Chapter 14: Air Quality

A. INTRODUCTION

The potential for air quality impacts from the Proposed Action 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. Indirect impacts are impacts that are caused by emissions from nearby existing stationary sources (impacts on the Proposed Action) or by emissions from on-road vehicle trips generated by the Proposed Action or other changes to future traffic conditions due to the Proposed Action.

The Proposed Action would include fossil fuel-burning heat and hot water systems at development sites. Therefore, a stationary source analysis was conducted to evaluate potential future pollutant concentrations with the proposed heat and hot water systems.

In the future with the Proposed Action, emissions from existing sources that would not be developed or enlarged would be anticipated to be the same as the No Action condition. However, since pollutant concentrations from existing sources at development and enlargement sites may be different than the No Action condition, potential air quality impacts on the Proposed Action were also examined. In addition, since portions of the Rezoning Area are within areas zoned for manufacturing uses, potential effects of stationary source emissions from existing nearby industrial facilities on the proposed residential uses were assessed.

The maximum hourly traffic generated by the Proposed Action would not exceed the 2012 *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) screening threshold of 170 peak-hour vehicle trips at an intersection in the study area. However, the particulate matter emissions screening threshold discussed in Chapter 17, Sections 210 and 311 of the *CEQR Technical Manual* would be exceeded in the 2022 analysis year. Therefore, a quantified assessment of the potential impacts on air quality from traffic generated by the Proposed Action was conducted. A quantified analysis was also conducted to evaluate potential future CO concentrations in the vicinity of the ventilation outlets for parking facilities assumed to be developed with the Proposed Action.

PRINCIPAL CONCLUSIONS

As discussed below, a screening level analysis was performed to analyze potential air quality impacts from parking facilities that would be developed with the Proposed Action, and a detailed microscale analysis was performed to evaluate potential air quality impacts at traffic intersections in the study area. Screening and refined analyses were performed to evaluate potential air quality impacts associated with the Proposed Actions' stationary sources of emissions. A refined analysis was performed to evaluate potential air quality impacts at certain development and enlargement sites from existing stationary sources of emissions. An industrial analysis was performed to evaluate potential emissions of toxic air contaminants at development and enlargement sites from existing industrial sources. The analyses conducted for the Proposed

Action concluded that, with the implementation of the proposed (E) designations (E-288), there would be no significant adverse air quality impacts.

As discussed below, the maximum predicted increase in concentrations from mobile sources with the Proposed Action would be below applicable National Ambient Air Quality Standards (NAAQS) and the city's current interim guidance criteria for particulate matter less than 2.5 microns in diameter ($PM_{2.5}$). The parking facilities assumed to be developed as a result of the Proposed Action would also not result in any significant adverse air quality impacts.

The stationary source analysis determined that at certain projected and potential development or enlargement sites, environmental requirements would be necessary to ensure that emissions from heat and hot water systems would not result in a significant adverse impact. ~~At these sites,~~ An (E) designation~~s~~ would be assigned to the affected sites as part of the Proposed Action to address the potential effects of specific pollutants, if applicable, to ensure that the developments would not result in any significant air quality impacts from heat and hot water systems emissions due to individual or groups of development sites. The proposed (E) designations for these sites are presented in **Appendix 5**.

~~Four~~ Three existing buildings—201 Varick Street, ~~233 Spring Street,~~ 345 Hudson Street, and 75 Varick Street, and one proposed No-Action enlargement, One SoHo Square (located at 161 Avenue of the Americas)—were found to have potential significant adverse air quality impacts on development that would occur with the Proposed Action (at Projected Development Sites 1, 4, 6, ~~16~~ and 19; Potential Development Site 24; and Projected Enlargement Site 2), based on their potential emissions. Restrictions would be necessary for these seven affected development and enlargement sites with respect to the placement of operable windows and air intakes. An (E) designation would be assigned to the affected sites as part of the Proposed Action to enforce the restrictions on these projected and potential sites. The proposed (E) designations for these sites are presented in **Appendix 5**.

Zoning Resolution Section 11-15, "Environmental Requirements", and Chapter 24 of Title 15 of the Rules of the City of New York (the E-Rule) allow for the modifications of the measures required under an (E) designation based on new information or technology, additional facts or updated standards that are relevant at the time the site is ultimately developed. Since the air quality analyses are based on conservative assumptions due to the absence of information on the actual design of buildings that would be constructed, the actual design of buildings may result in modification of the (E) designation measures under these procedures.

Nearby existing sources from manufacturing or processing facilities were also analyzed for their potential impacts on the projected and potential development sites. The results of the industrial source analysis demonstrated that there would be no significant adverse air quality impacts resulting from these existing sources on the Proposed Action.

B. POLLUTANTS FOR ANALYSIS

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

CARBON MONOXIDE

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

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

NITROGEN OXIDES, VOCS, AND OZONE

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

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated criteria pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and not a local concern from mobile sources. ~~(NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source.)~~ However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant. An assessment of NO_2 emissions from stationary sources at projected and potential development sites was conducted, following the *CEQR Technical Manual* and EPA guidance. In addition, potential impacts of NO_2 emissions from large existing sources in the vicinity of development sites were evaluated.

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

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

LEAD

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

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

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

As described below, PM is regulated in two size categories: particles with an aerodynamic diameter of less than or equal to 2.5 micrometers ($PM_{2.5}$), and particles with an aerodynamic diameter of less than or equal to 10 micrometers (PM_{10}, which includes $PM_{2.5}$). $PM_{2.5}$ has the ability to reach the lower regions of the respiratory tract, delivering with it other compounds that adsorb to the surfaces of the particles, and is also extremely persistent in the atmosphere. $PM_{2.5}$ is mainly derived from combustion material that has volatilized and then condensed to form primary PM (often soon after the release from a source exhaust) or from precursor gases reacting in the atmosphere to form secondary PM. EPA recently lowered the primary annual standard to 12 micrograms per cubic meter ($\mu g/m^3$).

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

An assessment of PM emissions from heat and hot water systems at the projected and potential development sites was conducted, following the *CEQR Technical Manual* and EPA guidance. The potential impacts of PM emissions from existing buildings on the projected and potential development sites were also analyzed, following the *CEQR Technical Manual* guidance.

SULFUR DIOXIDE

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

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

NONCRITERIA POLLUTANTS

In addition to the criteria pollutants discussed above, noncriteria pollutants may be of concern. Noncriteria pollutants are emitted by a wide range of man-made and naturally occurring sources. Emissions of noncriteria from industries are regulated by EPA. Federal ambient air quality standards do not exist for noncriteria pollutants; however, the New York State Department of Environmental Conservation (NYSDEC) has issued standards for certain noncriteria compounds, including beryllium, gaseous fluorides, and hydrogen sulfide. NYSDEC has also developed guideline concentrations for numerous noncriteria pollutants. The NYSDEC guidance document DAR-1 (October 2010)[1] 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

[1] NYSDEC DAR-1 (Air Guide-1) AGC/SGC Tables, October 2010.

assessing exposure to noncriteria pollutants. These exposure guidelines are used in health risk assessments to determine the potential effects to the public.

C. AIR QUALITY STANDARDS, REGULATIONS AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the Clean Air Act (CAA), primary and secondary NAAQS have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM (24-hour), and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 14-1**. The NAAQS for CO, annual NO_2, and 3-hour SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended particulate matter (TSP), settleable particles, non-methane hydrocarbons (NMHC), 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the noncriteria pollutants beryllium, fluoride, and hydrogen sulfide (H_2S).

EPA recently announced a final decision to lower the primary annual average standard for $PM_{2.5}$ from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

EPA 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.

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

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

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

Table 14-1
National Ambient Air Quality Standards (NAAQS)

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average (1)	9	10,000	None	
1-Hour Average (1)	35	40,000		
Lead				
Rolling 3-Month Average (2)	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average (3)	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average (4)	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average (1)	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean (5)	NA	12 ~~15~~	NA	15
24-Hour Average (6)	NA	35	NA	35
Sulfur Dioxide (SO_2) (7)				
1-Hour Average (8)	0.075	197	NA	NA
Maximum 3-Hour Average (1)	NA	NA	0.50	1,300

Notes:
ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable
All annual periods refer to calendar year.
PM concentrations (including lead) are in µg/m^3 since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m^3 are presented.
(1) Not to be exceeded more than once a year.
(2) EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.
(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.
(5) EPA has lowered the NAAQS down from 15 µg/m^3, effective March 2013.
(6) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
(7) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.
(8) 3-year average of the annual 99th percentile daily maximum 1-hr average concentration.
Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

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

Manhattan has been designated as a moderate NAA for PM_{10}. On December 17, 2004, EPA took final action, designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ NAA under the CAA due to exceedance of the annual average standard. Based on recent monitoring data (2007-2010 during the 2006-2009 period, as well as more recent data), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. EPA has determined that the area has attained the 1997 $PM_{2.5}$ NAAQS, effective December 15, 2010. As stated earlier, EPA has recently lowered the annual average primary standard to 12 µg/m^3. EPA will make initial attainment designations by December 2014. Based on analysis of 2009-2011 monitoring data, it is likely that the region will be in attainment for the new standard.

In October 2009 EPA finalized the designation of the New York City Metropolitan Area as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS, effective in November 2009. The nonattainment area includes the same 10-county area originally designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2008-2010), 24-hour average concentrations of $PM_{2.5}$ in this area no longer exceed the annual standard. New York has submitted a “Clean Data” request to the USEPA. Any requirement to submit a SIP is stayed until EPA acts on New York’s request.

The five New York City counties, Nassau, Rockland, Suffolk, Westchester, and Lower Orange County Metropolitan Area (LOCMA) counties had been designated as a severe NAA for ozone (1-hour average standard). On June 18 January 25, 2012, EPA proposed to determined that the New York-New Jersey-Long Island NAA Metropolitan Area (NYMA) has attained the standard. Although this is not yet a redesignation to attainment status, this determination would removes further requirements under the 1-hour standard.

On April 15, 2004, EPA designated the same counties as moderate non-attainment for the 1997 8-hour average ozone standard. On February 8, 2008, NYSDEC submitted final revisions to the SIP to EPA to address the 1997 8-hour ozone standard. On June 18 January 25, 2012, EPA proposed to determined that the New York-New Jersey-Long Island NAA NYMA has attained the 1997 8-hour ozone NAAQS (0.08 ppm). Although not yet a redesignation to attainment status, this determination removes further requirements under the 1997 8-hour standard.

In March 2008 EPA strengthened the 8–hour ozone standards. EPA designated the counties of Suffolk, Nassau, Bronx, Kings, New York, Queens, Richmond, Rockland, and Westchester (NY portion of the New York-Northern New Jersey-Long Island, NY-NJ-CT NAA) as a marginal NAA for the 2008 ozone NAAQS effective July 20, 2012. SIPs are due in 2015.

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

EPA has established a 1-hour SO_2 standard, replacing the former 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. EPA plans to make final attainment designations in 2013. SIPs for nonattainment areas will be due by 2015.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The State Environmental Quality Review Act (SEQRA) regulations and the *CEQR Technical Manual* state that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 14-1**) would be deemed to have a potential significant adverse impact. Similarly, for non-criteria pollutants, predicted exceedance of the DAR-1 guideline concentrations would be considered a potential significant adverse impact.

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

DE MINIMIS CRITERIA REGARDING CO IMPACTS

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

$PM_{2.5}$ INTERIM GUIDANCE CRITERIA

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts[2]. This policy applies only to facilities applying for permits or major permit modifications subject to SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 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 Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

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

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

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

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

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

The above CEQR interim guidance criteria were used to evaluate the significance of predicted impacts of the Proposed Action on $PM_{2.5}$ concentrations and determine the need to minimize particulate matter emissions from the Proposed Action.

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

INTRODUCTION

This section presents the methodologies, data, and assumptions used to conduct the air quality analyses for the Proposed Action. The following mobile source and stationary source analyses were conducted for the expected year for project completion (2022):

Mobile Source Analyses

- On Street Sources
  - Potential $PM_{2.5}$ impacts from vehicle trips generated by the Proposed Action.
- Parking Garage
  - Potential CO impacts from ventilation of the parking garages.
- Holland Tunnel Emissions
  - Evaluation of potential impacts from tunnel ventilation structures and exit portals.

Stationary Source Analyses

- Heating and Hot Water Systems
  - Potential impacts from the individual heat and hot water systems at the projected and potential development sites.
  - Potential impacts from the heat and hot water systems serving large existing buildings within 400 feet of a development site.
- Cumulative Impacts from Heating and Hot Water Systems

  - Potential cumulative impacts from a group or "cluster" of heat and hot water systems.
- Industrial Sources
  - Potential air toxic pollutant impacts from uses in the nearby manufacturing zone.

MOBILE SOURCES

ON STREET SOURCES

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

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

Vehicle Emissions

Vehicular $PM_{2.5}$ engine emissions factors were computed using the EPA mobile source emissions model, MOBILE6.2.[1] This emissions model is capable of calculating engine emissions 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 the New York City Department of Environmental Protection (DEP).

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

Appropriate credits were used to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system comply with emissions

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[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).

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

In accordance with the *CEQR Technical Manual* guidance, $PM_{2.5}$ emission rates also include fugitive road dust to account for their impacts in local microscale analyses.[1] However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analysis, since based on current DEP guidance it is considered it to have 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 Action (see Chapter 13, “Transportation”). Traffic data for the future No-Action and With-Action conditions were employed in the respective air quality modeling scenarios. The weekday morning and evening peak hour traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the existing condition and No-Action condition, and off-peak increments from the Proposed Action, were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations.

Dispersion Model for Microscale Analyses

To determine motor vehicle generated $PM_{2.5}$ concentrations adjacent to streets in the Rezoning Area, the CAL3QHCR model was applied. This is a refined version of the CAL3QHC model Version 2.0.[2] The CAL3QHCR model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHCR predicts emissions and dispersion of $PM_{2.5}$ from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to predict the number of idling vehicles. The CAL3QHCR model can utilize hourly traffic and meteorology data, and is therefore appropriate for calculating 24-hour and annual average concentrations.

Meteorology

In general, the transport and concentration of pollutants from vehicular sources are influenced by three principal meteorological factors: wind direction, wind speed, and atmospheric stability. Wind direction influences the direction in which pollutants are dispersed, and atmospheric stability accounts for the effects of vertical mixing in the atmosphere. These factors, therefore, influence the concentration at a particular prediction location (receptor). Using the CAL3QHCR model, hourly concentrations were predicted based on hourly traffic data and five years (~~2005-2009~~ 2006-2010) of monitored hourly meteorological data. The data consist of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

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[1] EPA, Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1, NC, http://www.epa.gov/ttn/chief/ap42, ~~December 2003~~ January 2011.

[2] 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.

Analysis Year

The microscale analyses were performed for "Existing Conditions" in 2011 and future conditions in 2022. The future analysis was performed for traffic conditions in the No-Action and With-Action conditions.

Background Concentrations

Background concentrations are those pollutant concentrations originating from distant sources that are not directly included in the modeling analysis, which directly accounts for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations are added to modeling results to obtain total pollutant concentrations at an analysis site. $PM_{2.5}$ impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ interim guidance criteria. Therefore, a background concentration for $PM_{2.5}$ is not included.

Analysis Sites

Two analysis sites were selected for microscale analysis (see **Table 14-2**). Analysis Site ~~2~~1 was selected due to the heavy traffic congestion and the high level of project-generated traffic expected at this location. Analysis Site ~~1~~2 was selected because it is the location in the study area where the largest level of project-generated traffic is expected, and, therefore, where the greatest air quality impacts and maximum changes in concentrations would be expected.

Table 14-2
Mobile Source Analysis Sites

Analysis Site	Location
1	Varick Street and Broome Street
2	Varick Street and Spring Street

Receptor Placement

Multiple receptors (i.e., locations at which concentrations are predicted) were modeled at 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 analysis model for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters from the nearest moving lanes, based on the current DEP procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

PARKING GARAGE

The Proposed Action would include accessory parking garages to account for the new parking demand. Emissions from vehicles using the garages could potentially affect future ambient levels of CO in the vicinity of the garage exhaust vents. Therefore, an analysis was conducted to determine the potential for significant adverse impacts from the proposed garages' exhaust vents. Of the parking facilities associated with the development sites, the garages at Projected Development Site 3 and the adjacent Projected Development Site 12 were selected for analysis. These sites are located across the street from each other and collectively have the greatest potential parking demand, and therefore the highest potential air quality impact. Since the parking garages for these sites has not been designed, it was conservatively assumed that each of the garages would have one vent that would exhaust air onto Spring Street, i.e., that the vents for the two garages analyzed would be facing each other, potentially affecting the same sidewalk receptors. Representative receptor locations on the developments on Sites 3 and 12 were also modeled.

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

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

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

A persistence factor of 0.79 was used to convert the calculated 1-hour average maximum concentrations to 8-hour averages, accounting for meteorological variability over the average 8-hour period. Background CO concentrations and concentrations from on-street traffic were added to the parking garage modeling results to obtain the total ambient CO levels. The 8-hour average background concentration used in the analysis was 2.0 ppm, which is based on the highest second-highest 8-hour measurements over the most recent five-year period for which complete monitoring data are available (2006-2010). The 1-hour CO background used in the analysis was 3.4 ppm and was obtained using the same procedure as the 8-hour average background. The monitored values were obtained at the Queens College 2 monitoring station, which is the currently operating monitoring station nearest to the Rezoning Area.

HOLLAND TUNNEL EMISSIONS

Potential air quality impacts from the Holland Tunnel itself are not considered to be significant since the Rezoning Area is not located near any sources of tunnel emissions, i.e., the tunnel ventilation structures or exit portals. There are four tunnel ventilation buildings, two on each side of the Hudson River. The closest ventilation building is located on the west side of Washington Street between Canal Street and Spring Street, approximately 300 feet away from the nearest development site (Projected Development Site 9). The exit portal of the tunnel is located on the south side of Canal Street, east of Hudson Street, approximately 500 feet away from the nearest development site (Projected Development Site 1). The entrance portal is located approximately 70 feet from the nearest development site (Potential Development Site 23); however, the entrance portal is not a source of emissions in the area since vehicles entering the tunnel would pull air into the tunnel rather than release tunnel air to the surroundings, and because the tunnel portals are maintained under a negative pressure provided by the tunnel's mechanical ventilation systems. As described above, a mobile source analysis was conducted to examine the potential air quality impacts on the Proposed Action from traffic approaching the tunnel entrance.

STATIONARY SOURCES

A stationary source analysis was conducted to evaluate potential impacts from the development sites' fossil fuel-fired heat and hot water systems. In addition, an assessment was conducted to determine the potential for impacts due to combustion sources and industrial activities within the Rezoning Area. The project-related (i.e., projected and potential) development sites analyzed are described in Chapter 1, "Project Description".

The stationary source analysis reflects the proposed enlargement at 161 Avenue of the Americas (referred to as the One SoHo Square development), since this site includes 233 Spring Street, which was analyzed as an existing emission source in the DEIS. In addition, the proposed enlargement of One SoHo Square would utilize excess development rights from 26 Vandam Street, which had been identified in the DEIS as Potential Enlargement Site 4. Because the excess development rights are being transferred to One SoHo Square rather than being used in an on-site development, Potential Enlargement Site 4 is no longer considered as a development site under the Proposed Action.

INDIVIDUAL HEAT AND HOT WATER SOURCES

Screening Analysis

A screening analysis was performed to assess air quality impacts associated with emissions from heat and hot water systems associated with each projected and potential development site. The methodology described in the *CEQR Technical Manual* was used for the analysis and considered impacts on sensitive uses (i.e., existing residences and other developments under construction).

The methodology determines the threshold of development size below which the action would not have a significant adverse impact. The screening procedures utilize information regarding the type of fuel to be used, the maximum development size, and the heat and hot water systems exhaust stack height to evaluate whether a significant adverse impact may occur. Based on the distance from the development site to the nearest building of similar or greater height, if the maximum development size is greater than the threshold size in the *CEQR Technical Manual,* 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.

Since information on the heat and hot water systems' design was not available, each projected and potential development site was evaluated with the nearest existing or proposed residential development of a similar or greater height analyzed as a potential receptor. The maximum floor area of each projected and potential development site from RWCDS was used as input for the screening analysis.

It was assumed that No. 2 fuel oil or natural gas would be used in the heat and hot water systems for new construction and conversion sites, and that exhaust stacks would be located 3 feet above roof height (as per the *CEQR Technical Manual*). For enlargement sites, it was conservatively assumed that No. 4 fuel oil, No. 2 fuel oil, or natural gas would be used. For sources that did not pass the screening analyses using the *CEQR Technical Manual* procedures, a refined modeling analysis was performed. For fuel oil, the primary pollutants of concern are SO_2 and PM, while for natural gas, the primary pollutant of concern is NO_2.

Refined Dispersion Modeling Analysis

Development sites that did not pass the screening analysis were further analyzed using a refined dispersion model, the EPA/AMS AERMOD dispersion model[1]. A description of the methodology and assumptions used in the AERMOD analysis follows. To address potential impacts associated with the emissions of $PM_{2.5}$ from certain development and enlargement sites, a more detailed ("second tier") refined modeling analysis using the AERMOD was undertaken, as discussed further below.

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

The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability to calculate pollutant concentrations at locations where the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. The analyses of potential impacts from exhaust stacks were made assuming stack tip downwash, urban dispersion and surface roughness length, and elimination of calms. AERMOD can be run with and without building downwash (the downwash option accounts for the effects on plume dispersion created by the structure the stack is located on, and other nearby structures). In general, modeling "without" building downwash produces higher estimates of pollutant concentrations when assessing the impact of elevated sources on elevated receptor locations. Therefore, the analysis was performed using the AERMOD model with the no downwash option only.

For the refined analysis, the exhaust stacks for the heat and hot water systems were assumed to be located at the edge of the development or enlargement massing closest to the receptor, unless the source and receptor were immediately adjacent to each other. In these cases, the stack was assumed to be located at an initial distance of 10 feet from the nearest receptor. For Projected Development Site 18, which would undergo residential conversion, the current exhaust stack location was used in the analysis.

The refined dispersion modeling analysis was performed for $PM_{2.5}$, NO_2 and SO_2 (for sites where fuel oil was modeled). The analysis was then performed using calculated emission rates for fuel oil and natural gas. If a source could not meet the NO_2 NAAQS or $PM_{2.5}$ interim guidance criteria, the stack would then be set back in 5 foot increments until the source met the respective criteria.

Methodology Utilized for Estimating 1-Hour NO_2 Concentrations

EPA has recently issued guidance for assessing 1-hour average NO_2 concentrations for compliance with NAAQS.[2] Background concentrations are currently monitored at several sites within New York City, which are used for reporting concentrations on a "community" scale. Because this data is compiled on a 1-hour average format, it can be used for comparison with the new 1-hour standards. Therefore, background 1-hour NO_2 concentrations currently measured at

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[1] EPA, AERMOD: Description Of Model Formulation, 454/R-03-004, September 2004; and EPA, User's Guide for the AMS/EPA Regulatory Model AERMOD, 454/B-03-001, September 2004 and Addendum December 2006.

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

the community-scale monitors can be considered representative of background concentrations for purposes of assessing the impact of heat and hot water systems.

EPA's preferred regulatory stationary source model, AERMOD, is capable of producing detailed output data that can be analyzed at the hourly level required for the form of the 1-hour standards. EPA has also developed guidance to estimate the transformation ratio of NO_2 to NO_x, applicable to heating and hot water systems, as discussed further below.

1-Hour average NO_2 concentration increments associated with proposed and existing heat and hot water systems were estimated using AERMOD model's Plume Volume Molar Ratio Method (PVMRM) module to analyze chemical transformation within the model. The PVMRM module incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. Ozone concentrations were taken from the DEC Queens College monitoring station that is the nearest ozone monitoring station and had complete five years of hourly data available. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust stack was assumed, which is considered representative for boilers.

Meteorological Data

The meteorological data set consisted of five consecutive years of meteorological data: surface data collected at LaGuardia Airport (2006–2010) and concurrent upper air data collected at Brookhaven, New York. The meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevation over the 5-year period. These data were processed using the EPA AERMET program to develop data in a format that can be readily processed by the AERMOD model. The land uses around the site where meteorological surface data were available were classified using categories defined in digital United States Geological Survey (USGS) maps to determine surface parameters used by the AERMET program.

Background Concentrations

To estimate the maximum expected pollutant concentration at a given location (receptor), the predicted impacts must be added to a background value that accounts for existing pollutant concentrations from other sources that are not directly accounted for in the model (see **Table 14-3**). To develop background levels, concentrations measured at the most representative NYSDEC ambient monitoring station over the latest available 5-year period (2006-2010) were used for annual average NO_2 and 3-hour average SO_2 background (consistent with DEP guidance), while the latest available 3-year period was used for the 24-hour PM_{10} background concentration. Note that the background concentrations for the 1-hour and 24-hour standards are consistent with the form of the NAAQS.

Table 14-3
Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration (µg/m^3)	NAAQS (µg/m^3)
NO_2	Annual[1]	Queens College 2, Queens	67.7	100
	1-hour[2]		126.1	188
SO_2	1-hour[3]	Queens College 2, Queens	78.2	196
	3-hour[4]		102	1,300
PM_{10}	24-Hour[5]	Division Street, Manhattan	52	150

Notes:
(1) Annual average NO_2 background concentration is based on the 5-year highest value from 2006–2010.
(2) The 1-Hour NO_2 background concentration is based on the maximum 98th percentile 1-Hour NO_2 concentration averaged over three years of data, from 2009–2011.
(3) The 1-Hour SO_2 background concentration is based on the maximum 99th percentile concentration averaged over three years of data, from 2008–2010.
(4) The 3-hour SO_2 background concentration is based on the 5-year highest second-highest measured value from 2006–2010.
(5) PM_{10} is based on the 3-year highest second-highest value from 2008–2010.
Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2006-2011.

Total 1-hour NO_2 concentrations were determined following methodologies that are accepted by the EPA, and which were accepted by the lead agency, in consultation with DEP, as appropriate and conservative for this review. The methodology used to determine the compliance of total 1-hour NO_2 concentrations from new and enlarged building sources with the 1-hour NO_2 NAAQS[1] was based on adding the 98th percentile modeled concentrations to the 98th percentile background monitored concentrations averaged over the latest three years. The methodology used to determine the total 1-hour NO_2 concentrations from existing sources compliance with the 1-hour NO_2 NAAQS[2] was based on adding the monitored background to modeled concentrations, as follows: hourly modeled concentrations from existing sources were first added to the seasonal hourly background monitored concentrations; then the highest combined daily 1-hour NO_2 concentration was determined at each receptor location and the 98th percentile daily 1-hour maximum concentration for each modeled year was calculated within the AERMOD model; finally the 98th percentile concentrations were averaged over the latest five years. These methodologies are recognized by EPA and the City and are referenced in EPA modeling guidance.

Receptor Placement

Discrete receptors (i.e., locations at which concentrations are calculated) were placed along the façade of the projected and potential development sites and on nearby buildings for the stationary source modeling analysis. The model receptor network consisted of operable windows, intake vents, and otherwise accessible locations such as terraces. Rows of receptors were placed in the model on the building at an elevation interval of approximately 10 feet.

Emission Estimates and Stack Parameters

Emission factors for the development sites' heating and hot water systems were developed using energy intensity data from the Air Quality Appendix of the *CEQR Technical Manual* and EPA's *Compilation of Air Pollutant Emission Factors (AP-42)*[3]. Annual fuel usage was determined using the proposed development size (square feet) and *CEQR Technical Manual* fuel consumption factors. As explained earlier, the PVMRM module was applied within AERMOD for the 1-hour NO_2 analysis. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust and an equilibrium ratio of 90 percent was assumed. Since design information is not available regarding the proposed sites energy systems, typical stack parameters for exhaust velocity, exit diameter, and temperature were determined based on expected heat and hot water systems ratings associated with the calculated fuel usage rates. These factors are more reasonable than the default assumptions in the *CEQR Technical Manual*, which are highly conservative and more appropriate for screening level analyses.

Second Tier AERMOD Analysis

To address the potential for impacts associated with the emissions of $PM_{2.5}$ from certain development and enlargement sites, a more detailed ("second tier") refined modeling analysis was undertaken. This analysis, described below, accounts for the incremental emissions of the Proposed Action as compared to the No Action scenario and the fact that heating equipment is

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

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

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

not employed on a continuous basis year-round. This more refined analysis was undertaken because the series of highly conservative assumptions that were made for the "first tier" analysis, due to the lack of specific information regarding the capacity and utilization of fossil fuel-fired heating and hot water equipment for development and enlargement sites, likely overstated exceedances of the $PM_{2.5}$ interim guidance criteria and thus the reasonably anticipated impacts of the Proposed Action. The principal conservative assumptions of the first tier analysis are summarized as follows:

- Due to the lack of specific information available regarding fossil fuel-fired heating and hot water equipment, the analysis used conservative information on fuel usage, emission factors and stack parameters;
- It was assumed for each of the development and enlargement sites that they would be developed to their maximum bulk and height envelope. This is highly conservative since the allowable development envelope exceeds the maximum development FAR that could be constructed; and
- The analysis assumed a continuous level of heating and hot water equipment usage over the five-year meteorological study period, using *CEQR Technical Manual* assumptions regarding energy consumption on an annual and short-term basis. This approach uses an annual energy consumption factor, which is then converted to a daily energy consumption rate assuming a 100 day heating season. On an annual basis it provides a reasonable estimate of annual emissions, but for the purpose of calculating short-term concentrations it is highly conservative since it assumes the heating equipment operates continuously throughout the year, even during periods when heating equipment would normally not operate, or would operate at low loads.

Given the above, the second tier analysis used revised assumptions tailored to the Proposed Action regarding No Action development and energy consumption in order to better reflect a reasonable worst-case operating scenario. All other assumptions from the first tier analysis remained unchanged. This approach remains conservative, while being more realistic than the first tier analysis. The second tier analysis was developed to address specific parameters of the Proposed Action, based upon consideration by the lead agency, acting in consultation with DEP, for the following development and enlargement sites: Projected Development Sites 2, 11, 12, 15 and 16; Potential Development Sites 20, and 22, and 23; Projected Enlargement Sites 2 and 3; and Potential Enlargement Sites 5, 10, 11, 13, 14 and 15, where the initial prediction of $PM_{2.5}$ incremental concentrations resulted in a potential significant adverse air quality impact due to the relative magnitude, frequency and extent of predicted incremental concentrations of $PM_{2.5}$ using the first tier analysis assumptions. The details of the second tier analysis are described below.

Energy Consumption Analysis - During the peak heating period in the winter, heating equipment is operated at the highest levels, at lower levels during the spring and fall, with little or no usage in the summer, while cooling equipment operates at the highest levels during the summer with lower levels in the spring and fall, with little or no usage in the winter. The second tier analysis was performed based on examination of the number of heating and cooling degree-days[1] based

[1] A heating degree-day is determined based on the number of degrees that the daily average temperature fall below 65° F during the heating season, and a cooling degree day is based on the number of degrees that the daily average temperature rises above 65° F during the heating season during the cooling season.

on historical data available for New York City. Degree-days are used as an indicator of energy utilization for heating and cooling. On a daily average basis, the highest number of degree-days is in January. Therefore, for January the emission rates estimated based on the *CEQR Technical Manual* methodology were used since they are representative of peak heating and hot water system utilization. Then, using January as a baseline, the daily heating and cooling emission rates for the other months were estimated, based on the ratio of daily average degree days for each month to the January daily average[1]. The emission rates for each month were then input into the AERMOD model to determine maximum predicted $PM_{2.5}$ incremental concentrations.

No Action Analysis - Except for Projected Development 12, all of the development and enlargement sites identified as part of the Proposed Action have a No Action development. For some of these sites, specifically, Projected Development Site 11, Potential Development Site 20, Projected Enlargement Site 3, and all of the potential enlargement sites, the Proposed Action would involve enlargements of up to two additional floors. Therefore, for most sites, the actual increase in emissions is lower than the first tier analysis assumes, and the associated change in $PM_{2.5}$ concentrations at receptor locations in certain cases may be lower; further, in cases where the existing buildings' heating and hot water systems are oil-fired, the use of natural gas (or other non-oil fuel) may represent a decrease in $PM_{2.5}$ concentrations at receptors between the No Build and Build.

Consequently, in cases where the first tier analysis of $PM_{2.5}$ incremental concentrations resulted in a potential significant adverse air quality impact, further analysis was performed to examine the incremental change in $PM_{2.5}$ at affected receptors between the No Action and With Action condition. Fuel usage was estimated using the procedure outlined in the *CEQR Technical Manual*, based on the square footage of the No Action buildings. For the existing development sites, available information was reviewed on the type of fuel used at the existing building (New York State Department of Buildings records, DEP certificates to operate, Con Edison and building operator information). Emissions were estimated using EPA AP-42 emission factors and fuel usage. Stack height, diameter exhaust temperature and flow were determined based on available information, where possible, or estimated based on the same assumptions used for the analysis of development and enlargement sites as outlined previously for the first tier refined dispersion modeling analysis. The stack location was assumed to be at the same roof location as the With Action building.

CUMULATIVE IMPACTS FROM HEAT AND HOT WATER SYSTEMS

In addition to the individual source analysis, groups or "clusters" of heat and hot water sources with similar stack heights were analyzed, in order to address the cumulative impacts of multiple sources.

This analysis was performed using the EPA-approved AERSCREEN model (version 11076, EPA, 2011). The AERSCREEN model was recently endorsed by EPA[2] as a replacement to the SCREEN3 model. If the worst-case concentrations predicted by AERSCREEN are above significant impact levels, further analysis with AERMOD is required to determine the potential for air quality impacts from the Proposed Action. However, if the worst-case concentrations

[1] Degree-day information obtained from data referenced by NYSERDA, at http://www.nyserda.ny.gov/Page-Sections/Energy-Prices-Supplies-and-Weather-Data/Weather-Data/Monthly-Cooling-and-Heating-Degree-Day-Data.aspx

[2] Memorandum, "AERSCREEN Released as the EPA Recommended Screening Model," April 11, 2011.

predicted by the AERSCREEN model are below impact levels, there is no potential for impact and no further analysis is required.

The Rezoning Area was reviewed to determine areas where clusters of development sites with similar building heights would be located which could result in cumulative impacts on nearby buildings of a similar or greater height. The AERSCREEN model considered these source groups as a single area source. A total of three clusters were selected for analysis. The locations and development sites associated with each cluster are presented in **Figure 14-1**. Cluster 1 encompasses Projected Development Site 3 and Projected Enlargement Sites 1 and 2. Cluster 2 includes Projected Development Sites 9 and 17 and Potential Development Site 21. Cluster 3 includes Projected Development Site 5 and Potential Development Site 22.

ADDITIONAL SOURCE ANALYSIS

The *CEQR Technical Manual* requires an assessment of any actions that could result in the location of sensitive uses within 1,000 feet of a large emission source (e.g., a power plant), or within 400 feet of commercial, institutional, or residential developments where the proposed structure would be of a height similar to or greater than the height of an existing emission stack. To assess the potential effects of these existing sources on the Proposed Action, a review of existing permitted facilities was conducted. Sources of information reviewed included the USEPA's Envirofacts database[1], the NYSDEC Title V and state facility permit websites[2], the New York City Department of Buildings website[3], and DEP permit data.

One facility with a state facility permit was identified: the GSA Greater Manhattan Building at 201 Varick Street, which is within 400 feet of Projected Development Site 6 and Potential Development Site 24. The primary emissions sources for this facility are four cogeneration engines that provide electricity and heat for the building, and a diesel engine generator that is limited to emergency or peak shaving operations. The four cogeneration engines operate exclusively on natural gas and exhaust above the roof through a common stack. Each engine includes a three-way catalyst at the exhaust to control emissions. For the purposes of the analysis the short-term and annual emissions from the GSA Greater Manhattan Building were based on the engines' capacities.

In addition, ~~three~~ two large existing buildings (~~233 Spring Street,~~ 345 Hudson Street and 75 Varick Street) and one proposed No Action enlargement (One SoHo Square at 161 Avenue of the Americas) within 400 feet of a projected or potential development site were identified for analysis of air quality impact on the development site. DEP permit records and information from the building owner/operator (where available) were used to determine the fuel types and fuel usage rates for these buildings. **Table 14-4** presents the emission rates and stack parameters used in the dispersion modeling analysis.

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

[2] NYSDEC Title V and State Facility permit websites: http://www.dec.ny.gov/dardata/boss/afs/issued_atv.html; http://www.dec.ny.gov/dardata/boss/afs/issued_asf.html

[3] DOB website: http://a810-bisweb.nyc.gov/bisweb/bispi00.jsp

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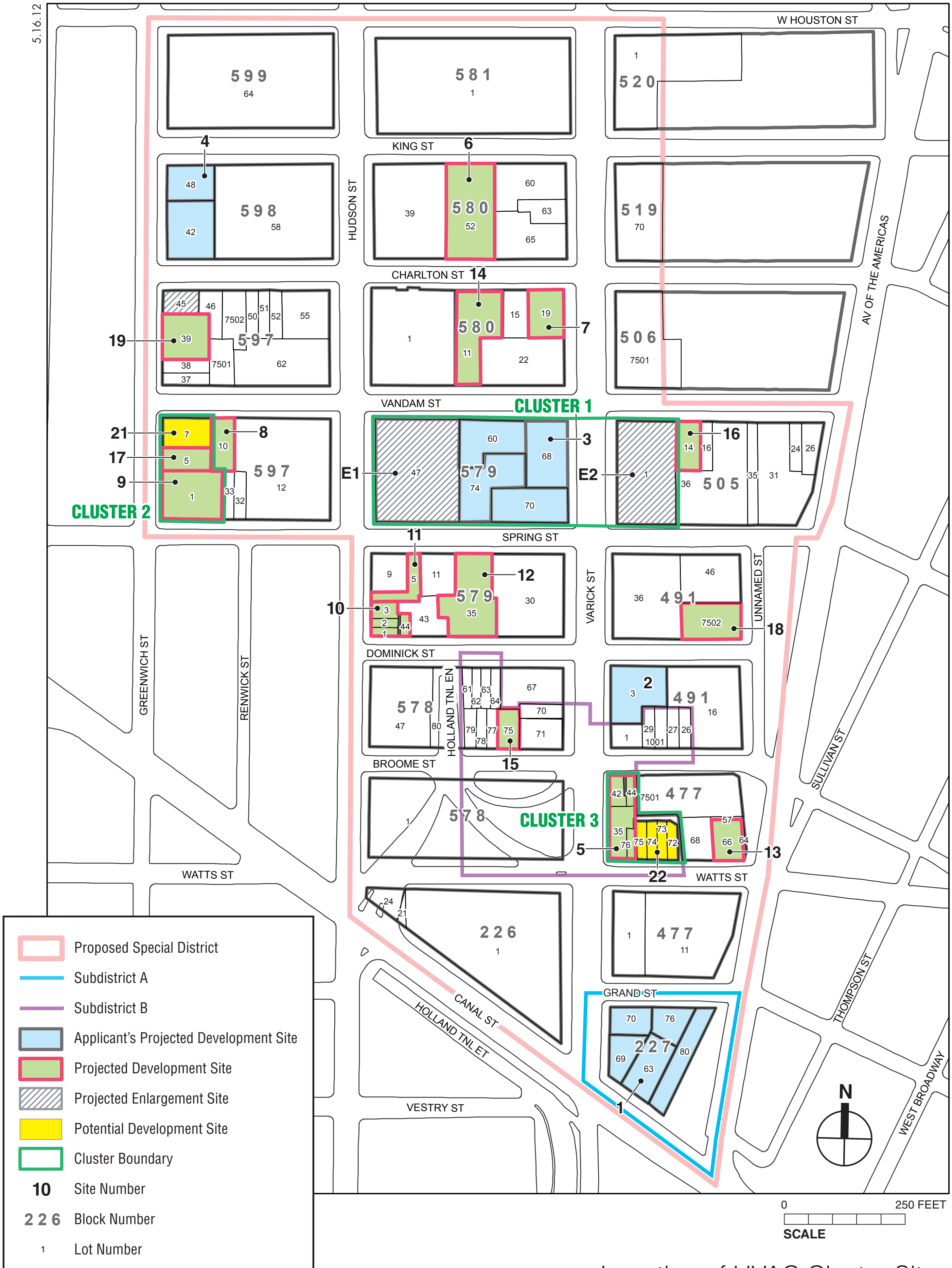

Location of HVAC Cluster Sites

Figure 14-1

Table 14-4
Emission Rates and Stack Parameters for ~~Existing Buildings~~ Additional Source Analysis

Emission Rate/Stack Parameter	201 Varick Street(1)	~~233 Spring Street~~ One SoHo Square(4)	345 Hudson Street(2,3)	75 Varick Street(2,3)
Fuel Modeled	Natural Gas	No. 4 oil	No. 2 oil / Natural Gas	No. 2 oil
NO_x (g/s)	9.58 x 10^{-2}	~~1.11~~2.71	1.05 x 10^{-1} / 2.67 x 10^{-1}	5.53 x 10^{-1}
PM_{10} (g/s)	2.02 x 10^{-2}	~~2.01~~4.90 x10^{-2}	6.02 x 10^{-3} / 1.01 x 10^{-2}	3.18 x 10^{-2}
$PM_{2.5}$ (g/s)	2.02 x 10^{-2}	~~1.45~~3.54 x 10^{-2}	4.10 x 10^{-3} / 1.01 x 10^{-2}	2.14 x 10^{-2}
SO_2 (g/s)	1.26 x 10^{-3}	1.11 X 10^{-2} ~~4.54 x 10^{-1}~~	1.11 x 10^{-3} / 1.60 x 10^{-3}	5.89 x 10^{-3}
Exhaust Height (m)	56.4	~~53.0~~78.7	84.4	84.1
Inside Diameter (m)	0.46	0.76	2.29	2.59
Exhaust Velocity (m/s)	12.8	7.8	0.9	1.2
Exhaust Temperature (K)	423	371	321	414

Notes:
(1) The emission rates, stack diameter, exhaust velocity, exhaust temperature, and stack height are based on the existing State Facility Permit and DEP Permit.
(2) The emission rates shown are based on energy consumption rates provided by the building owner/operator.
(3) The stack diameter, exhaust velocity, exhaust temperature, and stack height are based on DEP information.
(4) The ~~emission rates,~~ stack diameter, exhaust velocity, and exhaust temperature~~, and stack height~~ are based on DEP information for the existing 233 Spring Street Building. No. 4 fuel oil was modeled to reflect compliance with NYC Local Law 43 regarding the use of cleaner fuels, prior to the Proposed Action. The emission rate was estimated based on on DEP information for the existing 233 Spring Street Building prorated for the total size of the proposed development.

As with the analysis of the projected and potential development sites' heat and hot water systems, the AERMOD dispersion model was used in the analysis of the large existing buildings, with the same set of meteorological data and the same background concentration values.

INDUSTRIAL SOURCES

Pollutants emitted from the exhaust vents of existing permitted industrial facilities were examined to identify the potential for air quality impacts on the Proposed Action.

Screening Analysis

The potential impacts of existing industrial operations in the surrounding area on pollutant concentrations in the area of the Proposed Action were analyzed. All industrial air pollutant emissions sources within 400 feet of any projected or potential development site were considered for inclusion in the air quality impact analyses.

Information regarding the release of air pollutants from existing industrial sources was obtained from the DEP's Bureau of Environmental Compliance (BEC) and NYSDEC records. The DEP 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. A comprehensive search was also performed to identify NYSDEC Title V permits and permits listed in the EPA Envirofacts database.[1]

Field surveys were conducted on July 2008 and October 2011 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 surveys were compared against DEP data sources. In certain areas within the Rezoning Area, the proposed mixed-use provisions would allow existing

[1] EPA, Envirofacts Data Warehouse, http://oaspub.epa.gov/enviro/ef_home2.air, July 2010.

industrial businesses; therefore, these sources were included in the analysis since they could remain in the future.

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 lot lines of the development sites and the source sites. Predicted worst-case impacts on the development sites were compared with the short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) established by the NYSDEC and represent levels that are considered safe for inhalation exposure by the public. A significant impact would potentially occur if the predicted concentration exceeds an SGC or an AGC.

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 any projected or potential development site were combined and compared with the guideline concentrations discussed above. If a source did not pass the screening level analysis, the AERMOD refined dispersion model was used to estimate maximum potential impacts on that receptor location.

Refined Dispersion Modeling Analysis

Development sites that did not pass the industrial source screening analysis were further analyzed using the AERMOD refined dispersion model. Source input data obtained from the air permits was utilized for the refined analysis. These potential impacts were evaluated with a refined modeling analysis using the EPA/AMS AERMOD dispersion model. In all cases, the maximum emission rates and stack parameters provided in the permits were input to the model. If a stack was fitted with a rain cap, or if a horizontal stack was noted in the permit, then *CEQR Technical Manual* default values were used for the stack parameters (e.g., a 0.001 meters/second stack velocity). CEQR default values were also used if stack parameters were unavailable. If the location of the stack was not available, the stack was assumed to be located at the lot line closest to the receptor in question.

Discrete receptors (i.e., locations at which concentrations were calculated) were placed on the potentially affected development sites. The receptor network consisted of receptors located at spaced intervals along the sides of the building from the ground floor to the upper level.

Predicted worst-case impacts were compared with the SGCs and AGCs established in *NYSDEC's DAR-1 AGC/SGC Tables*.[1] A significant impact occurs if the predicted concentration exceeds an SGC or an AGC.

Health Risk Assessment

In addition, potential cumulative impacts were evaluated based on EPA's Hazard Index Approach for non-carcinogenic compounds and EPA's Unit Risk Factors for carcinogenic compounds. Both methods are based on equations that use EPA health risk information at referenced concentrations for individual compounds to determine the level of health risk posed by an expected ambient concentration of these compounds at a sensitive receptor. For non-

[1] NYSDEC Division of Air Resources, October 18, 2010.

carcinogenic compounds, EPA considers a concentration-to-reference dose level ratio of less than 1.0 to be acceptable. For carcinogenic compounds, the EPA unit risk factors represent the concentration at which an excess cancer risk of 1 in 1 million is predicted. In cases where an EPA reference dose or unit risk factor did not exist, the NYSDEC AGC was used.

E. EXISTING CONDITIONS

Representative criteria pollutant concentrations measured in recent years at NYSDEC air quality monitoring stations nearest to the Rezoning Area are presented in **Table 14-5**. The values presented are consistent with the form of the NAAQS. For example, the 8-hour ozone concentration shown is the 3-year average of the 4th highest daily maximum 8-hour average concentrations. As shown in **Table 14-5**, the recently monitored levels did not exceed the NAAQS. It should be noted that these values are somewhat different from the background concentrations used in the stationary source and parking garage analyses, since these are the most recent reported monitored values, rather than more conservative values used for dispersion modeling. The concentrations presented in **Table 14-5** provide a comparison of the air quality in the Rezoning Area with the NAAQS, while background concentrations are obtained from several years of monitoring data, and represent a conservative estimate of the highest concentrations for future ambient conditions.

Table 14-5
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	Queens College 2, Queens	ppm	8-hour	1.4	9
			1-hour	1.9	35
SO_2	Queens College 2, Queens	$\mu g/m^3$	3-hour	78	1,300
			1-hour	78.5 [1]	196
PM_{10}	Division Street, Manhattan	$\mu g/m^3$	24-hour	48	150
$PM_{2.5}$	Division Street, Manhattan	$\mu g/m^3$	Annual	12.0	15
			24-hour	26.8	35
NO_2	Queens College 2, Queens	$\mu g/m^3$	Annual	40.7	100
			1-hour	126.1 [2]	188
Lead	Morrisania, Bronx	$\mu g/m^3$	3-month	0.008	0.15
Ozone	Queens College 2, Queens	ppm	8-hour	0.075	0.075

Notes:
(1) The 1-hour value is based on a three-year average (2009-2011) of the 99th percentile of daily maximum 1-hour average concentrations.
(2) The 1-hour value is based on a three-year average (2009-2011) of the 98th percentile of daily maximum 1-hour average concentrations.
Source: NYSDEC, New York State Ambient Air Quality Report (2009-2011).

F. THE FUTURE WITHOUT THE PROPOSED ACTION

MOBILE SOURCES

PM_{10} concentrations without the Proposed Action were determined for the 2022 With-Action year using the methodology previously described. **Table 14-6** presents the future maximum predicted PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in 2022 without the Proposed Action. The values shown are the highest predicted concentrations for the receptor locations. Note that $PM_{2.5}$ concentrations for future without the Proposed Action are not presented, since impacts are assessed on an incremental basis.

Table 14-6
No-Action Condition Maximum Predicted 24-Hour Average PM_{10} Concentrations (μg/m^3)

Receptor Site	Location	Concentration
1	Varick Street and Broome Street	~~69.2~~69.5
2	Varick Street and Spring Street	~~76.0~~76.1
Note: NAAQS—24-hour average 150 μg/m^3.		

STATIONARY SOURCES

Except for Projected Development Site 12, all of the development and enlargement sites identified as part of the Proposed Action have a No Action development. Smaller as-of-right buildings would be constructed at certain development sites, and would be shorter in height as compared with the developments analyzed for the Proposed Action. At other sites, the as-of-right buildings would be larger in size as compared with the developments analyzed for the Proposed Action, and taller in height. The Proposed Action would result in a greater amount of development and therefore the emissions from the heat and hot water systems associated with the Proposed Action would cumulatively be greater than the emissions from the heat and hot water systems assumed in the No-Action condition; however, under the No Action condition, the controls measures provided in the proposed (E) designations would not be implemented.

G. THE FUTURE WITH THE PROPOSED ACTION

MOBILE SOURCES

Using the methodology previously described, PM_{10} concentrations in the No-Action and With-Action conditions were determined for the 2022 analysis year. The values shown in **Table 14-7** are the highest predicted concentrations for all receptors analyzed and include the PM_{10} ambient background concentration. The results indicate that the vehicle trips generated by the Proposed Action would not result in PM_{10} concentrations that would exceed the NAAQS.

Table 14-7
No-Action and With-Action Conditions Maximum Predicted 24-Hour Average PM_{10} Concentrations (μg/m^3)

Receptor Site	Location	No-Action	With-Action
1	Varick Street and Broome Street	~~69.2~~69.5	~~69.5~~69.6
2	Varick Street and Spring Street	~~76.0~~76.1	~~76.3~~76.5
Note: NAAQS—24-hour average 150 μg/m^3.			

Future maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared to the interim guidance criteria that would determine the potential significance of any impacts from the Proposed Action. The maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in **Table 14-8** and **Table 14-9**, respectively. $PM_{2.5}$ concentrations without the Proposed Action are not presented, since impacts are assessed on an incremental basis.

Table 14-8
Maximum Predicted 24-Hour Average $PM_{2.5}$ Increments ($\mu g/m^3$)

Receptor Site	Location	Increment
1	Varick Street and Broome Street	0.1
2	Varick Street and Spring Street	0.1
Note: $PM_{2.5}$ interim guidance criteria—24-hour average, 2 $\mu g/m^3$ (5 $\mu g/m^3$ not-to-exceed value).		

Table 14-9
Maximum Predicted Annual Average $PM_{2.5}$ Increments ($\mu g/m^3$)

Receptor Site	Location	Increment
1	Varick Street and Broome Street	0.01
2	Varick Street and Spring Street	~~0.02~~0.01
Note: $PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 $\mu g/m^3$.		

The results show that the annual and daily (24-hour) $PM_{2.5}$ increments are predicted to be well below the interim guidance criteria. Therefore, there would be no potential for significant adverse impacts on air quality from vehicle trips generated by the Proposed Action.

PARKING GARAGES

The CO levels from parking garages at the projected and potential development sites were predicted using the methodology set forth in the *CEQR Technical Manual*. Based on the projected parking demand developed for the Proposed Action, the number of vehicles entering and exiting the garages would be greatest during the weekday PM (5 PM to 6 PM) peak hour. Over the peak weekday 8-hours of garage usage, 12 PM to 8 PM, an average of 19 vehicles per hour would enter the parking garage at Projected Development Site 3, while an average of 18 vehicles per hour would exit. Over the same 8 hours, an average of 7 vehicles per hour would enter the parking garage at Projected Development Site 12, while an average of 5 vehicles per hour would exit.

The vent for each of the garages was modeled at a height of 10 feet above ground level, along Spring Street, between Hudson and Varick Streets. Pollutant levels were predicted at the height of the vents at a distance of 15 feet, accounting for the minimum vent to window distance requirements specified by the New York City Mechanical Code. Receptors (locations where CO levels were predicted) were also modeled along the Spring Street sidewalks.

The maximum predicted CO concentration from a single garage, with ambient background, and on-street traffic levels would be 4.3 ppm for the 1-hour period, and 2.5 ppm for the 8-hour period. The maximum 1- and 8-hour contributions from the parking garage alone would be ~~0.9~~ 0.6 ppm and ~~0.5~~ 0.3 ppm, respectively. Maximum potential cumulative impacts from the two garages (Sites 3 and 12) would be ~~4.7~~ 4.4 ppm for the 1-hour period, and ~~2.8~~ 2.5 ppm for the 8-hour period. These maximum predicted CO levels would be in compliance with the applicable CO NAAQS and the CO *de minimis* criteria. As these results show, the parking garages at the projected and potential development sites would not result in any significant adverse air quality impacts based on the conservative assumptions (described above) regarding the locations of the garage exhaust vents. Therefore, as the mechanical designs and exhaust locations of the parking garages would comply with applicable codes, there would be no potential for significant adverse impacts on air quality.

STATIONARY SOURCES

HEAT AND HOT WATER SYSTEMS

Screening Analysis

The screening analysis was performed to evaluate whether potential air quality impacts from the heat and hot water systems associated with the projected and potential development and enlargement sites could potentially impact other projected and potential development and enlargement sites, or existing buildings.

A total of 16 projected and potential development sites (13 projected and 3 potential) that were analyzed using No. 2 fuel oil as the fuel source (Projected Development Sites 2, 3, 4, 5, 6, 8, 11, 12, 14, 15, 16, 18, and 19 and Potential Development Sites 20, 22, and 23) were found based on the screening analysis to necessitate a refined analysis to determine whether they would have a potential significant air quality impact. Therefore, each of these development sites required a refined modeling analysis.

All of the analyzed enlargement sites using No. 4 fuel oil or No. 2 fuel oil as the fuel source were found based on the screening analysis to necessitate a refined analysis to determine whether they would to have a potential significant air quality impact. Therefore, a total of ~~15~~ 14 projected and potential enlargement sites (3 projected and ~~12~~ 11 potential) required a refined modeling analysis.

Refined Dispersion Modeling Analysis

As indicated above, 16 projected and potential development sites (13 projected and 3 potential) and ~~15~~ 14 projected and potential enlargement sites (3 projected and ~~12~~ 11 potential) required a refined modeling analysis to determine the potential for air quality impacts. The results of the refined modeling analysis determined the following:

- Two of the ~~31~~ 30 sites analyzed using refined dispersion modeling passed the refined analysis for fuel oil; therefore, no restrictions are required for these sites.
- If the fuel type is restricted to natural gas only to address $PM_{2.5}$ emissions, no significant adverse impacts are predicted at 3 of the sites.
- If the fuel type is restricted to natural gas only to address $PM_{2.5}$ and NO_2 emissions, and low NO_x burners are required to address NO_2 emissions, no significant adverse impacts are predicted at ~~4~~ 2 of the sites.
- If the fuel type is restricted to natural gas only, minimum distances are increased from the most conservative distance (building line to building line) to address $PM_{2.5}$ and NO_2 emissions, and low NO_x burners are required to address NO_2 emissions, no significant adverse impacts are predicted at ~~16~~ 15 of the sites.
- ~~If the fuel type is restricted to natural gas only, minimum distances are increased from the most conservative distance (building line to building line), and the height of the exhaust stack is increased where feasible to address $PM_{2.5}$ and NO_2 emissions, and low NO_x burners are required to address NO_2 emissions, no significant adverse impacts are predicted at 2 of sites.~~
- For the remaining four sites (Projected Development Sites 3, 6, 8, and 14), utility steam from Con Edison must be used for the building's heat and hot water systems to avoid any potential significant impacts, to address $PM_{2.5}$ emissions (at all four sites) and to address NO_2 emissions (at three of the four sites).

- In addition to the above restrictions, at Potential Enlargement Sites 9 and 15, the installation of operable windows on lot lines potentially affected by $PM_{2.5}$ from Projected Enlargement Site 10 and Potential Enlargement Site 14, respectively, would be prohibited.

~~Five~~ Four potential enlargement sites (Potential Enlargement Sites~~, 4,~~ 6, 7, 8 and 9) would need to comply with New York City Department of Buildings (DOB) Code restrictions governing placement of low temperature chimneys or gas vents for which the provisions of the existing DOB Code are more stringent than the contemplated (E) Designation requirements. Although compliance with DOB Codes would be a prerequisite for construction of any enlargement, the agency has the authority under certain circumstances to waive some or all of these restrictions. Accordingly, an (E) designation that incorporates the standards of the DOB Code would be placed on these five sites to ensure that equivalent restrictive measures on fossil fuel-fired stack exhaust placement would be implemented to avoid the potential for significant air quality impacts.

The results of the refined air quality analysis (Tier 1 and Tier 2) are presented in **Appendix 5** for the projected and potential sites. As shown in **Appendix 5**, the analysis determined that maximum concentrations of NO_2 would be less than the annual and 1-hour NAAQS for all sites for which a refined modeling analysis was performed (excluding sites that would be restricted by (E) designation to utilize Con Edison steam and potential enlargement sites that would be subject to DOB restrictions under the (E) designation, which would ensure compliance with these standards). The air quality modeling analysis also determined the highest predicted increase in $PM_{2.5}$ concentrations. The maximum projected $PM_{2.5}$ increments from the Proposed Action would be less than the applicable interim guidance criteria of 0.3 µg/m^3 on an annual basis and 5 µg/m^3 on a 24-hour average basis.

At 12 of the 30 projected and potential sites analyzed using refined modeling, with the proposed (E) designations in place, ~~at 16 projected and potential sites,~~ the maximum 24-hour average $PM_{2.5}$ incremental concentration was predicted to exceed the interim guidance criterion of 2 µg/m^3. Therefore, the $PM_{2.5}$ concentration increments with the Proposed Action were compared to the 24-hour average interim guidance criterion of 2 µg/m^3 for discrete receptor locations (see Section D, *Air Quality Standards, Regulations Benchmarks* for a description of the City's $PM_{2.5}$ interim guidance criteria). The assessment examined the magnitude, duration, frequency, and extent of the increments at locations where exposure above the 2 µg/m^3 threshold averaged over a 24-hour period could occur.

In determining the significance of 24-hour average $PM_{2.5}$ incremental concentrations greater than 2 µg/m^3, the following factors were considered. First, concentrations that were predicted to occur on proposed sites at lot line window locations were excluded from the evaluation, since these locations are not required by DOB code to have operable windows for any residential building constructed in New York City (i.e., residential spaces must be designed to be compliant with DOB codes regarding legal light and air without operable lot line windows). To ensure that these locations are constructed without operable windows, the (E) designations for the affected sites will prohibit installation of operable windows on lot lines. Second, impacts from three sites (Projected Development Site 2, Potential Development Site ~~2~~ 22 and Projected Enlargement Site 2) were predicted to occur on existing hotels with transient occupants. However, these impacts are not considered significant, since occupants would not be exposed to $PM_{2.5}$ incremental concentrations greater than 2 µg/m^{3}at the predicted annual frequencies based on dispersion modeling, considering the transient use of these hotels by guests. Based on these factors, it was determined that the predicted 24-hour average $PM_{2.5}$ incremental concentrations would not result in a significant adverse impact under the City's interim guidance criteria.

Overall, the relative magnitude, extent, and frequency of 24-hour average $PM_{2.5}$ concentrations above 2.0 $\mu g/m^3$ are low. Therefore, the Proposed Action's stationary source emissions, incorporating the proposed (E) designations, would not result in a significant adverse impact from $PM_{2.5}$ emissions based on the City's $PM_{2.5}$ interim guidance criteria.

Overall, to preclude the potential for significant adverse air quality impacts on other projected and potential development sites, or existing buildings, from the heat and hot water emissions, an (E) designation would be assigned as part of the Proposed Action for ~~29~~28 projected and potential sites (including 11 projected and 3 potential development sites, and 3 projected and ~~12~~11 potential enlargement sites). These designations would specify the various restrictions, such as type of fuel to be used, the use of low NO_x burners, the distance that the vent stack on the building roof must be from its lot line(s), ~~the increase of the exhaust stack height,~~ prohibitions on operable windows on affected lot lines, and/or the use of Con Edison utility steam. The text of the proposed (E) designations is discussed later in this section, under *Proposed (E) Designation Requirements* (see Table 14-10).

Cumulative Impacts from Heat and Hot Water Systems

An analysis was conducted to evaluate potential air quality impacts from groups or "clusters" of heat and hot water systems in close proximity with similar stack heights. Three clusters were identified: Cluster 1 encompasses Projected Development Site 3 and Projected Enlargement Sites 1 and 2. Cluster 2 includes Projected Development Sites 9 and 17 and Potential Development Site 21. Cluster 3 includes Projected Development Site 5 and Potential Development Site 22.

The analysis was first performed using AERSCREEN. Based on the cumulative effects of the sources, Cluster 1 failed the screening analysis for both No. 2 fuel oil and natural gas as potential fuel types. Cluster 2 passed the screening analysis assuming No. 2 fuel oil or natural gas as potential fuel types. For Cluster 3 (Projected Development Site 5 and Potential Development Site 22), a screening analysis was conducted only for natural gas because the individual boiler screening analysis above concluded that an (E) designation would be assigned as part of the Proposed Action for these development sites specifying the use of natural gas only as the fuel type; Cluster 3 passed the screening analysis assuming natural gas as the fuel type.

Since Cluster 1 failed the screening analysis, further analysis with AERMOD was conducted for this cluster to determine the potential for air quality impacts. The result of the refined analysis showed that Cluster 1 would not result in significant adverse air quality impacts when assuming natural gas as the fuel type.

To preclude the potential for significant adverse impacts, Projected Development Sites 3 and Projected Enlargements Sites 1 and 2, which failed the cluster analysis for No. 2 oil, but not natural gas, would be restricted to using natural gas. An (E) designation would be assigned to these sites as part of the Proposed Action to enforce this restriction on these projected and potential sites.

Additional Source Analysis

~~Four~~ Three existing buildings—201 Varick Street, ~~233 Spring Street,~~ 345 Hudson Street, and 75 Varick Street—and one proposed No Action enlargement—One SoHo Square at 161 Avenue of the Americas—were found to have potential significant adverse air quality impacts on development that would occur with the Proposed Action (at Projected Development Sites 1, 4, 6~~,~~

~~16~~ and 19; Potential Development Site 24; and Projected Enlargement Site 2), based on their potential emissions. Projected Development Site 4, which is affected by 345 Hudson Street, are both owned by the Applicant. Similarly, Projected Development Site 1, which is affected by 75 Varick Street, are both owned by the Applicant. The other ~~two~~ existing building~~s~~, 201 Varick Street ~~and 233 Spring Street~~, the proposed No Build development of One SoHo Square, and the other ~~five~~ four affected development sites—Projected Development Sites 6~~, 16~~ and 19, Potential Development Site 24, and Projected Enlargement Site 2—are not owned by the Applicant.

The results of the analysis of existing buildings determined that certain restrictions would be necessary for each of the ~~seven~~ six affected development and enlargement sites (Projected Development Sites 1, 4, 6~~, 16~~ and 19, Potential Development Site 24, and Enlargement Site 2) with respect to the placement of operable windows and air intakes. The affected areas of the sites are shown in **Appendix 5.** An (E) designation would be assigned to these sites as part of the Proposed Action to enforce the restrictions on these projected and potential sites.

Proposed (E) Designation Requirements

At affected projected and potential development sites and enlargement sites, the proposed (E) designation would specify the type of fuel to be used (or would alternately specify the use of Con Edison steam), whether low NO_x burners are required, and/or the distance that the vent stack on the building roof must be from its lot line(s). In addition, at certain development sites, the proposed (E) designation would restrict the placement of operable windows and air intakes. A summary of the proposed (E) designations is presented in **Table 14-10**.

Although the restrictions on operable windows and air intakes would potentially place some limitations on the development of these sites, it is expected that the sites would still be able to develop most or all of the maximum permitted FAR. Furthermore, for each of the projected and potential development sites and enlargement sites with a proposed (E) designation, the (E) designation process, as set forth in Zoning Resolution Section 11-15 and Chapter 24 of Title 15 of the Rules of the City of New York, allows for the modification of the measures required under an (E) designation in the event of new information or technology, additional facts or updated standards that are relevant at the time the site is ultimately developed. Since the air quality analysis is based on conservative assumptions due to the absence of information on the actual design of buildings that would be constructed, the actual design of buildings may result in modification of the (E) designation measures under these procedures. When an (E) designation is placed for more than one pollutant (e.g., for $PM_{2.5}$ and NO_2), any modifications must address the measures required with respect to each pollutant.

With the foregoing, the evaluation of $PM_{2.5}$, and thus the (E) designations, would be able to take into account the fact that air quality in New York City is expected to improve. Prior to the projected completion of the Proposed Action in 2022, the current short-term $PM_{2.5}$ NAAQS is expected to have been attained at all locations in the New York City Metropolitan Area. This will also result in lower total 24-hour average $PM_{2.5}$ concentrations with the Proposed Action. NYSDEC will also continue to address the attainment of the 24-hour NAAQS in the area, which will require further reductions in emissions of $PM_{2.5}$ and its precursors. In addition, New York City has prohibited the use of No. 6 fuel oil in new boiler installations, and is phasing out its use at existing installations, which will result in direct reductions of $PM_{2.5}$ emissions and SO_2 emissions, which is a $PM_{2.5}$ precursor. Although these measures do not address the emissions of $PM_{2.5}$ associated with Proposed Action, taken together, they are anticipated to result in an improvement in air quality in the Rezoning Area, resulting in significant reductions from current levels of the ambient background $PM_{2.5}$ concentrations and, consequently, in the total $PM_{2.5}$ concentrations with the Proposed Action.

Table 14-10
Proposed (E) Designations

Site	Block	Lot(s)	Proposed Restriction
Projected Development Site 1	~~226~~ **227**	~~1~~**63,69,70,76, 80**	No operable windows or air intakes on the northern, western, and southern facades between a height of 265 feet and 290 feet above grade
Projected Development Site 2	491	~~2~~ 3	Natural gas, stack location and low NO_x burners
Projected Development Site 3	579	60, 68, 70, 74	Con Edison Steam
Projected Development Site 4	598	42, 48	~~Natural gas;~~ No operable windows or air intakes on the northern, eastern, and southern facades between a height of 255 feet and 300 feet above grade
Projected Development Site 5	477	35, 42, 44, 76	Natural gas and low NO_x burners
Projected Development Site 6	580	52	Con Edison Steam; no operable windows or air intakes on the northern, eastern, and western facades above a height of ~~170~~ 160 feet above grade
Projected Development Site 8	597	10	Con Edison Steam
Projected Development Site 11	579	5	Natural gas, stack location and low NO_x burners
Projected Development Site 12	579	35	Natural gas, stack location and low NO_x burners
Projected Development Site 14	580	11	Con Edison Steam
Projected Development Site 15	578	75	Natural gas, stack location and low NO_x burners
Projected Development Site 16	505	14	Natural gas, stack location and low NO_x burners~~; no operable windows or air intakes on the northern, eastern, and southern facades above a height of 170 feet above grade~~
Projected Development Site 18	491	7502	Natural gas
Projected Development Site 19	~~598~~ **597**	~~58~~**39**	No operable windows or air intakes on the northern, eastern, and western facades between a height of 265 feet and 280 feet above grade
Potential Development Site 20	597	46	Natural gas, stack location and low NO_x burners
Potential Development Site 22	477	72 to 75	Natural gas, stack location and low NO_x burners
Potential Development Site 23	578	77 to 79	Natural gas, stack location and low NO_x burners
Potential Development Site 24	580	60	No operable windows or air intakes on the northern, eastern, and western facades between a height of 160 and 260 feet above grade
Projected Enlargement Site 1	579	47	Natural gas
Projected Enlargement Site 2	505	1	Natural gas, stack location and low NO_x burners; no operable windows or air intakes on the northern, eastern, and southern facades between a height of ~~175 and 230~~245 to 320 feet above grade
Projected Enlargement Site 3	597	45	Natural gas, stack location and low NO_x burners
~~Potential Enlargement Site 4~~	~~505~~	~~16~~	~~Stack must meet DOB Code restrictions on placement~~
Potential Enlargement Site 5	505	26	Natural gas, stack location and low NO_x burners
Potential Enlargement Site 6	597	32	Stack must meet DOB Code restrictions on placement
Potential Enlargement Site 7	597	33	Stack must meet DOB Code restrictions on placement
Potential Enlargement Site 8	597	50	Stack must meet DOB Code restrictions on placement
Potential Enlargement Site 9	597	52	Stack must meet DOB Code restrictions on placement; no operable lot line windows on the western façade
Potential Enlargement Site 10	597	51	Natural gas, stack location and low NO_x burners
Potential Enlargement Site 11	491	1	Natural gas, stack location and low NO_x burners
Potential Enlargement Site 12	491	26	Natural gas ~~and stack location~~
Potential Enlargement Site 13	491	27	Natural gas, stack location and low NO_x burners
Potential Enlargement Site 14	578	70	Natural gas, stack location and low NO_x burners
Potential Enlargement Site 15	597	37	Natural gas and low NO_x burners; no operable lot line windows on the eastern façade

For those sites which have a proposed (E) designation restricting fuel type, stack location, ~~stack height,~~ and/or requiring the use of low NO_x burners, an alternate method of demonstrating that there would be no potential for significant adverse impacts would be by utilizing Con Edison steam for heating.

The text of the proposed air quality (E) designations is set forth in **Appendix 5**.

INDUSTRIAL SOURCE ANALYSIS

Screening Analysis

As discussed above, a study was conducted to analyze industrial uses within 400 feet of the projected and potential development sites, large sources within 1,000 feet of a projected or potential development site, and commercial, institutional and large-scale residential sources within 400 feet of a projected or potential development site. DEP and NYSDEC permit databases were used to identify existing sources of emissions. A total of 18 facilities (consisting of 25 emissions sources) were analyzed. The predicted concentrations at each affected development site were then compared with the applicable SGCs and AGCs. As a result of the screening procedures, the SGCs and AGCs were predicted to be exceeded at three projected development sites (6, 15, and 16), two potential development sites (23 and 24), and two potential enlargement sites (5 and 15). The AERMOD refined dispersion model was then used to estimate maximum potential impacts at these locations. At all other projected and potential sites, the maximum concentration levels were predicted to be below the air toxic guideline levels and therefore would not result in any significant adverse air quality impacts.

Refined Dispersion Modeling Analysis

Table 14-11 presents the maximum predicted impacts at the projected and potential development and enlargement sites using the AERMOD refined dispersion model. As shown in **Table 14-11**, for all projected and potential development and enlargement sites that failed the initial screening analysis, the refined modeling demonstrates that there would be no predicted significant adverse air quality impacts on these development sites from existing industrial sources in the area.

Table 14-11
Maximum Predicted Impacts on Projected and Potential Sites from Industrial Sources

Pollutant	Chemical Abstracts Service (CAS) Number	AERMOD Model Short-Term Impact (µg/m3)	SGC	AERMOD Model Annual Impact (µg/m3)	AGC
Formaldehyde	00050-00-0	11	30	0.0003	0.06
Acetic Acid	00064-19-7	54	3,700	0.1	60
Isopropyl Alcohol	00067-63-0	82,587	98,000	422.6	7,000
2-Butoxyethanol	00111-76-2	1,200	14,000	7.7	1,600
Xylene	01330-20-7	1,285	4,300	1.3	100
Ammonium Hydroxide	01336-21-6	2,085	2,400	13.3	100
Phosphoric Acid	07664-28-2	11	300	0.003	10
Total Aliphatic Acid	NY559-00-0	956	---	1.7	3,200
Particulates	NY075-00-0	11	380	0.01	45

Health Risk Assessment

Cumulative impacts were also determined for the combined effects of multiple air contaminants in accordance with the approach described above in the "Methodology for Predicting Pollutant Concentrations" section. Using the predicted concentrations of each pollutant, the maximum hazard index and total cancer risk were calculated for each affected projected and potential development and enlargement site associated with the Proposed Action. The hazard index approach was used to determine the effects of multiple non-carcinogenic compounds and unit risk factors were used to determine the effects of carcinogenic compounds. As shown in **Table 14-12,** the results of this assessment indicated that there would be no significant adverse air quality impacts on the projected and potential development and enlargement sites because the hazard index for any affected site would not exceed 1.0 and the cancer risk would not exceed one in one million.

Table 14-12
Estimated Maximum Cancer Risk and Hazard Index

Pollutant	CAS Number	Estimated Pollutant Concentration (ug/m3)	AGC (ug/m3)	Concentration to AGC Pollutant Ratio
Carcinogenic Compounds				
Formaldehyde	00050-00-0	2.70E-04	5.0E-01	5.40E-04
Tetrachloroethylene	00127-18-4	4.17E-03	1.0E+00	4.17E-03
			Total Estimated Cancer Risk	**4.71E-09**
			Cancer Risk Threshold Value	**1.00E-06**
Non-Carcinogenic Compounds				
Acetic Acid	00064-19-7	1.15E-01	6.0E+01	1.92E-03
Isopropyl Alcohol	00067-63-0	4.23E+02	7.0E+03	6.04E-02
Methyl Ethyl Ketone	00078-93-3	1.95E+01	5.0E+03	3.89E-05
2-Butoxyethanol	00111-76-2	7.66E+00	1.6E+03	4.79E-03
Butyl Acetate	00123-86-4	8.90E-02	1.7E+04	5.24E-06
Xylene	01330-20-7	1.29E+00	1.0E+02[(1)]	1.29E-02
Ammonimum Hydroxide	01336-21-6	1.33E+01	1.0E+02	1.33E-01
Phosphoric Acid	07664-28-2	2.74E-03	1.0E+01	2.74E-04
Total Aliphitic Hydrocarbon	NY559-00-0	1.66E+00	3.2E+03	5.19E-04
Particulates	NY075-00-0	8.56E-02	4.5E+01	1.90E-03
			Total Hazard Index	**2.16E-01**
			Hazard Index Threshold Value	**1.00E+00**

Note: [(1)] Rfc Values (ug/m3) established by the EPA's Inhalation Risk Information System (IRIS) were used instead of the AGC.

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