Chapter 18: Air Quality and Greenhouse Gas Emissions

A. AIR QUALITY

INTRODUCTION

The potential for air quality impacts from the proposed project is examined in this chapter. Air quality impacts can be either direct or indirect. Direct impacts result from emissions generated by stationary sources at a development site, such as emissions from on-site fuel combustion for heat and hot water systems, or emissions from parking garage ventilation systems. Indirect impacts are impacts that are caused by emissions from on-road vehicle trips generated by a project or other changes to future traffic conditions due to the project.

The proposed project's heating and hot water needs would be met through a connection to Con Edison steam, while cooling would be provided by electric chillers. Therefore, stationary sources of emissions from the proposed project are considered insignificant. However, potential impacts on the proposed project from fossil-fuel fired heat and hot water systems serving large existing buildings in the study area were examined. In addition, potential effects of stationary source emissions from existing nearby industrial facilities on the proposed project were assessed.

The potential for indirect mobile source impacts from the proposed project was analyzed. In addition, the proposed project may include an accessory parking garage. Therefore, an analysis was conducted to evaluate potential future pollutant concentrations in the vicinity of the ventilation outlets with the proposed accessory parking garage. The predicted increments from the garage ventilation were also added, where appropriate, to the predicted concentrations from the mobile source analysis, to assess the cumulative impact of both sources.

The Reasonable Worst-Case Development Scenario (RWCDS) for the mobile source air quality analysis is the same as for the traffic analysis, which assumes the Single-Tenant Office Scenario for the peak morning period and the Multi-Tenant Office Scenario for the peak midday, evening, and Saturday periods.

PRINCIPAL CONCLUSIONS

As discussed below, the maximum predicted pollutant concentrations and concentration increments from mobile sources with the proposed project would be below the corresponding guidance thresholds and ambient air quality standards. The project's accessory parking facility would also not result in any significant adverse air quality impacts. Thus, the proposed project would not have significant adverse impacts from mobile source emissions.

The potential impacts on the proposed project from fossil-fuel fired heat and hot water systems serving large existing buildings in the study area were also assessed. An analysis was performed which determined that there would be no impacts on the proposed project from existing buildings in the study area.

The potential impacts on the proposed project from existing nearby industrial facilities in the study area were assessed. An analysis was performed which determined that there would be no impacts on the proposed project from existing industrial facilities in the study area.

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 carbon monoxide (CO) are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and sources utilizing non-road diesel such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs.

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. A parking garage analysis was also conducted to evaluate future CO concentrations with the operation of the proposed parking garage.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions; the 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 is predicted. An analysis of project-related emissions of these pollutants from mobile sources was therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated 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 consist of approximately 90 percent NO and 10 percent NO_2 at the source.) However, with the promulgation of the new 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant. The proposed project would not involve the addition of any new stationary emission sources. Therefore, an analysis of potential local impacts on NO_2 concentrations was not warranted.

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, analysis was not warranted.

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

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

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

Diesel-powered vehicles, especially heavy duty trucks and buses, are a significant source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. An analysis was conducted to assess the worst-case $PM_{2.5}$ and PM_{10} impacts due to the increased traffic associated with the proposed project, based on the latest available guidance.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Monitored SO_2 concentrations in New York City 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 SO_2 from mobile sources was not warranted. The proposed project would not involve the addition of any new stationary emission sources; however, nearby existing oil-fired HVAC sources were examined to assess their potential SO_2 impacts on the proposed project.

AIR TOXICS

In addition to the criteria pollutants discussed above, air toxics are of concern. 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 air toxics; however, the New York State Department of Environmental Conservation (NYSDEC) has issued standards for certain non-criteria compounds, including beryllium, gaseous fluorides, and hydrogen sulfide. NYSDEC has also developed guideline concentrations for numerous air toxic 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.

EPA has also developed guidelines for assessing exposure to air toxics. These exposure guidelines are used in health risk assessments to determine the potential effects to the public.

The potential impact from adjacent industrial sources on air toxics concentrations within the proposed project area was examined.

AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary 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 current 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 total suspended particulate matter (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).

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

Pollutant	Primary		Secondary	
	ppm	µg/m³	ppm	µg/m³
Carbon Monoxide (CO)				
8-Hour Average [(1)]	9	10,000	None	
1-Hour Average [(1)]	35	40,000		
Lead				
Rolling 3-Month Average [(5)]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
Annual Average	0.053	100	0.053	100
Maximum 1-Hour Average [(6)]	0.100	188	None	
Ozone (O_3)				
8-Hour Average [(2)]	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)				
Annual Arithmetic Mean	0.03	80	None	
Maximum 24-Hour Average [(1) (7)]	0.14	365	None	
Maximum 3-Hour Average [(1) (7)]	NA	NA	0.50	1,300
Maximum 1-Hour Average [(8)]	75	196	None	

Notes: ppm – parts per million
µg/m³ – micrograms per cubic meter
NA – not applicable
All annual periods refer to calendar year.
PM concentrations (including lead) are in µg/m³ since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m³ are presented.
(1) Not to be exceeded more than once a year.
(2) 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/m³, effective December 18, 2006.
(5) EPA has lowered the NAAQS down from 1.5 µg/m³, effective January 12, 2009.
(6) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
(7) Standard to be revoked 60 days after promulgation of new 1-hour standard.
(8) 3-year average of the annual fourth highest daily maximum 1-hr average concentration.
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 µg/m³ to 35 µg/m³ and retaining the level of the annual standard at 15 µg/m³. 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.

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

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

On June 3, 2010 EPA announced a new 1-hour average SO_2 standard of 0.075 ppm, effective 60 days after the promulgation of the standard, replacing the current 24-hour and annual primary standards. The statistical form is the 3-year average of the 4th highest daily maximum 1-hour average concentration in a year (the 4th highest daily maximum corresponds approximately to 99th percentile for a year.)

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 intends to complete this reconsideration of the 2008 ozone NAAQS by August 31, 2010.

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS (SIP)

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.

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 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, annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard.

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 demonstrating 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 (1-hour average standard). In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. 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 the 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).

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 will 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 classified once three years of monitoring data are available (2016 or 2017). Overall, NYSDEC is projecting lower NO_x (including NO_2) concentrations in the future due to existing plans for reducing emissions aimed at attaining the ozone standards.

New York City is currently in attainment of the annual and 24-hour primary and 3-hour secondary SO_2 standards. EPA recently promulgated a new 1-hour standard which will replace the current primary standards. Based on the recent monitoring data, 1-hour SO_2 concentrations in all areas of the state are below the new standard.

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.

As mentioned earlier, EPA recently promulgated a new 1-hour NAAQS for NO_2. NYSDEC is projecting lower NO_x (including NO_2) concentrations in the future due to existing plans for reducing emissions aimed at attaining the ozone standards.

Overall, the proposed project may result in some increases in local NO_2 concentrations due to project-generated traffic. At the present time there are not sufficient data and established technical analysis techniques and guidance 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. These analysis limitations 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. The proposed project's stationary source emissions are negligible, while HVAC emissions from existing buildings were screened out in the Draft Environmental Impact Statement (DEIS) as insignificant for the annual NO_2 and annual and short-term SO_2 NAAQS; therefore, no additional analysis has been performed.

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

1 CEQR Technical Manual, section 222, 2001; and State Environmental Quality Review Regulations, 6 NYCRR § 617.7

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

significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ 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 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's traffic on $PM_{2.5}$ concentrations.

METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

The prediction of vehicle-generated CO and PM 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.

Vehicle Emissions Data

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 New York City Environmental Protection (NYCDEP).

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

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.[2]

An ambient temperature of 50.0° Fahrenheit was used. The use of this temperature is recommended in the *CEQR Technical Manual* and is consistent with current NYCDEP 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. Road dust emission factors were calculated according to the latest procedure delineated by EPA.[3] In accordance with the City's current guidance, $PM_{2.5}$ emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, consistent with this same guidance, the $PM_{2.5}$ component of the fugitive road dust was not

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

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

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

included in the neighborhood scale $PM_{2.5}$ microscale analysis, since it is considered to be an insignificant contribution on that scale.

Traffic Data

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the proposed 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 midday (12 to 1 PM), weekday evening (5 to 6 PM), and Saturday midday (12 to 1 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 existing condition and in the No Action condition, 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.

Dispersion Models for Microscale Analyses

Maximum CO concentrations adjacent to streets near the project site, resulting from vehicle emissions, were predicted using the CAL3QHC model Version 2.0.[1] The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to accurately predict the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first level of CAL3QHC modeling.

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

Meteorology

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the direction in which pollutants are dispersed, and atmospheric

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

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 0.70 to account for persistence of meteorological conditions and fluctuations in traffic volumes. A surface roughness of 3.21 meters was chosen. At each receptor location, concentrations were calculated for all wind directions, and the highest predicted concentration was reported, regardless of frequency of occurrence. These assumptions ensured that 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.

Analysis Year

The microscale analyses were performed for existing conditions and 2014, the year by which the proposed project is expected to be completed. The future analysis was performed both without the proposed project (the No Action condition) and with the proposed project.

Background Concentrations

Background concentrations are those pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations must be added to modeling results to obtain total pollutant concentrations at an analysis site. The highest background concentrations monitored at the nearest NYSDEC background monitoring station in the most recent 3-year period were used. It was conservatively assumed that the maximum background concentrations occur on all days.

The 8-hour average background concentration used in the analysis was 2.0 ppm, which is based on the highest second-highest 8-hour measurements over the most recent five-year period for which complete monitoring data are available (2004-2008), utilizing measurements obtained at the P.S. 59 monitoring station. The 1-hour CO background used in the analysis was 2.6 ppm.

The PM_{10} 24-hour background concentration of 60 $\mu g/m^3$ was based on the second-highest concentration, measured over the most recent three-year period for which complete data are available (2006–2008). The nearest NYSDEC monitoring site, at P.S. 59, was used. $PM_{2.5}$ background concentrations are not presented, since impacts are assessed on an incremental basis.

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

Mobile Source Analysis Sites

A total of 2 analysis sites were selected for microscale analysis (see **Table 18a-2** and **Figure 18a-1**). These sites were selected because they are the locations in the study area where the largest levels of project-generated traffic and future with the proposed project traffic are expected, and, therefore, where the greatest air quality impacts and maximum changes in the concentrations would be expected. Each of these intersections was analyzed for CO.

Table 18a-2
Mobile Source Analysis Intersection Locations

Receptor Site	Location
1	Seventh Avenue and West 34th Street
2	Third Avenue and East 34th Street

For the PM analyses, the intersection of Seventh Avenue and West 32nd Street was selected since it has the highest overall calculated emissions from project-generated mobile sources and, therefore, could potentially result in maximum incremental changes in 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. Receptors in the annual $PM_{2.5}$ neighborhood scale models were placed at a distance of 15 meters from the nearest moving lane, based on the NYCDEP procedure for neighborhood-scale $PM_{2.5}$ modeling.

Parking Facilities

The proposed project may include an underground accessory parking garage located on the project site with a capacity of approximately 100 spaces. The outlet air from the garage's ventilation systems could contain elevated levels of CO due to emissions from vehicular exhaust emissions in the garage. The ventilation air could potentially affect ambient levels of CO at locations near the outlet vent. An analysis of the emissions from the outlet vent 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 garage were estimated using the EPA MOBILE6.2 mobile source emission model and an ambient temperature of 50°F, as referenced in the *CEQR Technical Manual*. All arriving and departing vehicles were conservatively assumed to travel at an average speed of 5 miles per hour within the parking garages. In addition, all departing vehicles were assumed to idle for 1 minute before exiting. The concentration of CO within the garage was calculated assuming a minimum ventilation rate, based on New York City Building Code requirements, of 1 cubic foot per minute of fresh air per gross square foot of garage area. To determine compliance with the NAAQS, CO concentrations were predicted for the maximum 8-hour average period. (No exceedances of the 1-hour standard would occur and the 8-hour values are the most critical for impact assessment.)

To determine pollutant concentrations, the outlet vent was analyzed as a "virtual point source" using the methodology in EPA's Workbook of Atmospheric Dispersion Estimates, AP-26. This methodology estimates CO concentrations at various distances from an outlet vent by assuming that

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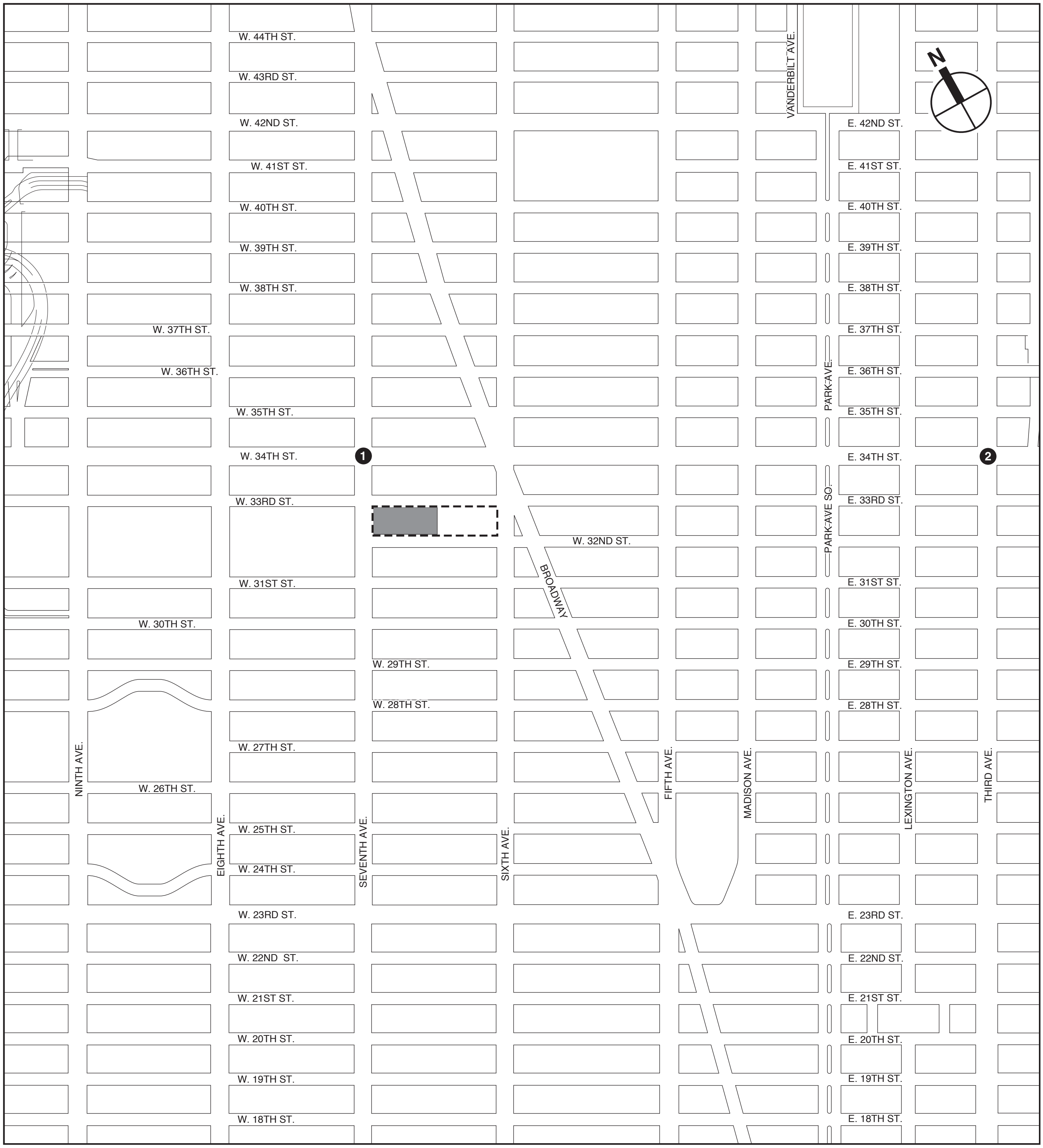

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SCALE

Development Site

Project Site

Air Quality Mobile Source/ Analysis Sites

1 *Seventh Avenue/ 34th Street*

2 *Third Avenue/ 34th Street*

Mobile Source Analysis Site Locations

Figure 18a-1

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 conservatively 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".

The air from the parking garage was assumed to be vented through a single outlet at a height of approximately 10 feet. The vent face was modeled to directly discharge to Seventh Avenue. Receptors were placed along the sidewalks on both sides of the street (both near the vent and across the street) at a pedestrian height of 6 feet and at a distance 12 feet and 89 feet, respectively, from the vent. In addition, a receptor was placed on the building façade at a pedestrian height of 6 feet above the vent. A persistence factor of 0.77, supplied by NYCDEP, was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period.

Background 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 from a traffic survey conducted in the study area.

STATIONARY SOURCES

HVAC Sources

As stated earlier, Con Edison steam would be supplied to the proposed project to provide heating and domestic hot water. Ventilation and cooling systems would be electrically powered. Therefore, no analysis of potential air quality impacts from the proposed project's HVAC systems was performed.

A screening analysis was performed to assess potential air quality impacts associated with emissions from fossil fuel-fired HVAC systems associated with existing buildings on the proposed project. The methodology described in the *CEQR Technical Manual* was used for the analysis of existing permitted boilers found using the Department of Buildings and NYCDEP databases. The *CEQR* methodology determines the threshold of development size below which there is no potential for significant adverse impact. The screening procedures use information regarding the type of fuel used, the building size, and the boiler exhaust stack height to evaluate whether a significant adverse impact is likely. Based on the distance from the existing building to the receptor of similar or greater height, if the maximum existing building size is greater than the threshold size in the *CEQR Technical Manual,* there is the potential for significant air quality impacts, and a refined dispersion modeling analysis would be required. Otherwise, the source passes the screening analysis and no further analysis is required.

Emergency Generators

Emergency diesel-fueled generators would be installed to serve the proposed project 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 DEC air permitting requirements, but would require a permit or registration issued by NYCDEP, depending on the generator capacity. The emergency generators would be installed and operated in accordance with NYCDEP requirements, as well as other applicable codes and standards. Potential air quality impacts from the emergency generators would be insignificant, since they would be used only for testing purposes outside of an actual emergency use (once per week for approximately 15 to 20 minutes), and individual generators would be tested at different times.

Industrial Sources

Pollutants emitted from the exhaust vents of existing permitted industrial facilities were examined to identify potential adverse impacts on future residents of the proposed project.

The potential impact of existing industrial operations in the surrounding area on pollutant concentrations in the area of the proposed project was analyzed. All industrial air pollutant emission sources within 400 feet of the proposed project boundaries were considered for inclusion in the air quality impact analyses.

A request was made to NYCDEP's Bureau of Environmental Compliance (BEC) to obtain the most current information regarding the release of air pollutants from all existing manufacturing or industrial sources within the entire study area. A comprehensive search was also performed to identify NYSDEC Title V permits and permits listed in the EPA Envirofacts database.[2] The NYCDEP and NYSDEC air permit data provided was compiled into a database of source locations, air emission rates, and other data pertinent to determining source impacts. Facilities that appeared in the Envirofacts database but did not also possess a NYCDEP certificate to operate were cross-referenced against NYSDEC's Air Guide-1 software emissions database, which presents a statewide compilation of permit data for toxic air pollutants, to obtain emissions data and stack parameters.

A field survey was conducted on April 1, 2009, to determine the operating status of permitted industries and identify any potential industrial sites not included in the permit databases. The results of the field survey were compared against NYCDEP and NYSDEC data sources.

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 screening database in the *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 property boundary of the development sites and the source sites. Predicted worst-case impacts on the proposed project were compared with the short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) recommended in NYSDEC's DAR-1 AGC/SGC tables. These guidelines present the airborne concentrations which are applied as a screening threshold to determine if the future residents of the projected

[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.

[2] EPA, Envirofacts Data Warehouse, http://oaspub.epa.gov/enviro/ef_home2.air

development sites could be significantly impacted by nearby sources of air pollution. To assess the effects of multiple sources emitting the same pollutants, cumulative source impacts were determined. Concentrations of the same pollutant from industrial sources that were within 400 feet of the proposed project were combined and compared to the guideline concentrations discussed above.

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-3**. All data statistical forms and averaging periods are consistent with the definitions of the NAAQS. These existing concentrations are the most 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 2009 with the exception of the annual standard of 15 µg/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 µg/m^3 (based on the three-year average of the 98th percentile concentrations).

Table 18a-3
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	CCNY, Manhattan	ppm	8-hour	1.8	9
	CCNY, Manhattan		1-hour	2.3	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. 19, Manhattan	µg/m^3	24-hour	38	150
$PM_{2.5}$	P.S. 19, Manhattan	µg/m^3	Annual	13.6	15
			24-hour	30.8	35
NO_2	P.S. 59, Manhattan	µg/m^3	Annual	68	100
Lead	J.H.S. 126, Brooklyn	µg/m^3	3-month	0.012 (1)	1.5
Ozone	I.S. 52, Bronx	ppm	8-hour	0.072	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 2007, 2008, and 2009, and the 24-hour concentration is the average of the annual 98th percentiles in 2007, 2008 and 2009. 8-hour average ozone concentrations are the average of the 4th highest-daily values from 2007 to 2009.

(1) The lead NAAQS was recently lowered to 0.15 µg/m^3. The previous standard is shown since it was in effect at the time the monitoring was performed.

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-4**. (One-hour average values are not shown since predicted values are much lower than the 1-hour standard of 35 ppm).

Table 18a-4
Maximum Predicted Existing 8-Hour Average CO Concentrations for 2009

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Seventh Avenue and West 34th Street	Weekday MD	3.4
2	Third Avenue and East 34th Street	Weekday PM	3.9
Note: 8-hour standard is 9 ppm.			

FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCE ANALYSIS

CO

CO concentrations without the proposed project were determined for the 2014 Build year using the methodology previously described. **Table 18a-5** shows future maximum predicted 8-hour average CO concentrations at the analysis intersections without the proposed project (i.e., 2014 No Action values). The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 18a-5
Maximum Predicted Future (2014) 8-Hour Average CO No Action Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)
1	Seventh Avenue and West 34th Street	Weekday PM	3.6
2	Third Avenue and East 34th Street	Weekday PM	3.5
Note: 8-hour standard is 9 ppm.			

As shown in **Table 18a-5**, 2014 No Action 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-4**). 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.

PM

PM concentrations without the proposed project were determined for the Build year using the methodology previously described. Table 18a-6 presents the future maximum predicted 24-hour average PM_{10} concentrations at the analysis intersection 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 in the No Build condition are not presented, since impacts are assessed on an incremental basis.

Table 18a-6
Maximum Predicted Future (2014) 24-Hour Average PM_{10} No Action Concentrations

Receptor Site	Location	Concentration (µg/m³)
3	Seventh Avenue and West 32nd Street	91.9
Note: NAAQS—24-hour, 150 µg/m³.		

STATIONARY SOURCE ANALYSIS

HVAC emissions in the No Action condition would likely be similar to existing conditions. Consequently, air quality as affected by local sources of emissions would be anticipated to be similar to existing conditions.

PROBABLE IMPACTS OF THE PROPOSED PROJECT

MOBILE SOURCES

CO

CO concentrations with the proposed project were determined for the Build year at traffic intersections using the methodology previously described. **Table 18a-7** shows the future maximum predicted 8-hour average CO concentration with the proposed project at the two 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 significant CO air quality impacts.

Table 18a-7
Maximum Predicted Future (2014) 8-Hour Average No Action and Future with the Proposed Project CO Concentrations

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)	
			No Action	Future with the Proposed Project
1	Seventh Avenue and West 34th Street	PM	3.6	3.6
2	Third Avenue and East 34th Street	PM	3.5	3.5
Note: 8-hour standard is 9 ppm.				

PM

PM concentrations with the proposed project were determined for the Build year using the methodology previously described. Table 18a-8 shows the future maximum predicted 24-hour average PM_{10} concentrations with the proposed project.

Table 18a-8
Maximum Predicted Future (2014) 24-Hour Average
No Action and Future with the Proposed Project PM_{10} Concentrations

Receptor Site	Location	24-Hour Concentration (µg/m³) No Action	Future with the Proposed Project
3	Seventh Avenue and West 32nd Street	91.9	92.9
Note: NAAQS—24-hour, 150 µg/m³.			

The values shown are the highest predicted concentrations for any of the time periods analyzed. The results indicate that the proposed project would not result in any violations of the PM_{10} standard at any of the receptor locations analyzed.

Future maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments with the proposed project were determined so that they could be compared with the interim guidance criteria that would determine the potential significance of the proposed project's impacts. 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-9 and 18a-10, respectively. The results show that the annual and daily (24-hour) $PM_{2.5}$ increments are predicted to be well below the updated NYCDEP interim guidance criteria and, therefore, the proposed project would not result in significant $PM_{2.5}$ impacts at the analyzed receptor locations.

Table 18a-9
Maximum Predicted Future (2014)
24-Hour Average $PM_{2.5}$ Increment

Receptor Site	Location	Increment
3	Seventh Avenue and West 32nd Street	0.03
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, > 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.		

Table 18a-10
Maximum Predicted Future (2014)
Annual Average $PM_{2.5}$ Increment

Receptor Site	Location	Increment
3	Seventh Avenue and West 32nd Street	0.009
Note: $PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 µg/m³.		

Parking Facilities

Based on the methodology previously described, the maximum predicted 8-hour average CO concentrations from the potential parking facility 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.

The maximum predicted 8-hour average CO concentration of all the sensitive receptors described above would be 4.0 ppm for the building façade receptor. This value includes a predicted concentration of 2.3 ppm from the parking garage vent and includes a background level of 1.7 ppm. This concentration is substantially below the applicable standard of 9 ppm. As the results show, the potential parking garage would not result in any significant adverse air quality impacts.

34th Street Bus Rapid Transitway (BRT)

Since the DEIS was completed, NYCDOT announced a proposal for the construction of a new right-of-way for crosstown bus service along 34th Street. The 34th Street Transitway (Transitway) proposal envisions a physically separate right-of-way for buses on 34th Street, as well as passenger boarding islands, a prepayment fare system, and other bus operations improvements. As currently proposed, buses would be the only through traffic allowed between Fifth and Sixth Avenues, with the remainder of the space devoted to new pedestrian spaces.

The proposed Transitway would result in the diversion of traffic at intersections within the proposed project's study area. However, as discussed above, the maximum predicted CO and PM_{10} concentrations from mobile sources with the proposed project are well below the corresponding ambient air quality standards. The traffic diversions associated with the Transitway would be distributed throughout the traffic network and would not be anticipated to increase local pollutant concentrations at any intersection by a significant amount. The proposed Transitway would also have a minimal effect on $PM_{2.5}$ concentrations since they are assessed on an incremental basis. Therefore, no significant adverse air quality impacts would be anticipated to occur as a result of the proposed Transitway.

STATIONARY SOURCES

HVAC Analysis

As described previously, the proposed project would not have the potential for significant adverse impacts on air quality from stationary sources, since the proposed project would use central steam and electric chillers for HVAC.

An assessment of the potential impacts on the proposed project from heat and hot water systems serving large existing buildings in the study area was undertaken since the proposed project would be taller than other buildings within a 400-foot radius. Buildings within this study area were evaluated for their potential for air quality impacts on the proposed project, based on their floor area, height, and proximity to the project site. In addition, only large buildings 10 stories or taller having active boiler permits or certificates to operate from NYCDEP were included in the analysis. Other buildings that were considered but found to have no NYCDEP permit or certificate to operate for heating or hot water systems were excluded from the analysis based on the availability of Con Edison steam in the area. **Table 18a-11** presents a summary of the buildings that were included in the HVAC analysis.

Table 18a-11
Existing Buildings Analyzed in the HVAC Assessment

Building	Address	Floor Area (gsf)	Distance to Project Site (feet)
1	875 Sixth Avenue	214,349	340
2	119 West 31st Street	221,227	135
3	370 Seventh Avenue	332,383	320
4	371 Seventh Avenue	473,391	310
5	132 West 31st Street	384,655	310

Sources: New York City Map: http://gis.nyc.gov/doitt/cm/CityMap.htm; New York City Buildings Information System: http://www.nyc.gov/html/dob/html/bis/bis.shtml

875 Sixth Avenue, 119 West 31st Street, 370 Seventh Avenue, and 371 Seventh Avenue use No. 6 oil for their HVAC systems. 132 West 31st Street uses No.4 oil for its HVAC system. Based on their distances to the project site, the total gross floor area for each of these buildings is below the maximum development size shown in Figure 3Q-4 and 3Q-8 of the *CEQR Technical Manual* for No. 6 oil and No. 4 oil, respectively. Therefore, these buildings do not have the potential to adversely affect the proposed project.

Industrial Sources

As discussed above, a study was conducted to identify manufacturing and industrial uses within the 400-foot study area. NYCDEP-BEC and EPA permit databases were used to identify existing sources of industrial emissions. Three permitted facilities were identified within 400 feet of the project site in the future with the proposed project condition.

The screening procedure used to estimate the pollutant concentrations from these businesses is based on information contained in the certificates to operate obtained from NYCDEP-BEC and NYSDEC. 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-12 presents the maximum impacts at the proposed project. The table also lists the Short-Term Guideline Concentrations (SGC) and Annual Guideline Concentrations (AGC) for each toxic air pollutant. The results of the industrial source analysis demonstrate that there would be no predicted significant adverse impacts on the proposed project from existing industries in the area.

Table 18a-12
Maximum Predicted Impacts from Industrial Sources

Potential Contaminants	Estimated Short-term Impact (ug/m^3)	SGC[a] (ug/m^3)	Estimated Long-term Impact (ug/m^3)	AGC[a] (ug/m^3)
1-Methyl 2-Pyrrolidinone	1.9	--	0.05	100
2-Butoxyethanol	168.1	14,000	0.90	13,000
2-Butoxyethanol Acetate	33.0	--	0.22	310
2-Propanone	576.0	180,000	17.32	280,000
2-Propoxyethanol	239.0	430	4.59	230
Butane	14.3	--	0.12	57,000
Butanol	2.3	--	0.008	710
Butyl Benzyl Phthalate	0.4	--	0.008	12
Carbon Black	1.9	--	0.04	8.3
Carbon Monoxide	0.02	14,000	0.008	--
Cyclohexanone	38.1	20,000	0.18	190
Ethyl Acetate	192.9	--	4.54	3,400
Ethyl Alcohol	12.8	--	0.11	45,000
Ethyl Benzene	1.0	54,000	0.008	1,000
Ethylene Glycol	1.5	10,000	0.013	400
Hexane	15.4	--	0.16	700
Isopropanol	44.6	98,000	0.61	7,000
Manganese Compounds	0.03	--	0.0002	0.05
Med. Aromatic Hydrocarbons	0.05	--	0.0004	3,800
N-Propyl Acetate	192.9	100,000	1.28	20,000
Oxides of Nitrogen	4.0	--	0.14	100
Particulates	7.3	380	0.13	45
Propane	14.3	--	0.12	43,000
Silica, Amorphous	1.8	--	0.04	0.06
Silicon Dioxide	1.8	--	0.04	0.06
Sulfur Dioxide	0.2	910	0.008	80
Titanium Dioxide	1.3	--	0.03	24
Toluene	10.9	37,000	0.08	5,000
Turpentine	30.5	--	0.11	2,700
Xylene	28.4	4,300	0.26	100

Notes:
[a] NYSDEC DAR-1 (Air Guide-1) AGC/SGC Tables, September, 2007.
AGC-Annual Guideline Concentrations.
SGC-Short-term Guideline Concentrations.

B. GREENHOUSE GAS EMISSIONS

INTRODUCTION

There is general consensus in the scientific community that the global climate is changing as a result of increased concentrations of greenhouse gases (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 long-term sustainability program, PlaNYC 2030.

As discussed in Chapter 2, "Procedural and Analytical Framework," two program options are proposed—a Single-Tenant Office Scenario and a Multi-Tenant Office Scenario. GHG emissions generated by various activities (heating, consumption of electricity, vehicle use, waste generation, construction, and construction material use) are presented in this section for each of the proposed scenarios, since the contribution of each activity to the overall project GHG emissions is different under the two scenarios. For example, electricity use is the greatest contributor to GHG emissions under the Singe-Tenant Office Scenario, due to the relatively high electricity demand associated with trading floor activities, while vehicle trips (including truck deliveries) contribute the most emissions under the Multi-Tenant Office Scenario, due to the greater space dedicated to retail uses, which generally induce more personal vehicle and delivery truck trips. Specific measures to reduce GHG emissions and improve energy efficiency that are either included as part of the proposed project or are under consideration are discussed and quantified to the extent possible.

The proximity to public transportation and dense design are all factors that contribute to the energy efficiency of the proposed project, resulting in lower GHG emissions.

PRINCIPAL CONCLUSIONS

The proposed project is being designed to incorporate “green” building elements that would achieve, if not exceed, the guidelines outlined by the Leadership in Energy and Environmental Design (LEED) Certification by the United States Green Building Council (USGBC). It is currently estimated that the proposed building would achieve the LEED Silver rating. Overall, the site selection, the reuse of existing building materials, the design density, 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 commercial uses, and, thus, would advance New York City’s GHG reduction goals as stated in PlaNYC.

The annual GHG emissions from the Single-Tenant Office Scenario are predicted to be approximately 53,987 metric tons of carbon dioxide equivalent (CO_2e, defined below). The annual GHG emissions from the Multi-Tenant Office Scenario are predicted to be approximately 54,547 metric tons of CO_2e. This does not represent a net increment in GHG emissions as compared to a No Action condition, but rather represents a conservative estimate of the total GHG emissions associated with the proposed project. GHG emissions would also occur if the development similar to the proposed project was to be constructed elsewhere, and those emissions could be higher if the development was constructed with less energy efficiency, further from residential uses, and with less access to transit than the proposed project.

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 emission of criteria pollutant 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, the nature of the climate change impact 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 the No Action condition, but rather presents the total GHG emissions associated with the proposed project (steam use, electricity use, vehicle use, waste generation, and construction) and identifies the measures incorporated in 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 the proposed uses were to be constructed elsewhere to accommodate the same number of people, the GHG emissions could equal or exceed those of the proposed project, depending on the location, access to transit, building type, construction materials, and energy efficiency measures.

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.

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.

There are also 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.

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[1] "Uptake" refers to biological and chemical processes by which CO_2 is removed from the atmosphere and stored in the oceans.

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.

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 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 legislation activity is still in progress, without such legislation EPA would be obliged to act as a regulator, under a U.S. Supreme Court ruling which affirmed GHG's as pollutants 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 American Recovery and Reinvestment Act of 2009 (ARRA, "economic stimulus package") funds actions and research that can lead to reduced GHG emissions. The wind, biomass, geothermal, and landfill 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. EPA and USDOT have recently proposed legislation to establish the first GHG emission standards and more stringent CAFE standards for MY2012 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. The 2009 New York State Energy Plan,[1]

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

outlines the state's energy goals and provides strategies and recommendations for meeting those goals. The state's goals include:

- implementing programs to reduce electricity use by 15 percent below 2015 forecasts;
- updating the energy code;
- 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
- developing a Climate Action Plan in accordance with Executive Order No. 24 to identify strategies, actions, and infrastructure needs to reduce GHG emissions by 80 percent by 2050.

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 by 2017 to 30 percent less than fiscal year 2006 emissions. Of particular relevance to GHGs from development projects are PlaNYC initiatives to encourage higher density where appropriate, mixed use, infill, and transit-oriented development, promote cycling, expand clean distributed generation, foster a market for renewable energy, and improve private vehicle fuel efficiency. In December 2009, the New York City Council enacted a suite of four laws aimed at achieving higher energy efficiency in new and existing buildings, in accordance with PlaNYC. The laws will 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 would also require lighting upgrades, including the installation of sensors and controls, more efficient light fixtures, and the installation of submeters, so that tenants could be provided with information on their electricity consumption. The legislation would also create a local New York City Energy Code, which would require 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 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.

There is an emerging consensus that GHGs need to be considered in the environmental review of major projects. The New York State Department of Environmental Conservation (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,[1] and the City of New York is currently formulating guidance for analysis under CEQR. However, there are currently 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 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.

METHODOLOGY

Emissions of GHG that would be associated with the proposed project have been quantified, including off-site emissions associated with steam used for heating, off-site emissions associated with the production of electricity used on-site, 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 proposed project and disposed of in landfills. Average annual and total GHG emissions that would result from construction of the proposed project, 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 CO_2 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**.[2]

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.

1 NYSDEC, Guide for Assessing Energy Use and Greenhouse Gas Emissions in an Environmental Impact Statement, July 15, 2009.

2 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.

EPA estimates that the well-to-pump GHG emissions of gasoline and diesel are approximately 20 and 22 percent of the tailpipe emissions, respectively.[1] Although upstream emissions (emissions associated with production, processing, and transportation) of all fuels can be substantial and are important to 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.[2]

The project is considering the incorporation of energy efficiency design and measures. Since the precise measures and the extent to which they would reduce energy consumption are uncertain at this time, the analysis below assumes standard practice. Specifically, the energy demand for the proposed project was estimated assuming the buildings and systems would be designed to exceed the ASHRAE 90.1 2004 standard—the energy efficiency standard required by the New York City building code—by 10 percent.

OFF-SITE GHG EMISSIONS FROM STEAM USE

It is expected that utility steam would be used in heat and hot water systems for the proposed project. 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.[3] Since the Con Edison steam is largely 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. The amount of steam needed for building heat and hot water systems was assessed (see Appendix E: Air Quality and Greenhouse Gas Emissions), and is estimated at 81,259 Mlb of steam per year for both the Single-Tenant Office Scenario and the Multi-Tenant Office Scenario, assuming no energy efficiency beyond that required by code. Based on the commitment to implement energy efficiency measures that would reduce building energy use by at least 10 percent as compared with code, it was assumed that steam use in heat and hot water systems for the proposed building would be 10 percent lower than the baseline consumption described above. The commitment to energy efficiency would apply to total energy consumption, from electricity use and steam use. For the purposes of this assessment, it was assumed that the commitment to 10 percent overall energy efficiency would result in a 10 percent reduction from each of the energy use components (electricity and on-site fuel use).

OFF-SITE GHG EMISSIONS FROM ELECTRICITY USE

The demand for electricity for the proposed project was calculated (see Appendix E: Air Quality and Greenhouse Gas Emissions), and is estimated at approximately 77,013 MWh per year for the Single-Tenant Office Scenario, and 52,844 MWh per year for the Multi-Tenant Office Scenario, assuming no energy efficiency beyond that required by code. Based on the energy

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1 EPA, Renewable Fuel Standard Program—Lifecycle Analysis of Renewable Fuels, May 2009, http://www.epa.gov/otaq/renewablefuels/index.htm.

2 *Inventory of New York City Greenhouse Gas Emissions 2008*, Mayor's Office of Long-Term Planning and Sustainability, September 2009.

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

efficiency commitment, a 10 percent reduction in the above quoted electricity consumption was assumed in estimating the GHG emissions. A GHG emission factor of 775 lbs/MWh was applied based on the coefficient for electricity consumed in New York City in 2008.[1] 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 2014 due to an expected increase in the amount of electricity produced from renewable sources, the 2008 emissions factor was conservatively used without an adjustment for the future.

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 and truck trips that could be attributed to the proposed project was calculated from average daily weekday, Saturday, and Sunday person trips for office, trading floor, and retail uses, percentage of trips by car and taxi, and average vehicle occupancy, as described in Chapter 17, "Transit and Pedestrians." An average trip distance for personal vehicles was developed using weekday and weekend data from the 2001 National Household Travel Survey.[2] The distances used were 11.2, and 4.6 miles per trip on weekdays, and 8.2, and 7.8 miles per trip on weekends, for office/trading floor and retail trips, respectively.

Delivery truck distances were calculated based on data from the FHWA's Freight Analysis Framework for the New York Metropolitan Area.[3] The average one-way truck trip distance used in the analysis was 112 miles. This distance is likely a conservatively high estimate, since it does not account for linked trips on multi destination deliveries.

The average car and truck fuel efficiencies of 21.7 mpg and 6.1 mpg, respectively, projected for the 2014 analysis year, were employed in estimating the annual fuel consumed by vehicle use connected with the proposed project.[4] 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,[5] 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

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1 *Inventory of New York City Greenhouse Gas Emissions 2008*, Appendix: Electricity Coefficients, Mayor's Office of Long-Term Planning and Sustainability, PlaNYC2030, September 2009.

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

3 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.

4 Energy Information Administration, An Updated Annual Energy Outlook 2009 Reference Case Reflecting Provisions of the American Recovery and Reinvestment Act and Recent Changes in the Economic Outlook, 2009. Table 7 Transportation Sector Key Indicators and Delivered Energy Consumption.

5 The Code of Federal Regulations (40 CFR 600.113).

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 Commercial Waste Study[1]. Annual GHG emissions associated with each waste type were estimated using EPA's Waste Reduction Model (WARM)[2]. WARM calculates GHG emissions for a variety of waste management practices—source reduction, recycling, combustion, composting, and landfilling for 34 types of waste materials.

CONSTRUCTION GHG EMISSIONS

Construction activities for the proposed project would result in GHG emissions from on-site construction equipment, truck trips associated with construction material and deliveries and disposal, and construction worker trips. In addition, the use of steel, rebar, aluminum, and concrete is associated with GHGs emitted during production of those materials.

Construction Activity

GHG emissions from construction material delivery and disposal by trucks, construction worker trips, as well as construction equipment, were quantified using the construction activity estimates developed as part of Chapter 21, "Construction Impacts." 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 6.1 miles per gallon—the Energy Information Administration (EIA) projected average fuel economy for trucks (2010-2014). For most truck deliveries, the average one-way trip distance was assumed to be 112 miles (see "GHG Emissions from Vehicle Use", above). 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 proposed 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 use of steel, rebar, aluminum, and cement are included in this assessment because their production would comprise a large 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 in blast furnaces or heat metal in electric arc furnaces.[3] The production of steel also generates

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

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

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

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 IPCC guidelines.[1] 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.

Fly ash (a byproduct of coal-fired power generation) or slag will be used as a partial replacement for ordinary portland cement (OPC) in the concrete used for the proposed buildings. The production of OPC cement results in substantial GHG emissions, which can be reduced by approximately 8 to 11 percent through substitution of up to 15 or 20 percent fly ash.[2] However, the fraction of cement to be replaced is unknown at this time, since it will depend on the varying properties required for concrete for the different portions of the project. 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 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 metric tons ingot was used.[4] Recycled steel is often used for rebar which is used to reinforce concrete, but since the quantity of recycled steel is not known, no credit has been taken for that in this analysis.

Structure Lifetime

Construction-related emissions are also presented as annualized emissions over the lifetime of the buildings. The REGENER 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 longer lasting, 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 for a new building—which is unknown

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

[2] A lifecycle emission factor for OPC was based on Building for Environmental and Economic Sustainability (BEES) software data.

[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 Aluminum 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] Median age is measured from renovation, so this number is conservatively low for overall building materials lifecycle.

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.

at this time—will be much longer. Therefore, for the purpose of this analysis, building lifetimes were estimated at 80 years. This assumption was applied to all construction, including the podium and mass transit improvements.

Note that these lifetimes may result in a somewhat conservatively high annualized emission level, since the actual lifetimes could be much longer. However, since all of the construction 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, while the emissions associated with energy consumption for heat, electricity, and transportation are expected to decrease in the future, as a result of renewable energy alternatives and energy efficiency improvements, emissions from the construction of the proposed project 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 annualized contribution.

PROBABLE EMISSIONS FROM THE PROPOSED PROJECT

The estimated 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** for the Single-Tenant Office Scenario and in **Table 18b-4** for the Multi-Tenant Office Scenario.

Table 18b-2
GHG Emissions from Construction Activity and Material Use
2010-2014

Construction Activity	Fuel / Material Use		GHG Emissions (metric tons CO_2e)	
	Single-Tenant	Multi-Tenant	Single-Tenant	Multi-Tenant
Construction Materials:				
Concrete (cubic yards)	104,225	101,887	51,951	50,786
Steel and Rebar (tons)	101,483	97,438	168,477	161,762
Aluminum (tons)	28,871	27,744	253,451	243,560
Construction Equipment	various	various	6,343	5,380
Construction Trucks (million gal diesel)	1.0	1.0	10,332	10,238
Worker Trips (thousand gal gasoline)	98	96	869	852
TOTAL (4 years)			491,423	472,577
Annualized, Per Year[2]			*6,143*	*5,907*

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

Table 18b-3
Summary of Annual GHG Emissions
Single-Tenant Office Scenario

Sector	Annual Consumption or Generation	GHG Emissions (metric tons CO_2e)	Fraction of Total Emissions
Heat and Hot Water[1]	73,133 Mlbs steam (mixed source)	5,254	9.7%
Electricity[1]	69,312 MWh (mixed source)	24,357	45.1%
Vehicle Use[2]	1.5 Mgal diesel and 0.3 Mgal gasoline	17,986	33.3%
Solid Waste	3,400 short tons	247	0.5%
Construction (Annualized)[3]	Various	6,143	11.4%
TOTAL		53,987	*100.0%*

Notes: Mlbs=million pounds.
Mgal=million gallons.
All emissions are expressed in metric tons CO_2e/ year.
1. Estimates include the commitment to reducing energy use by 10 percent, as compared with energy use in buildings designed to meet building code requirements.
2. Vehicle Use includes truck deliveries, representing the majority of emissions in this category.
3. Total construction emissions of 491,423 metric tons CO_2e were annualized over 80 years.

Table 18b-4
Summary of Annual GHG Emissions
Multi-Tenant Office Scenario

Sector	Annual Consumption or Generation	GHG Emissions (metric tons CO_2e)	Fraction of Total Emissions
Heat and Hot Water[1]	73,133 Mlbs steam (mixed source)	5,254	9.6%
Electricity[1]	47,599 MWh (mixed source)	16,713	30.6%
Vehicle Use[2]	2.1 Mgal diesel and 0.6 Mgal gasoline	26,302	48.2%
Solid Waste	5,108 short tons	371	0.7%
Construction (Annualized)[3]	Various	5,907	10.8%
TOTAL		54,547	*100.0%*

Notes: Mlbs=million pounds.
Mgal=million gallons.
All emissions are expressed in metric tons CO_2e/ year.
1. Estimates include the commitment to reducing energy use by 10 percent, as compared with energy use in buildings designed to meet building code requirements.
2. Vehicle Use includes truck deliveries, representing the majority of emissions in this category.
3. Total construction emissions of 472,577 metric tons CO_2e were annualized over 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]

Note that most 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 in the City and the adjacency to regional distribution centers reduce emissions associated with deliveries in the City.

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

Emissions from private vehicles would be much higher for a similar project that was not close to transit, such as a suburban development.

Emissions associated with construction as annualized represent approximately 11 percent of the overall annual emissions, and are equivalent to the total emissions from the operation of the project over approximately 10 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 emissions associated with transportation because of the access to transit, as discussed in the section below.

PROJECT ELEMENTS THAT WOULD REDUCE GHG EMISSIONS

The proposed project would include a number of measures aimed at reducing energy consumption and GHG emissions. The measures include:

- **Site Selection:** The project site is located in the heart of a major transportation hub, near 14 subway lines, New Jersey Transit, Long Island Rail Road, PATH, and Amtrak trains, as well as multiple bus lines. The project site is also within walking distance of residential areas, shopping, restaurants, and parks. The project site is located in an area that is already developed and serviced by existing infrastructure. Therefore, the proposed project would not result in GHG emissions associated with urban sprawl and would be consistent with the goals of reducing the dependence on personal vehicles discussed in PlaNYC.
- **LEED Certification:** The proposed project is being designed to incorporate "green" building elements that would achieve, if not exceed, the requirements for LEED silver certification. Almost every LEED credit directly or indirectly reduces GHG emissions. For example, if the building attains LEED credits aimed at optimizing building energy efficiency and use of renewable energy, use of local, recycled and renewable materials, and/or water conservation, then GHG emissions from the proposed project would be lower than reported above.
- **Energy Efficiency:** Energy efficient systems and design measures (e.g., high performance building envelope, daylighting, HVAC systems, efficient fixtures and equipment, automated lighting controls) and efficient practices will be incorporated in project design. The proposed project would exceed the building energy performance required by the current building code by at least 10 percent. At a minimum, this additional energy efficiency would reduce the Single-Tenant Office Scenario annual GHG emissions by 3,290 metric tons CO_2e, and the Multi-Tenant Office Scenario annual GHG emissions by 2,441 metric tons CO_2e.

In addition, the following measures, which could result in further reduction in GHG emissions, are currently under consideration by the project sponsor:

- **Construction Materials and Waste:** During the construction phase, waste materials would be recycled to divert materials from landfill. The project sponsor would use recycled materials to the extent practicable, especially recycled steel, and use fly ash or slag in concrete as a replacement for OPC. Construction and finish materials which have recycled content and rapidly renewable materials would be favored. To the extent feasible, wood

[1] PlaNYC: A Greener, Greater New York, pp 135, The City of New York, 2007.

products would be certified by the Forest Stewardship Council. Locally purchased materials would be used to the extent practicable, reducing GHG emissions associated with transport.

- **Water Consumption:** A number of sustainable components for the proposed site that could reduce water and energy consumption are being considered. These include use of low-flow plumbing fixtures, and storm water and waste water management systems. Reducing water demand reduces GHG emissions associated with treatment and delivery of potable water. It also reduces the amount of wastewater requiring treatment, and thereby reduces the emissions from wastewater treatment.
- **Green Roofs:** Installation of green roofs could help mitigate storm water runoff, reduce the heat-island effect, and contribute increased insulation to the building envelope to improve the building energy efficiency. Rainwater would be harvested for landscape irrigation.
- **Distributed Generation and Combined Heat and Power:** The project is currently investigating the feasibility of a co-generation plant to produce power and heat for the proposed project (see Chapter 24, "Alternatives"). 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. A viable cogeneration option was identified for the Single-Tenant Office Scenario, which would have a payback of six to seven years. However, none of the options identified for the Multi-Tenant Office Scenario would be economically feasible. The payback period for the cogeneration options considered for the Multi-Tenant Office Scenario ranges from more than eight years to more than 15 years. In addition, for the Multi-Tenant Office Scenario cogeneration option that would result in the shortest payback period (more than eight years), the upfront costs would be prohibitively high (more than 22 percent higher than for the Single-Tenant Office Scenario cogeneration option).
- **Preferred Alternative Vehicle Parking:** At least 5 percent of parking (or more in future years) could be dedicated as preferred parking for alternative vehicles and may include charging stations for electric vehicles. This measure would be consistent with the Air Quality Initiative #11 in PlaNYC, which calls for promoting wider use of clean vehicles, and is also consistent with PlaNYC's climate change goals.
- **Car Sharing:** Some of the proposed parking spaces may be reserved for vehicles belonging to a car sharing service.
- **Bicycle Usage:** Bicycle racks and changing rooms may be provided to encourage alternative transportation use thereby reducing emissions from automobiles.
- **Renewable Energy Purchase:** Energy Initiative #11 in PlaNYC calls for fostering the market for renewable energy. The project sponsor is exploring options to buy energy exclusively from renewable sources reducing GHG emissions.
- **On-Site Renewable Energy Generation:** The project sponsor is considering producing renewable energy on-site from sources such as geothermal, wind, and solar photo voltaic cells integrated into the building envelope.

Implementing these measures would reduce the GHG emissions from the proposed project and would advance the PlaNYC goal to reduce GHG emissions citywide by 30 percent.

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

Overall, the site selection, the reuse of the existing building materials, the design density, 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 commercial uses, and would thus 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 53,987 metric tons of CO_2e with the Single-Tenant Office Scenario, and 54,547 metric tons of CO_2e with the Multi-Tenant Office Scenario. This does not represent a net increment in GHG emissions, since similar GHG emissions would occur if the proposed uses were to be constructed elsewhere, and could be higher if constructed with less energy efficiency, at lower density, further from residential uses, and with less access to transit service. ✷