Chapter 18: Air Quality and Greenhouse Gas Emissions

This chapter examines the potential for air quality impacts from the Proposed Project. An analysis of the potential greenhouse gas (GHG) emissions associated with the Proposed Project is also presented in this chapter, along with specific measures to reduce GHG emissions and improve energy efficiency that are either included as part of the Proposed Project or are under consideration.

A. AIR QUALITY

INTRODUCTION

This section examines the potential for air quality impacts from the Proposed Project. Air quality impacts can be either direct or indirect. Direct impacts result from emissions generated by stationary sources at a development site, such as emissions from fuel burned on site for heating. Indirect effects include emissions from motor vehicles ("mobile sources") traveling to and from a project, or from existing pollutant emission sources impacting air quality on the Proposed Project. This section presents the air quality impacts from the future operation of the Proposed Project. Chapter 20, "Construction," presents a cumulative analysis of the air quality impacts from operational and construction activities.

For the purpose of this air quality analysis, it is assumed that Con Edison supplied steam would be used to provide heating and domestic hot water to Buildings 1, 2, 3, and 4. For Building 5, it is assumed that Con Edison steam would be used to provide heating, with a natural gas-fired boiler to provide domestic hot water. The potential effects on the Proposed Project from nearby existing emission sources, including the Consolidated Edison Power House (also known as the Con Edison 59th Street Station), are examined. Portions of the Proposed Project site are located adjacent to a zoned industrial area; therefore, air quality impacts from nearby industrial sources of air pollution (e.g., from manufacturing or processing facilities) are also examined.

The Proposed Project would increase traffic in the vicinity of the Proposed Project site and along feeder streets to and from the Proposed Project site. Therefore, an analysis was performed on the potential impacts on air quality from motor vehicles.

The Reasonable Worst-Case Development Scenario (RWCDS) for the mobile source air quality analysis is the same as for the traffic analysis, which assumes a mix of uses that maximizes retail uses. Therefore, the analysis is based on RWCDS 3d for the AM peak period and 3b for the weekday midday, weekday PM and Saturday midday periods (see Chapter 1, "Project Description"). Both RWCDS 3b and 3d assume 2,100 residential units, 1,012 hotel rooms, 151,598 gross square feet (gsf) of community facility (a 1,332 seat public school), and 276,011 gsf of auto showroom/service. RWCDS 3b assumes 325,022 gsf of retail and 52,209 gsf of office, whereas RWCDS 3d assumes 165,938 gsf of retail and 211,293 gsf of office.

In May 2010, shortly prior to the completion of the Draft SEIS, a substantive update to the 2001 *CEQR Technical Manual* was released. Prior to the public hearing for the Proposed Project, a

Technical Memorandum was prepared (published on DCP's website in September 2010) that considered whether one or more analyses contained in the Draft SEIS should be revised in the Final SEIS in light of the updated guidance set forth in the 2010 *CEQR Technical Manual*. This chapter reflects updated 2010 *CEQR Technical Manual* guidance with respect to air quality analysis.

PRINCIPAL CONCLUSIONS

The analyses conclude that the Proposed Project would not result in any significant adverse air quality impacts on sensitive uses in the surrounding community, and the new or existing sources of air emissions in the project area would not cause significant adverse air quality impacts on the Proposed Project. A summary of the general findings is presented below.

Concentrations of carbon monoxide (CO) and fine particulate matter less than 10 microns in diameter (PM_{10}) due to project-generated traffic at intersections near the Proposed Project site (the primary study area) and along main corridors outside the primary study area (the secondary study area) would not result in any violations of National Ambient Air Quality Standards (NAAQS). It was also determined that CO impacts from mobile sources associated with the Proposed Project would not exceed CEQR *de minimis* criteria, while incremental increases in fine particulate matter less than 2.5 microns in diameter ($PM_{2.5}$) would not exceed the city's current interim guidance criteria. Impacts due to the Proposed Project's parking facilities were found to result in no significant adverse air quality impacts.

Con Edison steam would be supplied to the Proposed Project's buildings to provide heating and domestic hot water, except that it was assumed that for Building 5, a natural gas fired boiler would be used to provide domestic hot water. Analysis of the emissions and dispersion of nitrogen dioxide (NO_2) and PM_{10} from this source indicates that such emissions would not result in violations of NAAQS. Emissions of $PM_{2.5}$ were analyzed in accordance with the city's current $PM_{2.5}$ interim guidance criteria, which determined that the maximum incremental increases in $PM_{2.5}$ concentrations from stationary sources would be below the significant impact thresholds.

Nearby existing sources from manufacturing or processing facilities were analyzed for their potential impacts on the Proposed Project. The results of the industrial source analysis demonstrated that there would be no significant adverse air quality impacts on the Proposed Project.

The Proposed Project would result in the development of new residential and commercial uses in close proximity to Con Edison's existing West 59th Street Generating Station ("the 59th Street Station"), a steam plant which operates pursuant to and in compliance with federal and state air permitting requirements. Concentrations of pollutants from the Con Edison 59th Street Station were therefore estimated for their potential impacts on the Proposed Project.

Air quality dispersion modeling performed in connection with the preparation of this Final Supplemental Environmental Impact Statement (SEIS) demonstrate that concentrations of NO_2, sulfur dioxide (SO_2) and PM_{10} from the Con Edison 59th Street Station's approximately 500 foot boiler stack on the Proposed Project would not result in any violations of the NAAQS for these pollutants, and it was determined that incremental increases in $PM_{2.5}$ concentrations from the Con Edison boiler stack would not exceed the city's current interim guidance criteria that are applicable to the Proposed Project. As noted in the DSEIS, air quality screening studies conducted during project planning indicated that emissions from the Con Edison combustion turbine through the existing approximately 130-foot stack (GT001) at the 59th Street Station would exceed the City's current interim guidance criteria for $PM_{2.5}$ at elevated receptors along portions of building facades and would have the potential to affect air quality on the Proposed Project. However, air quality dispersion modeling performed in connection with the preparation of the DSEIS demonstrates that this potential problem can be eliminated if emissions from the combustion turbine are rerouted from the 130-foot high stack to the taller boiler stack. At the request of the project sponsor, Parsons Brinckerhoff has conducted an evaluation (Appendix F) which concludes that ducting the exhaust gases from the combustion turbine to the existing boiler stack (Stack 00001) is feasible, subject to the outcome of further engineering studies. Con Edison has advised the New York City Department of City Planning (DCP) that it concurs in this evaluation.

Implementation would be subject to the project sponsor performing the modifications at the 59th Street Station pursuant to an agreement with Con Edison that will address access, responsibility for costs and liabilities incurred as a result of this initiative, construction risks, and other issues. Con Edison entered into a non-binding Letter of Intent with the project sponsor indicating its willingness to enter into negotiations for that purpose. Implementation would also be subject to obtaining the necessary permits. Permitting actions would occur after the Uniform Land Use Review Procedure (ULURP) process.

The project sponsor and Con Edison are also considering another option that would address $PM_{2.5}$ emissions from the combustion turbine in a manner that is protective of the environment. That option is a fuel-switching option, which would involve the modification of the combustion turbine so that it would fire natural gas instead of kerosene for normal operation and testing. Under this option, natural gas would be delivered to the 59th Street Station via a dedicated pipeline that would be directly connected to a nearby gas transmission main. This change from kerosene to natural gas would have benefits that would not occur with the rerouting option, in that it would reduce $PM_{2.5}$ emissions by more than 80 percent, and would also have the benefit of reducing the emissions of other pollutants substantially. This option will be considered and analyzed further to determine its effectiveness in addressing the $PM_{2.5}$ impacts of the combustion turbine, as an alternative to rerouting emissions from the combustion turbine to the existing boiler stack. In order for this option to be implemented as an alternative, the results of such analysis would need to be considered in a Technical Memorandum.

The Proposed Project's Restrictive Declaration would include provisions requiring completion of modifications related to the combustion turbine at the 59th Street Station to address elevated $PM_{2.5}$ levels at the Project buildings.

Concentrations of pollutants from commercial, institutional and large-scale residential developments within 400 feet of the Proposed Project Site were estimated for their potential impacts on the Proposed Project. It was determined that concentrations of NO_2, SO_2 and PM_{10} from these sources would not result in any violations of the NAAQS for these pollutants, and it was determined that incremental increases in $PM_{2.5}$ would not exceed the city's current interim guidance criteria.

In addition, potential cumulative impacts from the Con Edison 59th Street Station and commercial, institutional and large-scale residential developments within 400 feet of the Proposed Project Site were estimated for their potential impacts on the Proposed Project. It was determined that maximum concentrations of NO_2, SO_2 and PM_{10} would not result in any violations of the NAAQS for these pollutants, and it was determined that incremental increases in $PM_{2.5}$ would not exceed the city's current interim guidance criteria.

Existing and proposed developments near the Proposed Project site were evaluated to assess whether the Proposed Project's effect on plume dispersion from the Con Edison 59th Street

Station would result in any significant adverse air quality impact. The results of the analysis determined that the Proposed Project would not result in any significant adverse air quality impacts with respect to emissions from the Con Edison 59th Street Station on existing and proposed buildings within 400 feet of the Proposed Project Site. Concentrations of NO_2, SO_2, and PM_{10} from the Con Edison 59th Street Station, when added to background concentrations, would not exceed NAAQS, and incremental increases in $PM_{2.5}$ concentrations would not exceed the city's interim guidance criteria.

As previously mentioned, NO_2 concentrations due to emissions from large stationary sources in the area would not be expected to have any significant adverse air quality impacts at the project site. At the present time there are not sufficient data and established technical analysis techniques to determine reliably whether concentrations due to emissions from mobile sources in the project study area would be above or below the 1-hour standard in the Build condition. However, the traffic associated with the Proposed Project is not expected to change NO_2 concentrations appreciably, since the vehicular traffic associated with the Proposed Project would be a very small percentage of the total number of vehicles in the area. The NO_2 emissions associated with equipment that would be used in project construction are typical of emissions at other projects involving large-scale, long-term and intensive construction activities. Exceedances of the 1-hour NO_2 standard resulting from such activities cannot be ruled out and, as discussed in Chapter 20, "Construction," certain measures would be implemented by the Proposed Project in order to minimize emissions from construction activities.

SUMMARY OF 1992 FEIS FINDINGS

The 1992 FEIS analyzed the potential impacts to air quality resulting from the proposed redevelopment of the full Riverside South project site, which comprised 15 development parcels (Parcels A through O) in the area roughly bounded by West 72nd Street and Riverside Park on the north, Freedom Place and West End Avenue on the east, West 59th Street on the south, and the Hudson River to the west.

For the stationary source air quality analysis, computer dispersion modeling determined that buildings to be constructed in Phase I (i.e., buildings located north of 64th Street) were too far from the Con Edison 59th Street Station to be affected by, or to cause an effect on emissions from that facility. To determine the effects of the Con Edison 59th Street Station on the proposed buildings south of 64th Street, and the effects that the 1992 FEIS project as a whole might have on nearby off-site buildings by affecting the plume from the Con Edison facility, additional air quality studies were performed using fluid modeling in a wind tunnel. It was determined that exceedances of the 24-hour SO_2 standard would occur at elevated locations on the proposed residential buildings on parcels K1, K2, O and J1, at existing buildings at 790 Eleventh Avenue and 515 West 59th Street and a proposed development known as the Macklowe Building; and exceedances of the 24-hour SO_2 and PM_{10} standards would occur at the upper level air intakes on the north face of a sealed commercial building located at the southeast corner of 58th Street and 11th Avenue. These impacts would constitute significant adverse air quality impacts; therefore, mitigation measures were specified to reduce impacts on these buildings. Specifically, one of the three boilers emitting through Stack No. 5 at the Con Edison 59th Street Station would be connected to Stack No. 1, which is taller in height. This mitigation measure was determined to result in no exceedance of air quality standards, and to eliminate the need to seal portions of the residential buildings on parcels K1, K2, O and J1. Implementation of this mitigation would have required a modification of the operating permits issued by the New York State Department of Environmental Conservation (NYSDEC), and would have been funded by the applicant. It should be noted that since the 1992 FEIS was completed, Con Edison decommissioned Stack No. 5, eliminating the need to implement the air quality mitigation measures specified in the 1992 FEIS.

POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of CO are predominantly influenced by mobile source emissions. PM, volatile organic compounds (VOCs), and nitrogen oxides (NO and NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of SO_2 are associated mainly with stationary sources, and 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.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas which does not persist in the atmosphere, CO concentrations can vary greatly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

The Proposed Project would result in changes in traffic patterns and an increase in traffic volume in the study area. Therefore, a mobile source analysis was conducted at critical intersections in the study area to evaluate future CO concentrations with and without the Proposed Project.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x together with VOCs, are precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions. The change in regional mobile source emissions of these pollutants would be related to the total vehicle miles traveled added or subtracted on various roadway types throughout the New York metropolitan area, which is designated as a moderate non-attainment area for ozone by the U.S. Environmental Protection Agency (EPA).

The Proposed Project would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels would result. An analysis of project-related emissions of these pollutants from mobile sources is 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 pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and is not a local concern from mobile sources. (NO_x emissions from fuel combustion are typically greater than 90 percent NO with the remaining fraction primarily NO_2 at the source.[1]) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as mobile sources become of greater concern for this pollutant. Emissions of NO_2 were analyzed from the natural gas fired water heater assumed for Building 5. In addition, potential impacts of NO_2 emissions from existing sources in the vicinity of the Proposed Project site were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Effective January 1, 1996, the Clean Air Act (CAA) banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, concluding a 25-year effort to phase out lead in gasoline. Even at locations in the New York City area where traffic volumes are very high, atmospheric lead concentrations are far below the 3-month average national standard of 0.15 micrograms per cubic meter ($\mu g/m^3$).

No significant sources of lead are associated with the Proposed Project, and, therefore, an analysis of this pollutant from stationary or mobile sources 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 VOCs; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions, and forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, construction and agricultural activities, and wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic, and some likely carcinogenic compounds.

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

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

primary PM (often soon after the release from a source exhaust) or from precursor gases reacting in the atmosphere to form secondary PM.

There is also a New York standard for total suspended particulate matter (TSP), which represents both coarse and fine particles. However, NYSDEC no longer conducts monitoring for this pollutant.

An analysis was conducted to assess the PM impacts due to the increased automobile and truck traffic associated with the Proposed Project, and from Building 5's natural gas-fired domestic hot water system. In addition, potential impacts of PM emissions from existing sources of concern were evaluated for their potential impact on the Proposed Project.

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 are lower than the national standards. Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources. Vehicular sources of SO_2 are not significant, and, therefore, an analysis of this pollutant from mobile sources is not warranted.

Emissions of sulfur dioxide from the Proposed Project's stationary sources would be negligible; therefore, no analysis was conducted. However, potential impacts of SO_2 emissions from existing sources in the vicinity of the Proposed Project site were evaluated.

AIR TOXICS

In addition to the criteria pollutants discussed above, non-criteria toxic air pollutants, also called air toxics, are regulated. Air toxics are those pollutants that are known or suspected to cause serious health effects in small doses. Air toxics are emitted by a wide range of man-made and naturally occurring sources. Emissions of air toxics from industries are regulated by EPA. Federal ambient air quality standards do not exist for non-criteria compounds. However, NYSDEC has issued standards for certain non-criteria compounds, including beryllium, gaseous fluorides, and hydrogen sulfide. NYSDEC has also developed ambient guideline concentrations for numerous air toxic non-criteria compounds. The NYSDEC guidance document DAR-1 (September 2007) contains a compilation of annual and short term (1-hour) guideline concentrations for these compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure.

Portions of the Proposed Project site are adjacent to a zoned industrial area. Therefore, an analysis to examine the potential for impacts on the Proposed Project from industrial emissions was performed.

AIR QUALITY STANDARDS, REGULATIONS AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary NAAQS have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 18a-1**. The NAAQS for CO, annual NO_2, and SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for TSP, settleable particles, non-methane hydrocarbons (NMHC), and ozone which correspond to federal standards that have since been revoked or replaced, and for beryllium, fluoride, and hydrogen sulfide (H_2S).

EPA revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 µg/m^3 to 35 µg/m^3 and retaining the level of the annual standard at 15 µg/m^3. EPA is currently considering whether to lower the concentration level of the annual standard for $PM_{2.5}$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060-0.070 ppm. EPA is also proposing a secondary standard, measured as a cumulative concentration within the range of 7-15 ppm-hours aimed mainly at protecting sensitive vegetation.

EPA lowered the primary and secondary standards for lead to 0.15 µg/m^3, effective January 12, 2009. EPA revised the averaging time to a rolling 3-month average and the form of the standard to not-to-exceed across a 3-year span. The current lead NAAQS will remain in place for one year following the effective date of attainment designations for any new or revised NAAQS before being revoked, except in current non-attainment areas, where the existing NAAQS will not be revoked until the affected area submits, and EPA approves, an attainment demonstration for the revised lead NAAQS.

On January 22, 2010, EPA established a new 1-hour average NO_2 standard of 0.100 ppm, in addition to the current 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 new 1-hour average SO_2 standard of 0.075 ppm, replacing the current 24-hour and annual primary standards, effective August 23, 2010. The statistical form is the 3-year average of the 99th percentile of the annual distribution of the daily maximum 1-hour average concentration (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

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

Table 18a-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [(1)]	9	10,000	None	
1-Hour Average [(1)]	35	40,000		
Lead				
Rolling 3-Month Average [(5)]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [(6)]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [(2) (7)]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [(1)]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Average of 3 Annual Means	NA	15	NA	15
24-Hour Average [(3)(4)]	NA	35	NA	35
Sulfur Dioxide (SO_2) [(8)]				
Annual Arithmetic Mean [(9)]	0.03	80	NA	NA
Maximum 24-Hour Average [(1) (9)]	0.14	365	NA	NA
Maximum 3-Hour Average [(1)]	NA	NA	0.50	1,300
1-Hour Average [(10)]	0.75	196	NA	NA

Notes: ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable

All annual periods refer to calendar year.

PM concentrations (including lead) are in µg/m^3 since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m^3 are presented.

(1) Not to be exceeded more than once a year.

(2) 3-year average of the annual fourth highest daily maximum 8-hr average concentration. EPA has reduced these standards down from 0.08 ppm, effective May 27, 2008.

(3) Not to be exceeded by the annual 98th percentile when averaged over 3 years.

(4) EPA has lowered the NAAQS down from 65 µg/m^3, effective December 18, 2006.

(5) EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.

(6) 3-Year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.

(7) EPA has proposed lowering this standard further to within the range 0.060-0.070 ppm.

(8) EPA has proposed replacing the 24-hour and annual primary standards with a 1-hour average standard in the range of 0.050-0.100 ppm.

(9) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010

(10) 3-Year average of the annual 99th percentile daily maximum 1-hour average concentration. Effective August 23, 2010.

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

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, Nassau, Suffolk, Rockland, Westchester, and Orange counties as a $PM_{2.5}$ non-attainment area under the CAA due to exceedance of the annual average standard. New York State has submitted a final SIP to EPA, dated October 2009, designed to meet the annual average standard by April 5, 2010. Based on recent monitoring data (2006-2009), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. On August 2, 2010, EPA proposed to determine that the New York–Northern New Jersey–Long Island $PM_{2.5}$ nonattainment area has attained the 1997 annual NAAQS.

As described above, EPA has revised the 24-hour average $PM_{2.5}$ 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 EPA designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. By November 2012 New York will be required to submit a SIP to demonstrate attainment with the 2006 24-hour standard by November 2014 (EPA may grant attainment date extensions for up to five additional years).

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe non-attainment area for ozone under the former 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.[1] These SIP revisions included additional emission reductions that EPA requested to demonstrate attainment of the standard, and an update of the SIP estimates using the latest versions of the mobile source emissions model, MOBILE6.2, and the nonroad emissions model, NONROAD—which have been updated to reflect current knowledge of engine emissions and the latest mobile and nonroad engine emissions regulations.

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

In March 2008 EPA strengthened the 8–hour ozone standards. 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). EPA expects designations to take effect no later than March 2010.

New York City is currently in attainment of the annual-average NO_2 standard. EPA has promulgated a new 1-hour standard, but it is unclear at this time what the city’s attainment status

[1] The 1-hour ozone NAAQS was revoked on June 15, 2005.

will ultimately be due to the need for additional near road monitoring required for the new standard. The existing monitoring data indicates background concentrations below the standard. It is likely that New York City will be designated as "unclassifiable" at first (January 2012), and then be classified once three years of near-road monitoring data are available (2016 or 2017).

EPA has established a new 1-hour SO_2 standard, replacing the 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 *City Environmental Quality Review (CEQR) Technical Manual* state that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 18a-1**) would be deemed to have a potential significant adverse impact. In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

De Minimis Criteria Regarding CO Impacts

New York City has developed *de minimis* criteria to assess the significance of the increase in CO concentrations that would result from the impact of proposed projects or actions on mobile sources, as set forth in the *CEQR Technical Manual*. These criteria set the minimum change in CO concentration that defines a significant environmental impact. Significant increases of CO concentrations in New York City are defined as: (1) an increase of 0.5 ppm or more in the maximum 8-hour average CO concentration at a location where the predicted No Action 8-hour concentration is equal to or between 8 and 9 ppm; or (2) an increase of more than half the difference between baseline (i.e., No Action) concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.

Interim Guidance Criteria Regarding $PM_{2.5}$ Impacts

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts.[2] This policy would apply only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. NYSDEC deems projects with emissions below this threshold to be insignificant with respect to $PM_{2.5}$ and does not require further assessment under the policy. The policy states that a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$

[1] *CEQR Technical Manual*, Section 222, 2001; and 6NYCRR Part 617.7.

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

concentrations by more than 0.3 µg/m^3 averaged annually or more than 5 µg/m^3 on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an 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.

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

- 24-hour average $PM_{2.5}$ concentration increments which are predicted to be greater than 5 µg/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 µg/m^3 but no greater than 5 µg/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 µg/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 µg/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 CEQR or NYSDEC interim guidance criteria above will be considered to have a potential significant adverse impact. Actions subject to CEQR that fail the interim guidance criteria should prepare an environmental impact statement (EIS) and examine potential measures to reduce or eliminate such potential significant adverse impacts.

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

METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

INTRODUCTION

This section presents the methodologies, data, and assumptions used to conduct the air quality analyses for the Proposed Project. The analyses presented below are as follows:

- Mobile Source Analysis
  - Impacts at intersections due to the Proposed Project; and
  - Impacts due to the Proposed Project's parking facilities.

- Stationary Source Analysis
  - Impacts from the Proposed Project's fossil fuel-fired heating, ventilation and air conditioning (HVAC) system;
  - Impacts on the Proposed Project from nearby industrial sources;
  - Impacts from the Con Edison 59th Street Station on the Proposed Project;
  - Impacts of HVAC systems on the Proposed Project from nearby commercial, institutional and large-scale residential buildings; and
  - Impacts on nearby developments due to the Proposed Project's effect on plume dispersion from the Con Edison 59th Street Station.

MOBILE SOURCES

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

The mobile source analyses for the Proposed Project employ 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 Project. The assumptions used in the PM analysis were based on the latest $PM_{2.5}$ interim guidance developed by the New York City Department of Environmental Protection (DEP).

Vehicle Emissions

Engine Emissions

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

Vehicle classification data were based on traffic data collected for this project and data obtained from other traffic studies. Appropriate credits were used to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust

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

system are lower than emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

All taxis were assumed to be in hot stabilized mode (i.e., excluding any start emissions). The general categories of vehicle types for specific roadways were further categorized into subcategories based on their relative breakdown within the fleet.[1]

An ambient temperature of 50° Fahrenheit (°F) was used. The use of this temperature is recommended in the *CEQR Technical Manual* for the Borough of Manhattan and is consistent with current DEP guidance.

Road Dust

The contribution of re-entrained road dust to PM_{10} concentrations, as presented in the PM_{10} SIP, is considered to be significant; therefore, the PM_{10} estimates include both exhaust and road dust. In accordance with the DEP $PM_{2.5}$ interim guidance criteria methodology, emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analyses, since DEP considers it to have an insignificant contribution on that scale. Road dust emission factors were calculated according to the latest procedure delineated by EPA.[2]

Traffic Data

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the Proposed Project (see Chapter 16, "Traffic and Parking"). Traffic data for the future without and with the Proposed Project were employed in the respective air quality modeling scenarios. The weekday morning (8:00 to 9:00 AM), evening (5:00 to 6:00 PM) and Saturday midday (1:00 to 2:00 PM) peak periods were analyzed. These time periods were selected for the mobile source analysis because they produce the maximum anticipated project-generated and future Build traffic, and therefore have the greatest potential for significant air quality impacts.

For particulate matter, the projected weekday and weekend peak period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the future without and with the Proposed Project, and off-peak increments from the Proposed Project, were determined by adjusting the peak period volumes by the 24-hour weekday distributions of actual vehicle counts collected at appropriate locations. For annual impacts, average weekday and weekend 24-hour distributions were used to more accurately simulate traffic patterns over longer periods.

Dispersion Model for Microscale Analyses

Maximum CO concentrations adjacent to streets near the Proposed Project site, resulting from vehicle emissions, were predicted using the CAL3QHC model Version 2.0.[3] The CAL3QHC

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[1] 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).

[2] EPA, Compilations of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42, November 2006.

[3] 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.

model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to accurately predict the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first level of CAL3QHC modeling.

To determine motor vehicle generated PM concentrations adjacent to streets near the Proposed Project site, the CAL3QHCR model was applied. This refined version of the model can utilize hourly traffic and meteorology data, and is therefore more appropriate for calculating 24-hour and annual average concentrations.

Meteorology

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

Tier I Analyses—CAL3QHC

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

Following the EPA guidelines,[1] CAL3QHC computations were performed using a wind speed of 1 meter per second, and the neutral stability class D. The 8-hour average CO concentrations were estimated by multiplying the predicted 1-hour average CO concentrations by a factor of 0.77 for midtown Manhattan and 0.70 for intersections north of 61st Street to account for persistence of meteorological conditions and fluctuations in traffic volumes. A surface roughness of 3.21 meters was chosen. At each receptor location, concentrations were calculated for all wind directions, and the highest predicted concentration was reported, regardless of frequency of occurrence. These assumptions ensured that worst-case meteorology was used to estimate impacts.

Tier II Analyses—CAL3QHCR

A Tier II analysis performed with the CAL3QHCR model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consists of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York for the period 2003-2007. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

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

Analysis Year

The microscale analyses were performed for existing conditions and 2018, the year by which the Proposed Project is likely to be completed. The future analysis was performed both without the Proposed Project (the No Build condition) and with the Proposed Project (the Build condition).

As described in Chapter 16, "Traffic and Parking," the No Build condition includes the traffic that would result from known major development projects to be completed by 2018, and considers an additional annual background growth rate of 0.5 percent per year (2008 to 2018) applied to 2008 existing conditions. Also, since it was determined that No Build Scenario 2 (the original FEIS approved program for Parcels L and M would be completed, but Parcel N would remain in its current parking use) would result in the largest increment for the Proposed Project in terms of traffic, the mobile source air quality analysis was also conducted assuming this scenario.

The Build condition for the mobile source analysis is based on the same RWCDS assumed for the traffic analysis in Chapter 16, "Traffic and Parking."

Background Concentrations

Background concentrations are those pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations must be added to modeling results to obtain total pollutant concentrations at an analysis site. In connection with the impact analysis for mobile sources, the highest background concentrations monitored at the nearest NYSDEC background monitoring station in the 5-year period were used, and it was conservatively assumed that the maximum background concentrations occur on all days.

The background concentrations used in the mobile source analysis are presented in **Table 18a-2**. The background concentrations are based on the second-highest measured concentration from the latest available five years of monitored data (2004-2008) for CO and second-highest of latest available three years for PM_{10}, consistent with current DEP guidance. These values were used as the background concentrations for all analyses, including mobile source analyses. Note that $PM_{2.5}$ concentrations are not presented, since impacts are assessed on an incremental basis.

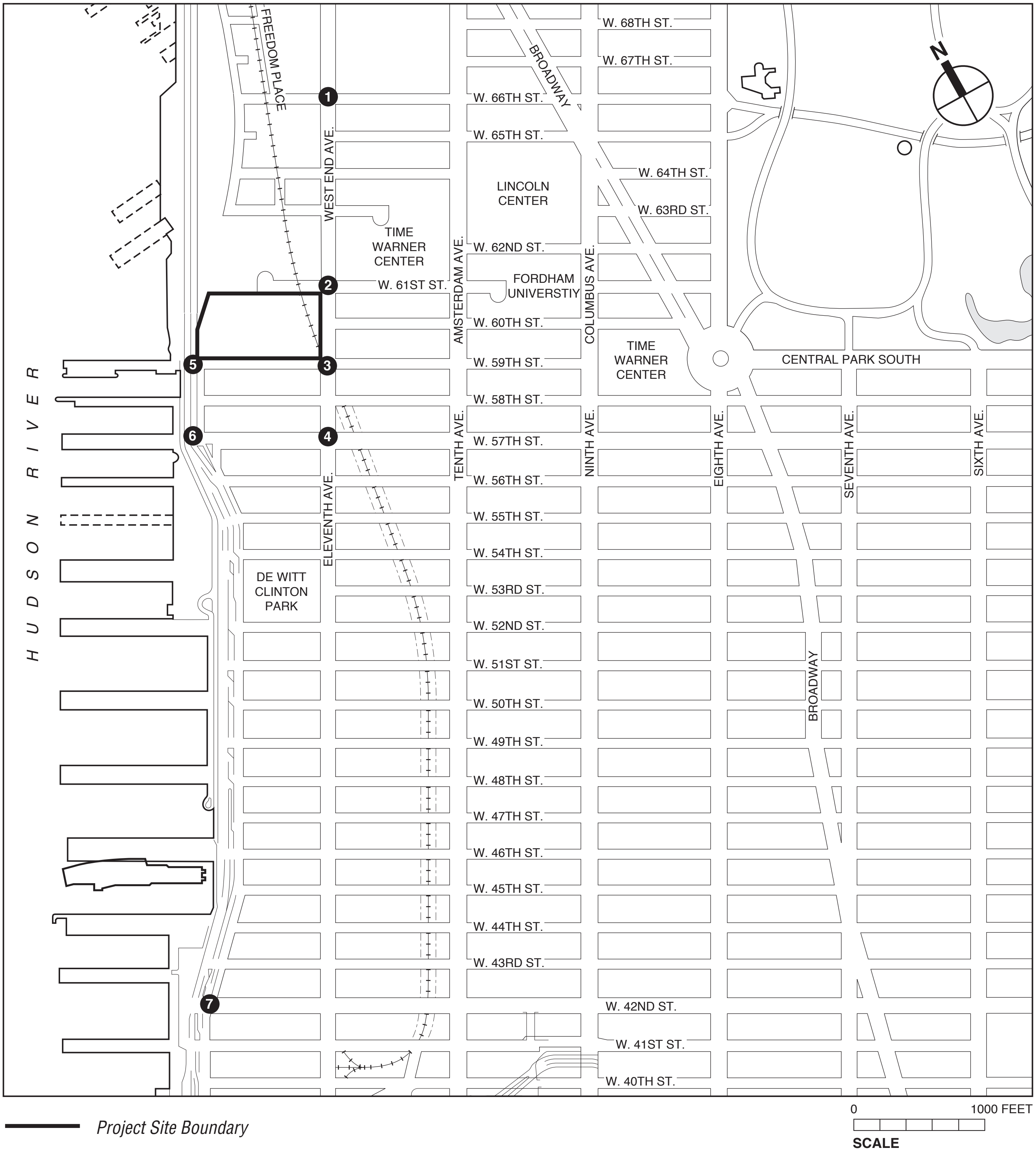
Table 18a-2
Maximum Background Pollutant Concentrations
For Mobile Source Analysis

Pollutant	Average Period	Location	Concentration (µg/m^3)	NAAQS (µg/m^3)
CO	1-hour	PS 59, Manhattan	2,977.5	40,000
	8-hour		2,290.4	10,000
PM_{10}	24-hour	PS 59, Manhattan	60	150

Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2004–2008.

Mobile Source Analysis Sites

Seven intersection locations were selected for microscale analysis (see **Table 18a-3** and Figure 18a-1). These intersections were selected because they are the locations in the primary and secondary study areas where the largest levels of project-generated traffic are expected and, therefore, where the maximum changes in the concentrations would be expected and the highest potential for air quality impacts would occur. Each of these intersections was analyzed for CO.



Project Site Boundary

Air Quality Mobile Source Analysis Sites

1. *West End Avenue/66th Street*
2. *West End Avenue/61st Street*
3. *West End Avenue/59th Street*
4. *Eleventh Avenue/57th Street*
5. *Twelfth Avenue/59th Street*
6. *Twelfth Avenue/57th Street*
7. *Twelfth Avenue/42nd Street*

Air Quality Mobile Source Analysis Sites
Figure 18a-1

Table 18a-3
Mobile Source Analysis Intersection Locations

Analysis Site	Location
1	West End Avenue and West 66th Street
2	West End Avenue and 61st Street
3	West End Avenue and West 59th Street
4	Eleventh Avenue and West 57th Street
5	Twelfth Avenue and West 59th Street
6	Twelfth Avenue and West 57th Street
7	Twelfth Avenue and West 42nd Street

For the PM_{10} and $PM_{2.5}$ analyses, two of the seven intersections presented in **Table 18a-3** were analyzed. Based on review of predicted project-generated traffic, the intersection of Twelfth Avenue and West 57th Street was selected, since it has the highest Build traffic volumes and the highest overall build increment, and would therefore result in the highest predicted PM_{10} emissions and potentially the maximum changes in $PM_{2.5}$ concentrations. The intersection of West End Avenue and West 59th Street was chosen because it has the highest overall truck increment and, therefore, could potentially result in maximum changes in $PM_{2.5}$ concentrations.

Receptor Placement

Multiple receptors (i.e. precise locations at which concentrations are predicted) were modeled at each of the selected sites; receptors were placed along the approach and departure links at spaced intervals. Receptors were placed at sidewalk or roadside locations near intersections with continuous public access.

Parking Facilities

The Proposed Project would include below-grade parking facilities. These facilities would contain a combined total of approximately 1,800 parking spaces. The air exhausted from the garages' ventilation systems would contain elevated levels of pollutants due to emissions from vehicles using the garages. Ventilation air from the Proposed Project's parking facilities would be directed to various exhausts located above street level.

An analysis of the emissions from the outlet vents and their dispersion in the environment was performed, calculating pollutant levels in the surrounding area, using the methodology set forth in the *CEQR Technical Manual*. Emissions from vehicles entering, parking, and exiting the garages were estimated using the EPA MOBILE6.2 mobile source emission model and an ambient temperature of 50°F, as referenced in the *CEQR Technical Manual*. For all arriving and departing vehicles, an average speed of 5 miles per hour was conservatively assumed for travel within the parking garages. In addition, all departing vehicles were assumed to idle for 1 minute before proceeding to the exit. The concentration of CO within the garages was calculated assuming a minimum ventilation rate, based on New York City Building Code requirements, of 1 cubic foot per minute of fresh air per gross square foot of garage area. To determine compliance with the NAAQS, CO concentrations were determined for the maximum 8-hour average period.

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

The CO concentrations were determined for the time periods when overall garage usage would be the greatest, considering the hours when the greatest number of vehicles would exit the facility. Departing vehicles were assumed to be operating in a "cold-start" mode, emitting higher levels of CO than arriving vehicles. Traffic data for the parking garage analysis were derived from the trip generation analysis described in Chapter 16, "Traffic and Parking."

As described in Chapter 1, "Project Description," the parking uses would primarily be located within two sub-cellar levels. Each of these two levels may operate as either one interconnected garage beneath all five project buildings, or as separate garages operated individually. Under both garage plans, a separate parking garage entrance would service each project building (depending on the location of the building, these entrances would be accessed from either Freedom Place South or West 59th Street). Since design information regarding the garages' mechanical ventilation systems is not available, the worst-case assumption that the air from the proposed parking garages would be vented through a single outlet for both garage plans. The vent face was modeled to directly discharge to West End Avenue at a height of approximately 10 feet, and "near" and "far" receptors were placed along the sidewalks at a pedestrian height of 6 feet at a distance of 8 feet and 96 feet, respectively, from the vent. In addition, receptors were placed on the building façade at a height of 6 feet above the vent, and within the open space at a pedestrian height of 6 feet at a distance of 5 feet. A persistence factor of 0.77, supplied by DEP, was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. This persistence factor was chosen since it applies to mid-town Manhattan, between 30th and 61st Street, and the Proposed Project site lies within this boundary. Background and on-street CO concentrations were added to the modeling results to obtain the total ambient levels. The on-street CO concentration was determined using the methodology in Air Quality Appendix 1 of the *CEQR Technical Manual*, utilizing traffic volumes utilized in the mobile source analysis.

STATIONARY SOURCES

HVAC Systems

As stated earlier, Con Edison steam would be supplied to the Proposed Project's buildings to provide heating. Ventilation and cooling systems would be electrically or steam powered. In addition, Con Edison steam would be used for domestic hot water systems in Buildings 1-4. Therefore, no analysis of potential air quality impacts from HVAC systems was performed for these buildings. For Building 5, it was assumed that a natural gas fired boiler would be used to provide domestic hot water. Therefore, a stationary source analysis was conducted to evaluate potential impacts from the domestic hot water heater for Building 5.

The heater was assumed to exhaust to a single stack that would be three feet above the height of the building at the center of the roof. Stack exhaust parameters and emission estimates for the proposed HVAC installation were conservatively estimated. Emissions rates were calculated based on emissions factors obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*. Fuel usage information was obtained based on the current design loads for this building. **Table 18a-4** summarizes the emissions rates for the domestic hot water heater.

Table 18a-4
Building 5 Domestic Water Heater Emissions

Pollutant	Heat Input (MMbtu/hr)	Stack Height (ft)	Emission Rate (g/sec)
SO_2	0.636	492.0	0.00005
$PM_{2.5}$			0.0006
PM_{10}			0.0006
NO_x			0.008
Notes: Building hot water demand is approximately constant throughout the year so annual consumption was divided by 365 days to determine the daily consumption.			

Dispersion Modeling

Potential impacts from boiler stack emissions were evaluated using the EPA/AMS AERMOD dispersion model. The AERMOD model was designed as a replacement to the EPA Industrial Source Complex (ISC3) model and has been approved for use by the EPA. AERMOD is a state-of-the-art dispersion model, applicable to rural and urban areas, flat and complex terrain, surface and elevated releases, and multiple sources (including point, area, and volume sources). AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions.

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

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

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

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at La Guardia Airport (2003–2007) 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 which 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.

Receptor Placement

A comprehensive receptor network (i.e., locations with continuous public access) was developed for the modeling analyses. Discrete receptors were analyzed, including locations on the Proposed Project site and other nearby buildings, at operable windows, air intakes, and at publicly accessible ground-level locations. The model also included elevated and ground-level receptor grids in order to address more distant locations and to identify the highest ground-level impact.

Background Concentrations

To estimate the maximum expected total pollutant concentrations, the calculated impacts from the emission sources must be added to a background value that accounts for existing pollutant concentrations from other sources (see **Table 18a-5**). The background levels are based on concentrations monitored at the nearest NYSDEC ambient air monitoring stations over a recent five-year period for which data are available (2004-2008), with the exception of PM_{10}, which is based on three years of data, consistent with current DEP guidance (2006-2008). For the short-term averages (3-hour and 24-hour) the highest second-highest measured values over the specified period were used. The annual average background values are the highest measured average concentrations for these pollutants. The measured background concentration was added to the predicted contribution from the modeled source to determine the maximum predicted total pollutant concentration. It was conservatively assumed that the maximum background concentrations occur on all days.

Table 18a-5
Maximum Background Pollutant Concentrations
For Stationary Source Analysis

Pollutant	Average Period	Location	Concentration (μg/m^3)	NAAQS (μg/m^3)
NO_2	Annual	PS 59 Manhattan	67.7	100
SO_2	3-hour	PS 59, Manhattan	183	1,300
	24-hour		99	365
	Annual		29	80
PM_{10}	24-hour	PS 59, Manhattan	60	150
Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2004–2008.				

Emergency Generators

Emergency diesel-fueled generators would be installed to serve each of the Proposed Project's buildings in the event of the loss of utility electrical power. The emergency generators would be tested periodically for a short period to ensure their availability and reliability in the event of a sudden loss in utility electrical power. They would not be utilized in a peak load shaving program,[1] minimizing the use of this equipment during non-emergency periods. Emergency generators are exempt from NYSDEC air permitting requirements, but would require a permit or registration issued by DEP, depending on the generator capacity. The emergency generators would be installed and operated in accordance with DEP requirements, as well as other

[1] The term "peak load shaving" refers to the use of customer-operated (non-utility) generators to produce electricity at the request of the local electrical utility in order to reduce the electrical demand during peak demand periods, particularly during the summer period.

applicable codes and standards. Potential air quality impacts from the emergency generators would be insignificant, since they would be used only for testing purposes (once per week or less for approximately 15 to 20 minutes) outside of an actual emergency use, and individual generators would be tested at different times.

Industrial Sources

Potential air quality impacts from existing industrial operations in the surrounding area on the development parcels were analyzed. Industrial air pollutant emission sources within 400 feet of the development parcels' boundaries were considered for inclusion in the air quality impact analysis, as recommended in the *CEQR Technical Manual*.

As the first step in this analysis, a request was made to DEP's Bureau of Environmental Compliance (BEC) and NYSDEC to obtain all the available certificates of operation for these locations and to determine whether manufacturing or industrial emissions occur. In addition, a search of federal and state-permitted facilities within the study area was conducted using the EPA's Envirofacts database.[1]

Land use and Sanborn maps were reviewed to identify potential sources of emissions from manufacturing/industrial operations. Next, a field survey was conducted to identify buildings within 400 feet of the Proposed Project site that have the potential for emitting air pollutants. The survey was conducted on October 14, 2008.

The results of the industrial source surveys and permit searches identified two permitted facilities within 400 feet of the project site. Two waterside facilities within 400 feet of the Proposed Project Site were also evaluated, a fuel oil transfer station operated by Con Edison, and the West 59th Street Marine Transfer Station (MTS) operated by the Department of Sanitation (DSNY). The Con Edison fuel oil transfer station located at Pier 98 is used to transfer fuel oil to the 59th Street Steam Station. Fuel is delivered to the facility by barges, where it is temporarily stored prior to pumping from the barges to the plant. No fossil fuel-fired equipment is located at this facility. The only source of emissions would be fugitive emissions of VOCs from the barges due to storage and filling of oil tanks on the barges. These emissions are considered minor in nature and would not result in any significant adverse air quality impact on the Proposed Project. The city has announced plans to convert the MTS to containerize DSNY waste delivered to the facility for transfer to barge for disposal outside of the city. It would also have the capability of receiving recyclable materials from DSNY vehicles and private haulers. An analysis of the potential air quality impacts from on-site operations at the converted MTS was conducted as part of the FEIS for the city's Comprehensive Solid Waste Management Plan (DSNY April 2005). The results of the toxic air pollutant analysis from that FEIS were cumulatively added to the industrial screening analysis for the Proposed Project.

After compiling the information on facilities with manufacturing or process operations in the study area, maximum potential pollutant concentrations from different sources, at various distances from the site, were estimated based on the reference values found in Table 17-3 in the revised 2010 *CEQR Technical Manual*. The database provides factors for estimating maximum concentrations based on emissions levels at the source, which were derived from generic AERMOD dispersion modeling for the New York City area. Impact distances selected for each source were the minimum distances between the boundary of the Proposed Project site and the source site.

[1] http://oaspub.epa.gov/enviro/ef_home2.air

Predicted worst-case impacts on the proposed development parcels were compared with the short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) recommended in NYSDEC's *DAR-1 AGC/SGC Tables.*[1] These guideline concentrations present the airborne concentrations, which are applied as a screening threshold to determine whether future occupants in the development parcels could be significantly impacted from nearby sources of air pollution.

To assess the effects of multiple sources emitting the same pollutants, cumulative source impacts were conservatively estimated. Concentrations of the same pollutant from industrial sources that were within 400 feet of the development parcels were combined and compared to the NYSDEC AGCs and SGCs.

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.

To assess the potential effects of these existing sources on the Proposed Project, a review of existing permitted facilities was conducted. Within the study area boundaries, sources permitted under NYSDEC's Title V program and State Facility permit program were considered. Other sources of information reviewed included the DEP permit data, and EPA's Envirofacts database.

One facility with a Title V permit was identified: the Con Edison 59th Street Station, which lies within the 1,000-foot study area, and is considered a large source according to the example classifications provided in the *CEQR Technical Manual*. Within the 400 foot area, developments that have a combined heat input rating of 20 million BTU/hour[2] or greater were analyzed. This includes large-scale developments of a size greater than approximately 335,000 square feet. Developments below this size within 400 feet of the Project site were excluded from the analysis since they are typical of the area, and are therefore already included in the types of sources accounted for in the monitored background concentrations.

Con Edison 59th Street Station

The 1992 FEIS concluded that construction of the Riverside South project would have a significant stationary source impact due to emissions from the existing Con Edison 59th Street Station on certain existing and proposed buildings. Mitigation proposed for this impact was to transfer emissions from one stack (Stack No. 5) to the much taller Stack No. 1 (referenced as Emission Point 00001 in the current NYSDEC Title V permit). The implementation of this mitigation measure would eliminate the need to seal any part of the four proposed residential buildings. Since the 1992 FEIS was issued, Con Edison deactivated the use of Stack No. 5, eliminating the need to implement the air quality mitigation measures.

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[1] NYSDEC Division of Air Resources, Bureau of Stationary Sources, September 10, 2007.

[2] British Thermal Units, or BTUs, are a measure of energy used to compare consumption of energy from different sources, such as gasoline, electricity, etc., taking into consideration how efficiently those sources are converted to energy. One BTU is the quantity of heat required to raise the temperature of one pound of water by one Fahrenheit degree.

Since the Proposed Project would result in buildings that are taller in height than the buildings proposed at parcels L, M and N in the 1992 FEIS, a wind tunnel study was conducted to assess the potential impacts of the Con Edison 59th Street Station on the Proposed Project.

The Con Edison facility has two permitted emission points, referenced as Stack 00001 and GT001 in the current Title V permit. Stack 00001 is used to exhaust emissions from a total of five steam boilers (identified as boilers 114, 115, 116, 117 and 118), while GT001 exhausts emissions from a combustion turbine with a maximum output of approximately 17 megawatts (MW). The boilers produce steam for the Con Edison district steam system; they do not produce electricity. The combustion turbine is used on a very limited basis (about 1 percent of the year on average) to provide peaking power to the electrical grid as well as for periodic testing to ensure its availability and reliability to provide emergency back-up power to Con Edison equipment.

Wind Tunnel Test Procedure. Concentrations of air pollutants emitted from the Con Edison Plant were estimated through wind tunnel tests on a scale model of the Proposed Project, the Con Edison plant, and their surroundings. The wind tunnel data were analyzed in combination with historical hour-by-hour wind conditions and pollutant background levels, in addition to variations in the boiler and turbine operational loads.

Rowan Williams Davies & Irwin (RWDI), Inc. constructed a scale model of the Proposed Project and its surroundings, for the purpose of analysis in a boundary layer wind tunnel. A 1:400 scale model of the Proposed Project (and all surrounding buildings and structures within a 1,600 foot radius) was constructed on a circular disk. The atmospheric turbulence was simulated in the long working section of a wind tunnel by means of spires at the upwind end and roughness blocks on the tunnel floor. For each wind direction, the spires and roughness were selected to produce wind velocity profiles similar to what would be expected at the site, based on the terrain upwind of the site. The mean tracer gas concentration measured at each receptor was then recorded in the form of a dilution ratio.

The wind tunnel tests were conducted by emitting a tracer gas at a known concentration and scaled flow rate from the Con Edison plant exhaust stack using established scaling procedures. Mean concentrations of tracer gas (carbon monoxide) were measured at receptor locations by drawing samples through flush-mounted tubes leading to a bank of infrared gas analyzers.

To reduce the potential for boiler stack exhaust plume meandering in the horizontal and vertical axis, RWDI measured concentrations in the wind tunnel for five minutes for each speed/wind angle combination. In addition, to reduce potential variability with respect to the wind angle, an increment of every 5° was used. A 3-point average was used to represent each of the 15°-increment values required for the post-processing analysis (e.g., 180° was represented by an average of values measured at 175°, 180°, and 185°). The turbine and boilers were assessed independently in the wind tunnel to quantify the pollutant contribution from each exhaust source.

To avoid potential significant adverse air quality impacts on the Proposed Project, the Con Edison 59th Street Station would be modified to duct the exhaust gas from the combustion turbine to the taller boiler stack (referenced as Stack 00001 in the NYSDEC Title V air permit). The air quality analysis was performed assuming this modification would take place.

The analysis was performed to account for three different types of operation: 1) when the boilers are operating and the combustion turbine is not operational; 2) when the boilers and the combustion turbine are operational; and 3) when the combustion turbine is operating and the boilers are not operational. The wind tunnel tests were performed for seven different operating scenarios, as defined below:

- The boilers operate at 25 load with the combustion turbine not operating;
- The boilers operate at 50 load with the combustion turbine not operating;
- The boilers operate at 90 load with the combustion turbine not operating;
- The turbine operates at 100 percent load while the boilers operate at 25 percent load;
- The turbine operates at 100 percent load while the boilers operate at 50 percent load;
- The turbine operates at 100 percent load while the boilers operate at 90 percent load.
- The combustion turbine operates at 100 percent load with the boilers not operating.

Information on the Con Edison facility was obtained from several sources. Stack exhaust parameters were obtained primarily from the most recent performance tests conducted by Con Edison. Additional information on historical operations was obtained from the EPA Clean Air Markets Division website[1] and monthly reports submitted by Con Edison to NYSDEC. Emission test data from Con Edison was used to estimate emissions of particulate matter from the combustion turbine, along with estimates of filterable and condensable fractions from EPA AP-42 to estimate PM_{10} and $PM_{2.5}$ emissions. NO_2 emissions from the boilers were determined based on actual NO_x monitoring data. SO_2 emissions from the boilers when firing No. 6 oil was estimated based on the quantities of fuel used and the maximum annual average sulfur content of the fuel based on data from 2005 to 2007. A summary of the stack parameters and emission rates is presented in **Table 18a-6** for each of the selected boiler loads, and with and without the turbine operating. The turbine is assumed to operate at maximum load when it is operating, based on information obtained from Con Edison.

Table 18a-6
Con Edison Plant Stack Parameters and Emission Rates (g/sec)

Stack Parameters	Combustion Turbine Only[1]	Boilers Only			Boilers & Combustion Turbine		
		90 Percent Load	50 Percent Load	25 Percent Load	90 Percent Load	50 Percent Load	25 Percent Load
Height (ft)	507[2]	507	507	507	507	507	507
Stack Exhaust Diameter (ft)	16.5	16.5	16.5	16.5	16.5	16.5	16.5
Exhaust Velocity (ft/min)	1,506	4,145	2,303	1,151	5,651	3,809	2,658
Temp (°F)	403	403	403	403	403	403	403
NO_2 (oil)	16.16	205.26	54.60	29.99	221.42	70.76	46.14
NO_2 (gas)	N/A[3]	30.97	24.57	21.27	47.12[4]	40.73[4]	37.43[4]
SO_2 (oil)	0.75	68.18	37.9	18.9	68.92	38.62	19.68
SO_2 (gas)	N/A[3]	0.14	0.08	0.04	0.89[4]	0.83[4]	0.79[4]
PM_{10} (oil)	1.11	12.14	6.75	3.37	13.25	7.86	4.48
PM_{10} (gas)	N/A[3]	1.83	1.02	0.51	2.94[4]	2.13[4]	1.62[4]
$PM_{2.5}$ (oil)	1.11	9.53	5.29	2.65	10.64	6.40	3.75
$PM_{2.5}$ (gas)	N/A[3]	1.83	1.02	0.51	1.83[4]	1.02[4]	0.51[4]

Notes:
Emission rates are reported in grams/second.
(1) The combustion turbine operates at 100% load only.
(2) For the SEIS, the combustion turbine is assumed to be vented to the existing boiler stack.
(3) The combustion turbine combusts kerosene.
(4) Emission rate represents the total emissions from the boilers running on gas and the combustion turbine running on kerosene.
Sources: Con Edison, EPA AP-42.

[1] http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard

The full boiler load was established at 90 percent through examination of the hourly operating data for the Con Edison plant, which found that loads exceeding this level did not occur for any period during the five years for which the analysis was conducted (2003-2007). The operating loads of 25 and 50 percent were considered to be representative of reduced operation over a wide range of operating conditions. The operating loads for the boilers were determined by proportionately adjusting the stack flow for the load condition measured during the stack test.

HOURGAS Analysis. The wind tunnel analysis employed a post-processing step using RWDI's HOURGAS software program. The HOURGAS analysis accounts for the time variation in wind conditions to predict concentrations over the six years of meteorological data considered. This was achieved by calculating the appropriate dilution factor for each hour, based on the wind speed and direction during that hour from the LaGuardia Airport meteorological station over a period of five years. The actual dilution factor for a specific wind speed and direction was calculated by interpolating the data for the nearest wind speed and direction. Boiler load was accounted for indirectly by applying the dilution factor resulting from either the 25, 50 or 90 percent load scenario results, based on the load that occurred at the specific hour corresponding to the same date and time as the meteorological conditions over the 5-year period.

The wind tunnel analysis adjusted the hourly boiler operating load to the nearest higher tested load (i.e., operating loads of 25 and 50 percent and lower were assumed to be at 25 and 50 percent, respectively, and loads greater than 50 percent were assumed to be at 90 percent). This is a very conservative assumption. As an illustration of this, using the procedure outlined above, the air quality analysis was performed with an average annual capacity factor of approximately 40 to 50 percent, which is on average more than 80 percent greater than the actual load over the 2002-2007 period, which ranged from approximately 23 percent to 33 percent. Short-term pollutant emissions were also conservatively modeled using this procedure.

The Con Edison 59th Street Station provides steam to connected customers in Manhattan for heating and cooling needs, as well as some process uses such as cleaning. The highest steam demand occurs during the winter heating season. The district steam system that Con Edison operates is not anticipated to experience any significant future growth based on Con Edison's own projections. Although the analysis does not directly account for potential additional steam generation at the Con Edison 59th Street Station as a direct result of the Proposed Project, it would represent a very small percentage of the overall steam generating output of that facility. This is due to the fact that the Con Edison 59th Street Station serves a much larger area, and since the Con Edison steam distribution system allows for any number of steam production facilities to supply steam to the Proposed Project, including facilities that are more energy efficient like the Con Edison East River Power Plant, which operates a combined cycle turbine plant, generating both steam and electricity. In light of regulatory considerations, it is reasonable to anticipate that in the future, Con Edison facility's boilers will utilize natural gas at levels similar or greater than in recent years.[1] Furthermore, as outlined above, the wind tunnel methodology is conservative in terms of the modeled mass emissions from the Con Edison 59th Street Station. Therefore, any such increase in emissions from the Con Edison 59th Street Station due to the Proposed Project is considered *de minimis*.

[1] Proposed Subpart 227-2, Reasonably Available Control Technologies (RACT) for Oxides of Nitrogen (NO_x), January, 2010.

As discussed earlier, the combustion turbine is used very infrequently, with an approximately 1 percent annual capacity factor. Pollutant concentrations from the Con Edison facility were determined both with and without the combustion turbine operating. Pollutant concentrations with the peaking turbine were determined based on the actual hours of operation from available operating records over the study period. This is a conservative assumption, as discussed further below in the section "Future with the Proposed Project." As noted above, the load for the turbine is assumed to be at 100 percent load when operating.

The wind tunnel analysis and the HOURGAS analysis also assumed that the boilers operate on either No. 6 fuel oil or natural gas. Historically, natural gas usage for the Con Edison boiler represents approximately 30 to 50 percent of the total fuel usage on an annual heat input basis. Daily records on boiler fuel usage were used to determine the proportion of each fuel type.

Receptors. Receptors were placed to represent the general impacts over a broad area of the Proposed Project's building façades. A higher density of receptors was placed on the upper locations of buildings where higher concentrations of pollutants from the boiler stack are anticipated.

Other Sources

Existing and proposed large-scale developments with emission sources within 400 feet of the Proposed Project site were analyzed to assess the potential for air quality impacts on the Proposed Project's buildings, consistent with the recommendations in the *CEQR Technical Manual*. Sources with fossil fuel-fired combustion equipment having a total estimated heat input capacity of 20 MMBtu/hr were included in the analysis.

Stack exhaust parameters and emission estimates for the combustion equipment were conservatively estimated. Short-term emissions rates (emission rates over periods of 24 hours or less) were calculated based on emissions factors obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*. The SO_2 emissions factors when burning fuel oil were calculated based on the maximum allowable sulfur content of the fuel, accounting for the recent New York State legislation which mandates a decrease the sulfur content of No. 2 heating oil to 15 ppm, effective July 1, 2012. PM_{10} and $PM_{2.5}$ emissions include both the filterable and condensable fractions.

Three large-scale developments were identified within the study area. The stack exhaust parameters and the estimated emission rates are provided in **Table 18a-7**.

Potential air quality impacts from existing boilers on the Proposed Project were evaluated using the EPA/AMS AERMOD dispersion model. 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.

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at La Guardia Airport (2003–2007) and concurrent upper air data collected at Brookhaven, New York.

To estimate the maximum expected total pollutant concentrations for NO_2, SO_2, and PM_{10} the predicted levels were added to corresponding background concentrations, presented in **Table 18a-5**. It was conservatively assumed that the maximum short-term background concentrations occur on all days. To assess the potential impact of $PM_{2.5}$, concentrations were compared with the city's interim guidance criteria.

Table 18a-7
Stack, Building Parameters, and Pollutant Emission Rates of Existing and Future No Build Developments

Pollutant	Development Size (ft^2)	Stack Height (ft)	Pollutant Emission Rates (g/sec)	
			Oil	Natural Gas
Riverside Parcel J1				
SO_2	571,608	469.0	0.0028	0.0011
$PM_{2.5}$			0.0278	0.0133
PM_{10}			0.0311	0.0133
NO_x			0.2611	0.1756
Riverside Parcel J2				
SO_2	335,068	299.6	0.0016	0.0006
$PM_{2.5}$			0.0163	0.0078
PM_{10}			0.0182	0.0078
NO_x			0.1530	0.1029
Element Condominium, 555 W. 59th Street-Boiler				
SO_2	290,588	388.0	-	0.0005
$PM_{2.5}$			-	0.0068
PM_{10}			-	0.0068
NO_x			-	0.0892

Effect of Proposed Project on Plume Dispersion from the Con Edison 59th Street Station

Existing and proposed developments near the Proposed Project site were evaluated to assess whether the Proposed Project's effect on plume dispersion from the Con Edison 59th Street Station would result in any significant adverse air quality impact. Existing and proposed developments within 400 feet of the Proposed Project site were studied using the AERMOD model. The same stack and emission parameters to estimate potential impacts on the Proposed Project from the Con Edison 59th Street Station were used. Impacts were calculated using the downwash assumptions in the AERMOD model to assess the effects of the project buildings on plume dispersion.

EXISTING CONDITIONS

EXISTING MONITORED AIR QUALITY CONDITIONS

The most recent concentrations of all criteria pollutants at NYSDEC air quality monitoring stations nearest the study area are presented in **Table 18a-8**. All data statistical forms and averaging periods are consistent with the definitions of the NAAQS. It should be noted that these values are somewhat different than the background concentrations presented in **Table 18a-5**, above. These existing concentrations are based on recent published measurements, averaged according to the NAAQS (e.g., $PM_{2.5}$ concentrations are averaged over the three years); the background concentrations are the highest values in past years, and are used as a conservative estimate of the highest background concentrations for future conditions.

There were no monitored violations of the NAAQS for the pollutants at these sites in 2008 with the exception of the annual standard of 15 $\mu g/m^3$ (based on the three-year average of the annual concentrations) for $PM_{2.5}$ and the 24-hour standard for $PM_{2.5}$ of 35 $\mu g/m^3$ (based on the three-year average of the 98th percentile concentrations).

Table 18a-8
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	P.S. 59, Manhattan	ppm	8-hour	1.2	9
	P.S. 59, Manhattan		1-hour	1.5	35
SO_2	P.S. 59, Manhattan	µg/m^3	Annual	29	80
			24-hour	78	365
			3-hour	110	1,300
PM_{10}	P.S. 59, Manhattan	µg/m^3	24-hour	46	150
$PM_{2.5}$	P.S. 59, Manhattan	µg/m^3	Annual	15.5	15
			24-hour	36.9	35
NO_2	P.S. 59, Manhattan	µg/m^3	Annual	68	100
Lead	J.H.S. 126, Brooklyn	µg/m^3	3-month	0.014	0.15
Ozone	I.S. 52, Bronx	ppm	8-hour	0.074	0.075

Notes:

Based on the NAAQS definitions, the CO and SO_2 concentrations for short-term averages are the second-highest from the year. $PM_{2.5}$ annual concentrations are the average of 2006, 2007, and 2008, and the 24-hour concentration is the average of the annual 98th percentiles in 2006, 2007 and 2008. 8-hour average ozone concentrations are the average of the 4th highest-daily values from 2006 to 2008.

Source: NYSDEC, New York State Ambient Air Quality Data.

EXISTING SIMULATED POLLUTANT CONCENTRATIONS IN THE STUDY AREA

The monitored concentrations (presented above) represent general air quality in the study area. However, the concentrations adjacent to the mobile-source analysis sites in the existing condition may be higher than at the monitoring stations, due to the adjacent vehicular emissions. The highest simulated existing 8-hour average CO concentrations at the mobile-source analysis sites are presented in **Table 18a-9**. (One-hour average values are not shown since predicted values are much lower than the 1-hour standard of 35 ppm.)

Table 18a-9
Maximum Predicted Existing 8-Hour Average CO Concentrations for 2008

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	West End Avenue and West 66th Street	AM	3.9
2	West End Avenue and West 61st Street	PM	3.2
3	West End Avenue and West 59th Street	PM	3.6
4	Eleventh Avenue and West 57th Street	AM	3.9
5	Twelfth Avenue and West 59th Street	AM	4.5
6	Twelfth Avenue and West 57th Street	PM	6.2
7	Twelfth Avenue and West 42nd Street	SAT MD	7.2

Note: 8-hour standard is 9 ppm.

FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCES

Carbon Monoxide

CO concentrations without the Proposed Project were determined for future 2018 conditions using the methodology previously described. **Table 18a-10** shows future maximum predicted 8-hour average CO concentrations at the analysis intersections without the Proposed Project (i.e., 2018 No Build values). The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 18a-10
Maximum Predicted Future (2018) 8-Hour
Average Carbon Monoxide No Build Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	West End Avenue and West 66th Street	AM	3.3
2	West End Avenue and West 61st Street	AM	3.0
3	West End Avenue and West 59th Street	PM	3.2
4	Eleventh Avenue and West 57th Street	AM	3.5
5	Twelfth Avenue and West 59th Street	AM	4.1
6	Twelfth Avenue and West 57th Street	PM	4.9
7	Twelfth Avenue and West 42nd Street	SAT MD	5.9
Note: 8-hour standard is 9 ppm.			

As shown in **Table 18a-10**, 2018 No Build values are predicted to be well below the 8-hour CO standard of 9 ppm, and lower than predicted existing average concentrations (shown in **Table 18a-9**). The predicted decrease in CO concentrations would result from the increasing proportion of newer vehicles with more effective pollution controls as well as the continuing benefits of the New York State I&M Program.

Particulate Matter

PM concentrations without the Proposed Project were determined for future 2018 conditions using the methodology previously described. **Table 18a-11** presents the future maximum predicted 24-hour average PM_{10} concentrations at the analysis intersections without the Proposed Project (i.e., No Build values). The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed. Note that $PM_{2.5}$ concentrations without the Proposed Project are not presented, since impacts are assessed on an incremental basis.

Table 18a-11
Maximum Predicted Future (2018) No Build
24-Hour PM_{10} Concentrations

Receptor Site	Location	Concentration (μg/m^3)
3	West End Avenue and West 59th Street	88.1
6	Twelfth Avenue and West 57th Street	110.2
Note: NAAQS—24-hour, 150 μg/m^3.		

STATIONARY SOURCES

In the future without the Proposed Project, HVAC emissions in the area would be higher than existing conditions due to the development of parcels under both No Build scenarios. Emissions from HVAC equipment would also be higher than with the Proposed Project since the 1992 FEIS assumed that these systems would be served by fossil fuel fired boilers, compared to the Proposed Project's use of Con Edison steam.

In addition, in the Future Without the Proposed Project, the proposed ducting of the exhaust gas from the relatively short combustion turbine stack (GT0001) to the taller boiler stack (Stack 00001) would not occur.

FUTURE WITH THE PROPOSED PROJECT

The Proposed Project would result in increased mobile source emissions in the immediate vicinity of the project area and could also affect the surrounding community with emissions from HVAC equipment. The following sections describe the results of the studies performed to analyze the potential impacts on the surrounding community from these sources for the Build year. In addition, existing industrial facilities, as well as large combustion sources including the Con Edison Steam Station, were assessed for potential adverse impacts on the Proposed Project's buildings.

MOBILE SOURCES ANALYSIS

Carbon Monoxide

CO concentrations with the Proposed Project were determined for future 2018 conditions at traffic intersections using the methodology previously described. **Table 18a-12** shows the future maximum predicted 8-hour average CO concentration with the Proposed Project at the seven intersections studied. (No 1-hour values are shown, since no exceedances of the NAAQS would occur and the *de minimis* criteria are only applicable to 8-hour concentrations; therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentration for any of the time periods analyzed. The results indicate that the Proposed Project would not result in any violations of the 8-hour CO standard. In addition, the incremental increases in 8-hour average CO concentrations are very small, and consequently would not result in a violation of the CEQR *de minimis* CO criteria. Consequently, the Proposed Project would not result in any significantly CO air quality impacts in the Build condition.

Table 18a-12
Maximum Predicted Future (2018) 8-Hour Average
No Build and Build CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)	
			No Build	Build
1	West End Avenue and West 66th Street	AM	3.3	3.4
2	West End Avenue and West 61st Street	AM	3.0	3.1
3	West End Avenue and West 59th Street	PM	3.2	3.1
4	Eleventh Avenue and West 57th Street	AM	3.5	3.5
5	Twelfth Avenue and West 59th Street	AM	4.1	4.2
6	Twelfth Avenue and West 57th Street	PM	4.9	5.0
7	Twelfth Avenue and West 42nd Street	SAT MD	5.9	6.2
Note: 8-hour standard is 9 ppm.				

Particulate Matter

PM concentrations with the Proposed Project were determined for future 2018 conditions using the methodology previously described. **Table 18a-13** shows the future maximum predicted 24-hour average PM_{10} concentrations with the Proposed Project. The values shown are the highest predicted concentrations for all locations analyzed and include the ambient background concentrations. The results indicate that the Proposed Project would not result in any violations of the PM_{10} standard or any significant adverse impacts on air quality.

Table 18a-13
Maximum Predicted Future (2018) 24-Hour Average No Build and Build PM_{10} Concentrations

Receptor Site	Location	24-Hour Concentration (μg/m^3)	
		No Build	Build
3	West End Avenue and West 59th Street	88.1	89.0
6	Twelfth Avenue and West 57th Street	110.2	111.6
Note: National Ambient Air Quality Standards—24-hour, 150 μg/m^3.			

Future maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared to the interim guidance criteria that would determine the potential significance of any impacts from the Proposed Project. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Tables 18a-14 and 18a-15**, respectively. The results show that the annual and daily (24-hour) $PM_{2.5}$ increments are predicted to be well below the interim guidance criteria and, therefore, the Proposed Project would not result in significant $PM_{2.5}$ impacts at the analyzed receptor locations.

Table 18a-14
Maximum Predicted Future (2018) 24-Hour Average $PM_{2.5}$ Concentrations

Receptor Site	Location	Increment (μg/m^3)
3	West End Avenue and West 59th Street	0.02
6	Twelfth Avenue and West 57th Street	0.02
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, 2 μg/m^3 (5 μg/m^3 not-to-exceed value).		

Table 18a-15
Maximum Predicted Future (2018) Annual Average $PM_{2.5}$ Concentrations

Receptor Site	Location	Increment (μg/m^3)
3	West End Avenue and West 59th Street	0.005
6	Twelfth Avenue and West 57th Street	0.004
Note: $PM_{2.5}$ interim guidance criteria—annual (neighborhood scale) 0.1 μg/m^3.		

PARKING GARAGE

Based on the methodology previously described, the maximum predicted 8-hour average CO concentrations from the proposed parking facilities were analyzed using several receptor points, a near side receptor on the same side of the street as the parking facility and a far side receptor on the opposite side of the street from the parking facility for a street side vent. The total CO impacts included both background CO levels and contributions from traffic on adjacent roadways (for the far side receptor only). There was also a receptor placed on the façade of the building above the parking garage and receptor in the courtyard.

The maximum predicted 8-hour average CO concentration of all the sensitive receptors described above would be 3.2 ppm for the building facade receptor. This value includes a predicted concentration of 1.2 ppm from the parking garage vent, and includes a background level of 2.0 ppm. This concentration is substantially below the applicable standard of 9 ppm. As the results show, the proposed parking garages would not result in any significant adverse air quality impacts.

STATIONARY SOURCE ANALYSIS

HVAC Analysis

Table 18a-16 shows maximum predicted concentrations for NO_2, SO_2 and PM_{10} from the proposed domestic hot water heating at Building 5. As shown in the table, the maximum concentrations from stack emissions, when added to ambient background levels, would be well below the NAAQS.

Table 18a-16
Future (2018) Maximum Modeled Pollutant Concentrations from Building 5 Domestic Hot Water Heater (in μg/m³)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	0.13 (1)	67.7	67.8	100
SO_2	3-hour	0.04	183	183	1,300
	24-hour	0.01	99	99	365
	Annual	0.001	29	29	80
PM_{10}	24-hour	0.16	60	60.2	150
Note: (1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.					

The air quality modeling analysis also determined the highest predicted increase in 24-hour and annual average $PM_{2.5}$ concentrations from the boiler system proposed for domestic hot water heating at Building 5 (see **Table 18a-17**). As shown in the table, the maximum 24-hour incremental impact at any discrete receptor location would be less than the applicable interim guidance criteria of 2 μg/m³ and 5 μg/m³. On an annual basis, the projected $PM_{2.5}$ impacts would be less than the applicable interim guidance criterion of 0.3 μg/m³, and the DEP interim guidance criteria of 0.1 μg/m³ for neighborhood scale impacts. Therefore, no potential significant stationary source air quality impacts related to $PM_{2.5}$ are expected to occur with the Proposed Project.

To conform to the assumptions made in this Final SEIS, the Restrictive Declaration for the Proposed Project would have the following requirements for the proposed developments:

Block 1171, Lots 155, 165 (Building 1, 2, 3 and 4). Any new development on this property must ensure that utility steam or electricity would be utilized to serve its heating and hot water needs.

Block 1171, Lot 165 (Building 5). Any new development on this property must ensure that utility steam or electricity would be utilized to serve its heating needs (excluding domestic hot water production). The domestic hot water heater must utilize utility steam or natural gas.

Table 18a-17
Future (2018) Maximum Predicted $PM_{2.5}$ Concentrations from Building 5 Domestic Hot Water Heater (in μg/m³)

Pollutant	Averaging Period	Maximum Concentration	Threshold Concentration
$PM_{2.5}$	24-hour	0.16	5/2
	Annual (discrete)	0.02	0.3
	Annual (neighborhood scale)	<0.10 (1)	0.1

Note: (1) The annual average neighborhood scale was not required to be modeled since the maximum concentration at any discrete receptor is less than the 0.1 μg/m³ criterion.

Industrial Source Analysis

As discussed above, a study was conducted to identify manufacturing and industrial uses within the 400-foot study area. DEP-BEC and EPA permit databases were used to identify existing sources of industrial emissions. Two permitted facilities were identified within 400 feet of the project site in the Build condition. The results also include the maximum impacts from the West 59th Street Converted MTS facility as presented in the FEIS prepared for the facility. This is a very conservative approach since it assumes that maximum concentrations from the converted MTS would occur at locations on the Proposed Project site, rather than at locations closer to the MTS. In addition, the maximum concentrations from all of the sites analyzed were assumed to occur at the same receptor location.

The screening procedure used to estimate the pollutant concentrations from other businesses is based on information contained in the certificates to operate obtained from DEP-BEC. The information describes potential contaminants emitted by the permitted processes, hours per day, and days per year in which there may be emissions (which is related to the hours of business operation), and the characteristics of the emission exhaust systems (temperature, exhaust velocity, height, and dimensions of exhaust).

Table 18a-18 presents the maximum impacts at the Proposed Project. The table also lists the SGC and AGC for each toxic air pollutant. The results of the industrial source analysis demonstrate that there would be no predicted significant adverse air quality impacts on the Proposed Project from existing industries in the area.

Additional Sources

Con Edison 59th Street Station

Potential stationary source impacts on the Proposed Project from the Con Edison 59th Street Station were determined using the wind tunnel analysis methodology previously described. A determination was made that maximum $PM_{2.5}$ concentration increments from the existing stack for the Con Edison combustion turbine would exceed the city's $PM_{2.5}$ interim guidance criteria on portions of the Proposed Project. In recognition of this, to avoid potential significant adverse air quality impacts on the Proposed Project, as part of the Proposed Project the Con Edison 59th Street Station would be modified to duct the exhaust gas from the combustion turbine to the taller boiler stack.

As discussed earlier, the analysis was performed to account for three different types of operation: 1) when the boilers are operating and the combustion turbine is not operational; 2) the boilers and the combustion turbine are operational; and 3) when the combustion turbine is operating and the boilers are not operational.

Table 18a-18
Maximum Predicted Impacts from Industrial Sources

Potential Contaminants	Estimated Short-term Impact (ug/m³)	SGC[a] (ug/m³)	Estimated Long-term Impact (ug/m³)	AGC[a] (ug/m³)
Ethylene Glycol	0.62	10,000	0.007	400
Isopropyl Alcohol	477.86	98,000	0.593	7,000
Methanol	0.06	33,000	0.0008	4,000
Particulate	50.72	380	0.055	45
Polyethylene Glycol[b]	0.21	--	0.003	--
Tetrachloroethylene	1.03	1,000	0.012	1
Benzene[c]	0.192	1,300	0.005	0.13
Formaldehyde[c]	24.2	30	0.0063	0.06
1,3 Butadiene[c]	0.008	--	0.0002	0.033
Acetaldehyde[c]	0.158	4,500	0.0041	0.45
Benzo(a)pyrene[c]	3.86E-5	--	9.98E-7	9.1E-4
Propylene[c]	53	--	0.0137	3,000
Acrolein[c]	0.019	0.19	0.0005	0.02
Toluene[c]	0.084	37,000	0.0022	5,000
Xylenes[c]	0.0585	4,300	0.0015	100
Anthracene[c]	0.0004	--	9.93E-6	0.02
Benzo(a)anthracene[c]	3.45E-4	--	8.92E-6	0.02
Chrysene[c]	7.25E-5	--	1.87E-6	0.02
Naphthalene[c]	0.0174	7,900	0.00045	3
Pyrene[c]	0.00098	--	2.54E-5	0.02
Phenanthrene[c]	0.00604	--	0.00016	0.02
Dibenz(a,h)anthracene[c]	0.00012	--	3.1E-6	0.02

Notes:
[a] NYSDEC DAR-1 (Air Guide-1) AGC/SGC Tables, September, 2007.
AGC-Annual Guideline Concentrations.
SGC-Short-term Guideline Concentrations.
[b] Not listed in NYSDEC DAR-1 AGC/SGC Tables
[c] Results were obtained from the FEIS for the city's Comprehensive Solid Waste Management Plan (DSNY April 2005).

The maximum estimated concentrations from the modeling were added to the background concentrations to estimate total air quality concentrations on the Proposed Project. The results of this analysis for NO_2, SO_2 and PM_{10} are presented in **Table 18a-19** for the scenario when the Con Edison facility boilers are operating without the combustion turbine, and **Table 18a-20** for the scenario when the Con Edison facility boilers are operating with the combustion turbine operating based on its historical usage over the study period. As shown in the tables, the predicted pollutant concentrations for all of the pollutant time averaging periods shown are below their respective standards. For each of the pollutants and averaging periods, maximum predicted impacts were predicted to occur when the combustion turbine was assumed to not be operating (see **Table 18a-19**) due to the increased exhaust velocity when the combustion turbine is operating, which provides greater dispersion of emissions. With the combustion turbine operating, slightly lower annual concentrations are predicted, as shown in **Table 18a-20**. Short-term concentrations are identical to those presented in **Table 18a-19**, but reflect time periods when the combustion turbine is assumed to be not operating.

Table 18a-19
Future (2018) Maximum Predicted Concentrations on the Proposed Project from the Con Edison 59th Street Station—Combustion Turbine Not Operating (in μg/m³)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	0.85 (1)	67.7	68.6	100
SO_2	3-hour	96.2	183	279.2	1,300
	24-hour	37.4	99	136.4	365
	Annual	1.28	29	30.3	80
PM_{10}	24-hour	6.35	60	66.4	150

Note: (1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.

Table 18a-20
Future (2018) Maximum Predicted Concentrations on the Proposed Project from the Con Edison 59th Street Station—Combustion Turbine Operating (in μg/m³)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	0.84(1)	67.7	68.5	100
SO_2	3-hour	96.2	183	279.2	1,300
	24-hour	37.4	99	136.4	365
	Annual	1.25	29	30.3	80
PM_{10}	24-hour	6.35	60	66.4	150

Note: (1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.

The wind tunnel analysis also determined the maximum predicted increase in 24-hour and annual average $PM_{2.5}$ increments from the Con Edison plant on the Proposed Project. On an annual basis, the maximum projected $PM_{2.5}$ increments would be below the applicable interim guidance criterion of 0.3 μg/m³ for local impacts (see **Table 18a-21** for the scenario when the Con Edison facility boilers are operating without the combustion turbine, and **Table 18a-22** for the scenario when the Con Edison facility boilers are operating with the combustion turbine). Based upon the modeling studies, the maximum predicted $PM_{2.5}$ impacts would occur when the combustion turbine would not be operating.

Table 18a-21
Future Maximum Predicted $PM_{2.5}$ Annual Average Increments On the Proposed Project from the Con Edison 59th Street Station —Combustion Turbine Not Operating (in μg/m³)

Maximum Increment	Incremental Threshold
0.18	0.30

Table 18a-22
Future Maximum Predicted $PM_{2.5}$ Annual Average Increments On the Proposed Project from the Con Edison 59th Street Station —Combustion Turbine Operating (in μg/m³)

Maximum Increment	Incremental Threshold
0.17	0.30

The air quality analysis also evaluated concentration increments with the 24-hour average interim guidance criteria for discrete receptor locations. As described in the Section *Air Quality Standards, Regulations and Benchmarks,* the city's interim guidance criteria for $PM_{2.5}$ states that 24-hour average $PM_{2.5}$ concentration increments which are predicted to be greater than 2 μg/m³ but no greater than 5 μg/m³ 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. Therefore, the assessment examined the magnitude, duration, frequency, and extent of the increments at locations where exposure above the 2 μg/m³ threshold averaged over a 24-hour period could occur. **Table 18a-23** presents a summary of the frequency, magnitude and location of predicted $PM_{2.5}$ concentration increments at receptor locations which exceed 2 μg/m³ (there are no receptor locations where the maximum predicted incremental concentrations of $PM_{2.5}$ would exceed 5 μg/m³). The results presented in **Table 18a-23** represent the maximum incremental concentrations of $PM_{2.5}$ for a period of six years (2002 to 2007).

Table 18a-23
Magnitude, Frequency and Location of 24-hour $PM_{2.5}$ Impacts > 2 μg/m³ On the Proposed Project from the Con Edison 59th Street Station

Bldg	Receptor Elevation	Façade	2002	2003	2004	2005	2006	2007	Total	Max Conc. (μg/m³)	2nd Max Conc. (μg/m³)
1	419	East	0	1	1	3	0	0	5	3.79	2.53
1	409	South	0	2	2	5	1	1	11	**4.97**	2.67
1	419	West	0	0	0	1	0	0	1	2.95	<2
1	369	East	0	0	0	1	0	0	1	2.07	<2
1	369	South	0	1	1	5	1	1	9	4.86	2.56
1	369	West	0	0	0	1	0	0	1	2.35	<2
2	472	East	4	1	1	1	0	1	8	2.46	2.40
2	472	South	1	1	0	1	0	0	3	2.42	2.29
2	472	South	1	1	2	2	1	0	7	2.91	2.77
2	472	West	0	0	1	1	0	0	2	3.13	2.09
3	369	East	0	0	1	1	0	0	2	2.46	2.10
3	369	South	0	0	1	1	0	0	2	2.71	2.67
3	369	South	0	1	1	1	0	0	3	3.35	3.34
5	490	South	0	0	0	1	0	0	1	2.34	<2

Notes: Maximum predicated 24-hour average concentration increment shown in bold. Represents the maximum predicted 24-hour concentration over a six year period (2002-2007).

A discussion of the predicted $PM_{2.5}$ concentration increments between 2 μg/m³ and 5 μg/m³ on the Proposed Project's buildings follows.

Building 1. The receptor location with the maximum continual 24-hour exposure was predicted on the south façade of Building 1, at an elevation of approximately 409 feet above sea level. At this location, the maximum 24-hour $PM_{2.5}$ incremental concentration from the Con Edison boiler stack was predicted to be 4.97 μg/m^3. This occurred as a result of a highly unusual meteorological condition, as discussed later in this section. At this location, 24-hour incremental concentrations from the Con Edison boiler stack were predicted to exceed 2 μg/m^3 at a maximum annual frequency of five times per year, and at an average frequency of less than twice per year, over six years. Five other locations with incremental concentrations exceeding 2 μg/m^3 on Building 1 were predicted, on the east and west façades at an elevation of 419 feet, and on the east, west and south façades at an elevation of 369 feet. At these receptors, 24-hour incremental concentrations from the Con Edison boiler stack were predicted to exceed 2 μg/m^3 at a maximum frequency ranging from zero to five times per year, but with an average frequency of less than twice per year.

Building 2. At Building 2, the maximum 24-hour $PM_{2.5}$ incremental concentration from the Con Edison boiler stack was predicted to be 3.13 μg/m^3 on the west façade at an elevation of approximately 472 feet. Three other locations with incremental concentrations exceeding 2 μg/m^3 on Building 2 were predicted, on the east and south façades at an elevation of 472 feet. At these receptors, 24-hour incremental concentrations from the Con Edison boiler stack were predicted to exceed 2 μg/m^3 at a maximum frequency ranging from zero to four times per year, but with an average frequency of less than twice per year.

Building 3. At Building 3, the maximum 24-hour $PM_{2.5}$ incremental concentration from the Con Edison boiler stack was predicted to be 3.35 μg/m^3 on the south façade at an elevation of approximately 369 feet. Two other locations with incremental concentrations exceeding 2 μg/m^3 on Building 2 were predicted, on the east and south façades at an elevation of 369 feet. At these receptors, 24-hour incremental concentrations from the Con Edison boiler stack were predicted to exceed 2 μg/m^3 at a maximum frequency of only once per year, and at an average frequency of much less than once per year.

Building 4. At Building 4, maximum $PM_{2.5}$ incremental concentrations from the Con Edison boiler stack were predicted to be below the interim guidance criterion of 2 μg/m^3.

Building 5. At Building 5, the maximum 24-hour $PM_{2.5}$ incremental concentration from the Con Edison boiler stack was predicted to be 2.34 μg/m^3 on the south façade at an elevation of approximately 490 feet. This is the only occurrence exceeding 2 μg/m^3 predicted on this building.

As shown in the **Table 18a-21**, the highest predicted incremental concentration was 4.97 μg/m^3 with a second-highest maximum of 4.86 μg/m^3 (both of these values occurred on the same date – November 29th, 2005). While the maximum concentration is 4.97 μg/m^3, the concentration drops significantly, with the second maximum concentration at that receptor being 2.67 μg/m^3, which is approximately 50 percent of the maximum. Similarly, concentrations at the receptor location with a maximum concentration of 4.86 μg/m^3 falls to 2.56 μg/m^3. Considering the entire six-year period studied (over 2,100 days), these maximum concentrations are considered to be the result of a highly unusual meteorological condition, and are considered anomalous. At all other receptors, the magnitude of the impacts is well below the ceiling threshold of 5 μg/m^3, and at all receptors, the maximum and annual average frequencies above 2 μg/m^3 are low. The maximum number of events exceeding 2.0 μg/m^3 is five times per year, in 2005.The total number of exceedances is 11 times over the six modeled years, or an average of approximately 2 times/year .

Furthermore, there are a number of new and proposed air quality regulations and federal and state level which apply to Con Edison's steam system equipment and operations. Compliance with these regulations will likely necessitate reductions in the emissions of regulated pollutants such as NO_x prior to the Proposed Project's completion, requiring a greater reliance on cleaner burning fuels such as lower sulfur oil and natural gas compared to No. 6 oil. Since these fuels have emit lower levels of particulate matter than No. 6 oil, this will have a secondary benefit in reducing the magnitude and frequency of $PM_{2.5}$ impacts on the Proposed Project. 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 NYSDEC draft $PM_{2.5}$ SIP. Well before the projected completion of the Proposed Project in 2018, the annual $PM_{2.5}$ NAAQS is projected to be attained at all locations in the New York City Metropolitan Area, with reductions in annual average $PM_{2.5}$ concentrations exceeding any predicted localized annual increment from the Con Edison facility. 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. Taken together, these reductions are anticipated to result in an improvement in air quality at the project site, further reducing the 24-hour average $PM_{2.5}$ concentrations from the Con Edison facility, as well as from other sources in the ambient air. Overall, both the incremental $PM_{2.5}$ concentrations from the Con Edison 59th Street Steam Station and the ambient background $PM_{2.5}$ concentrations are anticipated to be significantly 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.

To ensure that there are no significant adverse impacts of $PM_{2.5}$ on Building 1 from the Con Edison 59th Street Steam Station, any locations on the south façade above an elevation of 409 feet, would have inoperable windows and no air intakes. With these restrictions in place, there would be no significant adverse air quality impacts from the Con Edison facility on the Proposed Project.

Implementation of the modification to the Con Edison 59th Street Station combustion turbine exhaust would be subject to performing the modifications at the 59th Street Station pursuant to an agreement with the Con Edison that will address access, responsibility for costs and liabilities incurred as a result of this initiative, construction risks, and other issues. Con Edison entered into a non-binding Letter of Intent with the project sponsor indicating its willingness to enter into negotiations for that purpose. Implementation would also be subject to obtaining the necessary permits. Permitting actions would occur after the ULURP process. The Project's Restrictive Declaration would include provisions requiring completion of modifications related to the combustion turbine at the 59th Street Station to address elevated $PM_{2.5}$ levels at the Project buildings. With this modification in place, there would be no significant adverse air quality impacts on the Proposed Project from the Con Edison 59th Street Station.

Other Sources

Potential stationary source impacts on the Proposed Project from other existing sources identified in **Table 18a-7** were determined using the AERMOD modeling methodology previously described. The maximum estimated concentrations from the modeling were added to the background concentrations to estimate total air quality concentrations on the Proposed Project. The results of this analysis are presented in **Table 18a-24** for NO_2, SO_2 and PM_{10}. As shown in the table, the predicted pollutant concentrations for all of the pollutant time averaging periods shown are well below their respective standards.

Table 18a-24
Future (2018) Maximum Predicted Concentrations on the Proposed Project from Other Sources (in µg/m³)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	0.29 (1)	67.7	68.0	100
SO_2	3-hour	0.49	183	183.5	1,300
	24-hour	0.19	99	99.2	365
	Annual	0.005	29	29.0	80
PM_{10}	24-hour	2.16	60	62.2	150

Note:
(1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.

The air quality modeling analysis also determined the maximum predicted increase in 24-hour and annual average $PM_{2.5}$ increments from other sources on the Proposed Project. **Table 18a-25** presents the results of the analysis. As shown in the table, the maximum 24-hour incremental concentrations at any discrete receptor location would be below the applicable interim guidance criterion of 2 µg/m³. On an annual basis, the maximum projected $PM_{2.5}$ increments would be well below the applicable interim guidance criterion of 0.3 µg/m³ for local impacts. Therefore, large-scale developments within 400 feet would not significantly impact air quality on the Proposed Project.

Table 18a-25
Future (2018) Maximum Predicted $PM_{2.5}$ Increments on the Proposed Project from Other Sources (in µg/m³)

Averaging Period	Maximum Increment	Incremental Threshold
24-Hour	1.94	5/2
Annual	0.05	0.30

Note: 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.

Potential Cumulative Impacts From the Con Edison 59th Street Station and Other Sources

Impacts from the Con Edison 59th Street Station and other, large-scale developments within 400 feet of the Project site were evaluated for their potential cumulative impacts. Potential cumulative impacts are not considered to be significant since the stack exhaust velocities and locations for the Con Edison and other sources are substantially different and due to the locations of the sources relative to each other. These factors would generally result in maximum impacts on the Proposed Project's buildings at different locations, and on a short-term basis, under different meteorological conditions. However, to confirm that these different sources would not result in a significant adverse air quality impact on the Proposed Project, the impacts from these separate analyses were also evaluated on a cumulative basis.

The results of the cumulative impact analysis are presented in **Table 18a-26** for NO_2, SO_2 and PM_{10}. As shown in the table, the predicted pollutant concentrations for all of the pollutant time averaging periods shown are below their respective standards. This is a conservative analysis since the maximum concentrations from each analysis (i.e., the Con Edison 59th Street Station and other boilers) were added together regardless of receptor location and for short-term analyses, the date of occurrence.

Table 18a-26
Future (2018) Maximum Predicted Cumulative Concentrations on the Proposed Project (in μg/m^3)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	1.0[(1)]	67.7	68.7	100
SO_2	3-hour	96.6	183	279.6	1,300
	24-hour	37.6	99	137.6	365
	Annual	1.28	29	30.3	80
PM_{10}	24-hour	8.51	60	68.5	150

Note: (1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.

The cumulative air quality impact analysis also determined the maximum predicted increase in 24-hour and annual average $PM_{2.5}$ increments. For this analysis 24-hour average $PM_{2.5}$ incremental concentrations were determined co-incidentally (i.e., on the same dates and years). Impacts were also determined on a cumulative basis for each of the Proposed Project's buildings and for each building façade.

On an annual basis, the maximum projected $PM_{2.5}$ increments would be below the applicable interim guidance criterion of 0.3 μg/m^3 for local impacts (see **Table 18a-27**). The air quality analysis also evaluated impacts with the 24-hour average interim guidance criteria 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 18a-27
Future Maximum Predicted Cumulative $PM_{2.5}$ Annual Average Increments on the Proposed Project (in μg/m^3)

Maximum Increment	Incremental Threshold
0.23	0.30

The receptor location with the maximum continual 24-hour exposure would be on the south façade of Building 1, at an elevation of approximately 409 feet above sea level. At this location, the maximum cumulative incremental 24-hour $PM_{2.5}$ concentration is predicted to be 4.98 μg/m^3. This is essentially identical to the maximum incremental $PM_{2.5}$ concentration predicted from the Con Edison 59th Street Station (4.97 μg/m^3). At other buildings, maximum concentrations were only slightly higher than shown in **Table 18a-21** (by 0.01 to 0.07 μg/m^3).

Overall, the magnitude, frequency, location, and size of the area of concentrations above 2 μg/m^3 is low and would not occur at locations where continuous 24-hour exposure would occur. These maximum concentrations are very similar to those presented for the Con Edison 59th Street Station alone, indicating that the additional emissions from other large-scale developments would have very little cumulative effect on the Proposed Project. Therefore, cumulative $PM_{2.5}$ impacts from the Con Edison 59th Street Station and large-scale developments within 400 feet would not significantly impact air quality on the Proposed Project.

Effect of Proposed Project on Plume Dispersion from the Con Edison 59th Street Station

Existing and proposed developments near the Proposed Project site were evaluated to assess whether the Proposed Project's effect on plume dispersion from the Con Edison 59th Street Station would result in any significant adverse air quality impact.

The results of the AERMOD analysis are presented in **Table 18a-28** for NO_2, SO_2 and PM_{10}. As shown in the table, the predicted pollutant concentrations for all of the pollutant time averaging periods shown are below their respective standards.

Table 18a-28
Future (2018) Maximum Predicted Concentrations from the Con Edison 59th Street Station on Developments Within 400 feet of the Proposed Project (in μg/m³)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	Annual	4.83(1)	67.7	72.5	100
SO_2	3-hour	125.0	183	308.0	1,300
	24-hour	92.3	99	191.3	365
	Annual	6.48	29	35.5	80
PM_{10}	24-hour	15.3	60	75.3	150

Note:
(1) NO_2 impacts were estimated using a NO_2/NO_x ratio of 0.59.

The analysis also determined the maximum predicted increase in 24-hour and annual average $PM_{2.5}$ increments on developments within 400 feet of the Proposed Project. **Table 18a-29** presents the results of the analysis. For this analysis $PM_{2.5}$ concentrations from the Con Edison 59th Street Station were determined both without and with the Proposed Project. As shown in the table, the maximum 24-hour incremental concentrations at any discrete receptor location would be well below the applicable interim guidance criterion of 5 μg/m³. On an annual basis, the maximum projected $PM_{2.5}$ increments would be well below the applicable interim guidance criterion of 0.3 μg/m³ for local impacts.

Table 18a-29
Future Maximum Predicted $PM_{2.5}$ Increments from the Con Edison 59th Street Station on Developments Within 400 feet of the Proposed Project (in μg/m³)

Averaging Period	Maximum Increment	Incremental Threshold
24-Hour	1.30	5/2
Annual	0.061	0.30

Note: 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.

The results of the analysis determined that the Proposed Project would not result in any significant adverse air quality impacts with respect to emissions from the Con Edison 59th Street Station on existing and proposed buildings within 400 feet of the Proposed Project Site. Concentrations of NO_2, SO_2 and PM_{10} from the Con Edison 59th Street Station, when added to background concentrations, would not exceed NAAQS, and incremental increases in $PM_{2.5}$ concentrations would not exceed the city's interim guidance criteria.

1-HOUR NO_2 NATIONAL AMBIENT AIR QUALITY STANDARD

INTRODUCTION AND OVERVIEW

EPA recently established a new 1-hour average NO_2 standard of 100 parts per billion (ppb), effective April 12, 2010, in addition to the current 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 is considering the need for changes to the secondary NO_2 standard under a separate review.

By promulgating the 1-hour NO_2 standard, EPA has initiated a process under the CAA that will ultimately result in the adoption of strategies designed to attain and maintain ambient NO_2 concentrations at levels below the standard. This process will first involve installation of additional ambient NO_2 monitoring stations for the purpose of identifying whether areas such as New York City meet the new standard. With respect to those areas that are identified as in non-attainment, states will be required to develop SIPs designed to meet the standard by specified time frames. EPA and the states also can be expected to issue new regulations and guidance that will address methodologies and criteria for performing assessments of 1-hour NO_2 concentrations from project-level emission sources and for evaluating their impacts. This information is not currently available. Therefore, although EPA has promulgated the 1-hour standard, it has yet to be fully implemented.

As discussed in greater detail below, given the limitations on information available regarding NO_2 background values, and the current lack of guidance and uncertainties regarding analysis methodologies, qualitative (rather than quantitative) discussion of construction and mobile source – related NO_2 is presented. While certain of the same issues exist with regard to stationary sources, there are unique circumstances with respect to the Proposed Project that allow for quantification of potential impacts relating to nearby stationary sources on the Proposed Project. The Proposed Project would be constructed adjacent to a major Title V emissions source, the Con Edison 59th Street Station. As discussed below, monitoring and reporting conducted by Con Edison in compliance with its Title V permit for this facility provide extensive hourly emissions data. In addition, the tall exhaust stack serving the facility releases emissions at a height where the distance from the ground allows sufficient mixing to occur such that the backgrounds for ambient air quality from existing monitors are representative of conditions for the purpose of analysis. Accordingly, many of the difficulties arising with respect to the performance of a quantitative assessment of NO_2 impacts from sources at lower elevations are avoided, and a quantified assessment of the effects of NO_2 emissions from the 59th Street Station in combination with other sources on the Proposed Project buildings is possible.

The following section addresses the sources of NO_2 in the ambient environment; a description of this regulatory action; a summary of the current NO_2 background values; a discussion of area-wide measures expected to reduce emissions in the future and the expected changes in NO_2 levels in the future; a description of the methodologies utilized in this Final SEIS for addressing the new standard for the Proposed Project; and the results of that assessment. Note that this assessment addresses both the operational and construction aspects of the Proposed Project with respect to the new 1-hour NO_2 standard (see Chapter 20, "Construction" for the analysis of air quality impacts due to construction activities with respect to other standards).

SOURCES OF NO_2 IN THE AMBIENT ENVIRONMENT

Nitrogen oxides (nitric oxide, NO, and NO_2, collectively referred to as NO_x) are often addressed together, due to the chemical reactions that cause NO to transform to NO_2 and vice versa. NO_x

emissions from combustion sources, such as cars, trucks and buses, power plants, and off-road equipment, are mostly in the form of NO (on the order of 90 percent or greater), but transform in the atmosphere into a mixture consisting mostly of NO_2.

NO_2 is linked with a number of adverse effects on the human respiratory system. NO_x as a whole are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. NO_x emissions are also of concern as precursors to fine particulate matter (PM) formation in the atmosphere. The transformation of NO_x to fine particulate matter is generally of concern for long-range transport, since the chemical reactions involved in this process are much slower than the more rapid transformation from NO to NO_2 and back.

Until recently, the NO_2 NAAQS was based on annual average concentrations, at a level that addressed its role as a region-wide pollutant and for local impacts from large stationary sources. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, the increment in NO_2 concentrations at locations in close proximity to emission sources of NO_x (most of which is emitted as NO) is generally small. However, with the promulgation of the new 1-hour average standard for NO_2, local sources, including mobile sources, may become of greater concern for this pollutant. EPA, in promulgating the standard, has expressed specific concern regarding mobile source impacts, and estimated that ambient concentrations of NO_2 at near-roadway locations could be 30 to 100 percent higher than the concentrations measured at community scale (rooftop) monitoring stations[1]. Therefore, EPA is requiring additional monitoring at near-road locations to determine whether these areas demonstrate attainment with the new standard.

The relative contribution of source categories to NO_x emissions in New York State and in Manhattan are presented in **Table 18a-30**.

Table 18a-30
NO_x Source Contributions, 2005

Source Category	New York State	Manhattan
On-Road	43%	18%
Non-Road	20%	31%
Heating, Process, and Other Fuel Combustion	20%	47%
Electricity Generation	12%	4%
Other Sources	5%	<1%

Sources: EPA, 2005 emissions inventory data, http://www.epa.gov/air/emissions/nox.htm.

NATIONAL AMBIENT AIR QUALITY STANDARD FOR NO_2

Attainment Status and Implementation

EPA first established NAAQS for NO_2 in 1971, setting both a primary standard and a secondary standard at 0.053 ppm, averaged annually. Currently there are no areas in the United States that are designated as nonattainment of the annual NO_2 standard. However, it can be expected that some areas could be classified as in nonattainment with the NO_2 1-hour NAAQS in the future.

EPA is required to identify or “designate” areas as attaining or not attaining the new standard by January 2012. These initial designations will be based on the existing monitoring network,

[1] EPA, Final Regulatory Impact Analysis (RIA) for the NO_2 National Ambient Air Quality Standards (NAAQS), January 2010.

which consists of monitors established at community-scale locations[1]. Areas with monitors recording violations of the new standards will be designated nonattainment. EPA has identified only one county in the U.S. (in Illinois) that may be classified as nonattainment based on the existing data, and anticipates designating all other areas of the country as "unclassifiable" to reflect the fact that there are insufficient data available to determine if those areas are meeting the revised NAAQS.

To determine compliance with the new 1-hour standard, EPA is establishing new ambient air monitoring and reporting requirements for NO_2. In urban areas, monitors are required near major roads as well as in other locations where maximum concentrations are expected. Additional monitors are required in large urban areas to measure the highest concentrations of NO_2 that occur more broadly throughout communities. Working with the states, EPA will site a subset of monitors in locations where communities are susceptible and vulnerable to NO_2-related health effects. All new NO_2 monitors must begin operating no later than January 1, 2013.

Once the expanded network of near-road and other NO_2 monitors is fully deployed and three years of air quality data have been collected, in 2016 or 2017, EPA intends to re-designate areas as appropriate, based on the air quality data from the new monitoring network.

Any state with nonattainment areas will be required to develop a SIP that identifies and implements specific measures to reduce ambient NO_2 concentrations to attain and maintain the new 1-hour NO_2 standard, most likely by requiring further reductions of NO_x emissions from sources.

In issuing the 1-hour NO_2 standard, EPA indicated that the new standard must be taken into account when permitting new or modified major sources of NO_x emissions such as fossil-fuel fired power plants, boilers, and a variety of other manufacturing operations. Major new and modified sources subject to New Source Review (NSR) applying for permits will initially be required to demonstrate that their proposed emissions increases of NO_x will not cause or contribute to a violation of either the annual or 1-hour NO_2 NAAQS[2]. Similarly, it is reasonable to present in the Final SEIS a quantitative 1-hour NO_2 assessment of emissions from a major source such as the 59th Street Station on the Proposed Project's buildings.

AMBIENT BACKGROUND LEVELS OF NO_2

Existing Monitored Ambient Concentrations of NO_2

Based on the current available monitoring information, all areas in the U.S. presently meet the 1971 NO_2 NAAQS, with annual NO_2 concentrations measured at community-scale monitors well below the level of the annual standard. Annual average ambient NO_2 concentrations, as measured at community-scale monitors, have decreased by more than 40 percent since 1980. Currently, the annual average NO_2 concentrations in New York City range from approximately 20 to 30 ppb, which is below the annual average NO_2 standard.

Table 18a-31 summarizes the 1-hour NO_2 concentrations measured at existing community-scale monitoring stations in New York City during the three recent years for which data have been

[1] Community-scale monitors are monitors that are located in areas that are generally more than 50 meters from roadways.

[2] Federal Register, Vol. 75, No. 26, Pg 6525.

made available by NYSDEC. As shown in the table, NO_2 concentrations have consistently been below the new 1-hour NAAQS at all existing monitoring sites in New York City. However, as noted earlier, additional monitoring stations will be established by 2013 near major roadways to collect additional data for the purpose of determining whether NYC in is attainment of the 1-hour standard.

Table 18a-31
Monitored Community-Scale 1-Hour NO_2 Levels In New York City (ppb)

NYSDEC Monitoring Station	2006	2007	2008
Botanical Gardens	67	N/A	N/A
Pfizer Lab	N/A	70	64
I.S. 52	72	72	67
P.S. 59	75	79	79
Queens College	66	68	67

Notes:
Reported concentrations represent the 98th percentile of daily maximum 1-hour concentrations.
* 2008 data available from P.S. 59 only until June 30th.
Concentrations at near-roadway locations are expected to be higher than the concentrations presented above.
Sources: NYSDEC, New York State Ambient Air Quality Data (2006-2008).

Projections of Future Concentrations

Due to its effect on ambient ozone and $PM_{2.5}$ concentrations, EPA has promulgated a number of regulations to reduce emissions of NO_x from certain source categories. For example, Tier 2 standards for light-duty vehicles began to be phased in during 2004, and new NO_x standards for heavy-duty engines are being phased in between 2007 and 2010 model years. Lower NO_x emission standards for nonroad diesel engines, locomotives, and certain marine engines are will be phased in throughout the next decade. Current air quality monitoring data reflect only a few years of vehicles entering the fleet that meet these stricter NO_x standards. In future decades, as these lower-NO_x vehicles and engines become an increasingly large fraction of in-use mobile sources, large NO_x emission reductions will be achieved. In addition, states (including New York) that have non-attainment areas for ozone and $PM_{2.5}$ have developed SIPs to document how attainment with the ozone and $PM_{2.5}$ NAAQS will be achieved by specified target dates, and have, as a result, promulgated regulations and put in place various programs at the state and regional levels to achieve additional reductions in emissions from sources of NO_x. As a result, EPA and New York State anticipate that NO_x emissions, and the ensuing ambient NO_2 concentrations, will continue to decrease in the future.

EPA projections indicate that based on the existing community-scale monitoring station data (which excludes data collected at the near-road monitoring stations to be sited in the future), no counties in the U.S. would have ambient 1-hour peak levels as high as the 100 ppb standard by 2020, assuming a baseline of no additional control beyond the controls expected from rules that are already in place (including the current $PM_{2.5}$ and ozone NAAQS) [1]. In fact, projections indicated that only one county, in Colorado, would have ambient 1-hour peak levels above 65 ppb in 2020. The RIA document reported that the 98th percentile concentrations for New York

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

City were projected to be approximately 23 ppb in 2020—well below the new standard. However, in spite of these projections, areas exceeding the 1-hour standard may occur at near-roadway locations, and at other locations in proximity to significant NO_2 sources. Those areas are to be addressed under the CAA process described above.

METHODOLOGIES UTILIZED FOR ESTIMATING 1-HOUR NO_2 CONCENTRATIONS

Stationary Sources

As noted above, the Proposed Project would be constructed adjacent to a Title V emissions source, the Con Edison 59th Street Station. As a result of unique circumstances (i.e., close proximity to the stack of the Con Edison facility, which is a Title V facility subject to the new 1-hour NO_2 standard with a long history of environmental analysis and reporting, where both release point and receptors are at high elevations) detailed information was available to allow for the determination of incremental concentrations of NO_2 from the Con Edison facility. Monitoring and reporting conducted by Con Edison in compliance with its Title V permit for this facility provided actual monitored NO_x emissions on an hourly basis from the facility's steam boilers. The NO_2 emissions from the facility's combustion turbine were estimated based on the EPA AP-42 emission factor (which was used in the annual NO_2 analysis presented earlier in this chapter) and detailed, hourly records of turbine use were available. As reported by Con Edison, the combustion turbine operates at peak load only, so emissions do not vary on an hourly basis when the turbine is operating, unlike the facility's boilers.

Methodologies for assessing annual average NO_2 concentrations from large stationary sources such as the Con Edison 59th Street Station are well established. Due to the unique circumstances of the Con Edison facility relative to the Proposed Project, information was available to allow for the determination of incremental concentrations of NO_2 from the Con Edison facility. Background concentrations are currently monitored at several sites within New York City, which are used for reporting NO_2 concentrations on a "community" scale. Because this data is compiled on a 1-hour average format, it can be used for comparison with the new 1-hour standard. Therefore, background 1-hour NO_2 concentrations currently measured at the community-scale monitors can be considered representative of background concentrations for purposes of assessing the impact of the Con Edison facility at elevated receptors. Conversely, concentrations from the Con Edison 59th Street Station on the Proposed Project at or near ground-level locations that are near roadways, where information on background concentrations is not yet available, would be very low. Until such time as more research on conversion of NO_x to NO_2 over relatively short distances is done in order to establish near-roadway background concentrations in accordance with appropriate criteria, and modifications to existing models are made for mobile sources for reporting maximum concentrations consistent with the form of the 1-hour standard, no methodology exists that could provide reasonable predictions about concentrations from the Con Edison 59th Street Station on the receptors at or near ground-level locations.

EPA's preferred regulatory stationary source model, AERMOD, is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standard. A reasonably conservative estimate of the transformation ratio of NO_2 to NO_x can be based on existing information, applicable to emission sources such as the Con Edison 59th Street Station, as discussed further below.

Therefore, a detailed modeling analysis was prepared for the Con Edison 59th Street Station, considered alone and in combination with three large-scale developments with emission sources within 400 feet of the Proposed Project site having a total heat input capacity of greater than 20 MMBtu/hr. An analysis was also prepared for a natural gas boiler that is assumed to provide domestic hot water for Building 5.

Emission rates for the Con Edison 59th Street Station's boilers were based on in-stack monitoring which is reported on EPA's CAMD website. The 1-hour NO_x emissions rate for the Building 5 domestic hot water heater was calculated based on the emissions factor obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources* and the current design loads for this building. The NO_x emissions from the other nearby sources were calculated using emission factors obtained from *AP-42*, and using annual fuel consumption factors with an adjustment to calculate the peak short-term emissions as outlined in *CEQR Technical Manual Appendix 7*.

Maximum predicted NO_x concentrations were calculated using physical modeling (a wind tunnel study), in the case of the nearby Con Edison facility, and EPA's AERMOD model, in the case of the Proposed Project's Building 5 boiler and other nearby sources. NO_2 concentration increments from these sources were then estimated using a NO_2 to NO_x ratio of 0.59, which is based on the ambient annual average NO_2 to NO_x ratio as measured at New York City monitoring stations in the recent three year period (2006-2008), as described in EPA's *Guideline on Air Quality Models* at 40 CFR part 51 Appendix W, Section 5.2.4.[1]Although this general guidance from EPA is focused on estimating annual-average NO_2 concentrations, the use of a 59 percent conversion ratio of NO to NO_2 is a reasonably conservative estimate for 1-hour concentrations as well. For example, in a document evaluating various modeling approaches to estimating NO_2 using EPA modeling procedures, a number of scenarios were evaluated showing transformation ratios to be lower than that level (59 percent) out to distances of hundreds of meters and more[2].

Total pollutant concentrations were estimated by modeling concentration increments from the emission sources and adding the predicted increments to background concentrations that account for pollutant contributions from more distant existing sources. Total hourly NO_2 concentrations throughout the modeling period were then determined by adding the hourly modeled concentrations to the detailed hourly ambient NO_2 concentrations measured at the P.S. 59 NYSDEC monitoring station for each corresponding hour. Then, the highest combined daily 1-hour NO_2 concentration was determined at each receptor location for each day. The 8th-highest daily 1-hour maximum concentration for each modeled year was then calculated at each receptor—this is a 98th percentile value. The 98th percentile concentrations were averaged over three years, in accordance with the form of the 1-hour standard. The highest three-year average calculated for the analyzed period (2003-2007) was then compared with the 1-hour NO_2 NAAQS standard.

Proposed Project receptors considered in the wind tunnel study of the Con Edison facility impacts were also included in the AERMOD analysis. Concurrent 1-hour concentration increments from both analyses were summed with concurrent 1-hour background NO_2 levels to determine total predicted concentrations and were compared with the NAAQS.

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[1] http://www.epa.gov/scram001/guidance/guide/appw_05.pdf

[2] MACTEC, Sensitivity Analysis Of PVMRM and OLM in AERMOD, September 2004. Available on EPA's website with distributed AERMOD materials.

Mobile Sources

In order to evaluate the effect of mobile source emissions due to the Proposed Project, 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. As described above, EPA estimates that concentrations near roadways may by 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, computation of the maximum 1-hour daily 98th percentile concentrations (including No Build traffic) cannot be accurately performed given the limitations of the existing EPA mobile source models, which are designed to provide only peak concentrations.

For the Proposed Project, the incremental increases in NO_2 concentrations are primarily due to relatively small increases in the number of vehicles (as compared to existing or No Build traffic in the study area). Given the current large uncertainty regarding background concentrations at specific locations near roadways, and the lack of agency guidance 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 Project on the receptors at or near ground-level locations, and a qualitative discussion of the 1-hour NO_2 impacts is appropriate.

Construction Equipment

Detailed dispersion modeling of construction-related emissions is focused primarily on ground-level emissions and, therefore, on potential impacts at nearby ground-level receptors. (Minor exceptions include emissions from elevated sources, such as interiors and cranes, which generally have lower emissions than ground-level construction activities.) Receptors adjacent to a construction site are influenced by ground level emissions from nearby roadways, and, as discussed above with respect to mobile sources, a large uncertainty exists as to 1-hour NO_2 background concentrations. In addition, as previously noted, there is no clear understanding with respect to the rate of transformation of NO to NO_2 at ground-level. Therefore, the significance of predicted impacts cannot be determined based on comparison with the NAAQS since total 98th percentile values, including local area roadway contributions, cannot be estimated. In addition, construction-related air quality analysis methodologies have not been developed to accurately predict 1-hour NO_2 concentrations from construction activities.

RESULTS

Stationary Sources

This section describes the results of the analysis of NO_2 emissions from the Con Edison 59th Street Station. In addition, an assessment of the potential effects of other nearby sources of NO_2 emissions in the vicinity of the Proposed Project, and an evaluation of the Proposed Project's NO_2 stationary source emissions, are also presented.

Con Edison 59th Street Station

Following the procedures outlined above, the potential impact of emissions from the Con Edison 59th Street Station on 1-hour NO_2 concentrations at the Proposed Project were estimated through wind tunnel tests on a scale model of the project, the Con Edison facility, and their surroundings. The analysis determined that the modeled concentrations, when added to the 98th percentile background concentration, would not result in any exceedances of the 1-hour NAAQS.

The maximum predicted increase in the three-year average 98th percentile NO_2 daily maximum 1-hour NO_2 concentration increment at any Proposed Project receptor location from the Con Edison is 1.06 ppb. The total maximum three-year averages of the 98th percentile of the daily maximum 1-hour NO_2 concentrations at each of the proposed buildings from the Con Edison 59th Street Station and the ambient background are presented in **Table 18a-32**.

Following the procedures outlined above, the predicted 1-hour NO_2 concentrations due to the Con Edison facility, combined with other large combustion sources in the area, when added to the ambient background, were also determined (see **Table 18a-33**). The maximum predicted impacts from the Con Edison facility and other modeled HVAC sources occur on different building facades and at different building elevations. The Con Edison stack is at a much higher elevation than other HVAC sources. The Con Edison stack is also located to the south of the proposed project buildings and therefore maximum NO_2 concentrations resulting from the Con Edison facility occur on the top floors on the southern facades of the proposed buildings, whereas the other modeled HVAC sources are located to the north and east of the project buildings, affecting the corresponding building facades, different from those affected by Con Edison.

Table 18a-32
Future (2018) Maximum Predicted 1-Hour NO_2 Concentration (ppb) at Proposed Project Buildings From the Background and Con Edison 59th Street Station

Building 1	Building 2	Building 3	Building 4	Building 5	NAAQS
80.3	80.7	80.0	80.0	80.0	100[1]

Notes:
1. Based on a 2003 to 2007 analysis period.
2. The NAAQS and the reported concentrations at the proposed buildings represent the highest three-year averages of the annual 98th percentile daily maximum 1-hr average concentration.
3. Reported concentrations are the maximum three-year averages (2003 - 2005) of the 98th percentile of daily maximum 1-hr average combined concentrations (Con Edison facility added to the ambient background).

The total 1-hour NO_2 concentration (including the Con Edison facility, other modeled HVAC sources, and the ambient background) are presented in **Table 18a-33**. The total cumulative NO_2 concentrations, including the ambient background, would be below the NAAQS. Therefore, there would be no potential for significant adverse NO_2 impacts on the Proposed Project from stationary sources of emissions.

HVAC Systems

Table 18a-34 shows maximum predicted 1-hour concentrations for NO_2 from the proposed domestic hot water heating at Building 5, utilizing the AERMOD modeling analysis and the NO_2 to NO_x ratio described earlier. As shown in the table, the maximum concentrations from stack emissions, when added to the 98th percentile background level, would be below the NAAQS.

Table 18a-33
Future (2018) Maximum Predicted 1-Hour NO_2 Concentrations (ppb)
Impact of Background, Con Edison 59th Street Station and Other Analyzed Sources at Proposed Project Buildings

Building 1	Building 2	Building 3	Building 4	Building 5	NAAQS
87.0	88.0	82.5	81.4	83.4	100[1]

Notes:
1. Based on a 2003 to 2007 analysis period.
2. The NAAQS and the reported concentrations at the proposed buildings represent the maximum three-year average of the annual 98th percentile daily maximum 1-hr average concentration. The concentrations include the ambient background.

Table 18a-34
Future (2018) Maximum Predicted 1-Hour NO_2 Concentration from Building 5 Domestic Hot Water Heater (ppb)

Pollutant	Averaging Period	Maximum Concentration Due to Stack Emission	Maximum Background Concentration	Total Concentration	Standard
NO_2	1-Hour	3.6 (1)	78.3	81.9	100

Notes:
(1) NO_2 impacts were conservatively estimated using a NO_2/NO_x ratio of 0.59.
(2) The NAAQS and the reported background concentration represent the three-year average of the annual 98th percentile daily maximum 1-hour average concentration.

Mobile Sources

Roadway sources are likely a substantial contributor to local 1-hour NO_2 background concentrations. In or before the Build Year (2018), the concentrations from roadway monitoring will be evaluated by DEC based on procedures established by state and federal agencies to determine whether the city is in attainment of the 1-hour NO_2 standard.

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 in most cases. It is not known whether conditions in the future No Build condition will be within or in excess of the NAAQS in these near-road areas and, as discussed above, background concentrations are in fact expected to decrease over time; however, project-related 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 Project.

If future monitoring identifies non-attainment areas due to transportation sources, it is anticipated that SIP strategies to reduce the 1-hour NO_2 concentrations in those areas would be developed. These steps may include additional regulations to further reduce emissions from sources of NO_2 that may contribute to exceedances near roadways. In addition, at the federal level, regulations have been recently promulgated which will increase fuel efficiency standards for vehicles in the future, which will have an overall benefit in reducing tailpipe emissions of NO_x and other pollutants.

Construction Equipment

Since a reasonable estimate of total NO_2 concentrations associated with construction activities is not practicable at this time, no quantified analysis is presented for the 1-hour standard. However, given the current understanding of construction-related NO_x emissions, it is likely that substantial 1-hour average incremental NO_2 concentrations would be expected during peak construction periods in the nearby area, potentially exceeding 100 ppb (the level of the 98th percentile NAAQS) during certain periods, even without accounting for background sources. This situation would not be unique to the Proposed Project, but would be possible at construction projects involving similarly large-scale, long-term and intensive construction activities.

Any impact of the Proposed Project's construction on 1-hour average NO_2 concentrations would be limited to the area near the construction site, and would be most pronounced during peak construction activity. Due to the limitations described above in quantifying 1-hour average NO_2 concentrations from construction activities and background concentrations, details regarding the frequency, duration, and magnitude of impacts are not available, and comparison with the NAAQS is not practicable. However, given the high NO_2 emission rates from current model construction equipment, temporary exceedances of the 1-hour NO_2 NAAQS from construction activities associated with the Proposed Project cannot be ruled out.

As discussed in Chapter 20, "Construction," certain measures would be implemented in order to minimize emissions from construction activities. Those measures would include the use of electric engines and grid power where practicable, and other measures for generally reducing pollutant emissions. In addition, to minimize hourly emissions of NO_2 to the maximum extent practicable, non-road diesel powered vehicles and construction equipment meeting the EPA Tier 3 Non-road Diesel Engine Emission Standard would be used in construction, and construction equipment meeting Tier 4 would be used where conforming equipment is widely available, and the use of such equipment is practicable[1].

1-HOUR SO_2 NATIONAL AMBIENT AIR QUALITY STANDARD

INTRODUCTION AND OVERVIEW

As required by the Clean Air Act, primary and secondary NAAQS have been established for six major air pollutants including SO_2. 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.

Effective August 23, 2010, EPA replaced the 24-hour average and annual average SO_2 primary standards with a 1-hour average SO_2 primary standard of 75 ppb. The statistical form of the new

[1] The first federal regulations for new nonroad diesel engines were adopted in 1994, and signed by EPA into regulation in a 1998 Final Rulemaking. The 1998 regulation introduces Tier 1 emissions standards for all equipment 50 hp and greater and phases in the increasingly stringent Tier 2 to Tier 3 standards for equipment manufactured in 2000 through 2008. In 2004, The EPA introduced Tier 4 emissions standards with a phased-in period of 2008 to 2015. The Tier 1 through 4 standards regulate the EPA criteria pollutants, including particulate matter (PM), hydrocarbons (HC), oxides of nitrogen (NO_x) and carbon monoxide (CO). Prior to 1998, emissions from nonroad diesel engines were unregulated. These engines are typically referred to as Tier 0.

standard is the 3-year average of the 99th percentile of daily maximum 1-hour average concentrations in a year. EPA determined that the 24-hour and annual standards can be revoked because they would not add additional public health protection given a 1-hour standard. EPA is also considering the need for changes to the secondary SO_2 standard under a separate review, to be completed in 2012.

SOURCES OF SO_2 IN THE AMBIENT ENVIRONMENT

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Other sources include industrial processes such as extracting metal from ore. Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources. SO_2 is generally co-emitted with other oxides of sulfur (SO_x), which react with other compounds in the atmosphere to form $PM_{2.5}$. The use of ultra low sulfur diesel (ULSD) fuel in construction engines results in reduced particulate matter emissions, as well as insignificant amounts of SO_2.

The relative contribution of source categories to SO_2 emissions in New York State and in Manhattan are presented in **Table 18a-35**.

Table 18a-35
SO_2 Source Contributions, 2005

Source Category	New York State	Manhattan
Fossil Fuel Electricity Generation	50%	6%
Fossil Fuel Combustion	38%	80%
Non Road Equipment	3%	12%
Other Sources	9%	2%
Sources: EPA, 2005 emissions inventory data, http://www.epa.gov/air/emissions/so2.htm		

NATIONAL AMBIENT AIR QUALITY STANDARD FOR SO_2

Attainment Status and Implementation

EPA first established NAAQS for SO_2 in 1971, setting a 24-hour primary standard at 140 ppb and an annual average standard at 30 ppb (to protect health). EPA also set a 3-hour average secondary standard at 500 ppb (to protect the public welfare).

EPA is required to identify or “designate” areas as attaining or not attaining the new standard by June 2012. States with areas designated as nonattainment need to submit state implementation plans (SIPs) to EPA by early 2014 outlining actions that will be taken to meet the standards as expeditiously as possible, but no later than August 2017.

EPA indicated that the new 1-hr SO_2 standard must be taken into account when permitting new or modified major sources of SO_2 emissions. Major new and modified sources subject to New Source Review (NSR) applying for permits are required to demonstrate that their proposed emissions increases of SO_2 will not cause or contribute to a violation of any NAAQS, including the new 1-hour SO_2[1]. EPA has also issued guidance on conducting air quality dispersion

[1] Federal Register, Vol. 75, No. 119, Pg 35579.

modeling for the 1-hour SO_2 standard and set forth a recommended interim 1-hour SO_2 significant impact level (SIL) at 3 ppb, or at 4 percent of the NAAQS[1].

AMBIENT BACKGROUND LEVELS OF SO_2

Existing Monitored Ambient Concentrations of SO_2

Based on the current available monitoring information, all areas in New York State presently meet the 1971 SO_2 NAAQS. The 2009 annual average SO_2 concentrations in New York City ranged from approximately 4 to 6 ppb, and the 24-hour average SO_2 concentrations ranged from 19 to 31 ppb – well below the 1971 annual and 24-hour average SO_2 standards.

Based on ambient air monitoring data collected from 2007 through 2009 in 249 counties, EPA has identified 59 counties nationwide that violate the 75 ppb 1-hour SO_2 standard, none of which are located in New York State. While EPA has indicated that these data will not be used to make initial attainment designations, the measured values indicate that SO_2 levels in New York State are currently lower than the 1-hour standard. EPA is requiring adjustments to the existing monitoring network to ensure that monitors meeting the network design regulations for the new 1-hour SO_2 standard are sited and operational by January 1, 2013.

Table 18a-36 summarizes the 1-hour SO_2 concentrations measured at existing monitoring stations in New York City during the three recent years for which data have been made available by NYSDEC (2007 to 2009). As shown in the table, SO_2 concentrations have consistently been below the new 1-hour NAAQS at all existing monitoring sites in New York City.

Table 18a-36
Monitored Community-Scale 1-Hour SO_2 Levels In New York City (ppb)

NYSDEC Monitoring Station	2007	2008	2009
Botanical Gardens	53	46	59
I.S. 52	61	47	50
P.S. 59	50	45	N/A
Queens College 2	35	32	32

Notes:
Reported concentrations represent the 99th percentile of daily maximum 1-hour concentrations.
* 2008 data available from P.S. 59 only until June 30th. 2006 to 2007 data from I.S. 52 is not complete.
1-hour SO_2 NAAQS is 75 ppb.
Sources: NYSDEC, New York State Ambient Air Quality Data (2007 to 2009).

Projections of Future Concentrations

EPA has promulgated a number of regulations that have resulted in a decrease of SO_2 levels over the years. For example, the Acid Rain Program has reduced SO_2 emissions from utilities. The Clean Air Nonroad Diesel Rule has reduced the maximum allowable levels of sulfur used in certain non-road equipment, including construction equipment such as excavators, backhoes, fork lifts, and cranes. Nationally, SO_2 concentrations have decreased drastically, with the

[1] EPA, Support Center for Regulatory Atmospheric Modeling, *Applicability of Appendix W Modeling Guidance for the 1-hour SO_2 NAAQS for the Prevention of Significant Deterioration Program*, August 23, 2010, www.epa.gove/scram011/.

national annual average decreasing by 71 percent from 1980 to 2008 and by 59 percent from 1990 to 2008. It is expected that with the implementation of the more stringent 1-hour standard, cleaner fuels, and newer technology, the ambient concentrations of SO_2 will continue to decrease in the future. No violations of the 1-hour standard are projected for Manhattan. The projections were based on air modeling and monitoring data from 2005 to 2007 and emissions from 2005. The modeled emissions reflect the expected reductions from federal programs to reduce SO_2 emissions, including the Clean Air Nonroad Diesel Rule, the Light-Duty Vehicle Tier 2 Rule, the Heavy Duty Diesel Rule, Renewable Fuel Standards, final rules for Locomotive and Marine Vessels and others. The projected design value for Manhattan in 2020 is 44 ppb.

Recently, New York State passed legislation that will reduce the maximum content of sulfur in No. 2 oil sold in the state to 15 ppm, effective July 1, 2012, and New York City enacted legislation which would reduce the maximum sulfur content of No. 4 oil sold in the City from 0.3 percent to 0.15 percent, effective October 2012. These measures will also result in further reductions in ambient SO_2 concentrations beyond the EPA projections.

METHODOLOGIES FOR ESTIMATING 1-HOUR SO_2 CONCENTRATIONS

Stationary Sources

As noted above, the Proposed Project would be constructed adjacent to a Title V emissions source, the Con Edison 59th Street Station. As a result of unique circumstances (i.e., close proximity to the stack of the Con Edison facility, which is a Title V facility subject to the new 1-hour SO_2 standard with a long history of environmental analysis and reporting, where both release point and receptors are at high elevations) detailed information was available to allow for the determination of incremental concentrations of SO_2 from the Con Edison facility. Monitoring and reporting conducted by Con Edison in compliance with its Title V permit for this facility provided SO_2 emissions from the facility's steam boilers. The SO_2 emissions from the facility's combustion turbine were estimated based on the EPA AP-42 emission factor (which was used in the SO_2 analysis presented earlier in this chapter) and detailed, hourly records of turbine use were available. As reported by Con Edison, the combustion turbine operates at peak load only, so generally emissions do not vary on an hourly basis when the turbine is operating, unlike the facility's boilers.

Methodologies for estimating short-term SO_2 concentrations from stationary sources are well established. For the most part, these methods can be readily applied to predicting 1-hour SO_2 concentrations and evaluating compliance with the new 1-hour standard. Concentrations measured at community-scale monitors are representative of background concentrations for assessing the impact of local sources.

EPA's preferred regulatory stationary source model, AERMOD, is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standard. Therefore, a detailed modeling analysis was prepared for these sources. The approach is consistent with the recommended EPA guidance.

An analysis of the predicted levels from the 59th Street Station alone, and in combination with three large-scale developments with emission sources within 400 feet of the Proposed Project site having a total heat input capacity of greater than 20 MMBtu/hr, was performed. For the proposed domestic hot water heater for Building 5, an analysis of the boilers impact on the 1-hour SO_2 levels was not performed, as the boiler would run on natural gas, which is an insignificant source of SO_2 emissions.

Hourly emission rates for the Con Edison 59th Street Station's boilers were based on monitored hourly heat input, reported on EPA's CAMD website, available emission statement information, which includes the fuel sulfur content, and the EPA Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: *Stationary Point and Area Sources* (AP-42). Hourly emission rates for the Con Edison combustion turbine were determined based on operating records and EPA AP-42. The SO_2 emissions from the other sources were calculated using annual fuel consumption factors with an adjustment to calculate the peak short-term emissions as outlined in 2010 *CEQR Technical Manual* and emission factors obtained from AP-42, accounting for the recent New York State legislation which mandates a decrease the sulfur content of No. 2 heating oil to 15 ppm, effective July 1, 2012.

Total pollutant concentrations were estimated by modeling concentration increments from the emission sources and adding the predicted increments to background concentrations that account for pollutant contributions from more distant existing sources. The EPA AERMOD dispersion model was used to estimate maximum 1-hour incremental concentrations of SO_2, using standard procedures generally outlined in the *CEQR Technical Manual* and other applicable sources. The maximum predicted concentration increments were added to the concurrent hourly SO_2 background values for each hour over a 5-year period, to determine the total predicted 99th percentile concentration, averaged over three years. This value was then compared with the 1-hour SO_2 NAAQS.

Maximum predicted SO_2 concentrations were calculated using physical modeling (a wind tunnel study), in the case of the nearby Con Edison facility, and EPA's AERMOD model from other nearby sources.

For each source, total hourly SO_2 concentrations throughout the modeling period were determined by adding the hourly modeled concentrations to the detailed hourly ambient SO_2 concentrations measured at the P.S. 59 NYSDEC monitoring station for each corresponding hour. Then, the highest combined daily 1-hour SO_2 concentration was determined at each receptor location for each day. The 4th-highest daily 1-hour maximum concentration for each modeled year was then calculated at each receptor—this is a 99th percentile value. The 99th percentile concentrations will be averaged over three years, in accordance with the form of the 1-hour standard. The highest three-year average calculated for the analyzed period (2003-2007) was then compared with the 1-hour SO_2 NAAQS.

Proposed Project receptors considered in the wind tunnel study of the Con Edison facility impacts were also included in the AERMOD analysis to predict the cumulative impact of the analyzed sources.

Mobile Sources and Construction Equipment

As acknowledged in the federal regulations at 40 CFR Part 60 Appendix W, and mentioned in the EPA guidance on its applicability for the 1-hour SO_2 NAAQS, ambient SO_2 impacts are largely a result of emissions from stationary sources. In addition, due to the current and future mandated federal restrictions on the sulfur content in diesel fuel for on-road and nonroad vehicles, no significant quantities are emitted from these sources. By December 1, 2010, all highway diesel fuel will be ULSD. The allowable sulfur content for ULSD (15 ppm) is much lower than the previous on-highway standard for low sulfur diesel (500 ppm).

Most diesel fuel for construction (non-road) engines produced this year will need to be ULSD. By the end of 2014, the production and imports of non-ULSD diesel fuel for highway, nonroad, locomotive and marine use will be phased out.

Therefore, an assessment of project-level impacts from mobile sources and construction equipment is not warranted.

RESULTS

Stationary Sources

This section describes the results of the analysis of SO_2 emissions from the Con Edison 59th Street Station. In addition, an assessment of the potential effects of other nearby sources of SO_2 emissions in the vicinity of the Proposed Project, and an evaluation of the Proposed Project's SO_2 stationary source emissions, are also presented.

Con Edison 59th Street Station

Following the procedures outlined above, the potential impact of emissions from the Con Edison 59th Street Station on 1-hour SO_2 concentrations at the Proposed Project were estimated through wind tunnel tests on a scale model of the project, the Con Edison facility, and their surroundings. The analysis determined that the modeled concentrations, when added to the 99th percentile background concentration, would not result in any exceedances of the 1-hour NAAQS.

The maximum predicted increase in the three-year average 99th percentile SO_2 daily maximum 1-hour NO_2 concentration increment at any Proposed Project receptor location from the Con Edison is 3.89 ppb. The total maximum three-year averages of the 99th percentile of the daily maximum 1-hour SO_2 concentrations at each of the proposed buildings from the Con Edison 59th Street Station and the ambient background are presented in **Table 18a-37**.

Table 18a-37
Future (2018) Maximum Predicted 1-Hour SO_2 Concentration (ppb) at Proposed Project Buildings From the Background and Con Edison 59th Street Station

Building 1	Building 2	Building 3	Building 4	Building 5	NAAQS
69.5	71.4	69.5	69.5	69.5	75

Notes:
1. Based on a 2003 to 2007 analysis period.
2. The NAAQS and the reported concentrations at the proposed buildings represent the highest three-year averages of the annual 99th percentile daily maximum 1-hr average concentration.
3. Reported concentrations are the maximum three-year averages (2003 - 2005) of the 99th percentile of daily maximum 1-hr average combined concentrations (Con Edison facility added to the ambient background).

Following the procedures outlined above, the predicted 1-hour SO_2 concentrations due to the Con Edison facility, combined with other large combustion sources in the area, when added to the ambient background, were also determined (see **Table 18a-38**). The maximum predicted impacts from the Con Edison facility and other modeled HVAC sources occur on different building facades and at different building elevations. The Con Edison stack is at a much higher elevation than other HVAC sources. The Con Edison stack is also located to the south of the proposed project buildings and therefore maximum NO_2 concentrations resulting from the Con Edison facility occur on the top floors on the southern facades of the proposed buildings, whereas the other modeled HVAC sources are located to the north and east of the project buildings, affecting the corresponding building facades, different from those affected by Con Edison.

The total 1-hour SO_2 concentration (including the Con Edison facility, other modeled HVAC sources, and the ambient background) are presented in **Table 18a-38**. The total cumulative SO_2 concentrations, including the ambient background, would be below the NAAQS. Therefore, there would be no potential for significant adverse SO_2 impacts on the Proposed Project from stationary sources of emissions.

Table 18a-38
Future (2018) Maximum Predicted 1-Hour SO_2 Concentrations (ppb)
Impact of Background, Con Edison 59th Street Station and Other Analyzed Sources at Proposed Project Buildings

Building 1	Building 2	Building 3	Building 4	Building 5	NAAQS
69.8	71.6	69.7	69.6	69.7	75

Notes:
1. Based on a 2003 to 2007 analysis period.
2. The NAAQS and the reported concentrations on the proposed buildings represent the maximum three-year average of the annual 99th percentile daily maximum 1-hr average concentration. The concentrations include the ambient background.

B. GREENHOUSE GAS ANALYSIS

INTRODUCTION

There is general consensus in the scientific community that the global climate is changing as a result of increased concentrations of GHG in the atmosphere. As a consequence, government policies have begun to address GHG emissions at global, national, and local levels, including New York City's GHG reduction goals, in PlaNYC 2030.

An analysis of the potential GHG emissions associated with the Proposed Project is presented in this section. Specific measures to reduce GHG emissions that are either included in the Proposed Project or are under consideration are discussed as well.

The proximity of the proposed development to public transportation, its mixed-use, and dense design are all factors that contribute to the energy efficiency of the Proposed Project, resulting in lower GHG emissions. In addition, the project sponsor is committed to implementing a number of voluntary measures that would further improve the energy efficiency of the Proposed Project and reduce potential GHG emissions.

PRINCIPAL CONCLUSIONS

Overall, the site selection, the dense and mixed-use design, the commitment to achieve a significant reduction in energy use, and other measures incorporated in the Proposed Project would result in lower GHG emissions than would otherwise be achieved by similar residential and commercial uses, and, thus, would advance New York City's GHG reduction goals as stated in PlaNYC.

The annual GHG emissions from the Proposed Project are predicted to be approximately 49,679 metric tons of carbon dioxide equivalent (defined below). This does not represent a net increment in GHG emissions, since similar GHG emissions would occur if residential units and associated uses were to be constructed elsewhere, and could be higher if constructed with less energy efficiency, as lower density residential, further from employment and commercial uses, and/or with less immediate access to transit service.

SUMMARY OF 1992 FEIS FINDINGS

The 1992 FEIS did not address greenhouse gas emissions.

ANALYSIS APPROACH

Although the contribution of any single project to climate change is infinitesimal, the combined GHG emissions from all human activity have a severe adverse impact on global climate. While the increments of criteria pollutants and toxic air emissions are assessed in the context of health-based standards and local impacts, there are no established thresholds for assessing the significance of a project's contribution to climate change. Nonetheless, prudent planning dictates that all sectors address GHG emissions by identifying GHG sources and practicable means to reduce them.

Therefore, this section does not identify the relative increment in GHG emissions due to the Proposed Project as compared with a No Build scenario, but rather presents the total GHG emissions associated with the Proposed Project and identifies the measures incorporated into the Proposed Project to limit those emissions. Note that much of these emissions would be associated with similar activity regardless of the Proposed Project. For example, if buildings were to be constructed elsewhere to accommodate the same number of people as the Proposed Project, the emissions from the use of electricity, energy for heating and hot water, vehicle use, and construction materials could equal or exceed those of the Proposed Project, depending on their location, access to transit, building type, construction materials, and energy efficiency measures.

The GHG emissions generated by various activities (steam and natural gas use for heat and hot water, electricity use, vehicles use, and waste generation) are presented for the Proposed Project. A summary of annual operational GHG emissions, and total and annualized emissions associated with the construction period are presented for a reasonable worst-case scenario. The estimates for building energy use and construction emissions were performed for a single development scenario, as those emissions would be similar for all RWCDSs described in Chapter 1, "Project Description." The building-by-building construction option, as discussed in Chapter 20, "Construction," is associated with somewhat higher GHG emissions than the podium option, and is therefore considered in this section as the reasonable worst-case. The reasonable worst-case results from solid waste are based on RWCDS 3b, since that scenario generates the greatest potential amount of solid waste, as presented in Chapter 14, "Solid Waste and Sanitation Services." RWCDS 3a indirectly generates the highest transportation-related GHG emissions, since it results in the highest amount of fuel consumption from car and delivery trips, combined (this differs from the RWCDS assumed in Chapter 16 for the traffic analysis since that is focused on congestion, and GHG emissions are based on total distance traveled and fuel consumption by vehicle type).

POLLUTANTS OF CONCERN

GHGs are those gaseous constituents of the atmosphere, from both natural and anthropogenic (i.e., resulting from the influence of human beings) emission sources, that absorb infrared radiation (heat) emitted from the earth's surface, the atmosphere, and clouds. This property causes the general warming of the earth's atmosphere, or the "greenhouse effect." Water vapor, carbon dioxide (CO_2), nitrous oxide, methane, and ozone are the primary greenhouse gases in the earth's atmosphere.

Moreover, there are a number of entirely human-made GHGs in the atmosphere, such as halocarbons and other chlorine- and bromine-containing substances, which are also responsible for damaging the stratospheric ozone layer (creating the "ozone hole"). Since these compounds are being replaced and phased out from use due to the 1987 Montreal Protocol, there is generally no need to address these chemicals in GHG assessments of residential and commercial uses, which are not sources of those gases. Ozone itself is also a substantial GHG; however, long-term project-level impacts on ozone emissions as a GHG do not need to be analyzed, since ozone is a rapidly reacting chemical, and since efforts are ongoing to reduce the production of ozone as a criteria pollutant.

Although water vapor is of great importance to global climate change, it is not directly of concern as an emitted pollutant, since the miniscule quantities of anthropogenic emissions are of no consequence. However, an increase in global temperature can increase evaporation and thereby, indirectly, cause further atmospheric warming.

CO_2 is the primary pollutant of concern from anthropogenic emission sources. CO_2 is by far the most abundant and has the greatest overall impact on global average atmospheric temperature. CO_2 is emitted as a product of combustion (both natural and anthropogenic), from some industrial processes such as the manufacture of cement, mineral production, metal production, and the use of petroleum-based products, from volcanic eruptions, and from the decay of organic matter. CO_2 is removed ("sequestered") from the lower atmosphere by natural processes such as photosynthesis and uptake[1] by the oceans. CO_2 is included in any analysis of GHG emissions.

Methane and nitrous oxide also play an important role in global climate change, since they have longer atmospheric lifetimes and a greater ability to absorb infrared radiation than an equal quantity of CO_2. Methane is emitted from agriculture, natural gas distribution, and decomposition of organic materials in landfills and wastewater treatment plants. Methane is also released from natural processes that include the decay of organic matter lacking sufficient oxygen, for example, in wetlands. Nitrous oxide is emitted from fertilizer use and fossil fuel burning. Natural processes in soils and the oceans also release nitrous oxide. Therefore, emissions of these compounds are included in GHG emissions analyses as appropriate.

Other GHGs—including certain hydrofluorocarbons (HFCs), used as refrigerants and foam blowers and released as byproducts from the production of other HFCs; some perfluorocarbons (PFCs), produced as byproducts of traditional aluminum production, among other activities; and sulfur hexafluoride (SF_6), used as an electrical insulating fluid in power distribution equipment—are sometimes included in GHG emissions analyses where relevant (e.g., analysis of manufacturing facilities), but are not included in the analysis of the Proposed Project, since the Proposed Project would not result in significant emissions of these GHGs.

POLICY, REGULATIONS, STANDARDS, AND BENCHMARKS

As a result of the growing consensus that human activity resulting in GHG emissions has the potential to profoundly impact the earth's climate, countries around the world have undertaken efforts to reduce emissions by implementing both global and local measures addressing energy

[1] Biological and chemical processes by which CO_2 is removed from the atmosphere and stored in the oceans.

consumption and production, land use, and other sectors. Although the U.S. has not ratified the international agreements which set emissions targets for GHGs, in a step toward the development of national climate change regulation, in June 2009 the U.S. House of Representatives passed the American Clean Energy and Security Act (ACES, “cap and trade bill“). The proposed legislation would place a national cap on GHG emissions, resulting in the gradual reduction of emission from large sources (accounting for approximately 85 percent of the U.S. GHG emissions) to 17 percent lower than 2005 levels by 2020 and to 83 percent lower than 2005 levels by 2050. ACES calls for the long-term investment of billions of dollars in energy efficiency and renewable energy, carbon capture and storage, electric and other advanced technology vehicles, and basic scientific research and development in related fields. Although this legislative activity is still in progress, without such legislation EPA would be likely to regulate greenhouse gases under the Clean Air Act.

EPA has established various voluntary programs to reduce emissions and increase energy efficiency and has recently embarked on a few regulatory initiatives related to GHG emissions, including regulation of geological sequestration of CO_2, and a GHG reporting rule to collect information on GHG emissions as pollutants.

The Energy Independence and Security Act of 2007 includes provisions for increasing the production of clean renewable fuels, increasing the efficiency of products, buildings, and vehicles, and for promoting research on greenhouse gas capture and storage options. The most recent renewable fuel standards regulations (February 2010) require 12.95 billion gallons of renewable fuels to be produced in 2010, increasing annually up to 36.0 billion gallons in 2022. The renewable fuel standards regulations also set volume standards for specific categories of renewable fuels including cellulosic, biomass-based diesel, and total advanced renewable fuels, and specify lifecycle GHG reduction thresholds ranging from 20 percent for renewable fuel to 60 percent for cellulosic biofuel (as compared to the baseline gasoline or diesel replaced).

The American Recovery and Reinvestment Act of 2009 (ARRA, “economic stimulus package”) funds actions and research that can lead to reduced GHG emissions. Renewable energy tax credits have also been extended. Funds from ARRA are currently being disbursed.

In March 2009, the U.S. Department of Transportation (USDOT) set combined corporate average fuel economy (CAFE) standards for light duty vehicles for the 2011 model year (MY). In June 2009, EPA granted California a previously denied waiver to regulate vehicular GHG emissions, allowing 19 other states (representing 40 percent of the light-duty vehicle market, including New York) to adopt the California mobile source GHG emissions standards. In April 2010, EPA and USDOT established the first GHG emission standards and more stringent CAFE standards for MY 2012 through 2016 light-duty vehicles. These regulations will all serve to reduce vehicular GHG emissions over time.

There are also regional, state, and local efforts to reduce GHG emissions. In 2009, Governor Paterson issued Executive Order No. 24, establishing a goal of reducing GHG emissions in New York by 80 percent, compared to 1990 levels, by 2050, and creating a Climate Action Council tasked with preparing a climate action plan outlining the policies required to attain the GHG reduction goal (that effort is currently under way[1]). The 2009 New York State Energy Plan,[2] outlines the state’s energy goals and provides strategies and recommendations for meeting those goals. The state’s goals include:

[1] http://www.nyclimatechange.us/

[2] New York State, *2009 New York State Energy Plan*, December 2009.

- Implementing programs to reduce electricity use by 15 percent below 2015 forecasts;
- Updating the energy code and enacting product efficiency standards;
- Reducing vehicle miles traveled by expanding alternative transportation options;
- Implementing programs to increase the proportion of electricity generated from renewable resources to 30 percent of electricity demand by 2015; and

New York State has also developed regulations to cap and reduce CO_2 emissions from power plants in order to meet its commitment to the Regional Greenhouse Gas Initiative (RGGI). Under the RGGI agreement, the governors of 10 northeastern and mid-Atlantic states have committed to regulate the amount of CO_2 that power plants are allowed to emit. The regional emissions from power plants will be held constant through 2014, and then gradually reduced to 10 percent below the initial cap through 2018. Each power source with a generating capacity of 25 megawatts or more would need to purchase a tradable CO_2 emission allowance for each ton of CO_2 it emits. The 10 RGGI states and Pennsylvania have also announced plans to reduce GHG emissions from transportation, through the use of biofuel, alternative fuel, and efficient vehicles.

Many local governments worldwide, including New York City, are participating in the Cities for Climate Protection™ (CCP) campaign and have committed to adopting policies and implementing quantifiable measures to reduce local GHG emissions, improve air quality, and enhance urban livability and sustainability.

New York City has a long-term sustainability program, PlaNYC 2030, which sets a citywide GHG emissions reduction goal of 30 percent below 2005 levels by 2030. PlaNYC includes specific initiatives that can result in emission reductions and initiatives targeted at adaptation to climate change impacts. The New York City Climate Protection Act (enacted in 2007) codified PlaNYC's GHG reduction goal in the Administrative Code of the City of New York. The law also requires the city to reduce GHG emissions from municipal operations to 30 percent less than fiscal year 2006 emissions by 2017. In December 2009, the New York City Council enacted four laws addressing energy efficiency in new and existing buildings, in accordance with PlaNYC. The laws require owners of existing buildings larger than 50,000 square feet to conduct energy efficiency audits every 10 years, to optimize building energy efficiency, and to "benchmark" the building energy and water consumption annually, using an EPA online tool. By 2025, commercial buildings over 50,000 square feet will also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants can be provided with information on their electricity consumption. The legislation also creates a local New York City Energy Code, which requires equipment installed during a renovation to meet current efficiency standards.

A number of benchmarks for energy efficiency and green building design have also been developed. For example, the United States Green Building Council's (USGBC) Leadership in Energy and Environmental Design (LEED) system is a benchmark for the design, construction, and operation of high performance green buildings that includes energy efficiency components. EPA's Energy Star is a voluntary labeling program designed to identify and promote energy efficient appliances, office equipment, lighting, home electronics, and building envelopes.

NYSDEC has published guidance on the analysis of GHG emissions for projects where GHG emissions or energy use have been identified as significant and where NYSDEC is the lead agency, and the City of New York is currently formulating guidance for performing a GHG analysis under CEQR. However, currently, there are no specific benchmarks or regulations applicable to GHG emission levels or impacts from actions subject to environmental review in

New York State or New York City. Accordingly, the potential effects of the Proposed Project have been evaluated in the context of their consistency with the objectives stated in PlaNYC. Potential GHG emissions from the Proposed Project are assessed and disclosed, and the feasibility and practicability of various measures available for reducing GHG emissions are discussed. Commitments to implement such measures are noted, where applicable.

METHODOLOGY

Emissions of GHGs that would be associated with the Proposed Project have been quantified, including off-site emissions associated with use of electricity and steam for heat and hot water on-site, on-site emissions from Building 5 hot water systems, emissions from vehicle use attributable to the Proposed Project, and emissions indirectly produced as a result of solid waste that would be generated by the development and disposed of in landfills. Average annual and total GHG emissions that would result from construction of the development, including on-site construction equipment, delivery trucks, and upstream emissions from the production of steel, rebar, aluminum, and cement used for construction were calculated as well.

GHG emissions for gases other than CO_2 are included where practicable or in cases where they comprise a substantial portion of overall emissions. The various GHG emissions are added together and presented as carbon dioxide equivalent (CO_2e) emissions—a sum which includes the quantity of each GHG weighted by a factor of its effectiveness as a GHG using CO_2 as a reference. This is achieved by multiplying the quantity of each GHG emitted by a factor called global warming potential (GWP). The GWP accounts for the lifetime and the radiative forcing of each gas over a period of 100 years (e.g., CO_2 has a much shorter atmospheric lifetime than SF_6, and therefore has a much lower GWP). The GWPs for the main GHGs discussed are presented in **Table 18b-1**.[1]

Table 18b-1
Global Warming Potential (GWP) for Major GHGs

Compound	100-year Horizon GWP
Carbon Dioxide (CO_2)	1
Methane (CH_4)	21
Nitrous Oxide (N_2O)	310
Hydrofluorocarbons (HFCs)	140 to 11,700
Perfluorocarbons (PFCs)	6,500 to 9,200
Sulfur Hexafluoride (SF_6)	23,900

Sources: IPCC, Climate Change 1995—The Science of Climate Change: Contribution of Working Group I to the Second Assessment of the Intergovernmental Panel on Climate Change, 1996.

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are approximately 22 percent of the tailpipe emissions.[2] Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial and are important to

[1] Following standard protocol for greenhouse gas inventories, and consistent with New York City's GHG inventory, the GWP factors from IPCC's Second Assessment Report (1996) are used. These GWP factors are specified for use for national GHG inventories under the Kyoto Protocol.

[2] Environmental Protection Agency, *MOVES2004 Energy and Emission Inputs*, Draft Report, EPA420-P-05-003, March 2005.

consider when comparing the emissions associated with the consumption of different fuels, they are not considered in the analysis for the Proposed Project, in accordance with the methodology used in developing the New York City GHG inventory. The GHG emissions are presented as metric tons of CO_2e per year, consistent with the New York City annual inventory.[1]

The project sponsor is obligated under a Special Permit for the site, to identify feasible methods of energy conservation with a payback period of five years and to incorporate such feasible measures into the project design. Although these measures may be expected to result in substantial energy efficiency, since they have not yet been identified, the calculation does not apply any credit reflecting the incorporation of such measures into the Proposed Project.

GHG EMISSIONS FROM HEAT AND HOT WATER SYSTEMS

It is expected that utility steam from Con Edison would be used in heat and hot water systems for the Proposed Project. For Building 5, Con Edison steam would be used for heating, but hot water would be supplied by on-site natural gas boilers. An emission factor of 158 pounds of CO_2e per thousand pounds (Mlb) of steam delivered to buildings was used in calculating the GHG emissions, based on the 2008 city-wide steam emission coefficient.[2] Since most Con Edison steam is produced in combined heat and power (CHP or cogeneration) plants, the use of the utility steam results in an inherent efficiency and lower GHG emissions than would result from standard building heating systems. Although the nearby 59th Street steam generation plant, which would provide much of the steam for the Proposed Project, is not a combined cycle (i.e., producing both steam and electricity) facility, the Con Edison steam system as a whole does operate as a unified combined cycle system. The projected amount of steam needed for building heat and hot water systems is 140,350 Mlb per year. An emission factor of 117 pounds of CO_2 per million British thermal units (MMBTU) of natural gas was used to calculate GHG emissions from the Building 5 hot water systems.[3] The amount of natural gas required for Building 5 is estimated at 5,570 MMBTU.

OFF-SITE GHG EMISSIONS FROM ELECTRICITY USE

The demand for electricity for residential, commercial, and school uses was estimated at approximately 51,000 MWh per year. The cooling systems assumed for the GHG analysis include heat pumps for Buildings 1, 3, 4, and 5, and Package Terminal Air Conditioners (PTAC) for Building 2. A GHG emission factor of 775 lbs/MWh was applied based on the coefficient for electricity consumed in New York City in 2008.[4] The coefficient included the consumption of both in-city-generated and imported electricity, and accounted for transmission and distribution losses. Emissions of CO_2, methane, and nitrous oxide were accounted for. Although the electricity emission factor would likely decrease by 2018 due to an expected increase in the

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[1] *Inventory of New York City Greenhouse Gas Emissions*, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

[2] *Inventory of New York City Greenhouse Gas Emissions*, Appendix: Steam Emission Coefficients, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

[3] Energy Information Administration. Voluntary Reporting of Greenhouse Gases Program, Fuel and Energy Source Codes and Emission Coefficients. http://www.eia.doe.gov/oiaf/1605/coefficients.html

[4] *Inventory of New York City Greenhouse Gas Emissions*, Appendix: Electricity Coefficients, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

amount of electricity produced from renewable sources, the 2008 emissions factor was conservatively used without an adjustment for future emissions.

GHG EMISSIONS FROM VEHICLE USE

The vehicle trips generated by the Proposed Project are discussed in Chapter 16, “Traffic and Parking.” The annual number of car, truck, and school bus trips that could be attributed to the Proposed Project was calculated from average daily weekday, Saturday, and Sunday person trips for each use group, percentage of trips by car and taxi, and average vehicle occupancy. An average trip distance for personal vehicles was developed using weekday and weekend data from the 2001 National Household Travel Survey.[1] The distances used were 7.52 miles per trip and 8.78 miles per trip for weekday and weekend residential uses, respectively. For commercial uses, the distances used were 4.57 miles per trip for weekdays and 7.75 miles per trip on weekends. The trip distance used for school students was 8.91 miles, and 11.19 miles for school staff. A one way distance of 38 miles for delivery trucks was used, based on research regarding truck vehicle miles travelled (VMT) in New York City and regional transportation modeling.[2] The annual school bus GHG emissions of 8.13 metric tons of CO_2e per bus were based on PlaNYC inventory and related information.

The average car and truck fuel efficiencies of 23.5 miles per gallon and 6.5 miles per gallon, respectively, projected for the 2018 analysis year, were employed in estimating the annual fuel consumed by vehicle use connected with the Proposed Project.[3] It was assumed that all trucks would be diesel fueled and that all cars would be gasoline fueled. The GHG emission factors were based on the gasoline and diesel fuel carbon content,[4] assuming that all carbon is transformed to CO_2, resulting in emission factors of 8,877 g CO_2 per gallon of gasoline and 10,186 g CO_2 per gallon of diesel.

GHG EMISSIONS FROM WASTE GENERATION

The quantity of waste that would be generated annually by the Proposed Project is described in Chapter 14, “Solid Waste and Sanitation Services.” Since information about the type of waste that would be generated by each of the uses that would be developed is not available, the waste stream composition was estimated based on data from the New York City Waste Composition Survey[5] (for the residential and school use), and from the Commercial Waste Study[6] (for the

[1] Center for Transportation Analysis, Oak Ridge National Laboratories, Add-on for New York State, National Household Travel Survey (NHTS), 2001.

[2] Holguín-Veras, J. and Brom, M. A. “Trucking Costs in a Metropolitan Area: A comparison of Alternative Estimation Approaches”, 2008 Annual Meeting of the Transportation Research Board, January, 2008.

[3] Energy Information Administration, Annual Energy Outlook 2010 Early Release Reference Case, 2009. Table 7 Transportation Sector Key Indicators and Delivered Energy Consumption.

[4] The Code of Federal Regulations (40 CFR 600.113).

[5] *The New York City 2004-05 Residential and Street Basket Waste Characterization Study (WCS)*, prepared for New York City Department of Sanitation, Bureau of Waste Prevention, Refuse and Recycling, March 2007

[6] *Commercial Waste Management Study*, prepared for New York City Department of Sanitation, March 2004.

commercial uses). Annual GHG emissions associated with each waste type were estimated using EPA's Waste Reduction Model (WARM)[1]. WARM calculates GHG emissions for a variety of waste management practices—source reduction, recycling, combustion, composting, and landfill disposal for 34 types of waste materials.

CONSTRUCTION GHG EMISSIONS

Construction activities for the Proposed Project would result in GHG emissions from on-site engines, truck travel associated with construction material deliveries and disposal, construction worker trips, and the use of steel, rebar, aluminum, and concrete.

Construction Activity

GHG emissions from construction delivery trucks and other construction traffic, as well as construction equipment, were quantified using the construction activity estimates developed as part of Chapter 20, "Construction." The emission factors for construction equipment were obtained from the EPA's NONROAD2008 Emission Model (NONROAD). The model is based on source inventory data accumulated for specific categories of nonroad equipment. The GHG emissions factor for diesel fuel used by on-road trucks and worker vehicles was based on diesel fuel and gasoline carbon content, respectively. The fuel efficiency of construction trucks was assumed to be 6.2 miles per gallon, the Energy Information Administration (EIA) projected average fuel economy for trucks (2010-2017). For most truck deliveries, the average one-way trip distance was assumed to be 112 miles, based on data from the Freight Analysis Framework (FHWA) for the New York Metropolitan Area.[2]. For concrete deliveries, the one-way distance was assumed to be 25 miles, based on the short time during which concrete must be poured before it hardens. The fuel delivery trucks and waste hauling trucks were also assumed to be traveling for 25 miles one way, based on the conservative estimate that there are fuel stations and construction waste processing facilities within 25 miles of the project site. All delivery trucks were assumed to be diesel fueled, and a GHG emission factor of 10,186 g CO_2e per gallon of diesel was used (see above).

Construction Materials

Upstream emissions associated with the production of steel, aluminum, and cement are included in this assessment because their production would comprise a major component of overall emissions from construction. GHG emissions from the chemical process and fossil fuel energy use in cement manufacturing account for more than 60 percent of industrial source GHG emissions in the U.S. According to a report from EIA, producing iron and steel ranks as one of the top sources of manufacturing GHG emissions, largely because of use of coal-based resources to reduce iron ores

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[1] Environmental Protection Agency WARM, updated August 2008. Available from: http://www.epa.gov/climatechange/wycd/waste/calculators/Warm_home.html

[2] AKRF, 2009. This estimate is based on the freight tonnage by mode, origin, and destination for the New York City Combined Statistical Area, obtained from FHWA's Freight Analysis Framework FAF2 Provisional Commodity Origin-Destination Database (2008 data). Driving distances for each origin/destination were estimated and multiplied by the tonnage, resulting in ton-miles for each origin/destination. Average distance was calculated by dividing the total ton-miles by the total tons delivered.

in blast furnaces or heat metal in electric arc furnaces.[1] The production of steel also generates process-related emissions of CO_2 and methane. Aluminum production is an energy intensive process, which also results in perfluoromethane, perfluoroethane, and CO_2 process emissions. The official U.S. National GHG inventory accounted for process and energy use emissions from GHG intensive industrial activity, including emissions from the production of cement, steel, and aluminum, following the International Panel on Climate Change (IPCC) guidelines.[2] Emissions associated with the production of construction materials other than steel, aluminum, and concrete are assumed to be negligible in comparison with the emissions from the production of the materials that were included.

The production of ordinary portland cement (OPC) results in substantial GHG emissions, which can be reduce through use of cement replacements such as flyash (a byproduct of coal-fired power generation) and/or slag (a byproduct of iron production). These cement replacements are often included as a small fraction of the total cement used in the concrete mix. However, the fraction of cement to be replaced for this project, if any, is unknown at this time. Therefore, for the purposes of this analysis, it was conservatively assumed that the concrete used for the development of the Proposed Project would be produced using 100 percent OPC. A lifecycle emission factor for OPC was based on Building for Environmental and Economic Sustainability (BEES) software results.

A range of values for the steel production GHG emission factor can be found in research literature (0.44 to 1.95 metric tons of CO_2 per metric ton of steel produced). A factor of 1.83 metric tons of CO_2 per metric ton of steel was used in the present analysis.[3] For aluminum, a life-cycle emission factor of approximately 9.7 metric tons CO_2e per one metric ton ingot was used.[4]

Building Lifetime

Construction-related emissions are also presented as annualized emissions over the lifetime of the buildings. The REGNER project[5] estimated the lifetime of buildings in Europe to be 80 to 120 years, and recommended that lifecycle analyses should cover up to 100 years. The median age of office buildings in midtown Manhattan is estimated at 37 years for Class A buildings and 80 years for Class B buildings.[6] Since more modern buildings have been constructed in past years, it can be assumed that the oldest Class A buildings are older than twice that age, 74 years, and if all of those buildings are still standing, the actual lifetime—which is unknown at this time—will be much

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[1] Energy-Related Carbon Dioxide Emissions in U.S. Manufacturing Mark Schipper, Energy Information Administration (EIA) Report #: DOE/EIA-0573(2005) Released Date: November 2006.

[2] IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 3, Industrial Processes and Product Use.

[3] Worrell, Martin, and Price, Energy Efficiency and Carbon Dioxide Emissions Reduction Opportunities in the U.S. Iron and Steel Sector, Ernest Orlando Lawrence Berkeley National Laboratory, 1999.

[4] European Aluminium Industry, Life Cycle Inventory Data for Aluminium Production and Transformation Processes in Europe, 2008.

[5] REGENER Project, European methodology for the evaluation of environmental impact of buildings, Regener Project final report, 1997, http://www.cenerg.ensmp.fr/francais/themes/cycle/html/11.html (accessed April 2009).

[6] Leon Glicksman, "Energy Efficient Buildings: Issues, Research Opportunities", presentation, Building Technology Program, MIT, January 27, 2005, http://web.mit.edu/ese/ (accessed April 17, 2009). Based on Costar database, September 2003.

longer. Lifetimes for new tall residential buildings is expected to be similar. Therefore, for the purpose of this analysis, building lifetimes were estimated at 80 years.

Note that these lifetimes may result in a somewhat conservatively high annualized emission level, since the actual lifetimes could be much higher. However, since all of the emissions would actually occur in the early years (during construction), they would have a higher long-term impact than if they were actually emitted over the entire building lifetime (CO_2 has a lifetime on the order of 100 years; therefore, the impact of the concentrated emissions during a few years early on would result in more warming by the end of the century than the cumulative effect of a slow release of the same quantity over 80 years.) In addition, as opposed to electricity and fuels, which may be replaced by renewable alternatives in the future, construction emission would all occur in the near future, at the rates estimated here. Therefore, it is also important to consider the total construction emissions, and not only their relative annualized contribution.

PROBABLE EMISSIONS FROM THE PROPOSED PROJECT

The estimated amount of fuel and materials that would be used throughout the duration of the construction period and the ensuing GHG emissions are presented in **Table 18b-2**. Total construction activity emissions as well as annualized emissions over 80 years are presented. A summary of GHG emissions by emission source type, along with total annual emissions from the Proposed Project, is presented in **Table 18b-3**.

Table 18b-2
GHG Emissions from Construction Activity and Material Use
2010-2017

Construction Activity	Fuel / Material Use	GHG Emissions (metric tons CO_2e)
Construction Materials:		
Concrete	321,227 cubic yards	160,116
Steel and Rebar	28,919 tons	48,010
Aluminum	6,500 tons	57,062
Construction Equipment	various	6,875
Construction Trucks	2.7 million gal diesel	27,001
Worker Trips	453 thousand gal gasoline	4,018
	TOTAL (9 years)	*303,082*
	Annualized, Per Year[2]	*3,789*

Notes:
1. Construction equipment GHG emissions include emissions from diesel, electricity, and other fuels.
2. Annualized emissions are the average over the lifetime of the project, assumed to be 80 years.

According to EIA data, consumption of electricity and heating fuels for residential use in U.S. cities is approximately 20 percent lower than the equivalent use per household in suburban areas. Moreover, the per capita annual electricity consumed in New York City is almost 50 percent lower than the per capita annual electricity consumed nationwide.[1]

[1] *Inventory of New York City Greenhouse Gas Emission*, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

Table 18b-3
Summary of Annual GHG Emissions

Sector	Consumption Rate	GHG Emissions (metric tons CO_2e)	Fraction of Total Emissions
Heat and Hot Water	140,350 Mlb steam (mixed source); 5,570 MMBTU natural gas	10,379	20.9%
Electricity	51,000 MWh (mixed source)	17,922	36.1%
Vehicle Use[1]	0.4 Mgal diesel and 1.5 Mgal gasoline	17,063	34.3%
Solid Waste	various	527	1.1%
Construction (Annualized)[2]	various	3,789	7.6%
TOTAL		*50,899*	*100.0%*

Notes: All emissions are expressed in metric tons CO_2e/ year.
1. Vehicle Use includes truck deliveries, representing almost one quarter of the emissions in this category.
2. Total construction emissions of 303,082 metric tons CO_2e were annualized over 80 years.

As presented above, energy-related emissions are conservatively high since feasible methods of energy conservation, with a payback period of five years, would be incorporated in the design and construction of the project (as per the Special Permit for the project site), but were not quantified here. These methods may be expected to result in substantial energy efficiency. Emissions related to heat and hot water are lower than would be expected for a similar standard project since the project is utilizing utility steam produced in combination with electricity generation (combined heat and power).

Note that almost a quarter of the emissions in the vehicle use category are associated with truck deliveries. The truck emissions are likely a conservatively high estimate, since they do not account for linked trips on multi-destination deliveries. Linked truck delivery trips reduce emissions associated with deliveries in the city. Emissions from private vehicles would be much higher for a similar project that was not located near urban transit systems, such as a suburban development.

Annualized emissions associated with construction represent 7.6 percent of the overall annual emissions for the project, and are equivalent to the total emissions from the operation of the project over approximately 6 years.

Overall, per capita GHG emissions in New York City are less than one-third of the nationwide average.[1] This is largely due to reduced vehicle use, denser development, and cleaner energy sources. Beyond that, the Proposed Project would reduce the emissions associated with electricity consumption and heating through energy-efficient design, and reduce emissions associated with transportation because of the available transit options.

PROJECT ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The Proposed Project would include a number of measures aimed at reducing energy consumption and GHG emissions. To the extent practicable, these measures were included in the quantified estimates presented above and are consistent with PlaNYC's goal of reducing energy consumption and GHG emissions. The measures include:

[1] *Inventory of New York City Greenhouse Gas Emission*, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

- **Site Selection:** The Proposed Project's mixed-use development would be situated at a distance of approximately half a mile from the nearest subway station and served by local bus service. The Project site is also within walking distance of shopping, restaurants, and parks. The presence of dense development at this location would take advantage of the urban mass transit services and decrease the need for personal vehicle ownership.
- **Design and Uses:** The Proposed Project's mixed use development and dense design would result in a community that would be less automobile dependent. The project site is located in an area that is already developed and serviced by transit and existing infrastructure, and would therefore not result in GHG emissions associated with urban sprawl.
- **Energy Efficiency:** Energy efficiency measures with respect to fuel consumption and energy use will be incorporated into the building design that will result in at least 10 percent less energy consumption in building systems than the required New York State Energy Code in effect at the time of building design. Examples of measures which would achieve this objective include high performance glazing, increased insulation, high efficiency lighting (occupancy sensors), more efficient HVAC equipment, variable frequency drives for pumps and fans, premium efficiency motors, improved temperature controls, and full control by residents of their fresh air, heating, and cooling.
- **Distributed Generation and Combined Heat and Power:** Energy Initiative #9 in PlaNYC calls for expanding clean distributed generation and combined heat and power, including the goal to require an analysis of the technical and economic feasibility of installing CHP for all projects larger than 350,000 square feet. The project will be utilizing steam provided by Con Edison. The Con Edison steam system, as a whole, combines steam production, delivered to consumers for heat and hot water, with electricity production. Although the nearby 59th Street steam generation plant, which would provide much of the steam for the Proposed Project, is not a combined cycle (i.e., producing both steam and electricity) facility, the Con Edison steam system as a whole does operate as a unified combined cycle system. The use of steam results in significant energy savings, and is consistent with the GHG reduction goals of PlaNYC.
- **Bicycle Lanes:** In addition to providing bicycle storage, as required by zoning, the proposed Project would include bicycle lanes along Freedom Place South and the extension of West 60th Street (the public access easements) that would be integrated with the planned bicycle route on West End Avenue. These measures would reduce GHG emissions by facilitating cycling as a commuting option, and would be consistent with the GHG reduction goals of PlaNYC.
- **Construction Materials:** To reduce GHG emissions from the manufacture and transport of building materials, especially concrete and steel, locally purchased materials would be used to the extent practicable. Recycled materials, including the use of fly ash or slag in concrete, or ultra low carbon cement or cement replacements would be used to the extent practicable. (For purpose of this commitment "local" is defined as within 500 miles.)
- **Building Commissioning:** To verify that the project's major energy-related systems are installed, and calibrated to perform according to the design specifications, and that they are operating properly after installation, building commissioning would be performed by an independent third party. The benefits would include reduced energy use, and resulting GHG emissions, as well as lower operating costs.
- **Measurement and Verification:** Energy use metering equipment would be installed to track energy efficiency performance for systems in the common areas of the buildings

during the first year of building operation. The tracking of energy performance would provide information on the energy savings achieved and identify the system components where corrective action would need to be implemented, if the results of the measurements indicate that energy performance is lower than expected.

- **Water Efficiency Measures:** Water conserving toilets and faucets would be installed in all buildings. Reducing water demand would reduce GHG emissions associated with treatment and delivery of potable water. It would also reduce the amount of wastewater requiring treatment, and thereby reduce the emissions associated with wastewater treatment.
- **Electric Vehicles:** Battery charging stations for electric vehicles would be installed in each of the garages subject to future demand and technical feasibility.
- **Distributed Generation and Combined Heat and Power:** In addition to the project steam, described above, the practicability of providing combined heating and power ("cogeneration") at the Project site has been evaluated. See Chapter 23, "Alternatives," for details.

Where applicable, implementation of the above measures will be required through the project's Restrictive Declaration.

In addition, the development associated with the Proposed Project could be subject to changes in the New York City Building Code that are currently being considered to require greater energy efficiency and to further the goals of PlaNYC. These could include energy efficiency requirements, specifications regarding cement, and other issues influencing GHG emissions.

CONCLUSION

The potential GHG emissions associated with the Proposed Project have been calculated and are presented above. Measures for reducing GHG emissions included in the Proposed Project and additional relevant measures under consideration have been identified. Overall, the site location, the dense, mixed-use design, the commitment to achieve energy efficiency, and other measures incorporated in the Proposed Project would result in lower GHG emissions than would otherwise be achieved by similar residential and commercial uses, and thus would advance New York City's GHG reduction goals as stated in PlaNYC.

The annual GHG emissions from the Proposed Project are predicted to be 49,679 metric tons of CO_2e. This does not represent a net increment in GHG emissions, since similar GHG emissions would occur if residential units and associated uses were to be constructed elsewhere, and could be higher if constructed with less energy efficiency, as lower density residential, further from employment and commercial uses, and/or with less access to transit service. ✷