Chapter 15: Air Quality

A. INTRODUCTION

This chapter examines the potential for air quality impacts from the Proposed Actions, which include the development of new academic space, student and faculty housing, a new athletic center, ground-floor retail, a University-oriented hotel, academic conference space, below-grade replacement parking facilities, and potentially a public school.[1] As part of the Proposed Actions, NYU is also proposing to convert ground-floor uses in existing buildings within the "Commercial Overlay Area" to retail uses, and to acquire the property that contains NYU's 251 Mercer Street Central Plant below-grade.

As discussed in Chapter 1, "Project Description," four new buildings are proposed within the Proposed Development Area—the two superblocks bounded by LaGuardia Place to the west, Mercer Street to the east, West Houston Street to the south, and West Third Street to the north, and separated by Bleecker Street. The proposed Zipper and Bleecker buildings would be developed in Phase 1, on the superblock south of Bleecker Street (the "South Block") by 2021 (the interim analysis year). Also in Phase 1, the temporary gymnasium building would be constructed on the superblock north of Bleecker Street (the "North Block"), and would be demolished once the new gymnasium facility in the Zipper Building is operational. Once the South Block is developed, Phase 2 construction would include the proposed Mercer Building and LaGuardia Building and the proposed below-grade academic space and parking garage on the North Block, all of which would be competed by 2031.

The Proposed Actions would create new sources of air pollutant emissions, both mobile (emissions from vehicle trips generated by the Proposed Actions) and stationary (such as exhaust from fossil fuel-fired heating and hot water systems). The Proposed Actions would also introduce new sensitive uses (such as student and faculty housing and potentially a public school) near existing sources of emissions. Existing emission sources include heating and hot water systems serving existing buildings and combustion sources at NYU's Central Plant, which provides heat, power, and cooling to a number of existing NYU buildings in the area. NYU's Central Plant would also serve the proposed Mercer Building, the proposed LaGuardia Building, and most of the proposed Zipper Building. The Central Plant includes a cogeneration facility, in which the thermal byproduct of power generation is used for heating and cooling of the buildings. Cogeneration is a highly efficient means of providing energy for buildings.

The maximum hourly traffic generated by the Proposed Actions would not exceed the *City Environmental Quality Review (CEQR) Technical Manual* (January 2012 Edition) carbon monoxide (CO) screening threshold of 170 peak hour vehicle trips at an intersection in the study

[1] If by 2025 the New York City School Construction Authority (SCA) does not exercise its option to build the public school, NYU would build and utilize the 100,000-square-foot space for its own academic purposes.

area. However, the particulate matter emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual* would be exceeded in the 2031 analysis year. Therefore, a quantified assessment of the potential impacts on air quality from traffic generated by the Proposed Actions was conducted.

A quantified analysis was also conducted to evaluate potential future CO concentrations in the vicinity of the ventilation outlets for the proposed parking garage, which would be developed by 2031.

The potential for impact on air quality from existing and proposed heat and hot water systems was analyzed, following the *CEQR Technical Manual* guidance. In addition, the potential for impact from the NYU Central Plant emissions on the Proposed Development Area was analyzed. The Proposed Actions would result in institutional, residential and commercial development near an area zoned for manufacturing. A site survey and air emission permit search was conducted to determine whether any businesses within the manufacturing zone are sources of emissions that could have the potential for air quality impacts on the proposed uses.

The proposed conversion of existing ground-floor uses to retail within the Commercial Overlay Area would not result in any change to the floor area of existing buildings, and would not be expected to result in any additional stationary sources of emissions. Therefore, a stationary source assessment of the Commercial Overlay Area component of the Proposed Actions is not warranted.

Although an Illustrative Program reflecting what is currently contemplated by NYU has been developed, the desired programming and timing of development of certain buildings may change over time. Given these potential variations with respect to the overall programming, three "reasonable worst-case development scenarios" (RWCDS) were formulated (see Table 1-8). The RWCDS for the mobile source air quality analysis is the same as for the traffic analysis, which assumes a mix of uses that maximizes hotel uses (RWCDS 3 - "Max Hotel" Scenario). The RWCDS for the stationary source analysis assumed that certain developments would have on-site fossil fuel-fired heat and hot water systems that maximize their energy usage (i.e., RWCDS 3 for the Zipper Building, and RWCDS 1 - "Max Academic" Scenario) for the Bleecker Building.

PRINCIPAL CONCLUSIONS

A detailed assessment found that the Proposed Actions would not result in significant adverse impacts from mobile source emissions. The maximum predicted concentration increments due to emissions from vehicle trips generated by the Proposed Actions would be in compliance with the City's interim guidance criteria for fine particulate matter ($PM_{2.5}$). Vehicle emissions inside the proposed parking garage would be mechanically vented. The concentrations in the Proposed Development Area resulting from the emissions within the parking garage and from on-street traffic would be in compliance with the applicable standards and thresholds.

Based on detailed stationary source analyses, there would be no potential for significant adverse air quality impacts from the heat and hot water systems of the proposed Bleecker Building, the temporary gymnasium, and the portion of the Zipper Building that would not be connected to the NYU Central Plant (approximately 350,000 square feet). Provisions would be included in a Restrictive Declaration for the Proposed Actions on the use of natural gas and the placement of heating and hot water system exhaust stacks for the proposed Zipper Building, Bleecker Building and temporary gymnasium. Other proposed buildings would not have on-site heating and hot water systems, and therefore, would not have the potential for significant adverse impacts on air quality.

Large existing buildings were analyzed for their potential to affect the Proposed Development Area. Based on detailed stationary source modeling of those existing buildings, they would not have a significant adverse impact on the Proposed Development Area's air quality.

To preclude the potential for significant adverse impact on air quality from the existing NYU Central Plant on the Proposed Actions, the location of operable windows and air intakes on the proposed Mercer Building would be restricted to a height of 195 feet and less. In addition, NYU would be required to switch the NYU Central Plant boiler fuel to natural gas or No. 2 fuel oil before the proposed Zipper and Mercer buildings are occupied. By this time, the sulfur content of No. 2 fuel oil for heating would be reduced to 15 parts per million (ppm) as a result of New York State regulations. These requirements would be included in a Restrictive Declaration for the Proposed Actions. With these restrictions in place, there would be no potential for significant adverse impacts on air quality from any existing sources.

Based on a cumulative assessment of proposed and existing sources, there would be no potential for significant adverse impact on air quality on the proposed buildings or at locations where the effect of the proposed buildings' heat and hot water systems would be greatest.

Nearby existing sources from manufacturing or processing facilities were surveyed for their potential impacts on the Proposed Development Area. There are no existing permitted sources of manufacturing use emissions within the study area that could affect the Proposed Development Area. Therefore, there would be no potential for significant adverse impacts on air quality with the Proposed Actions.

B. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of CO are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and sources utilizing non-road diesel such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs. These pollutants are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act, and are referred to as 'criteria pollutants'.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas which does not persist in the atmosphere, CO concentrations can vary greatly over relatively short distances;

elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

Since the Proposed Actions would result in fewer new peak hour vehicle trips than the *CEQR Technical Manual* screening threshold of 170 trips in the study area, a quantified assessment of on-street CO emissions is not warranted. A parking garage analysis was conducted to evaluate future CO concentrations with the operation of the proposed parking garage.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions. The Proposed Actions would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels is predicted. A regional analysis of emissions of these pollutants from mobile sources associated with the Proposed Actions was therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated criteria pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and not a local concern from mobile sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source.) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant.

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

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

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the Clean Air Act. No significant sources of lead are associated with the Proposed Actions and, therefore, analysis is not warranted.

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

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

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

Diesel-powered vehicles, especially heavy duty trucks and buses, are a major source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel powered vehicles. The Proposed Actions would result in traffic exceeding the $PM_{2.5}$ vehicle emission screening analysis thresholds as defined in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual*. Therefore, the potential impacts from vehicle $PM_{2.5}$ emissions were analyzed.

An assessment of PM emissions from the proposed building heat and hot water systems was conducted, following the *CEQR Technical Manual* and EPA guidance. The potential impacts of PM emissions from existing buildings and the NYU Central Plant on the Proposed Development Area were also analyzed, following the *CEQR Technical Manual* guidance.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Monitored SO_2 concentrations in New York City do not exceed national standards. SO_2 is also of concern as a precursor to $PM_{2.5}$ and is regulated as a $PM_{2.5}$ precursor under the New Source Review permitting program for large sources. Due to the federal restrictions on the sulfur content in diesel fuel for on-road and non-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant and therefore, analysis of SO_2 from mobile and non-road sources was not warranted.

An assessment of SO_2 emissions from stationary sources, including proposed and existing building heat and hot water systems and the NYU Central Plant was conducted, following the *CEQR Technical Manual* and EPA guidance**.**

NONCRITERIA POLLUTANTS

In addition to the criteria pollutants discussed above, noncriteria pollutants may be of concern. Noncriteria pollutants are emitted by a wide range of man-made and naturally occurring sources. These pollutants are sometimes referred to as hazardous air pollutants (HAP) and when emitted from mobile sources, as Mobile Source Air Toxics (MSATs). Emissions of noncriteria pollutants from industries are regulated by EPA. The existing uses within the area zoned for manufacturing were surveyed as potential sources of noncriteria pollutant emissions.

C. AIR QUALITY STANDARDS, REGULATIONS AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation’s welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 15-1**. The NAAQS for CO, annual NO_2, and 3-hour SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended particulate matter (TSP), settleable particles, non-methane hydrocarbons (NMHC), 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the noncriteria pollutants beryllium, fluoride, and hydrogen sulfide (H_2S).

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

Table 15-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m³	ppm	µg/m³
Carbon Monoxide (CO)				
8-Hour Average (1)	9	10,000	None	
1-Hour Average (1)	35	40,000		
Lead				
Rolling 3-Month Average (2)	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average (3)	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average (4)	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average (1)	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean	NA	15	NA	15
24-Hour Average (5)	NA	35	NA	35
Sulfur Dioxide (SO_2) (6)				
1-Hour Average (7)	0.075	197	NA	NA
Maximum 3-Hour Average (1)	NA	NA	0.50	1,300

Notes:
ppm – parts per million
µg/m³ – micrograms per cubic meter
NA – not applicable
All annual periods refer to calendar year.
PM concentrations (including lead) are in µg/m³ since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m³ are presented.
(1) Not to be exceeded more than once a year.
(2) EPA has lowered the NAAQS down from 1.5 µg/m³, effective January 12, 2009.
(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.
(5) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
(6) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.
(7) 3-year average of the annual 99th percentile daily maximum 1-hr average concentration.
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

EPA lowered the primary and secondary standards for lead to 0.15 µg/m³, effective January 12, 2009. EPA revised the averaging time to a rolling 3-month average and the form of the standard to not-to-exceed across a 3-year span.

EPA established a 1-hour average NO_2 standard of 0.100 ppm, effective April 12, 2010, in addition to the annual standard. The statistical form is the 3-year average of the 98th percentile of daily maximum 1-hour average concentration in a year.

EPA established a 1-hour average SO_2 standard of 0.075 ppm, replacing the 24-hour and annual primary standards, effective August 23, 2010. The statistical form is the 3-year average of the 99th percentile of the annual distribution of daily maximum 1-hour concentrations (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

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

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 Clean Air Act.

In 2002, EPA re-designated New York City as in attainment for CO. The Clean Air Act requires that a maintenance plan ensure continued compliance with the CO NAAQS for former non-attainment areas. New York City is also committed to implementing site-specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period.

Manhattan has been designated as a moderate NAA for PM_{10}. On December 17, 2004, EPA took final action designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ non-attainment area under the Clean Air Act due to exceedance of the annual average standard. Based on recent monitoring data (2006-2009), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard.

In October 2009 EPA finalized the designation of the New York City Metropolitan Area as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS, effective in November 2009. The nonattainment area includes the same 10-county area originally designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2007-2009), 24-hour average concentrations of $PM_{2.5}$ in this area no longer exceed the standard. New York has submitted a “Clean Data” request to the USEPA. Any requirement to submit a SIP is stayed until EPA acts on New York’s request.

The five New York City counties, Nassau, Rockland, Suffolk, Westchester, and Lower Orange County Metropolitan Area (LOCMA) counties had been designated as a severe non-attainment area for ozone (1-hour average standard). In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007.

On April 15, 2004, EPA designated the five New York City counties, Nassau, Rockland, Suffolk, and Westchester counties as moderate non-attainment for the 1997 8-hour average ozone standard. EPA revoked the 1-hour standard on June 15, 2005; however, some control measures for the 1-hour standard included in the 1-hour SIP are required to stay in place until the 8-hour standard is attained. On February 8, 2008, NYSDEC submitted final revisions to the SIP to EPA to address the 1997 8-hour ozone standard. On January 25, 2012, EPA proposed to determine that the NYMA has attained the 1997 8-hour ozone NAAQS (0.08 ppm).

In March 2008 EPA strengthened the 8–hour ozone standards. SIPs will be due three years after the final designations are made. On March 12, 2009, NYSDEC recommended that the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester be designated as a non-attainment area for the 2008 ozone NAAQS (the NYMA MSA nonattainment area).

New York City is currently in attainment of the annual-average NO_2 standard. EPA has designated the entire state of New York as "unclassifiable/attainment" for the new 1-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the 1-hour standard, areas will be reclassified once three years of monitoring data are available (2016 or 2017).

EPA has established a 1-hour SO_2 standard, replacing the former 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. EPA plans to make final attainment designations in June 2012, based on 2008 to 2010 monitoring data and refined modeling. SIPs for nonattainment areas will be due by June 2014.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and the *CEQR Technical Manual* state that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 15-1**) would be deemed to have a potential significant adverse impact. Similarly, for non-criteria pollutants, predicted exceedance of the DAR-1 guideline concentrations would be considered a potential significant adverse impact.

In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

DE MINIMIS CRITERIA REGARDING CO IMPACTS

New York City has developed *de minimis* criteria to assess the significance of the increase in CO concentrations that would result from the impact of proposed projects or actions on mobile sources, as set forth in the *CEQR Technical Manual*. These criteria set the minimum change in CO concentration that defines a significant environmental impact. Significant increases of CO concentrations in New York City are defined as: (1) an increase of 0.5 ppm or more in the

[1] *CEQR Technical Manual*, Chapter 17, section 400, ~~May 2010~~January 2012; and State Environmental Quality Review Regulations, 6 NYCRR § 617.7

maximum 8-hour average CO concentration at a location where the predicted No Action 8-hour concentration is equal to or between 8 and 9 ppm; or (2) an increase of more than half the difference between baseline (i.e., No Action) concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.

$PM_{2.5}$ INTERIM GUIDANCE CRITERIA

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts[1]. This policy applies only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 $\mu g/m^3$ averaged annually or more than 5 $\mu g/m^3$ on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

In addition, New York City uses interim guidance criteria for evaluating the potential $PM_{2.5}$ impacts for projects subject to CEQR. The interim guidance criteria currently employed to determine the potential significant adverse $PM_{2.5}$ impacts under CEQR are as follows:

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

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

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

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

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

INTRODUCTION

This section presents the methodologies, data, and assumptions used to conduct the air quality analyses for the Proposed Actions. The following mobile source and stationary source analyses were conducted for the interim analysis year (2021) and expected year for project completion (2031):

Mobile Source Analysis

- On Street Sources
  - $PM_{2.5}$ emissions from vehicle trips generated by the Proposed Actions.
- Parking Garage
  - Carbon monoxide emissions from ventilation of the proposed parking garage on the North Block.

Stationary Source Analysis

- Heating and Hot Water Systems
  - Emissions from the heat and hot water systems for the proposed temporary gymnasium that would be constructed on the North Block.
  - Emissions from the heat and hot water systems for the proposed buildings.
- Additional Sources
  - Emissions from the heat and hot water systems serving large existing buildings within 400 feet of the Proposed Development Area.
  - Emissions from the NYU Central Plant.
- Cumulative Combustion Source Analysis
  - Cumulative effects from the proposed buildings, the existing NYU Central Plant, and other large existing energy systems on the proposed buildings and existing uses.
- Industrial Sources
  - Assessment of uses in the nearby manufacturing zone for potential sources of air toxic pollutant emissions.

MOBILE SOURCES

As discussed, the proposed buildings would be constructed in phases. The number of project-generated trips would not exceed the CO screening threshold of 170 peak hour vehicle trips at an intersection in the study area in Phase 1 and Phase 2, or the particulate matter emission screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual* in Phase 1. Therefore, the mobile source analysis was conducted for particulate matter for the 2031 analysis year only. The proposed parking garage would be constructed in Phase 2; therefore, it was analyzed in the 2031 analysis year only.

ON STREET 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 analysis for the Proposed Actions employs a model approved by EPA that has been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the Proposed Actions. The assumptions used in the analysis are based on the *CEQR Technical Manual* guidance.

Emissions

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

Vehicle classification was based on data collected in the field. The general categories of vehicle types for specific roadways were further categorized into subcategories based on their prevalence within the fleet.[2]

Appropriate credits were used to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system comply with emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

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

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

[2] The MOBILE6.2 emissions model utilizes 28 vehicle categories by size and fuel. Traffic counts and predictions are based on broader size categories, and then broken down according to the fleet-wide distribution of subcategories and fuel types (diesel, gasoline, or alternative).

[3] EPA, Compilations of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42, December 2003.

Traffic Data

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the Proposed Actions (see Chapter 14, "Transportation"). Traffic data for the future without and with the Proposed Actions were employed in the respective air quality modeling scenarios. The weekday morning (8:30 to 9:30 AM) and midday (12:15 to 1:15 PM) peak hour traffic volumes were used as a baseline for determining project –off-peak volumes, since these periods had the highest number of project-generated $PM_{2.5}$ emissions from mobile sources (the number of project-generated vehicles for the PM peak period did not exceed the *CEQR Technical Manual* screening threshold). Off-peak traffic volumes in the existing condition and in the future without the Proposed Actions, and off-peak increments from the Proposed Actions, were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations.

Dispersion Model for Microscale Analyses

To determine motor vehicle generated $PM_{2.5}$ concentrations on sidewalks within the study area, the CAL3QHCR model was applied. This is a refined version of the CAL3QHC model Version 2.0.[1] The CAL3QHCR model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHCR predicts emissions and dispersion of $PM_{2.5}$ from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to predict the number of idling vehicles. The CAL3QHCR model can utilize hourly traffic and meteorology data, and is therefore appropriate for calculating 24-hour and annual average concentrations.

Meteorology

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the direction in which pollutants are dispersed, and atmospheric stability accounts for the effects of vertical mixing in the atmosphere. These factors, therefore, influence the concentration at a particular prediction location (receptor). Using the CAL3QHCR model, hourly concentrations were predicted based on hourly traffic data and five years (2005-2009) of monitored hourly meteorological data. The data consist of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

Analysis Year

The microscale analyses were performed for 2031, the year by which Phase 2 of the proposed development would be constructed. The analysis for 2031 was performed for traffic conditions with and without the Proposed Actions.

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

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

Receptor Placement

Multiple receptors (i.e., locations at which concentrations are predicted) were modeled at the selected site; receptors were placed along the approach and departure links at spaced intervals. Receptors were placed at sidewalk or roadside locations near intersections with continuous public access. Receptors in the analysis model for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters from the nearest moving lanes, based on the NYCDEP procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

PARKING GARAGE

The Proposed Actions would include the development of a new below-grade parking garage on the North Block, with an entrance on West Third Street. The 4-level garage would be mechanically ventilated and would accommodate 389 vehicles. The existing 670 space garage on the North Block would be replaced by the proposed below-grade academic space. Emissions from vehicles using the garage could potentially affect future ambient levels of CO in the vicinity of the garage exhaust vents. Therefore, an analysis was conducted to determine the potential for significant adverse impacts from the proposed garage's exhaust vents. Although the proposed garage, being smaller, would have lower emissions than the existing garage, the analysis presented here is conservatively based on the total emissions from the proposed garage, without accounting for the displacement of the existing garage.

The analysis of emissions from the outlet vents and their dispersion in the environment was performed to calculate pollutant levels in the surrounding area, using the methodology set forth in the *CEQR Technical Manual*. Emissions from vehicles entering, parking, and exiting the garage were estimated using the EPA MOBILE6.2 mobile source emission model and an ambient temperature of 50°F, as referenced in the *CEQR Technical Manual*. For all arriving and departing vehicles, an average speed of 5 miles per hour was conservatively assumed for travel within the parking garage. In addition, all departing vehicles were assumed to idle for 1 minute before proceeding to the exit. The concentration of CO within the garage was calculated assuming a minimum ventilation rate, based on New York City Building Code requirements, of 1 cubic foot per minute of fresh air per gross square foot of garage area. The mechanical designs for the proposed parking garage have not been finalized. Therefore, it was conservatively assumed that the proposed garage would have one vent that would exhaust air towards West Third Street. CO concentrations were predicted for the maximum 8-hour and 1-hour averaging periods. Locations where CO concentrations were predicted included the West Third Street south and north sidewalk locations near the proposed garage entrance, locations on the existing Washington Square Village buildings, and the proposed Mercer Building.

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

The CO concentrations were determined for the time periods when overall garage usage would be the greatest. The weekday AM and PM peak periods were therefore analyzed. Departing vehicles were assumed to be operating in a “cold-start” mode, emitting higher levels of CO than arriving vehicles. Vehicle trip generation analysis data were used.

A persistence factor of 0.7 was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. Background CO concentrations and concentrations from on-street traffic were added to the parking garage modeling results to obtain the total ambient CO levels. The 8-hour average background concentration used in the analysis was 2.0 ppm, which is based on the highest second-highest 8-hour measurements over the most recent five-year period for which complete monitoring data are available (2005-2009). The 1-hour CO background used in the analysis was 3.1 ppm and was obtained using the same procedure as the 8-hour average background. The monitored values were obtained at the Queens College 2 monitoring station, which is the currently operating monitoring station nearest to the Proposed Development Area.

STATIONARY SOURCES

HEATING AND HOT WATER SYSTEMS

The thermal energy needs of the proposed LaGuardia Building and Mercer Building would be served by the NYU Central Plant and would therefore not require any on-site heat and hot water systems. The proposed buildings whose heat and hot water systems were included in the analysis are described below.

Temporary Gymnasium (Phase 1). The proposed temporary gymnasium would be constructed on the North Block and demolished when the proposed new athletic center on the South Block opens. The proposed temporary gymnasium would be heated and cooled through a connection to NYU’s existing Central Plant or it would have its own heating and cooling systems. To account for the reasonable worst case scenario, a stationary source analysis was conducted to evaluate the potential for impacts on air quality, assuming that the proposed temporary gymnasium would have its own heat and hot water system that would use natural gas as fuel (cooling systems were assumed to be electric).

Zipper Building (Phase 1). The proposed Zipper Building would be constructed on the South Block by the interim analysis year 2021. The tallest tower of the Zipper Building, with a floor area of approximately 350,000 gross square feet (gsf), would have its own natural gas-fired boiler plant, which was considered for its potential to impact existing buildings and proposed buildings, including buildings that would be constructed as part of Phase 2. The rest of the Zipper Building would be served by the NYU Central Plant.

Bleecker Building (Phase 1). The proposed Bleecker Building would be constructed on the South Block by the interim analysis year 2021. It is anticipated that this building would have an on-site heating and hot water system that would use natural gas. Therefore, emissions from the proposed Bleecker Building heating and hot water system were considered for their potential to impact the air quality at existing buildings and proposed buildings, including buildings that would be constructed as part of Phase 2.

Dispersion Modeling

Future concentrations of NO_2, SO_2, and PM_{10} and $PM_{2.5}$ concentration increments resulting from the proposed heating and hot water system emissions were predicted using the EPA/AMS AERMOD dispersion model.[1]

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

The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability to calculate pollutant concentrations at locations where the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. The analyses of potential impacts from the exhaust stacks were made assuming stack tip downwash, urban dispersion and surface roughness length, with and without building downwash (as recommended in the *CEQR Technical Manual*), and elimination of calms.

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

The analysis was performed both with and without downwash in order to assess the worst-case impacts at elevated receptors close to the height of the sources, which would occur without downwash, as well as the worst-case impacts at lower elevations and ground level, which would occur with downwash.

For the analysis of the Proposed Actions' effect on 1-hour average NO_2 concentrations, the Plume Volume Molar Ratio Method (PVMRM) module was applied within AERMOD, following EPA's modeling guidance.[2] PVMRM analyzes chemical transformation of NO emitted from the stack to NO_2. The PVMRM module incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. Ozone concentrations were obtained from the NYSDEC Queens College monitoring station, which is the station with recent ozone data nearest to the Proposed Development Area. An initial NO_2 to NO_x ratio of 10

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

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

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

percent at the source exhaust was assumed for the existing and proposed building heat and hot water systems. This ratio is appropriate for boilers.[1]

Total hourly NO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the detailed hourly ambient NO_2 concentrations measured at the Queens College monitoring station for each corresponding hour. Then, the highest combined daily 1-hour NO_2 concentration was determined at each receptor location for each day. The 98th percentile for each modeled year was then calculated at each receptor and averaged over the five year modeling period, in accordance with EPA guidance. The highest five-year average was then compared with the 1-hour NO_2 NAAQS standard.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at LaGuardia Airport (2006–2010) and concurrent upper air data collected at Brookhaven, New York. The meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevation over the five-year period. These data were processed using the EPA AERMET program to develop data in a format that can be readily processed by the AERMOD model. The land uses around the site where meteorological surface data were available were classified using categories defined in digital United States Geological Survey (USGS) maps to determine surface parameters used by the AERMET program.

Background Concentrations

To estimate the maximum expected pollutant concentration at a given location (receptor), the predicted impacts must be added to a background value that accounts for existing pollutant concentrations from other sources that are not directly accounted for in the model (see **Table 15-2**). To develop background levels, concentrations measured at the nearest NYSDEC ambient monitoring station over the latest available 5-year period (2005-2009) were used for annual average NO_2 and 3-hour average SO_2 background, while the latest available 3-year period was used for PM_{10} and the 1-hour average NO_2 and SO_2 background concentrations. The background concentrations were developed in accordance with the *CEQR Technical Manual* methodology. Note that the background for the 1-hour standards represents the concentration that is consistent with the format of the NAAQS. In the case of NO_2, the concentration shown in **Table 15-2** is the 3-year average of the annual 98th percentile daily maximum 1-hour average concentration.

Receptor Placement

Discrete receptors (i.e., locations at which concentrations are calculated) were modeled along the facades of buildings nearby each source to represent operable window locations, intake vents, and otherwise accessible locations such as terraces. Rows of receptors were placed in the model at spaced intervals on the existing buildings including the Washington Square Village and University Village buildings, and the proposed Bleecker Building, Zipper Building, Mercer Building and LaGuardia Building at multiple elevations.

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

Table 15-2
Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	Annual[1]	Queens College, Queens	47	100
SO_2	1-hour	Queens College, Queens	91.4	196
	3 hour		128	1,300
PM_{10}	24 Hour	Division Street, Manhattan	53	150

Sources: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2005-2009.
1. The 1-Hour NO_2 background concentration is not presented in the table since the AERMOD model determines the total 98th percentile 1-Hour NO_2 concentration at each receptor using hourly background concentrations.

Emission Estimates and Stack Parameters

The annual average emission rates for the proposed buildings, whose heat and hot water systems would operate on natural gas, were developed using energy intensity data from the Air Quality Appendix of the *CEQR Technical Manual* and EPA's *Compilations of Air Pollutant Emission Factors (AP-42)*[1] Table 1.4-1, Table 1.4-2, and Table 1.3-2a. AP-42 emission factors were used to calculate the annual emission rates. The annual average emission rate obtained using AP-42 and the procedures described in the *CEQR Technical Manual* were adjusted for seasonal and daily variations in emissions, accounting for greater boiler use during the heating season, based on energy modeling data. Emission rates and stack parameters are provided in **Table 15-3**. The heat and hot water system stacks for the proposed Zipper Building and Bleecker Building buildings were assumed to be located at the top building tier. This stack placement, required to avoid the potential for significant adverse impacts on air quality, would be included in the Restrictive Declaration for the Proposed Actions.

ADDITIONAL SOURCES

The *CEQR Technical Manual* requires an assessment of any actions that could result in the location of sensitive uses within 1,000 feet of a "large" emission source (examples of large emission sources provided in the *CEQR Technical Manual* include solid and medical waste incinerators, cogeneration plants, asphalt and concrete plants, or power plants) or within 400 feet of emission sources associated with commercial, institutional, or large-scale residential developments where the proposed structure would be of a height similar to or greater than the height of an existing emission stack. Facilities that warrant consideration typically operate pursuant to the NYSDEC's Title V program or the State Facility permit program. Sources for consideration are also identified through review of NYCDEP permit data and the EPA Envirofacts database.

Three large existing buildings within 400 feet of the Proposed Development Area (611 Broadway, 218 Mercer Street, and 683 Broadway) were identified for analysis of air quality impact on the proposed buildings. In addition, the NYU Central Plant warrants an analysis of the potential impact on the proposed uses because it operates as a major emission source pursuant to the Title V permit program and is within 1,000 feet of the Proposed Development Area.

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

Table 15-3
Emission Rates and Stack Parameters for Proposed Buildings

Proposed Building Emissions Source	Annual Average Emission Rate[1] (g/s)			
	NO_x	PM_{10}	$PM_{2.5}$	SO_2
Temporary Gymnasium[2]	1.95×10^{-3}	1.48×10^{-4}	1.48×10^{-4}	1.17×10^{-5}
Portion of the Zipper Building	2.95×10^{-2}	2.24×10^{-3}	2.24×10^{-3}	1.77×10^{-4}
Bleecker Building	1.46×10^{-2}	1.11×10^{-3}	1.11×10^{-3}	8.78×10^{-5}
	Stack Parameter[3]			
Building Emissions Source	Exhaust Height (m)	Inside Diameter (m)	Exhaust Velocity (m/s)	Exhaust Temperature (K)
Temporary Gymnasium	12.5	0.15	3.9	426
Portion of the Zipper Building	84.7	1.22	10.2	426
Bleecker Building	55.2	1.22	10.2	426

Notes:

1. For the portion of the Zipper Building not served by the NYU Central Plant (approximately 350,000 gsf) and the Bleecker Building, the short term emission rates were obtained by adjusting the annual average emission rates to account for seasonal variation in heat and hot water demand. The adjustment factors were obtained from representative energy modeling data.
2. Applicable energy modeling data for the temporary gymnasium were not available. The annual average emission rates were obtained using the annual natural gas per square foot consumption factor for commercial buildings referenced in the *CEQR Technical Manual*. The short-term emission rates assume a 100-day heating season.
3. The stack diameter, exhaust velocity, and exhaust temperature are based on a survey of New York City building boilers of similar size. The exhaust height was assumed to be 3 feet above the proposed rooftops.

Existing Building Heating and Hot Water Systems

There are a number of large existing residential, commercial and institutional buildings within or near the Proposed Development Area. The Silver Towers, the 505 LaGuardia Place building, and the Washington Square Village buildings receive heat and hot water from the NYU Central Plant. The Washington Square Village buildings have backup heating systems that would operate under emergency conditions or scheduled maintenance of the NYU Central Plant. As these conditions are infrequent or very temporary, an analysis of air quality impacts from these sources is not warranted. However, the three large buildings within the 400 feet of the Proposed Development Area have on-site fuel oil-burning heating and hot water systems that require an analysis of the potential for air quality on the proposed buildings that would be constructed in Phases 1 and 2. The methodology used to assess the potential for impacts from the existing building boilers was the same as the methodology used to assess the potential for impacts from the proposed buildings' boilers. In addition, the New York State and New York City regulations that require gradual phasing out of residual oil and a reduction of the sulfur content in No. 2 fuel oil to 15 ppm were considered.[1] This analysis took into account only those regulations that would take effect before the proposed buildings are constructed. **Table 15-4** shows annual emission rates and stack parameters.

[1] NYCDEP Promulgation of Amendments to Chapter 2 of Title 15 of the rules of the City of New York Rules Governing the Emissions from the Use of #4 and #6 Fuel Oil in Heat and Hot Water Boilers and Burners; New York State, Sulfur Reduction Requirements, http://assembly.state.ny.us/leg/?sh=printbill&bn=A08642&term=2009; Local Laws of the City of New York for the Year 2010, No. 43.

Table 15-4
Emission Rates and Stack Parameters for Existing Buildings

Emission Rate[1]/Stack Parameter	611 Broadway[2]	218 Mercer[3]	638 Broadway[4]
Fuel Currently Used	No. 6 oil	Unknown	No. 6 oil
Fuel Modeled	No. 4 oil	No. 2 oil	No. 4 oil
NO_x (g/s)	1.12×10^{-2}	2.44×10^{-2}	1.37×10^{-2}
PM_{10} (g/s)	3.61×10^{-3}	2.90×10^{-3}	1.09×10^{-2}
$PM_{2.5}$ (g/s)	1.93×10^{-3}	2.59×10^{-3}	5.79×10^{-3}
SO_2 (g/s)	1.39×10^{-2}	2.59×10^{-4}	4.18×10^{-2}
Exhaust Height (m)	42.7	29.0	62.8
Inside Diameter (m)	0.97	1.22	1.22
Exhaust Velocity (m/s)	4.7	10.2	10.2
Exhaust Temperature (K)	478	426	426

Notes:
1. The emission rates shown are annual average emission rates calculated using energy consumption rates provided in the *CEQR Technical Manual Air Quality Appendix* and AP-42 emission factors. Short term emission rates were obtained by adjusting the annual average emission rates to account for seasonal variation in heat and hot water demand. The adjustment factors were obtained from representative energy modeling data.
2. The stack diameter, exhaust velocity, exhaust temperature, and stack height are based on the NYCDEP information. No. 4 fuel oil was modeled to reflect compliance with the NYC Local Law regarding the use of cleaner fuels, prior to the Proposed Actions.
3. Information about the fuel currently used for the building is not available. Based on the type of equipment, it is likely that the building currently uses natural gas. The analysis conservatively assumed the use of ultra low sulfur No. 2 oil. The stack diameter, exhaust velocity, and exhaust temperature are based on a survey of New York City building boilers of similar size. The exhaust height is estimated based on the number of floors.
4. The stack diameter, exhaust velocity, and exhaust temperature are based on a survey of New York City building boilers of similar size. The exhaust height is based on information from the Department of Buildings. No. 4 fuel oil was modeled to reflect compliance with the NYC Local Law regarding the use of cleaner fuels, prior to the Proposed Actions.

NYU Central Plant

The NYU Central Plant includes a cogeneration facility and provides electricity and steam for heating, hot water, and cooling to portions of the campus. The primary emissions sources for the facility are two combustion turbines that operate on natural gas and No. 2 oil, two duct burners that operate on natural gas exclusively, and three hot water boilers that operate on natural gas and No. 6 fuel oil. Emissions from these sources exhaust from a stack located at 251 Mercer Street. There are also seven diesel generators, whose emissions exhaust from a separate stack, located at 40 West 4th Street.

The NYU Central Plant would supply electricity, steam and cooling to the Mercer Building, LaGuardia Building, and the Zipper Building (except for the portion of the Zipper Building that would have its own heating systems). No need for an increase in the NYU Central Plant capacity is projected with the Proposed Actions. Therefore, for the purposes of the analysis it was assumed that the annual emissions from the NYU Central Plant would be the maximum allowable in the existing Title V permit and that the short term emissions would be the reasonable worst case, within the permit limits. The Title V emission limits would allow the equipment at the NYU Central Plant to operate at a level sufficient to supply electricity, steam, and cooling to portions of the proposed project, as described in Chapter 16, “Greenhouse Gas Emissions”.

As with the analysis of the Proposed Action's heat and hot water systems, the AERMOD dispersion model was used in the analysis of the NYU Central Plant, with the same set of meteorological data. The same background concentration values used in the analysis of proposed and existing building heating and hot water systems were used for the analysis of the NYU Central Plant, except for SO_2, where hourly backgrounds were used for the NYU Central Plant analysis. For the 1-hour NO_2 analysis, the PVMRM module was applied within AERMOD. An initial NO_2 to NO_x ratio of 50 percent at the source exhaust was assumed to conservatively account for all of the combustions sources at the plant. The 50 percent NO_2 to NO_x ratio is recommended by EPA when more source specific information is unavailable. Receptors were modeled along the proposed building facades.

Annual emissions used in the analysis were calculated using the annual emission limits specified in the Title V permit. The Title V permit does not include limitations on short-term operation of the plant. Therefore, a short-term operating scenario was developed, to account for reasonable worst-case emissions within the Title V permit limits. A description of the annual and short-term operating scenarios follows.

Annual Operating Scenario

The annual average concentrations of pollutants of concern (NO_x and $PM_{2.5}$) were predicted using the facility-wide emission limits in the Title V permit. The combustion turbine and boiler emission limits in the Title V permit reflect nine months of operation on natural gas, and three months of operation on oil, since, although the preferred fuel for this equipment is natural gas, this service is interruptible. Therefore, the analysis assumed that the combustion turbines and boilers would operate on oil throughout the winter and on gas during the rest of the year. This is a highly conservative assumption, as the gas service is unlikely to be interrupted more than a few times per year. The two duct burners run on natural gas exclusively and were assumed to operate continuously throughout the year, which is the basis for the emission limit in the Title V permit.

The annual emission limits in the Title V permit are based on continuous operation of the combustion turbines and duct burners at maximum load, two boilers operating continuously at mid load, and the diesel generators operating for a total of 2,000 hours per year at mid load.

The Title V permit contains emission limits for NO_x for each emission unit (combustion turbines/duct burners, boilers and diesel generators). These emission rates were used in the air quality analysis. For $PM_{2.5}$, the Title V permit contains a facility-wide PM emission limit. The Title V permit does not specify how the facility-wide $PM_{2.5}$ emission limit is allocated to the two stacks. The annual emissions from the 40 West 4th Street stack were calculated using AP-42 emission factors for the diesel generators, operating for a total of 2,000 hours allowed by the Title V permit. The annual $PM_{2.5}$ emissions for the 251 Mercer Street stack were calculated by subtracting the annual engine generator $PM_{2.5}$ emissions from the facility $PM_{2.5}$ cap.

Short-Term Operating Scenario

The equipment operating assumptions made to develop the short-term emission rates for the combustion turbines and duct burners are consistent with the assumptions used in developing the annual emission limits included in the Title V permit. The combustion turbines and duct burners were assumed to operate continuously at maximum load, with the combustion turbines operating on oil throughout the winter and on gas during the rest of the year.

The three NYU Central Plant boilers currently serve as a backup heating supply. In anticipation of City laws that would require phasing out of No. 6 and No. 4 fuel oil, NYU will switch the boiler fuel to natural gas or No. 2 oil, before the proposed Zipper and Mercer buildings are occupied. State regulations limiting the sulfur content of No. 2 oil to 15 ppm (ultra low sulfur) would take effect by that time. Therefore, the boiler emissions were calculated based on using ultra low sulfur No. 2 oil. Although planned or proposed NYS regulations and EPA programs that would similarly limit the sulfur content of No. 2 fuel oil and diesel fuel for other emission units are expected to take effect before the proposed project is constructed, the analysis conservatively assumed the use of No. 2 oil with the existing sulfur content of up to 0.2 percent (2,000 ppm) by weight for these other units. With use of the cleaner, less emitting fuel, the boilers could potentially operate to a greater extent without exceeding the Title V emission limits, which, as discussed earlier, are based on two boilers operating continuously at mid-load. To account for a reasonable worst-case scenario, the boiler emission rates were calculated assuming the continuous operation of two boilers at maximum load. It is important to note that with the Proposed Actions, it is estimated that the NYU Central Plant has sufficient capacity to provide heat and hot water to all connected buildings at all times without the need for operation of the boilers, except potentially under extreme conditions.

The diesel generators are currently used for emergency and testing purposes only. They are not enrolled in a demand response program to curtail load or export power. In the future, pending an NYU investment in updated governor controls and mechanical overhauls, NYU could elect to enroll the generators in a NYISO peak load curtailment program, as per the Title V permit, which allows a total of 2,000 operating hours per year for all seven generators. To model emissions from NYU Central Plant in the event that NYU participates in a peak load curtailment program, a reasonable worst case scenario was developed for short term emissions from the generators. Considering the 2,000 hour limit, the need for testing and maintenance, the projected load for the University, and the need for spare capacity, in case of emergencies, it was assumed that on a short-term basis, up to 3 megawatts (MW) would be committed and that diesel generators would operate for four hours per day, during summer peak demand season. The 3 MW is equivalent to operating five to six diesel generators at mid load (525 kW). This is a conservative operating assumption, since to comply with the 2,000 hour permit limit, no more than five generators could be enrolled in a summer (June through August) peak load curtailment program that would require a 4-hour per day commitment, even without accounting for periodic testing and emergency operation of the seven diesel generators. It is also important to note that the Proposed Actions would not affect the operation of the diesel generators.

The Title V permit allows for operational flexibility for each of the emission sources. The short-term operating scenario described herein represents one potential operating condition for the NYU Central Plant. On a short-term, limited basis, other combinations of equipment may operate. The short-term operating scenario is considered a reasonable worst-case scenario for the purpose of evaluating potential impacts on the Proposed Actions from the NYU Central Plant.

NO_x emission rates for the combustion turbines and duct burners were based on stack test data (dated May 9-13, 2011), conducted pursuant to the Title V permit. Available emissions testing information for the boilers was used in developing NO_x emission rates for the non-winter (natural gas) scenario, consistent with the methodology used in developing the Title V permit limits for NO_x. The NO_x emission rate for the boilers on ultra low sulfur No. 2 oil (winter scenario) was based on AP-42 emission factors, since applicable test data are not available. The diesel generator emission rate for NO_x is based on the 9 grams per brake horsepower-hour, specified in the Title V permit. All other emission rates were calculated using AP-42 emission factors.

Stack Parameters

The stack height and the stack diameter for the combustion turbine/boiler and diesel generators stacks were obtained from the Title V permit, while the stack exit velocity and exhaust temperature, which were not specified in the Title V permit, were based on emission testing data. The stack parameters and emission rates are shown in **Table 15-5**.

Table 15-5
Stack Parameters and Emission Rates for the NYU Central Plant

Emission Rate	Combustion Turbine/Duct Burner/ Boiler Stack		Diesel Generator Stack[3]
	(winter)[1]	(rest of year)[2]	
PM_{10} emission rate (24-hour) g/s	0.548	0.314	0.074
$PM_{2.5}$ emission rate (24-hour) g/s	0.459	0.314	0.072
NO_x emission rate (1-hour) g/s	7.918	2.963	10.050
SO_2 emission rate (1- and 3-hour) g/s	0.536	0.069	0.8195
$PM_{2.5}$ emission rate[4] (annual) g/s	0.2096		0.0900
NO_x emission rate[4] (annual) g/s	4.161		1.751
Stack Parameter			
Stack Height[5] (m)	67.67		50.90
Stack Diameter[5] (m)	2.74		0.91
Stack Exit Temperature[6] (K)	483.7		727.6
Stack Exit Velocity[7] (m/s)	20.20	18.91	29.18

Notes:

1. The short term winter scenario emission rates for the combustion turbine/duct burner/boiler stack reflect the use of No. 2 fuel oil in the combustion turbines, with duct burners operating on natural gas, and the continuous operation of two boilers at full load on ultra low sulfur No. 2 oil. The turbine/duct burner 1-hour NO_x emission rate is based on stack test data obtained pursuant to the Title V permit. Short-term emission rates for other pollutants are based on AP-42 emission factors.
2. The short-term emission rates for the rest of the year reflect the continuous operation of combustion turbines, duct burners, and two boilers at full load, all on natural gas. Emission rates are based on AP-42 emission factors, except for the 1-hour NO_x emission rate for boilers on natural gas, which is based on boiler test data.
3. The diesel generator stack short term emission rates assume summer operation of generators for up to 3 MW at a time for up to 4 hours. The diesel generator emission rate for NO_x is based on the 9 grams per brake horsepower-hour, specified in the Title V permit. The emission rates for other pollutants are based on AP-42 emission factors.
4. All annual average emission rates are based on Title V permit limits.
5. Based on the Title V permit.
6. Based on emissions testing data.
7. The exhaust velocity is calculated from stack parameters and the flow rates obtained or calculated from stack testing data.

INDUSTRIAL SOURCES

The Proposed Development Area is located near an area zoned for manufacturing. Some manufacturing and industrial uses emit air pollutants and therefore warrant an environmental assessment. The first step in assessing a project's potential for impact on air quality from industrial and manufacturing uses is to perform a field survey to identify any processing or manufacturing facilities located within 400 feet of the project site. Once identified, information regarding the release of air contaminants from these facilities is obtained from NYCDEP, Bureau of Environmental Compliance (BEC). A comprehensive search is also performed to identify NYSDECs Title V permits and permits listed in the U.S. Environmental Protection

Agency (USEPA) Envirofacts database.[1] In the next step, if there are emission sources of concern, the potential ambient concentrations of each air toxic contaminant are determined using the *CEQR Technical Manual* screening procedures or the AERMOD dispersion model and compared to applicable guideline concentrations established by NYSDEC and applicable federal air quality standards.

E. EXISTING CONDITIONS

Representative criteria pollutant concentrations measured in recent years at NYSDEC air quality monitoring stations nearest to the Proposed Development Area are presented in **Table 15-6**. The values presented are consistent with the NAAQS format. For example, the 8-hour ozone concentration shown is the 3-year average of the 4th highest daily maximum 8-hour average concentrations. The concentrations were obtained from the 2009 New York State Ambient Air Quality Report, the most recent report available. The recently monitored levels did not exceed the NAAQS. It should be noted that these values are somewhat different from the background concentrations used in the stationary source and parking garage analyses. The concentrations presented in **Table 15-6** provide a comparison of the air quality in the project area with the NAAQS, while background concentrations are obtained from several years of monitoring data, and represent a conservative estimate of the highest concentrations for future ambient conditions.

Table 15-6
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Queens College 2, Queens	ppm	8-hour	1.7	9
			1-hour	2.8	35
SO_2	Queens College 2, Queens[1]	µg/m³	3-hour	89	1,300
			1-hour	91.4	196
PM_{10}	Division Street, Manhattan	µg/m³	24-hour	43	150
$PM_{2.5}$	Division Street, Manhattan	µg/m³	Annual	12.7	15
			24-hour	33	35
NO_2	Queens College 2, Queens[2]	µg/m³	Annual	39	100
			1-hour	126.7	188
Lead	J.H.S. 126, Brooklyn	µg/m³	3-month	0.019	0.15
Ozone	Queens College 2, Queens	ppm	8-hour	0.074	0.075

Notes:
(1) The 1-hour value is based on a three-year average (2007-2009) of the 99th percentile of daily maximum 1-hour average concentrations. EPA replaced the 24-hr and the annual standards with the 1-hour standard.
(2) The 1-hour value is based on a three-year average (2007-2009) of the 98th percentile of daily maximum 1-hour average concentrations.
Source: NYSDEC, New York State Ambient Air Quality Report (2007-2009).

[1] EPA, Envirofacts Data Warehouse, http://oaspub.epa.gov/enviro/ef_home2.air, 3/24/2011

F. THE FUTURE WITHOUT THE PROPOSED ACTIONS

Without the Proposed Actions, there would be no new buildings by 2021 within the Proposed Development Area.

Stationary source emissions from existing sources would decrease with the phased implementation of State and local laws to restrict the use of Nos. 6 and 4 fuel oil for heating, and lower the sulfur content of No. 2 fuel oil. With or without the Proposed Actions, vehicle technology would continue to improve, and emission standards for new vehicles would become more stringent. With the improvements in technology and the implementation of New York State and New York City regulations that would require the use of cleaner fuels for heat and hot water, an overall improvement in air quality is anticipated.

G. THE FUTURE WITH THE PROPOSED ACTIONS

PHASE 1

MOBILE SOURCES

There would be no potential for a significant adverse impact on air quality at intersections in the study area from mobile sources in Phase 1 because the vehicle trips generated by the Proposed Actions in Phase 1 would not exceed the *CEQR Technical Manual* screening analysis thresholds. In addition, in Phase 1, the proposed underground parking facilities would not be operational. For specific details of the modeling results for the parking facilities, see Phase 2 results below.

STATIONARY SOURCES

Heating and Hot Water Systems

Temporary Gymnasium

A detailed dispersion analysis was performed to assess the potential for air quality impacts from the emissions associated with the heat and hot water systems for the proposed temporary gymnasium, which would be constructed on the North Block and operate until the opening of the proposed athletic center on the South Block.

Table 15-7 shows maximum predicted concentrations for NO_2, SO_2 and PM_{10} from the proposed temporary gymnasium. As shown in the table, the maximum concentrations from stack emissions, when added to ambient background levels, would be below the NAAQS.

The air quality modeling analysis also determined the highest predicted increase in 24-hour and annual average $PM_{2.5}$ concentrations from the temporary gymnasium (see **Table 15-8**). As shown in the table, the maximum 24-hour incremental impact at any discrete receptor location would be less than the applicable interim guidance criterion of 5 $\mu g/m^3$. On an annual basis, the projected $PM_{2.5}$ impacts would be less than the applicable interim guidance criterion of 0.3 $\mu g/m^3$, and the City's interim guidance criteria of 0.1 $\mu g/m^3$ for neighborhood scale impacts.

Table 15-7
Maximum Predicted Pollutant Concentration (in µg/m^3)
From Temporary Gymnasium

Pollutant	Averaging Period	Maximum Modeled	Background	Total	NAAQS
NO_2	1-hour	Hourly	Hourly	144.2[1]	188
	Annual[2]	0.9	47	47.9	100
SO_2	1-hour	0.5	91.4	91.9	196
	3-hour	0.3	128	128.3	1,300
PM_{10}	24-hour	1.9	53	54.9	150

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

Table 15-8
Maximum Predicted $PM_{2.5}$ Increments (in µg/m^3)
From Temporary Gymnasium

Pollutant	Averaging Period	Maximum Concentration	Interim Guidance Threshold
$PM_{2.5}$	24-hour	1.9	2 to 5[(1)]
	Annual (discrete)	0.07	0.3
	Annual (neighborhood scale)	< 0.07[(2)]	0.1

Notes:
(1) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 µg/m^3 (5 µg/m^3 not-to-exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.
(2) The neighborhood scale annual average concentration would not exceed the maximum annual average concentration at a discrete receptor. Therefore, the annual neighborhood scale concentration is reported to be less than the maximum discrete receptor concentration.

To preclude the potential for temporary air quality impacts on the existing Washington Square Village buildings, which are approximately 50 feet away from the proposed gymnasium, any fossil fuel fired equipment shall be required to use natural gas exclusively and the stack shall be located at least 85 feet from the existing Washington Square Village buildings. With these measures, which would be included in a Restrictive Declaration for the Proposed Actions, there would be no potential for significant adverse impacts on air quality from the proposed temporary gymnasium heating and hot water system emissions.

Zipper Building and Bleecker Building

Although the Zipper Building and the Bleecker Building would be constructed in Phase 1, the analysis of the emissions from the heating and hot water systems from those buildings is addressed in the "Phase 2" section because the analysis included the buildings that would be constructed in Phase 2 as receptors.

Additional Sources

The analysis of existing stationary emission sources, including the existing building heating and hot water systems and the NYU Central Plant, was conducted to assess the potential for impact on the proposed buildings constructed in Phase 1 and in Phase 2. The results of the analysis are described in the “Phase 2” section.

Industrial Sources

The industrial source survey was conducted to assess the potential for impact from existing businesses in the manufacturing zone on the proposed buildings constructed in Phase 1 and in Phase 2. The results of the survey are described in the “Phase 2” section, below.

PHASE 2

MOBILE SOURCES

On Street Sources

Using the methodology previously described, future maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared to the interim guidance criteria that would determine the potential significance of any impacts from the Proposed Actions. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Tables 15-9** and **15-10**. Note that $PM_{2.5}$ concentrations without the Proposed Actions are not presented, since impacts are assessed on an incremental basis.

Table 15-9
Future (2031) Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations (in µg/m^3)

Location	Increment
Mercer Street and West Houston Street	0.11
Bleecker Street and West Houston Street	0.12
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, 2 µg/m^3 (5 µg/m^3 not-to-exceed value).	

Table 15-10
Future (2031) Maximum Predicted Annual Average $PM_{2.5}$ Concentrations (in µg/m^3)

Location	Increment
Mercer Street and West Houston Street	0.02
Bleecker Street and West Houston Street	0.02
Note: $PM_{2.5}$ interim guidance 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 well below the interim guidance criteria. Therefore, there would be no potential for significant adverse impact on air quality from vehicle trips generated by the Proposed Actions.

Parking Garage

The CO levels from the proposed parking garage were predicted using the methodology set forth in the *CEQR Technical Manual*. Based on projected parking demand developed for the Proposed Actions, the number of vehicles entering the garage would be greatest during the 8 AM to 9 PM and 5 PM to 6 PM peak hours. Over the peak 8-hours of garage usage, 2 PM to 10 PM, an average of 10 vehicles per hour would enter the proposed garage, while an average of 20 vehicles per hour would exit. The vent was modeled at a height of 10 feet above ground level, along West Third Street. Pollutant levels were predicted at the height of the vents at a distance of 15 feet, accounting for the minimum vent to window distance requirements specified by the New York City Mechanical Code. Receptors (locations where CO levels were predicted) were also modeled on the West Third Street south and north sidewalk locations near the proposed garage entrance, locations on the existing Washington Square Village buildings, and the proposed Mercer Building.

The maximum predicted CO concentration, with ambient background, and on-street traffic levels would be 4.2 ppm for the 1-hour period and 2.5 ppm for the 8-hour period. The maximum 1- and 8-hour contributions from the parking garage alone would be 0.79 ppm and 0.31 ppm, respectively. These maximum predicted CO levels are in compliance with the CO NAAQS and the City's CO *de minimis* criteria. As these results show, the proposed parking garages would not result in any significant adverse air quality impacts based on the reasonable worst-case assumptions regarding the locations of the garage exhaust vents. Therefore, there would be no potential for significant adverse impacts on air quality with alternative parking garage mechanical designs and exhaust locations that comply with applicable codes.

STATIONARY SOURCES

As discussed, the heating and hot water needs for the buildings that would be constructed as part of Phase 2 would be supplied by the NYU Central Plant and would not have on-site fossil fuel fired heating and hot water systems. The sections below describe the effects of the heat and hot water systems for the proposed Zipper Building Hotel and the Bleecker Building, which would be constructed in Phase 1, as well as the effect of existing stationary sources on the proposed Development Area.

Zipper Building

The emissions from the Zipper Building's heating and hot water systems would not result in a significant adverse impact on air quality. As shown in **Table 15-11**, the predicted concentrations of NO_2, SO_2, and PM_{10} would not exceed the NAAQS, and the $PM_{2.5}$ concentration increments would be below the City's interim guidance criteria as shown in **Table 15-12**. Therefore, the Zipper Building's heating and hot water systems would not have the potential for significant adverse impact on air quality. To preclude the potential for air quality impacts, the stack would be located at the top of the highest tier of the building. This requirement for the stack placement would be included in the Restrictive Declaration for the Proposed Actions.

Bleecker Building

A detailed dispersion analysis was performed to assess the potential for air quality impacts from the emissions associated with the heat and hot water systems for the proposed Bleecker Building. **Table 15-13** shows maximum predicted concentrations of NO_2, SO_2, and PM_{10} from the proposed Bleecker Building. As shown in the table, the maximum concentrations from the stack emissions, when added to ambient background levels, would be below the NAAQS.

The air quality modeling analysis also determined the highest predicted increase in 24-hour and annual average $PM_{2.5}$ concentrations from the proposed Bleecker Building (see **Table 15-14**). As shown in the table, the maximum 24-hour incremental impact at any discrete receptor location would be less than the applicable interim guidance criterion of 5 $\mu g/m^3$. On an annual basis, the projected $PM_{2.5}$ impacts would be less than the applicable interim guidance criterion of 0.3 $\mu g/m^3$, and the City's interim guidance criteria of 0.1 $\mu g/m^3$ for neighborhood scale impacts.

Table 15-11
Maximum Predicted Pollutant Concentration (in µg/m^3)
From Zipper Building

Pollutant	Averaging Period	Maximum Modeled	Background	Total	NAAQS
NO_2	1-hour	Hourly	Hourly	126.1[1]	188
	Annual[2]	0.21	47	47.2	100
SO_2	1-hour	0.19	91.4	91.6	196
	3-hour	0.16	128	128.2	1,300
PM_{10}	24-hour	0.58	53	53.6	150

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

Table 15-12
Maximum Predicted $PM_{2.5}$ Increments (in µg/m^3)
From Zipper Building

Pollutant	Averaging Period	Maximum Concentration	Interim Guidance Threshold
$PM_{2.5}$	24-hour	0.58	2 to 5[(1)]
	Annual (discrete)	0.02	0.3
	Annual (neighborhood scale)	< 0.02[(2)]	0.1

Notes:
(1) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 µg/m^3 (5 µg/m^3 not-to-exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.
(2) The neighborhood scale annual average concentration would not exceed the maximum annual average concentration at a discrete receptor. Therefore, the annual neighborhood scale concentration is reported to be less than the maximum concentration at a discrete receptor.

Table 15-13
Maximum Predicted Pollutant Concentrations (in µg/m^3)
From Bleecker Building

Pollutant	Averaging Period	Maximum Modeled	Background	Total	NAAQS
NO_2	1-hour	Hourly	Hourly	128.5[1]	188
	Annual[2]	1.05	47	48.1	100
SO_2	1-hour	0.47	91.4	91.9	196
	3-hour	0.35	128	128.4	1,300
PM_{10}	24-hour	1.45	53	54.5	150

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

Table 15-14
Maximum Predicted $PM_{2.5}$ Increments (in µg/m³)
From Bleecker Building

Pollutant	Averaging Period	Maximum Concentration	Interim Guidance Threshold
$PM_{2.5}$	24-hour	1.45	2 to 5[(1)]
	Annual (discrete)	0.08	0.3
	Annual (neighborhood scale)	< 0.08[(2)]	0.1

Notes:
(1) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 µg/m³ (5 µg/m³ not-to-exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.
(2) The neighborhood scale annual average concentration would not exceed the maximum annual average concentration at a discrete receptor. Therefore, the annual neighborhood scale concentration is reported to be less than the maximum discrete receptor concentration.

To preclude the potential for air quality impacts on the existing 505 LaGuardia building, which is approximately 63 feet away from the proposed Bleecker Building, the heat and hot water systems stack shall be located at the highest building rooftop, and at least 128 feet away from the 505 LaGuardia building. With these measures, which would be included in the Restrictive Declaration for the Proposed Actions, there would be no potential for significant adverse impacts on air quality from the proposed Bleecker Building heating and hot water system emissions.

Additional Sources

Existing Building Heating and Hot Water Systems

The emissions from the heating and hot water systems serving large existing buildings within 400 feet of the Proposed Development Area would not have the potential for a significant adverse impact on the proposed building air quality. As shown in **Table 15-15** the predicted concentrations of NO_2, SO_2, and PM_{10} from existing buildings would not exceed the NAAQS.

Table 15-15
Maximum Predicted Pollutant Concentration (in µg/m³)
From Existing Buildings

Pollutant	Averaging Period	Maximum Modeled	Background	Total	NAAQS
NO_2	1-hour	Hourly	Hourly	130.0[1]	188
	Annual[2]	1.22	47	48.2	100
SO_2	1-hour	45.27	91.4	136.7	196
	3-hour	83.5	128	211.5	1,300
PM_{10}	24-hour	2.94	53	55.9	150

Notes:
1 Total hourly NO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the hourly ambient NO_2 concentrations for each corresponding hour. The total 1-hour concentration reported is the five-year average of the annual 98th percentile of the highest combined daily 1-hour NO_2 concentrations, in accordance with EPA guidance.
2 The annual modeled NO_2 concentration was conservatively reported to be equal to the NO_x concentration. The increment presented is the highest concentration at any receptor over the five years modeled (2006-2010).
Source: NYSDEC, New York State Ambient Air Quality Report (2007-2009).

As shown in **Table 15-16**, the maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable interim guidance criterion of 5 μg/m^3. On an annual basis, the maximum projected $PM_{2.5}$ increments would be less than the applicable interim guidance criterion of 0.3 μg/m^3 for local impacts.

Table 15-16
Maximum Predicted $PM_{2.5}$ Increments (in μg/m^3) From Existing Buildings

Pollutant	Averaging Period	Maximum Concentration	Interim Guidance Threshold
$PM_{2.5}$	24-hour	2.14	2 to 5$^{(1)}$
	Annual (discrete)	0.14	0.3

Note: (1) 24-hour $PM_{2.5}$ interim guidance criterion, > 2 μg/m^3 (5 μg/m^3 not-to-exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.

The 24-hour average $PM_{2.5}$ concentration increment from existing buildings onto the proposed buildings was predicted to exceed the 24-hour average interim guidance criterion of 2 μg/m^3 only once over the five-year modeling period and at only one location at the north east corner of the proposed Zipper Building, at an elevation of approximately 130 feet. Overall, the magnitude, extent, and frequency of 24-hour average $PM_{2.5}$ concentrations above 2.0 μg/m^3 is extremely low and therefore the existing building heating and hot water systems would not result in any significant adverse air quality impacts on the Proposed Development Area.

NYU Central Plant

A detailed dispersion analysis was performed to assess the potential for air quality impacts from the emissions associated with the NYU Central Plant with the Proposed Actions. The analysis determined that NO_x and $PM_{2.5}$ emissions from the NYU Central Plant would have the potential to result in NO_2 levels above the 1-hour NAAQS and above the $PM_{2.5}$ interim guidance criteria at the Mercer Building, above a height of 195 feet. Therefore, to preclude the potential for a significant adverse air quality impact, no operable windows or air intakes on the proposed Mercer Building would be permitted above a height of 195 feet above grade. In addition, the NYU Central Plant boilers would be restricted to natural gas and No. 2 fuel oil once the proposed Zipper and/or Mercer buildings are occupied.

As shown in **Table 15-17,** the predicted concentrations of NO_2, SO_2, and PM_{10} from the NYU Central Plant would not exceed the NAAQS, with the above restrictions in place. The restrictions will be included in the Restrictive Declaration for the Proposed Actions.

The air quality modeling analysis also determined the highest predicted increase in 24-hour and annual average $PM_{2.5}$ concentrations from NYU Central Plant (see **Table 15-18**). As shown in the table, the maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable interim guidance criterion of 5 μg/m^3. On an annual basis, the maximum projected $PM_{2.5}$ increments would be less than the applicable interim guidance criterion of 0.3 μg/m^3.

The air quality analysis also evaluated impacts with the 24-hour average interim guidance criterion of 2 μg/m^3 for discrete receptor locations. The assessment examined the magnitude, duration, frequency, and extent of the increments at locations where exposure above the 2 μg/m^3 threshold averaged over a 24-hour period could occur.

Table 15-17
Maximum Predicted Pollutant Concentration (in μg/m^3)
From NYU Central Plant

Pollutant	Averaging Period	Maximum Modeled	Background	Total	NAAQS
NO_2	1-hour	Hourly	Hourly	158.7[1]	188
	Annual[2]	3.13	47	50.1	100
SO_2	1-hour	N/A	hourly	119.1[1]	196
	3-hour	156.2	128	284.2	1,300
PM_{10}	24-hour	3.15	53	56.2	150

Notes:
[1] Total hourly NO_2 and SO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the hourly ambient NO_2 and SO_2 concentrations for each corresponding hour. The total 1-hour NO_2 concentration reported is the five-year average of the annual 98th percentile of the highest combined daily 1-hour NO_2 concentrations, in accordance with EPA guidance. The total 1-hour SO_2 concentration reported is the five-year average of the annual 99th percentile of the highest combined daily 1-hour SO_2 concentrations, in accordance with EPA guidance.
[2] The annual modeled NO_2 concentration was conservatively reported to be equal to the NO_x concentration. The modeled concentration presented is the highest concentration at any receptor over the five years modeled (2006-2010).

Table 15-18
Maximum Predicted $PM_{2.5}$ Increments (in μg/m^3) from NYU Central Plant

Pollutant	Averaging Period	Maximum Concentration	Interim Guidance Threshold
$PM_{2.5}$	24-hour	2.97	2 to 5[(1)]
	Annual (discrete)	0.16	0.3

Note: [(1)] 24-hour $PM_{2.5}$ interim guidance criterion, > 2 μg/m^3 (5 μg/m^3 not-to-exceed value), depending on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations.

Zipper Building. The maximum 24-hour $PM_{2.5}$ incremental concentration from the NYU Central Plant was predicted to be 2.97 μg/m^3 on the northern façade of the tallest Zipper Building tower, at a height of approximately 275 feet above grade. At this receptor location, 24-hour incremental concentrations from the NYU Central Plant were predicted to exceed 2 μg/m^3 at a maximum frequency of four times per year, and at an average frequency of approximately two times per year. $PM_{2.5}$ incremental concentrations exceeding 2 μg/m^3 on this building were predicted on the eastern, western and southern façades of the tallest Zipper Building tower at heights above 238 feet, and on the northern façade of the same tower at heights above 228 feet. At each of these locations, maximum 24-hour average $PM_{2.5}$ incremental concentrations from the NYU Central Plant were predicted to exceed 2 μg/m^3 at a maximum frequency of from one to six times per year, and with an annual average frequency of twice per year or less. $PM_{2.5}$ incremental concentrations exceeding 2 μg/m^3 were also predicted to occur up to two times per year on all façades of the 228-foot tower of the Zipper Building, at heights above 218 feet (i.e., on the top floor). At other locations on this building, maximum 24-hour average incremental concentrations from the NYU Central Plant were predicted to be less than 2.0 μg/m^3.

Mercer Building. To ensure that there are no significant adverse impacts of $PM_{2.5}$ on the Mercer Building from the NYU Central Plant, any locations above a height of 195 feet, would have inoperable windows and no air intakes. With these restrictions, the maximum $PM_{2.5}$ 24-hour average exposure from the NYU Central Plant would be on the northern portion of the building, at a height of 195 feet. At this receptor location, 24-hour incremental concentrations from the NYU Central Plant were predicted to exceed 2 μg/m^3 at a maximum frequency of once over five years, and at an average frequency of less than once per year. No exceedances of the 24-hour interim guidance criterion of 2 μg/m^3 were predicted at other receptors on this building. Therefore, with the restrictions on the location of operable window locations and air intakes, there would be no significant adverse air quality impacts from the NYU Central Plant on the Proposed Actions.

LaGuardia Building, Bleecker Building. At each of these locations, maximum predicted $PM_{2.5}$ incremental concentrations from the NYU Central Plant were predicted to be below the interim guidance criterion of 2 $\mu g/m^3$.

As presented above, the 24-hour average $PM_{2.5}$ incremental concentrations are based on the assumptions for the reasonable worst case scenario for the operation of NYU Central Plant. These assumptions include continuous use of distillate oil instead of natural gas for the Central Plant's combustion turbines and boiler during the months of December, January and February. This is a highly unlikely scenario since the NYU Central Plant would normally operate using distillate oil only in the event natural gas supply is curtailed or interrupted by the utility. In addition, at other times during the year, particularly during the spring and fall seasons, there is less heating demand, and therefore, it is unlikely that the NYU Central Plant equipment would operate at a sustained peak load as assumed for the short-term scenario. Therefore, actual predictions of $PM_{2.5}$ incremental concentrations exceeding 2 $\mu g/m^3$ are considered to be fewer than as presented above.

Furthermore, there are a number of new and proposed air quality regulations and federal, state and city level which apply to NYU's Central Plant system equipment and operations. Compliance with these regulations will necessitate reductions in the emissions of regulated pollutants such as $PM_{2.5}$, NO_x and SO_2 prior to the completion of the development program under the Proposed Actions, requiring a greater reliance on cleaner burning fuels such as ultra low sulfur oil and natural gas. Since these fuels emit lower levels of particulate matter than the distillate oil currently used, this will have a secondary benefit in reducing the magnitude and frequency of $PM_{2.5}$ impacts on the Proposed Actions. While not accounted for in this analysis, the evaluation of $PM_{2.5}$ impacts should take into account future conditions that can be reasonably be expected to occur. More broadly, future air quality in New York City is expected to improve, as presented in the NYS $PM_{2.5}$ SIP.[1] Well before the projected completion of the development program under the Proposed Actions in 2031, the annual $PM_{2.5}$ NAAQS is projected to be attained at all locations in the New York City Metropolitan Area. This will also result in lower 24-hour average $PM_{2.5}$ concentrations. NYSDEC will also be addressing specifically the attainment of the 24-hour NAAQS in the area, which will require further reductions in emissions of $PM_{2.5}$ and its precursors, such as the use of ultra low sulfur fuel from home heating purposes and eventually for all stationary sources of combustion. Taken together, these reductions are anticipated to result in an improvement in air quality at the project site, reducing the 24-hour average $PM_{2.5}$ concentrations from the NYU Central Plant and other sources in the ambient air. Overall, both the incremental $PM_{2.5}$ concentrations from the NYU Central Plant and the ambient background $PM_{2.5}$ concentrations are anticipated to be reduced from the current levels.

Overall, the magnitude, frequency, location, and size of the area of concentrations above 2 $\mu g/m^3$ is low and would not occur at locations where continuous 24-hour exposure would occur. Consequently, no potential significant air quality impacts related to $PM_{2.5}$ are expected to occur from the NYU Central Plant on the proposed project.

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[1] New York State Implementation Plan for PM2.5 (Annual NAAQS): Attainment Demonstration for the New York Metropolitan Area, http://www.dec.ny.gov/chemical/60541.html

Cumulative Combustion Source Analysis

To assess the potential of the proposed building heating and hot water systems, when combined with the emissions from the NYU Central Plant and heating and hot water systems from large existing buildings within 400 feet of the Proposed Development Area, cumulative impacts were evaluated. 24-Hour average $PM_{2.5}$ incremental concentrations were considered, as individual source analysis described above indicated that $PM_{2.5}$ is the critical pollutant of concern, and the 24-hour average the critical time averaging period for $PM_{2.5}$ assessment. The analysis focused on the locations where the highest $PM_{2.5}$ incremental levels from the proposed buildings were predicted – the existing 505 LaGuardia building, and where the highest incremental $PM_{2.5}$ levels from the existing building heating and hot water systems and the NYU Central Plant were predicted - the proposed Zipper building. The heights of the proposed building and existing building heating and hot water system exhaust, and the height of the NYU Central Plant exhaust stacks are different and located such that on any given day there would be no significant overlap in the dispersion of pollutant emissions from these sources. Maximum short-term $PM_{2.5}$ increments from the proposed buildings at the 505 LaGuardia building combined with the $PM_{2.5}$ increments from the existing sources at the same receptor result in an overall maximum increment would be 3.10 $\mu g/m^3$. However, the maximum contribution from the proposed and existing sources would occur at different times and therefore, the overall maximum concentrations would not be materially above the $PM_{2.5}$ increments reported in **Table 15-10**, **Table 15-12**, **Table 15-16** and **Table 15-18**. The maximum combined annual average $PM_{2.5}$ increments would be less than 0.3 $\mu g/m^3$ at locations where the maximum increments from the proposed project alone are greatest (the 505 LaGuardia building). In addition, the maximum combined annual average $PM_{2.5}$ increments (from proposed project buildings, existing buildings, and the NYU Central Plant) at the proposed buildings would be below 0.3 $\mu g/m^3$. Overall, as with the predicted levels above 2.0 $\mu g/m^3$ resulting from the NYU Central Plant alone, the cumulative magnitude, frequency, location, and size of the area of concentrations above 2 $\mu g/m^3$ is low and would not occur at locations where continuous 24-hour exposure would occur. Therefore, there would be no potential for cumulative significant adverse impact on air quality from the existing and proposed combustion sources.

Industrial Sources

A field survey was conducted on March 25, 2011 to identify existing industrial emission sources or manufacturing uses in the project study area that might have NYCDEP air emission permits. No sources of concern were observed in the field visit. A request for information on sources within 400 feet of the Proposed Development Area was sent to NYCDEP to verify field visit observation. NYCDEP confirmed that there are no active sources with NYCDEP air emission permits on file. No sources of concern were identified through the search of the NYSDEC and Envirofacts databases. The potential impacts from the emissions associated with the NYU Central Plant, a Title V facility within the study area, are presented in the preceding section. Therefore, there is no potential for significant adverse impacts on air quality from industrial sources. ✷