the area.

HEATING SYSTEMS

A stationary source analysis was conducted to evaluate potential impacts from the proposed project's HVAC systems. The proposed project would include one single-story retail pad (Building E) and two two-story retail buildings (Buildings G and F). A screening analysis was performed using the methodology described in the *CEQR Technical Manual* to assess air quality impacts associated with emissions from Proposed Building E's heat and hot water systems. Due to the size and proximity of the project's buildings (G and F), a refined dispersion modeling analysis was prepared for those buildings, as described in the sections below.

CEQR TECHNICAL MANUAL SCREENING ANALYSIS (BUILDING E)

An initial screening analysis was performed using the methodology described in Section 322.1 of Chapter 17 of the *CEQR Technical Manual*. This methodology determines the threshold of development size below which the action would not have a significant impact. The screening procedure utilizes information regarding the type of fuel to be burned, the maximum development size, and the heating, ventilating, and air conditioning (HVAC) exhaust stack height, to evaluate whether or not a significant impact is possible.

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*, then 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.

REFINED ANALYSIS (BUILDINGS G AND F)

Since specific design information is not yet available, it was conservatively assumed that conventional boilers would be used to provide building space heating and domestic hot water. It was assumed that the proposed Buildings F and G would have individual boiler installations. The analysis was performed conservatively assuming that the combustion equipment would utilize No. 2 fuel oil. The analysis considered the effect of proposed project's HVAC systems on nearby surrounding buildings (project-on-existing) as well as project-on-project impacts. For each of the analysis, the boiler stacks for Buildings G and H were modeled at the worst case location closest to the potential receptors.

MODEL PARAMETERS

The boiler stacks for Building F and Building G were assumed to exhaust at heights of 39 feet and 56.5 feet (3 feet above each roof), respectively. Boiler fuel usage was estimated based on the

[3] EPA. *AERSCREEN User's Guide*. July 2015.

building's size (in square feet) and type of development, using the methodology referenced in the *CEQR Technical Manual*. Emission rates were calculated based on emission factors obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*. PM_{10} and $PM_{2.5}$ emissions include both the filterable and condensable fractions. The short-term emission rates were calculated by scaling the annual emissions to account for a 100-day heating season.

The exhaust velocity was calculated based on the exhaust flowrate for the boiler capacity, estimated using the energy use of the proposed project and EPA's fuel factors.[4] Assumptions for stack diameter and exhaust temperature for the proposed systems were obtained from a survey of boiler exhaust data performed and provided by New York City Department of Environmental Protection (NYCDEP) and were used to calculate the exhaust velocity.

Table 5-2 presents the stack parameters and emission rates used in the analysis.

Table 5-2
Exhaust Stack Parameters and Emission Rates

Stack Parameters	Building F	Building G
Building Size (gsf)	238,695	136,627
Stack Height (feet)	39	56.5
Stack Diameter (feet)(2)	1.0	1.0
Stack Exhaust Flow (ACFM)(1)(3)	800.4	458.1
Exhaust Velocity (feet/second)(3)	17.0	9.7
Exhaust Temperature (degrees Fahrenheit)(2)	300	300
Emission Rate (grams/second)		
NO_x (1-hour average)	0.053	0.030
NO_x (Annual average)	0.014	0.008
PM_{10} (24-hour average)	0.006	0.004
$PM_{2.5}$ (24-hour average)	0.006	0.003
$PM_{2.5}$ (Annual average)	0.002	0.001
SO_2 (1-hour average)	0.0006	0.0003
SO_2 (3-hour average)	0.0006	0.0003

Note:
(1) ACFM = actual cubic feet per minute.
(2) Stack parameters assumed based on survey of boiler exhaust data performed and provided by NYCDEP.
(3) The stack exhaust flow rate and velocity are estimated based on the type of fuel and the estimated boiler capacity.

DISPERSION MODELING

Potential impacts from the proposed project's heating system emissions were evaluated using the EPA/AMS AERMOD dispersion model.[5] AERMOD is EPA's preferred regulatory model for stationary source analyses.

[4] EPA. *Standards of Performance for New Stationary Sources.* 40 CFR Chapter I Subchapter C Part 60. Appendix A-7, Table 19-2. 2013.

[5] EPA. *AERMOD: Description Of Model Formulation*. 454/R-03-004. September 2004; and

AERMOD calculates pollutant concentrations from one or more sources (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 exhaust stack were made assuming stack tip downwash, urban dispersion and surface roughness length, with and without building downwash, and elimination of calms.

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

The analysis was performed both with and without downwash in order to assess the worst-case impacts at elevated receptors (specific locations at which concentrations are projected) close to the height of the source, which would occur without downwash, as well as the worst-case impacts at lower elevations and ground level, which would occur with downwash, consistent with the recommendations in the *CEQR Technical Manual*.

AERMOD is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standards. EPA has also developed guidance to estimate the transformation ratio of NO_2 to NO_x, applicable to combustion sources, as discussed further below.

1-hour average NO_2 concentration from the proposed project building's heating systems were estimated following guidance for assessing compliance with NAAQS.[6] 1-Hour average NO_2 concentration increments from the HVAC systems were estimated using AERMOD's Plume Volume Molar Ratio Method (PVMRM) module to analyze chemical transformation within the model. The PVMRM module incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. The model applied ozone concentrations measured in 2010–2014 at the nearest available NYSDEC ozone monitoring station—the Queens College monitoring station in Queens. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust stack was assumed, which is considered representative for boilers.[7]

To determine compliance with the 1-hour NO_2 NAAQS,[8] the monitored background was added to modeled concentrations, following EPA modeling guidance: hourly modeled concentrations from proposed sources were first added to the seasonal hourly background monitored

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EPA. *User's Guide for the AMS/EPA Regulatory Model – AERMOD.* 454/B-03-001, September 2004 and Addendum June 2015.

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

[7] This is a conservatively high assumption. AP-42 Section 1.3 for NO_x emission factors for fuel oil fired boilers states that 95 percent of NO_x by weight is NO. See *AP-42 Volume 1, Section 1.3.3.3 Nitrogen Oxide Emissions.*

[8] EPA. *Memorandum: Clarification on the use of AERMOD Dispersion Modeling for Demonstrating Compliance with the NO_2 National Ambient Air Quality Standard*. September 30, 2014.

concentrations within the AERMOD model; then the highest combined daily 1-hour NO_2 concentration was determined at each receptor location and the 98th percentile daily 1-hour maximum concentration for each modeled year was calculated within the AERMOD model; finally the 98th percentile concentrations were averaged over the latest five years.

Annual NO_2 concentrations from emission sources were estimated using a NO_2 to NO_x ratio of 0.75, as described in EPA's *Guideline on Air Quality Models* at 40 CFR part 51 Appendix W, Section 5.2.4.[9]

Five years of surface meteorological data collected at JFK Airport (2010–2014) and concurrent upper air data collected at Brookhaven, New York was used in the analysis.

RECEPTOR PLACEMENT

Receptors were placed at windows in residential or other sensitive buildings, air intakes, and publically accessible locations, as applicable. The analysis also considered the effect of project-on-project impacts. Receptors were placed on proposed Buildings G and F and at pedestrian gallery and walkways.

BACKGROUND CONCENTRATIONS

To estimate the maximum expected pollutant concentration at a given receptor, the predicted impact must be added to a background value that accounts for existing pollutant concentrations from other sources that are not directly accounted for in the mode (see **Table 5-3**).

Table 5-3
Maximum Background Pollutant Concentrations (µg/m^3)

Pollutant	Average Period	Location	Concentration	NAAQS
CO	8-Hour	Queens College, Queens	1.4 ppm	9 ppm
	1-Hour	Queens College, Queens	1.9 ppm	35 ppm
NO_2	Annual	Queens College, Queens	40.7	100
	1-Hour(1)	Queens College, Queens	113	188
SO_2	3-Hour	Queens College, Queens	77.7	1,300
	1-Hour(2)	Queens College, Queens	29.1	196
PM_{10}	24-hour	Queens College, Queens	38.0	150
$PM_{2.5}$	24-hour	Port Richmond, Richmond	20.3	35

Notes:
1. The 1-Hour NO_2 background concentration is the annual 98th percentile of daily maximum 1-hour average concentration, averaged over the recent 3-years (2013-2015).
2. The 1-Hour SO_2 background concentration is the annual 99th percentile of daily maximum 1-hour average concentration, averaged over the recent 3-years (2013-2015).
Sources: New York State Air Quality Report Ambient Air Monitoring System, NY State Department of Environmental Conservation (NYSDEC), 2011–2015.

The background levels are based on concentrations monitored at the nearest NYSDEC ambient air monitoring stations over a recent five-year period for which data are available (2011-2015),

[9] EPA. 40 CFR Part 51. *Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions*. November 9, 2005.

with the exception of PM_{10}, which is based on three years of data (2013-2015), consistent with *CEQR Technical Manual*. For the 24-hour PM_{10} concentration, the highest of the annual second-highest measured values over the 3-year period were used. The annual average background values are the highest measured average concentrations for these pollutants. The measured background concentration was added to the predicted contribution from the modeled source to determine the maximum predicted total pollutant concentration. It was conservatively assumed that the maximum background concentrations occur on all days.

$PM_{2.5}$ annual average impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ *de minimis* criteria, without considering the annual background. Therefore the annual $PM_{2.5}$ background is not presented in the table.

A 24-hour average background $PM_{2.5}$ concentration of 20.3 $\mu g/m^3$ (based on the 2012 to 2015 average of 98th percentile concentrations measured at the Port Richmond monitoring station) was used to establish the *de minimis* value for the 24-hour increment, consistent with the guidance provided in the *CEQR Technical Manual.*

E. PROBABLE IMPACTS OF THE PROPOSED PROJECT

PARKING FACILITIES

The analysis considered the maximum overall usage of all parking lots, and an additional analysis of the naturally ventilated two-story parking structure was also prepared. Based on the methodology previously described, the maximum predicted CO and PM concentrations from the proposed parking facility were analyzed at the following locations: a near side sidewalk receptor on the same side of the street as the parking facility and a far side sidewalk receptor on the opposite side of the street from the parking facility. The total CO and PM_{10} concentrations include both background levels and contributions from traffic on adjacent roadways for the far side receptor only. $PM_{2.5}$ concentrations include contributions from project-generated trips on adjacent roadways for the far side receptor.

OVERALL PARKING FACILITY

The maximum predicted 8-hour average CO concentration of all the receptors modeled was 1.7 ppm on the far side sidewalk receptor. This value includes a predicted concentration of 0.13 ppm from the parking lot, 0.14 ppm from on-street traffic, and a background level of 1.4 ppm. The maximum predicted total concentration is substantially below the applicable standard of 9 ppm. The maximum predicted 24-hour average PM_{10} concentration is 68.6 $\mu g/m^3$, on the far side sidewalk receptor. This value consists of a predicted concentration of 11.2 $\mu g/m^3$ from the parking lot, 19.4 $\mu g/m^3$ from on-street traffic, and a background concentration of 38 $\mu g/m^3$. The maximum predicted concentration is substantially below the applicable standard of 150 $\mu g/m^3$.

The maximum predicted 24-hour $PM_{2.5}$ increment is 3.6 $\mu g/m^3$, and the maximum annual average $PM_{2.5}$ increment is 0.06 $\mu g/m^3$, on the near side sidewalk receptor. The maximum predicted $PM_{2.5}$ increments are well below the respective $PM_{2.5}$ *de minimis* criteria of 7.4 $\mu g/m^3$ on a 24-hour average, 0.3 $\mu g/m^3$ on an annual average at the local scale, and 0.1 $\mu g/m^3$ on an annual average at the neighborhood scale.

NATURALLY VENTILATED PARKING STRUCTURE NEAR BUILDING F

The maximum predicted 8-hour average CO concentration at any of the receptors was 1.5 ppm on the far-side sidewalk receptor (across the street from the structure). This value includes a predicted concentration of 0.04 ppm from the parking lot, 0.09 ppm from on-street traffic, and a background level of 1.4 ppm.

The maximum predicted 24-hour average PM_{10} concentration is 53.2 $\mu g/m^3$, on the far-side sidewalk receptor. This value consists of a predicted concentration of 3.0 $\mu g/m^3$ from the parking lot, 12.2 $\mu g/m^3$ from on-street traffic, and a background concentration of 38 $\mu g/m^3$. The maximum predicted concentration is substantially below the applicable standard of 150 $\mu g/m^3$.

The maximum predicted increase in 24-hour average $PM_{2.5}$ concentration is 1.1 $\mu g/m^3$, on the far-side sidewalk receptor. This value consists of a predicted increment of 0.8 $\mu g/m^3$ from the parking lot, and 0.6 $\mu g/m^3$ from on-street project related traffic increment. The maximum predicted increase in annual average $PM_{2.5}$ concentration is 0.02 $\mu g/m^3$, at the far-side sidewalk receptor. This value consists of a predicted concentration of 0.01 $\mu g/m^3$ from the parking lot, and 0.01 $\mu g/m^3$ from on-street traffic increase. The maximum predicted $PM_{2.5}$ increments are well below the respective $PM_{2.5}$ *de minimis* criteria of 7.4 $\mu g/m^3$ on a 24-hour average, 0.3 $\mu g/m^3$ on an annual average at the local scale, and 0.1 $\mu g/m^3$ on an annual average at the neighborhood scale.

Based on the results of the analyses, the proposed parking expansion would not result in any significant adverse air quality impacts.

HEATING SYSTEMS

CEQR TECHNICAL MANUAL SCREENING ANALYSIS (BUILDING E)

The analysis was based on the proposed size of the development site (5,135 gross square feet), an exhaust stack height of 21 feet (three feet above the roof, per *CEQR Technical Manual* guidance), and the use of No. 2 fuel oil. The closest building of similar or greater height was determined to be the residences located across Hylan Boulevard, at a distance of approximately 158 feet, therefore, this distance was chosen for the analysis in accordance with the guidance provided in the *CEQR Technical Manual*. The proposed Building E is below the maximum development size shown in Figure 17-6 of the *CEQR Technical Manual*; therefore the proposed building passes the screening analysis. There would not be any measurable impacts at nearby ground level locations.

REFINED ANALYSIS (BUILDINGS G AND F)

Table 5-4 shows maximum overall predicted concentrations for NO_2, SO_2, and PM_{10} from the proposed project's heating systems on nearby surrounding buildings (project-on-existing). As shown in the table, the predicted pollutant concentrations, when added to ambient background levels for each of the pollutant time averaging periods are below their respective standards.

Table 5-4
Future Maximum Modeled Pollutant Concentrations from the Proposed Project at Offsite Locations (µg/m^3)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual(1)	0.4	40.7	41.1	100
	1-hour(2)	-	-	146.7	188
SO_2	3-hour	0.7	77.7	78.4	1300
	1-hour	0.8	29.1	29.9	196
PM_{10}	24-hour	2.9	38	40.9	150

Notes:
(1) Annual NO_2 impacts were estimated using a NO_2 /NO_x ratio of 0.75.
(2) Reported concentration is the maximum total 98th percentile concentration at any receptor using seasonal-hourly background concentrations.

The air quality modeling analysis also determined the highest predicted increase in $PM_{2.5}$ concentrations on nearby surrounding buildings (project-on-existing). The maximum predicted 24-hour and annual average $PM_{2.5}$ increments are presented in **Table 5-5**. The maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable *de minimis* criteria. On an annual basis, the maximum projected $PM_{2.5}$ increments would be less than the applicable *de minimis* criterion of 0.3 µg/m^3 for local impacts and 0.1 µg/m^3 at the neighborhood scale.

Table 5-5
Future Maximum Predicted $PM_{2.5}$ Concentrations from the Proposed Project at Offsite Locations (µg/m^3)

Pollutant	Averaging Period	Maximum Concentration	*De Minimis*
$PM_{2.5}$	24-hour	2.7	7.4(1)
	Annual (discrete)	0.08	0.3

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

Overall, there would not be any significant adverse air quality impacts due to the proposed project's heating systems.

Table 5-6 shows maximum overall predicted concentrations for NO_2, SO_2, and PM_{10} on the proposed buildings (project-on-project). As shown in the table, the predicted pollutant concentrations, when added to ambient background levels for each of the pollutant time averaging periods are below their respective standards.

Table 5-6
Future Maximum Modeled Project-on-Project Pollutant Concentrations (µg/m^3)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual(1)	1.1	40.7	41.8	100
	1-hour(2)	-	-	161.6	188
SO_2	3-hour	0.9	77.7	78.6	1300
	1-hour	1.0	29.1	30.1	196
PM_{10}	24-hour	3.8	38	41.8	150

Notes:
(1) Annual NO_2 impacts were estimated using a NO_2 /NO_x ratio of 0.75.
(2) Reported concentration is the maximum total 98th percentile concentration at any receptor using seasonal-hourly background concentrations.

The air quality modeling analysis also determined the highest predicted increase in $PM_{2.5}$ concentrations at the proposed buildings (project-on-project). The maximum predicted 24-hour and annual average $PM_{2.5}$ increments are presented in **Table 5-7**. The maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable *de minimis* criteria. On an annual basis, the maximum projected $PM_{2.5}$ increments would be less than the applicable *de minimis* criterion of 0.3 µg/m^3 for local impacts and 0.1 µg/m^3 at the neighborhood scale.

Table 5-7
Future Maximum Predicted Project-on-Project $PM_{2.5}$ Concentrations (µg/m^3)

Pollutant	Averaging Period	Maximum Concentration	*De Minimis*
$PM_{2.5}$	24-hour	3.7	7.4[(1)]
	Annual (discrete)	0.22	0.3

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

Based on the project-on-project analysis presented, the proposed project's heating systems would not result in any significant adverse air quality impacts. ✷