A. INTRODUCTION

The air quality analysis presented in this chapter considers whether the completion of Phase II of the Project in 2035 under the Extended Build-Out Scenario would result in new or different operational air quality impacts as compared with the completion of Phase II by 2016 as analyzed in the 2006 Final Environmental Impact Statement (FEIS). Specifically, the analysis focuses on whether changes in background conditions by 2035 (rather than 2016) and the completion of the Phase II program after an extended period of time would result in new or different significant adverse air quality impacts as a result of traffic or stationary source emissions generated by Phase II of the Project. This chapter presents the air quality impacts from the future operation of Phase II of the Project. Chapter 3I, "Construction—Air Quality," presents a cumulative analysis of the air quality impacts in the illustrative worst-case years due to construction activities.

Ambient air quality is affected by numerous sources and activities that introduce air pollutants into the atmosphere. Air quality impacts can be either direct or indirect. Direct effects stem from emissions generated by stationary sources such as emissions from fuel burned on site for boiler systems. Indirect effects include emissions from motor vehicles ("mobile sources") traveling to and from the project site or changes to future traffic conditions due to Phase II of the Project.

Fossil fuel-fired boiler systems would be required to provide heating to Phase II of the Project. Electrical power would be obtained from existing utilities in the area. This chapter assesses the stationary source impacts resulting from a delay in Phase II construction, and the proposed modifications to the Project (namely the proposed reduction in parking spaces and a shift of up to approximately 208,000 gsf of residential floor area from Phase I to Phase II.

With respect to mobile sources, the maximum hourly incremental traffic from Phase II of the Project would exceed the 2012 *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) screening threshold of 160 peak hour trips at certain nearby intersections in the study area, and the fine particulate matter ($PM_{2.5}$) emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. At those locations where Build traffic volumes for one or more peak periods have also been predicted to be greater than the volumes predicted for the 2006 FEIS, or where the predicted number of vehicle trips from Phase II of the Project is predicted to be greater than the 2006 FEIS, an analysis of traffic emissions in the future with the Project was performed. In addition, as the Phase II Project would include below-grade parking garages, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the ventilation outlets for the proposed parking garages.

PRINCIPAL CONCLUSIONS

As discussed below, the maximum predicted pollutant concentrations and concentration increments from mobile sources with Phase II of the Project would be below the corresponding

ambient air quality standards and guidance thresholds. The Phase II development's parking facilities would also not result in any significant adverse air quality impacts. Therefore, Phase II of the Project would not have significant adverse impacts from mobile source emissions.

Delayed completion of Phase II of the Project would not increase air emissions from any of the Project buildings. Based on a quantitative air dispersion modeling analysis, the 2006 FEIS analysis of air quality impacts concluded that because of the low emissions from Phase II of the Project, which has committed to the use of natural gas as its boiler fuel and the use of burners with low emissions of nitrogen oxides (NO_x), the impacts of emissions of particulate matter less than 2.5 microns in diameter ($PM_{2.5}$), CO, annual average nitrogen dioxide (NO_2) and sulfur dioxide (SO_2) would be insignificant. In the Extended Build-Out Scenario, the proposed gas-fired Phase II boilers would each be smaller in capacity than the boiler capacities modeled in the 2006 FEIS, even after accounting for the proposed shift in floor area from Phase I to Phase II. Therefore no additional quantitative air dispersion modeling analysis of these pollutants was performed in the SEIS. A new quantitative air dispersion modeling analysis of the emissions and dispersion of 1-hour average NO_2 from the Project's stationary sources indicate that such emissions would not result in violation of the 1-hour average NO_2 National Ambient Air Quality Standards (NAAQS) that was promulgated after the publication of the 2006 FEIS. Therefore, no significant adverse air quality impacts are anticipated from the stationary sources from Phase II of the Project under the Extended Build-Out Scenario.

B. SUMMARY OF FINDINGS FROM PREVIOUS ENVIRONMENTAL REVIEWS

MOBILE SOURCE ANALYSIS

The 2006 FEIS concluded that CO and PM_{10} concentrations due to project-generated traffic would not result in any violations of NAAQS. It was also determined that CO impacts would not exceed CEQR *de minimis* criteria, while $PM_{2.5}$ increments relating to mobile source emissions would not exceed the City's interim guidance criteria. An analysis was also performed to assess potential impacts from parking garages which determined that maximum predicted CO levels are below the applicable CO standards and, therefore, no significant adverse impacts from the Project's parking garages are expected.

STATIONARY SOURCE ANALYSIS

The 2006 FEIS included analyses of the emissions and dispersion of NO_2, CO, PM_{10}, and SO_2 from the Project's stationary sources, which determined that such emissions would not result in violation of NAAQS or in significant adverse air quality impacts. In addition, a $PM_{2.5}$ analysis was conducted, which identified a limited number of receptors on upper floors of Project buildings that would exceed the New York State Department of Environmental Conservation (NYSDEC) and City's annual $PM_{2.5}$ threshold for determining potential significance. However, these exceedances were found not to result in significant adverse impacts, for several reasons. The maximum annual emissions of PM_{10} would be below the NYSDEC applicability threshold of 15 tons per year used for assessing impacts of $PM_{2.5}$ from stationary sources. The potential exposure to $PM_{2.5}$ at these locations would be limited since occupants would not be expected to have their windows open continuously and be exposed to outdoor concentrations throughout the year (boiler emissions would be highest in the winter when windows would least likely be opened). In addition, the maximum predicted $PM_{2.5}$ concentration levels (including the

background concentration) were comparable to ambient levels of $PM_{2.5}$ measured at various locations in New York City over the past several years. On a neighborhood scale, $PM_{2.5}$ annual average impacts were below the City's interim guidance criterion. No off-site impacts were projected to exceed the NYSDEC criteria for potentially significant $PM_{2.5}$ impacts. Therefore, the 2006 FEIS determined that no significant adverse air quality impacts would occur from the Project's stationary sources. The 2006 FEIS also concluded that there would be no significant adverse air quality impacts on the Project from nearby industrial sources.

The 2009 Technical Memorandum analyzed modifications that would result in a decentralized system for heating and hot water on the Arena block, rather than the centralized system analyzed in the 2006 FEIS. The results of the analysis determined that maximum concentrations of air pollutants would not increase as compared with the scenario that was analyzed in the 2006 FEIS. Therefore, the Project in this scenario would not have the potential to result in significant adverse air quality impacts that were not previously identified in the 2006 FEIS.

C. 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. PM, volatile organic compounds (VOCs), and nitrogen oxides (NO and 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 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, and lead are regulated by the U.S. Environmental Protection Agency (USEPA) under the Clean Air Act, and are referred to as criteria pollutants; emissions of VOCs, NO_x, and other precursors to criteria pollutants are also regulated by USEPA.

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 predicted on a local, or microscale, basis.

Phase II of the Project would result in changes in traffic patterns and an increase in traffic volume in the study area. At some intersections, vehicle trips generated by Phase II development would exceed the *CEQR Technical Manual* CO threshold for a mobile source analysis, and would result in higher overall traffic volumes as compared with the 2006 FEIS conditions. Therefore, a mobile source analysis was conducted to evaluate future CO concentrations with and without Phase II of the Project. In addition, an assessment of CO impacts from the Phase II development's parking garages was conducted.

CO is generally not a concern from stationary combustion sources. As presented in the 2006 FEIS, an analysis of stationary sources determined that the Project would not result in the violations of NAAQS or in an exceedance of any significant impact levels for CO. The proposed modifications to the Project would not result in an increase in CO emissions from stationary sources, because the Extended Build-Out Scenario (inclusive of the proposed shift in floor area from Phase I to Phase II of the Project) would not increase the size of the boilers in the Phase II buildings above the size levels that served as the basis for the air quality impacts analysis in the 2006 FEIS. Therefore, an analysis of emissions of CO from the Phase II development's stationary sources is not warranted.

NITROGEN OXIDES, VOC, AND OZONE

NO_x together with VOCs, are 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. (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 such as mobile sources become of greater concern for this pollutant.

Phase II of the Project would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels would result. A regional-scale analysis of Project-related emissions of NO_x or other ozone precursors from mobile sources is therefore not warranted.

In order to evaluate the microscale effect of mobile source emissions of NO_x due to the Project, predicted mobile source pollutant concentrations at affected roadways and intersections would need to be added to background concentrations. Community-scale monitors currently in operation could 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. Furthermore, the existing USEPA 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 USEPA 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. Moreover, the assumed delay in completion of Phase II of the Project in the Extended Build-Out Scenario would not increase the Project's induced traffic and the Project's resulting indirect mobile source emissions; rather, a delay in Project completion would be expected to result in lower NO_x emissions from mobile sources because of the combined effect of additional fleet turnover and the application of more stringent emissions and fuel economy standards for trucks and other motor vehicles, as

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

compared with the completion of Phase II by 2016 as analyzed in the 2006 FEIS. Given these considerations, the effect of the Project on 1-hour NO_2 from mobile sources is evaluated qualitatively.

An analysis of NO_2 impacts from the Project's fossil fuel-fired equipment was conducted in the 2006 FEIS. The proposed modifications to the Project would not result in an increase in NO_2 emissions from stationary sources. However, since the 2006 FEIS was prepared a new 1-hour average NAAQS for NO_2 has been published. Therefore, a detailed analysis of the potential 1-hour average NO_2 impacts from the Phase II development's boiler systems has been performed. In addition, potential cumulative impacts from Phase I and Phase II of the Project were examined to determine the Project's compliance with the 1-hour NO_2 NAAQS.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the Clean Air Act (CAA), and therefore, lead is not a pollutant of concern for the Project; therefore, an analysis of this pollutant from stationary or mobile sources under Phase II is not warranted.

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

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of naturally occurring VOCs; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions, and 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, construction and agricultural activities, and wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic, and some likely carcinogenic compounds.

As described below, PM is regulated in two size categories: particles with an aerodynamic diameter of less than or equal to 2.5 micrometers, or $PM_{2.5}$, and particles with an aerodynamic diameter of less than or equal to 10 micrometers (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 directly emitted 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.

Phase II of the Project is predicted to result in increases in $PM_{2.5}$ vehicle emissions that would exceed the screening thresholds defined in Chapter 17, Sections 210 and 311 of the *CEQR*

Technical Manual, and would result in higher overall traffic volumes as compared with the 2006 FEIS conditions. Therefore, an analysis of potential impacts from PM was performed.

PM_{10} and $PM_{2.5}$ emissions from the Phase II development's boiler systems are not analyzed in this Supplemental Environmental Impact Statement (SEIS) because of the Project's low particulate matter emissions and the findings of the 2006 FEIS (see Section E., "Methodology for Predicting Pollutant Concentrations"). Since the publication of the 2006 FEIS, concentrations of PM_{10} and $PM_{2.5}$ in ambient air in New York City have declined. Moreover, the boilers in the Phase II buildings remain at or below the size levels that served as the basis for the air dispersion analysis for PM_{10} and $PM_{2.5}$ presented in the 2006 FEIS. Therefore, a new air dispersion analysis for PM_{10} and $PM_{2.5}$ emitted by the Phase II stationary source boilers is not required.

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 vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant, and, therefore, an analysis of SO_2 from mobile sources is not warranted.

Emissions of SO_2 from stationary sources with Phase II of the Project would be negligible since boiler systems for Phase II developments would use natural gas exclusively; therefore, no dispersion analysis of such emissions is warranted.

D. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary 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 4E-1**. The NAAQS for CO, annual NO_2, and SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended PM, settleable particles, non-methane hydrocarbons, and ozone that correspond to federal standards that have since been revoked or replaced, and for beryllium, fluoride, and hydrogen sulfide.

USEPA recently lowered the primary annual-average $PM_{2.5}$ standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

Table 4E-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [1]	9	10,000	None	
1-Hour Average [1]	35	40,000		
Lead				
Rolling 3-Month Average [2]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [3]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [4] [5]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [1]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean [6]	NA	12	NA	15
24-Hour Average [7]	NA	35	NA	35
Sulfur Dioxide (SO_2) [8]				
Maximum 3-Hour Average [1]	NA	NA	0.50	1,300
1-Hour Average [9]	0.075	196	NA	NA

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 for gases are defined in ppm. Approximately equivalent concentrations in µg/m^3 are presented.

[1] Not to be exceeded more than once a year.
[2] USEPA 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] USEPA has proposed lowering the primary standard further to within the range 0.060-0.070 ppm, and adding a secondary standard measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on these standards has been postponed and is currently in review.
[6] 3-Year average of annual mean. USEPA 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] USEPA 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-hour average concentration.

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

The current 8-hour ozone standard of 0.075 parts per million (ppm) is effective as of May 2008. On January 6, 2010, USEPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060-0.070 ppm and instituting a secondary ozone standard, measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on these standards has been postponed and is currently in review.

USEPA lowered the primary and secondary standards for lead to 0.15 $\mu g/m^3$, effective January 12, 2009. USEPA 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.

USEPA established a new 1-hour average NO_2 standard of 0.100 ppm, effective April 10, 2010, in addition to the current annual NO_2 standard. The statistical form of the new 1-hour average NO_2 standard is the 3-year average of the 98th percentile of daily maximum 1-hour average concentrations in a year.

USEPA 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 the daily maximum 1-hour average concentrations (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

Federal ambient air quality standards do not exist for non-criteria compounds. However, the NYSDEC has issued standards for certain non-criteria compounds, including beryllium, gaseous fluorides, and hydrogen sulfide. NYSDEC has also developed ambient guideline concentrations for numerous air toxic non-criteria compounds. The NYSDEC guidance document DAR-1 (October 2010) contains a compilation of annual and short term (1-hour) guideline concentrations for these compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure.

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 USEPA, 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, USEPA 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.

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

On December 17, 2004, USEPA designated the five New York City counties, Nassau, Suffolk, Rockland, Westchester, and Orange counties as a $PM_{2.5}$ non-attainment area under the CAA due to exceedance of the annual average standard. Based on recent monitoring data (2006-2011), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. USEPA has determined that the area has attained the 1997 annual $PM_{2.5}$ NAAQS, effective December 15, 2010. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions. On February 11, 2014, USEPA proposed to approve New York State's request to redesignate the area to attainment with the

1997 annual NAAQS and the associated maintenance plan. As stated above, USEPA has lowered the annual average primary standard to 12 µg/m^3. USEPA will make initial attainment designations for the new 12 µg/m^3 NAAQS by December 2014. Based on analysis of 2009-2011 monitoring data, it is possible that the region will be in attainment for the new standard.

As described above, USEPA has revised the 24-hour average $PM_{2.5}$ standard. In November 2009 USEPA designated the New York City Metropolitan Area as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS. The nonattainment area includes the same 10-county area USEPA designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2007-2011), USEPA determined that the area has attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions. On February 11, 2014, USEPA proposed to approve New York State's request to redesignate the area to attainment with the 2006 24-hour $PM_{2.5}$ NAAQS and the associated maintenance plan.

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties (the New York–New Jersey–Long Island Nonattainment Area, New York portion) had been designated as a severe non-attainment area for ozone (1-hour average standard, 0.12 ppm). Effective June 15, 2004, USEPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard. On June 18 2012, USEPA determined that these areas have attained both the 1990 1-hour ozone NAAQS (0.12 ppm) and the 1997 8-hour ozone NAAQS (0.08 ppm). Although not yet a redesignation to attainment status, this determination removes further requirements under the 1-hour and 1997 8-hour standards.

In March 2008 USEPA strengthened the 8-hour ozone standards. USEPA designated the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester as a marginal non-attainment area for the 2008 ozone NAAQS, effective July 20, 2012. SIPs will be due in 2015.

New York City is currently in attainment of the annual average NO_2 standard. USEPA has designated the entire state of New York as "unclassifiable/attainment" for the new 1-hour NO_2 standard effective February 29, 2012. Additional roadside NO_2 monitors are required in the New York City area, and are expected to be operational by mid-2014. Since this additional monitoring is required for the 1-hour standard attainment determination, areas will be reclassified once three years of monitoring data are available (likely 2017). If New York City is determined to be nonattainment with the 1-hour NO_2 NAAQS, New York State will be required to develop a SIP that identifies and implements specific measures to reduce ambient NO_2 concentrations to attain and maintain the new 1-hour NO_2 standard, most likely by requiring further reductions of NO_x emissions from various sources. Note that regardless of the 1-hour NO_2 attainment status determination, USEPA and New York State anticipate that NO_x emissions, and the ensuing ambient NO_2 concentrations, will continue to decrease in the future due to current efforts by USEPA and New York State to reduce NO_x emissions for the purpose of attaining ozone and $PM_{2.5}$ NAAQS. These efforts will have in increasing effect as lower-NO_x vehicles and engines become an increasingly large fraction of in-use mobile sources and as stationary sources increasingly reduce NO_x emissions. USEPA projections[1] indicate that based on the existing community-scale monitoring station data (which does not include data collected at the near-road monitoring stations to be sited in the future), assuming a baseline of no

[1] USEPA, Proposed NO_2 NAAQS Regulatory Impact Analysis, 2010.

additional control beyond the controls expected from rules that are already in place, the 98th percentile concentrations for New York City would be approximately 23 ppb in 2020—well below the NAAQS. However, in spite of these projections, areas exceeding the 1-hour NO_2 NAAQS may occur at near-roadway locations, and at other locations in proximity to significant NO_2 sources. Those areas are to be addressed under the CAA process described above.

USEPA has established a new 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 USEPA in February 2013, indicating that USEPA 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 *CEQR Technical Manual* state that the significance of a likely consequence (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
- The number of people affected

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 4E-1**) would be deemed to have a potential significant adverse impact. In addition, 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, requiring a detailed analysis of air quality impacts for that pollutant.

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 2012 *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.

DE MINIMIS CRITERIA REGARDING $PM_{2.5}$ IMPACTS

In addition, 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; or
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.1 $\mu g/m^3$ at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.3 $\mu g/m^3$ at a discrete or ground-level receptor location.

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

E. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

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

The mobile source analyses for the Phase II of the Project employ a model approved by USEPA 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 Phase II of the Project. The assumptions used in the PM analysis were based on the City's $PM_{2.5}$ *de minimis* criteria.

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the USEPA mobile source emissions model, MOVES.[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

[1] USEPA, Motor Vehicle Emission Simulator (MOVES), User Guide for MOVES2010b, June 2012.

conditions, vehicle speeds, vehicle age, roadway type and grade, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOVES incorporate the most current guidance available from NYSDEC.

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

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

Road Dust

The contribution of re-entrained road dust to PM_{10} concentrations, as presented in the PM_{10} SIP, is considered to be significant; therefore, the PM_{10} estimates include both exhaust and road dust. $PM_{2.5}$ emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analyses, since the New York City Department of Environmental Protection (DEP) considers it to have an insignificant contribution on that scale. Road dust emission factors were calculated according to the latest procedure delineated by USEPA[1] and the *CEQR Technical Manual*.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for Phase II of the Project (see Chapter 4D, "Operational Transportation"). Traffic data for the future No Build and Build conditions was employed in the respective air quality modeling scenarios. The Saturday Midday (MD) peak period was analyzed, since this is the only peak period that is projected to generate incremental traffic from Phase II of the Project that would exceed the *CEQR Technical Manual* CO screening threshold.

For PM_{10} and $PM_{2.5}$, off-peak traffic volumes in the future No Build condition were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations, and off-peak increments from the Phase II Project were determined by adjusting the peak period volumes by the 24-hour distribution of the parking garage arrivals and departures associated with the Phase II Project.

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets within the surrounding area, resulting from vehicle emissions, were predicted using the Tier 1 CAL3QHC model Version 2.0.[2] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes

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

[2] USEPA, 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, USEPA-454/R-92-006.

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 (Tier 2) 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 adjacent to streets within the traffic study area, the CAL3QHCR model was applied. This refined version of the model can utilize hourly traffic and meteorology data, and is therefore more appropriate for calculating 24-hour and annual average concentrations.

METEOROLOGY

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

Tier I Analyses—CAL3QHC

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

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

Tier II Analyses—CAL3QHCR

A Tier II analysis performed with the CAL3QHCR model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consist of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York for the period 2008–2012. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

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

ANALYSIS YEAR

The microscale analyses were performed for existing conditions and 2035, the year by which the Phase II of the Project is assumed to be completed under the Extended Build-Out Scenario. The future analysis was performed with and without the Phase II of the Project.

BACKGROUND CONCENTRATIONS

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

The background concentrations for the area of the project site are presented in **Table 4E-2**. PM_{10} backgrounds are the highest measured concentrations from the latest available three years of monitored data (2010–2012), consistent with the NAAQS. All other pollutants are based on the latest available five years of monitored data (2008–2012). Consistent with the NAAQS for each pollutant, for averaging periods shorter than a year, the second highest value is used. These values were used as the background concentrations for the mobile source analysis. $PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ *de minimis* criteria. $PM_{2.5}$ 24-hour average background concentration of 24 $\mu g/m^3$ (based on the 2010 to 2012 average of 98th percentile concentrations) was used to establish the *de minimis* value, consistent with the background concentration provided for monitoring station JHS 126 in Brooklyn in the *CEQR Technical Manual.*

Table 4E-2
Maximum Background Pollutant Concentrations
For Mobile Source Sites ($\mu g/m^3$)

Pollutant	Average Period	Location	Concentration	NAAQS
CO	1-hour	Queens College, Queens	3.4	35 ppm
	8-hour		1.7	9 ppm
PM_{10}	24-hour	Division Street, NY	48.0	150
$PM_{2.5}$	24-hour	JHS 126, Brooklyn	23.7	35

Notes: Consistent with the NAAQS, PM_{10} values are the highest of the latest available 3 years; CO is the highest of the latest 5 years.
Sources: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2008–2012.

ANALYSIS SITES

For the purposes of this SEIS, intersections were selected for analysis if they were locations where development of Phase II is expected to result in the addition of peak hour vehicle trips that exceed the CO and/or $PM_{2.5}$ mobile source thresholds referenced in the *CEQR Technical Manual*, and for which the total Build volume for one or more peak periods is predicted to exceed the level predicted in the 2006 FEIS. Based on these criteria, a total of three intersections were selected for detailed analysis for this SEIS (see **Table 4E-3**). These sites were also selected because they are the locations in the study area where the largest levels of project-generated traffic are expected, and, therefore, where the greatest air quality impacts and maximum changes in concentrations would be expected. The intersections were analyzed for CO, PM_{10} and $PM_{2.5}$.

Table 4E-3
Mobile Source Analysis Intersection Locations

Analysis Site	Location
1	Atlantic Avenue and Flatbush Avenue
2	Atlantic Avenue and Vanderbilt Avenue
3	Pacific Avenue and Vanderbilt Avenue

RECEPTOR PLACEMENT

Multiple receptors (i.e., precise locations at which concentrations are predicted) were modeled at each of the selected sites; receptors were placed along the approach and departure links at spaced intervals. Ground level receptors were placed at sidewalk or roadside locations near intersections with continuous public access, at a pedestrian height of 1.8 meters. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters, from the nearest moving lane at each analysis location, based on the DEP guidance for neighborhood-scale corridor $PM_{2.5}$ modeling. Consistent with DEP guidance and the analysis methodology used in the 2006 FEIS, the annual average $PM_{2.5}$ analysis results for mobile sources are compared with the neighborhood scale *de minimis* criteria.

PARKING GARAGE

Phase II of the Project would include parking at various locations. The largest of these facilities would be an underground parking facility on Block 1129 with a maximum capacity of 1,846 spaces. Emissions from vehicles using the parking facility could potentially affect ambient levels of pollutants at adjacent receptors. Since the parking facility would be used by automobiles, the primary pollutant of concern is CO. An analysis was performed using the methodology delineated in the 2012 *CEQR Technical Manual* to calculate pollutant levels.

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

A “near” and “far” receptor was placed on the sidewalk adjacent to the parking garage and on the sidewalk directly opposite the parking facility. In addition, a receptor was placed on the building façade at a height of 6 feet above the vent. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 1- and 8-hour average periods. A persistence factor of 0.81 was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period.

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

STATIONARY SOURCE ANALYSIS

PHASE II DEVELOPMENT

A stationary source analysis was conducted to evaluate potential impacts from the Phase II development's boiler systems. The boilers would generate hot water for building and domestic hot water heating.

The boilers would operate exclusively on natural gas, the cleanest fossil fuel. The boilers would be equipped with low-NO_x burners, which would limit NO_x emissions to no greater than 20 ppm. Each boiler installation would have one standby boiler available at any time to provide system redundancy.

Phase II of the Project would include individual boiler plants at each of the proposed buildings (Building 5 to Building 15) to provide heating and hot water. The boilers at Building 5 would have a maximum capacity of 472 horsepower, the boilers at Building 6 would have a maximum capacity of 315 horsepower, the boilers at Building 7 would have a maximum capacity of 525 horsepower, the boilers at Buildings 8 and 10 would have a maximum capacity of 367 horsepower, the boilers at Building 9 would have a maximum capacity of 500 horsepower, the boilers at Building 14 would have a maximum capacity of 236 horsepower and the boilers at Buildings 11, 12, 13 and 15 would have a maximum capacity of 250 horsepower. At each building, two boilers would be installed, with one boiler in use and one boiler serving as a spare.

Phase II of the Project may also include a school at the election of the New York City Department of Education (DOE). For the purposes of this SEIS, it is assumed to be located within the base of either Building 6 or Building 15, with a separate heating and hot water system. For this analysis, it is assumed that the heating and hot water systems for the school would be electrically powered and hence would not have any associated pollutant emissions. This assumption is considered reasonable based on information provided by the Project's design consultant that electric boiler systems have been specified for school projects under the jurisdiction of the School Construction Authority.

The proposed gas-fired Phase II boiler installations would each be smaller in capacity than the boiler capacities modeled in the 2006 FEIS, even accounting for the proposed shift in floor area from the Phase I development program into the Phase II development program (the proposed school's heating and hot water systems would be electrically powered, as stated earlier). Therefore, pollutant emissions from each of the Phase II boilers would be lower than the levels analyzed in the 2006 FEIS. Since the 2006 FEIS determined that there would be no significant adverse air quality impacts associated with emissions of $PM_{2.5}$, PM_{10}, CO, annual average NO_2 and SO_2 from the Project, and the standards for these pollutants are no more stringent than as analyzed at the time of the 2006 FEIS, no further analysis is required for these pollutants. A stationary source analysis was conducted to evaluate potential NO_2 impacts from the Project's boiler systems to ensure that impacts would not exceed the 1-hour average NO_2 NAAQS adopted by USEPA after completion of the 2006 FEIS.

Boiler Emissions

Stack exhaust parameters and emission estimates for the proposed Phase II development boiler installations were conservatively estimated. Short-term NO_x emissions rates were calculated based on emission factors obtained from representative vendor equipment specifications. Multiple scenarios were modeled to estimate emissions and predict short-term stationary source impacts. The boilers would be capable of operating at various loads depending on the heating and hot water demands of the Phase II buildings. Therefore, consistent with the 2006 FEIS, the

boilers were modeled at operating loads of 25, 50, 75, and 100 percent to calculate impacts over a full range of operating conditions. The stack exhaust parameters and the estimated maximum short-term emission rates are provided in **Table 4E-4** for the boilers operating at 100 percent load. The emissions presented in **Table 4E-4** are the same as or less than the emissions modeled in the 2006 FEIS based on updated design information for the Phase II project buildings.

Dispersion Modeling

Potential impacts were evaluated using the USEPA AERMOD dispersion model. AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of the interaction between the plume and terrain.

Table 4E-4
Boiler Emission Rates and Stack Parameters

		Boiler Capacity						
Parameter		**525 HP**	**500 HP**	**472 HP**	**367 HP**	**315 HP**	**250 HP**	**236 HP**
Heat Input Rate (MMBtu/hr, HHV)		20.67	19.69	18.60	14.47	12.40	9.85	9.30
Stack Exhaust Temp. (°F)		300	300	300	300	300	300	300
Stack Exhaust Flow (ACFM)		6,889	6,563	6,199	4,823	4,133	3,282	3,100
Stack Exhaust Velocity (ft/s)		18.2	17.4	16.4	12.7	14.0	11.1	10.5
Lb/MMBtu, HHV	NO_x	0.024	0.024	0.024	0.024	0.024	0.024	0.024
Lb/hr	NO_x	0.496	0.473	0.446	0.347	0.298	0.236	0.223

Notes:
HP = boiler horsepower rating.
MMBtu = million British thermal units per hour
HHV = higher heating value of fuel
ACFM = actual cubic feet per second
Emission rates and stack parameters are based on 100 percent load operation (per unit).
NO_x emissions based on the Project commitment of low NO_x boilers (≤ 20 ppm).

The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability of calculating pollutant concentrations at locations when the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. The analysis of potential impacts from exhaust stacks was 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 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) program for the PRIME model (BPIPRM) was used to determine the projected building dimensions modeling with the building downwash algorithm enabled. The modeling of downwash from sources accounts for all obstructions within a radius equal to five obstruction heights of the stack.

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, consistent with the recommendations in the 2012 *CEQR Technical Manual*.

USEPA has developed guidance for assessing 1-hour average NO_2 concentrations for compliance with NAAQS.[1] Background concentrations are currently monitored at several sites within New York City, which are used for reporting concentrations on a "community" scale. Because these data are compiled on a 1-hour average format, they can be used for comparison with the new 1-hour standards. Therefore, background 1-hour NO_2 concentrations currently measured at the community-scale monitors can be considered representative of background concentrations for purposes of assessing the potential impacts of the Project's boiler systems.

USEPA's preferred regulatory stationary source model, AERMOD, is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standards. USEPA has also developed guidance to estimate the transformation of NO to NO_2, applicable to boiler sources, as discussed further below.

1-Hour average NO_2 concentration increments from the Phase II Project's boiler systems were estimated using AERMOD model'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 transformation to NO_2 within the source plume. Ozone concentrations were taken from the nearest available NYSDEC ozone monitoring station, i.e., the Queens College monitoring station in Queens for the years 2008–2012. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust stack was assumed, which is considered representative for boilers.

Total 1-hour NO_2 concentrations were determined following methodologies that are accepted by the USEPA as appropriate and conservative. The methodology used to determine the compliance of total 1-hour NO_2 concentrations from the proposed sources with the 1-hour NO_2 NAAQS[2] was based on adding the monitored background to modeled concentrations, as follows: hourly modeled concentrations from proposed sources were first added to the seasonal hourly background monitored concentrations; 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. This refined approach is recognized as being conservative by USEPA and the City and is referenced in USEPA modeling guidance.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at La Guardia Airport (2008–2012) and concurrent upper air data collected at Brookhaven, New York. These meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevations over the five-year period. These data were processed using the USEPA AERMET program to develop data in a format which can be readily processed by the AERMOD model. The land use around the site where meteorological

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

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

surface data were available was classified using categories defined in digital United States Geological Survey (USGS) maps to determine surface parameters used by the AERMET program.

Receptor Locations

A comprehensive receptor network (i.e., off-site locations with continuous public access) was developed for the modeling analyses. The receptor network included regularly spaced ground- level receptors and numerous discrete receptors on nearby sensitive uses and tall buildings. A ground-level cartesian grid was used, centered on the project site and extending out to 1 kilometer (km), at a 100-meter interval, in all directions. Receptors were also placed at sensitive uses around the project site, such as at residential buildings, schools, religious institutions, and recreational facilities. In addition, numerous receptors were placed on residential buildings and open spaces located on the project site to determine project-on-project impacts. Receptors were placed at various building elevations on all façades to ensure that potential reasonable worst-case project-on-project impacts would be identified. Since the terrain around the project site is generally flat, terrain heights were not used in the model.

Background Concentrations

To estimate the maximum expected pollutant concentration at a receptor, the calculated impact from the modeled emission sources is added to a background value that accounts for existing pollutant concentrations from other sources. The NO_2 background levels are based on concentrations monitored at the nearest NYSDEC ambient air monitoring, i.e., the Queens College monitoring station in Queens for the years 2008-2012. Since the AERMOD model determines the total 98th percentile 1-Hour NO_2 concentration at each receptor, a single representative background concentration is not presented. The methodology uses multiyear averages of the 98th percentile of the available background concentrations by season and hour-of-day. Per USEPA guidance, for this seasonal hour-of-day approach, the 3rd highest value from each season and hour-of-day combination is used to represent the 98th percentile background concentration.

CUMULATIVE IMPACTS OF PHASE I AND PHASE II DEVELOPMENTS

Phase I of the Project would include individual boiler plants at each of the proposed buildings to provide heating and hot water. A stationary source analysis was conducted to evaluate potential cumulative impacts from the Project's Phase I and Phase II boiler systems.

Stack exhaust parameters and emission estimates for the proposed Phase I development boiler installations were conservatively estimated. Each boiler installation would have one standby boiler available at any time to provide system redundancy. The Arena boiler system exhaust would be vented through a single stack located on the roof of Building 2, while each of the other building's boiler plants would be vented to a stack located on the roof of the building.

Short-term NO_x emissions rates were calculated based on emission factors obtained from representative vendor equipment specifications. The Phase I boilers would operate exclusively on natural gas and would be equipped with low-NO_x burners, which would limit NO_x emissions to no greater than 20 ppm, as per the Amended Memorandum of Environmental Commitments (MEC). Multiple scenarios were modeled to estimate emissions and predict short-term stationary source impacts. The boilers would be capable of operating at various loads depending on the heating and hot water demands of the Phase I buildings. The stack exhaust parameters and the estimated maximum short-term emission rates are provided in **Table 4E-5** for the boilers operating at 100 percent load.

Table 4E-5
Phase I Boiler Emission Rates and Stack Parameters

		Boiler Capacity					
Parameter		**Arena**	**Building 1**	**Building 2**	**Building 3**	**Building 4**	**Site 5**
Heat Input Rate (MMBtu/hr, HHV)		32.0	22.73	3.89	3.69	25.0	12.4
Stack Exhaust Temp. (°F)		300	300	148	148	300	300
Stack Exhaust Flow (ACFM)		10,663	7,574	815	773	8,336	4,132
Stack Exhaust Velocity (ft/s)		28.2	20.0	2.8	2.6	22.0	10.9
Lb/MMBtu, HHV	NO_x	0.024	0.024	0.024	0.024	0.024	0.024
Lb/hr	NO_x	0.768	0.546	0.093	0.089	0.60	0.298

Notes:
MMBtu = million British thermal units per hour
HHV = higher heating value of fuel
ACFM = actual cubic feet per second
Emission rates and stack parameters are based on 100 percent load operation (per unit).
NO_x emissions based on the Project commitment of low NO_x boilers (≤ 20 ppm).

F. EXISTING CONDITIONS

EXISTING MONITORED AIR QUALITY CONDITIONS

Monitored background concentrations of SO_2, NO_2, CO, ozone, lead, PM_{10} and $PM_{2.5}$ for the study area are shown in **Table 4E-6**. These values are the most recent monitored data that have been made available by NYSDEC. With the exception of ozone, which is a regional pollutant, there were no monitored violations of NAAQS at these monitoring sites.

Based on the 1-hour NO_2 concentrations measured at existing community-scale monitoring stations in New York City during the three recent years for which data have been made available by NYSDEC, NO_2 concentrations have consistently been below the new 1-hour NAAQS at all existing monitoring sites in New York City. However, as noted earlier, additional monitoring stations will be established in 2014 near major roadways to collect additional data for the purpose of determining whether New York City is in attainment of the 1-hour standard. USEPA estimates that, in general, concentrations near roadways in the U.S. may be anywhere from 30 to 100 percent higher than those measured at community-scale monitors[1].

[1] EPA. January 2010, *Final Regulatory Impact Analysis (RIA) for the NO_2 NAAQS.*

Table 4E-6
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Queens College, Queens	ppm	8-hour	1.1	9
			1-hour	1.7	35
SO_2	Queens College, Queens	$\mu g/m^3$	3-hour	42.1	1,300
			1-hour	64.7	196
PM_{10}	Division Street, Manhattan	$\mu g/m^3$	24-hour	39	150
$PM_{2.5}$	JHS 126, Brooklyn	$\mu g/m^3$	Annual	10	12
			24-hour	24	35
NO_2	Queens College, Queens	$\mu g/m^3$	Annual	33	100
			1-hour	120	188
Lead	Morrisania, Bronx	$\mu g/m^3$	3-month	0.008	0.15
Ozone	Queens College, Queens	ppm	8-hour	0.081	0.075

Notes: Based on the NAAQS definitions, the CO and 3-hour SO_2 concentrations for short-term averages are the second-highest from the year. $PM_{2.5}$ annual concentrations are the average of 2010, 2011, and 2012, and the 24-hour concentration is the average of the annual 98th percentile concentrations in 2010, 2011 and 2012. 8-Hour average ozone concentrations are the average of the 4th highest-daily values from 2010 to 2012. SO_2 1-hour and NO_2 1-hour concentrations are the average of the 99th percentile and 98th percentile, respectively, of the highest daily 1-hour maximum concentration from 2010 to 2012.
Source: NYSDEC, New York State Ambient Air Quality Data.

G. FUTURE WITHOUT PHASE II

MOBILE SOURCES ANALYSIS

CO concentrations in the No Build condition were determined for future 2035 conditions using the methodology previously described. **Table 4E-7** shows future maximum predicted 8-hour average CO concentrations, including background concentrations, at the analysis intersections in the No Build condition. The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 4E-7
Maximum Predicted 8-Hour Average
CO No Build Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Atlantic Avenue and Flatbush Avenue	Saturday MD	2.8
2	Atlantic Avenue and Vanderbilt Avenue	Saturday MD	2.3
3	Pacific Avenue and Vanderbilt Avenue	Saturday MD	2.0

Notes:
8-hour standard (NAAQS) is 9 ppm.
Concentration includes a background concentration of 1.7 ppm.

As shown in **Table 4E-7**, 2035 No-Build values are predicted to be well below the 8-hour CO standard of 9 ppm.

PM_{10} concentrations for the No Build condition were also determined using the methodology previously described. **Table 4E-8** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2035 No Build condition. The values shown are the highest predicted concentrations for the receptor locations.

Table 4E-8
Maximum Predicted 24-Hour Average
PM_{10} No Build Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration
1	Atlantic Avenue and Flatbush Avenue	102.7
2	Atlantic Avenue and Vanderbilt Avenue	82.6
3	Pacific Avenue and Vanderbilt Avenue	60.6

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 48.0 $\mu g/m^3$.

$PM_{2.5}$ concentrations for the No Build condition are not presented, since impacts are assessed on an incremental basis.

STATIONARY SOURCE ANALYSIS

In the future without Phase II of the Project, it is assumed that the uses currently on the Phase II project site would remain. Boiler emissions would likely be lower in the No Build condition. The effect of the Phase I boiler emissions is addressed in the cumulative analysis of Phase I and Phase II boiler emissions.

H. FUTURE WITH PHASE II

Phase II of the Project would result in increased mobile source emissions in the immediate vicinity of the Project study area and could also affect the surrounding community with emissions from boiler equipment and parking facilities. The following sections describe the results of the studies performed to analyze the potential impacts on the surrounding community from these sources for the 2035 analysis year.

MOBILE SOURCES ANALYSIS

INTERSECTION ANALYSIS

CO concentrations for future conditions in the 2035 analysis year were predicted using the methodology previously described. **Table 4E-9** shows the future maximum predicted 8-hour average CO concentrations at the intersection studied. (No 1-hour values are shown, since no exceedances of the NAAQS would occur and the *de minimis* criteria are only applicable to 8-hour concentrations; therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentrations. The results indicate that Phase II of the Project would not result in any violations of the 8-hour CO standard. In addition, the incremental increases in 8-hour average CO concentrations are very small, and consequently would not result in a violation of the CEQR *de minimis* CO criteria. Therefore, mobile source CO emissions with Phase II of the Project would not result in a significant adverse impact on air quality.

Table 4E-9
Maximum Predicted 8-Hour
CO Build Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)		
			No Build	Build	*De Minimis*
1	Atlantic Avenue and Flatbush Avenue	Saturday MD	2.8	2.9	3.1
2	Atlantic Avenue and Vanderbilt Avenue	Saturday MD	2.3	2.4	3.3
3	Pacific Avenue and Vanderbilt Avenue	Saturday MD	2.0	2.0	3.5

Notes:
8-hour standard is 9 ppm.
Concentration includes a background concentration of 1.7 ppm.

PM_{10} concentrations for the Build condition were also determined using the methodology previously described. **Table 4E-10** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2035 Build condition. The values shown are the highest predicted concentrations for the receptor locations.

Using the methodology previously described, maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared with the *de minimis* criteria that would determine the potential significance of any impacts from Phase II of the Project. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Tables 4E-11 and 4E-12**, respectively. Note that $PM_{2.5}$ concentrations in the No Build condition are not presented, since impacts are assessed on an incremental basis.

Table 4E-10
Maximum Predicted 24-Hour Average
PM_{10} Build Concentrations ($\mu g/m^3$)

Receptor Site	Location	Concentration	
		No Build	Build
1	Atlantic Avenue and Flatbush Avenue	102.7	103.6
2	Atlantic Avenue and Vanderbilt Avenue	82.6	84.3
3	Pacific Avenue and Vanderbilt Avenue	60.6	61.3

Notes:
NAAQS—24-hour average 150 $\mu g/m^3$.
Concentration includes a background concentration of 48.0 $\mu g/m^3$.

Table 4E-11
2035 Maximum Predicted 24-Hour Average
$PM_{2.5}$ Incremental Concentrations

Receptor Site	Location	Increment (µg/m^3)	*De Minimis* (µg/m^3)
1	Atlantic Avenue and Flatbush Avenue	0.8	5.6
2	Atlantic Avenue and Vanderbilt Avenue	1.0	5.6
3	Pacific Avenue and Vanderbilt Avenue	0.3	5.6

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

Table 4E-12
2035 Maximum Predicted Annual Average
$PM_{2.5}$ Incremental Concentrations (µg/m^3)

Receptor Site	Location	Increment
1	Atlantic Avenue and Flatbush Avenue	0.07
2	Atlantic Avenue and Vanderbilt Avenue	0.05
3	Pacific Avenue and Vanderbilt Avenue	0.03

Note: $PM_{2.5}$ *de minimis* criteria—annual (neighborhood scale), 0.1 µg/m^3.

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

PARKING GARAGE

Based on the methodology previously described, the maximum predicted 8-hour average CO concentrations from the proposed underground parking facility on Lot 1129 were analyzed at the following locations, assuming a vent location on the façade of the proposed building: a near side sidewalk receptor on the same side of the street (5 feet) as the parking facility and a far side sidewalk receptor on the opposite side of the street (81 feet) from the parking facility. Pollutant levels were also predicted at the height of the vents at a distance of 15 feet, accounting for the minimum vent to window distance requirements specified by the New York City Mechanical Code.

The total CO concentrations include both background CO levels and contributions from traffic on adjacent roadways for the far side receptor only. The maximum predicted 8-hour average CO concentration of all the receptors modeled is 3.9 ppm on the building receptor. This value includes a predicted concentration of 2.2 ppm from the parking garage vent, and includes a background level of 1.7 ppm. The maximum predicted concentration is substantially below the applicable standard of 9 ppm. Therefore, the proposed parking garage would not result in any significant adverse air quality impacts.

STATIONARY SOURCES

PHASE II DEVELOPMENT

Table 4E-13 shows maximum overall predicted 1-hour NO_2 concentration for the Phase II development's boiler systems, which was predicted to occur on elevated locations on the Phase II buildings. Maximum predicted concentrations on other existing and proposed buildings, as well as at ground-level receptors, are much lower (the maximum ground-level 1-hour NO_2 concentration predicted with Phase II of the Project is presented in **Table 4E-14)**. As shown in the tables, the maximum 1-hour NO_2 concentrations from stack emissions, when added to ambient background levels, would be below the NAAQS. This indicates that there would be no significant adverse air quality impacts resulting from stationary source emissions associated with Phase II of the Project.

Table 4E-13
Future (2035) Maximum Modeled 1-Hour NO_2 Concentration ($\mu g/m^3$)

Pollutant	Averaging Period	Maximum Predicted Increment	Maximum Background Concentration	Total Concentration	NAAQS
NO_2	1-hour [1]	-	-	160.9	188

Notes:
[1] Reported concentration is the maximum total 98th percentile concentration at any receptor using seasonal-hourly background concentrations.

Table 4E-14
Future (2035) Maximum Modeled Ground Level 1-Hour NO_2 Concentration ($\mu g/m^3$)

Pollutant	Averaging Period	Maximum Predicted Increment	Maximum Background Concentration	Total Concentration	NAAQS
NO_2	1-hour[1]	-	-	115.1	188

Notes:
[1] Reported concentration is the maximum 5-year average of the total 98th percentile concentration at any receptor using seasonal-hourly background concentrations.

The MEC would incorporate restrictions regarding the potential school to be within the base of either Building 6 or Building 15 requiring either, that heating and hot water equipment not utilize fossil fuels, or that further air quality analysis be performed.

CUMULATIVE IMPACTS OF PHASE I AND PHASE II DEVELOPMENTS

1-Hour NO_2 concentrations from the Phase I and Phase II Project's boiler equipment were added to background concentrations to determine maximum cumulative effects of the Project. The maximum overall concentration is presented in **Table 4E-15**.

Table 4E-15
Future (2035) Maximum Modeled Cumulative Stationary Source Pollutant Concentrations ($\mu g/m^3$)

Pollutant	Averaging Period	Maximum Predicted Increment	Maximum Background Concentration	Total Concentration	NAAQS
NO_2	1-hour [1]	-	-	161.1	188

Notes:
[1] Reported concentration is the maximum 5-year average of the total 98th percentile concentration at any receptor using seasonal-hourly background concentrations.

As shown in the table, 1-hour NO_2 the maximum concentration from Phase I and Phase II stack emissions, added to the background concentration, would be below the NAAQS. Therefore, no significant adverse air quality impacts resulting from stationary source emissions would occur with the Project. ✷