CHAPTER 15: AIR QUALITY

A. INTRODUCTION

This chapter examines the potential for air quality impacts that may result from the Proposed Actions. Ambient air quality may be affected by pollutants produced by motor vehicles, referred to as "mobile sources," and by fixed facilities referred to as "stationary sources." Both types of sources can be on-site direct sources located within the development and indirect sources located off-site.

Fossil fuel-fired heat and hot water systems are anticipated at each Projected and Potential Development Site. A stationary source analysis was conducted to evaluate potential air quality impacts from the heating and hot water systems.

The peak hourly traffic generated by the Proposed Actions is predicted to exceed the *City Environmental Quality Review (CEQR) Technical Manual* carbon monoxide (CO) and particulate matter (PM) screening thresholds. Therefore, a quantified assessment of the potential impacts on air quality from traffic generated by the Proposed Actions was conducted for CO and PM.

Many of the Projected or Potential Development Sites within the rezoning area would include on-site parking. Therefore, an analysis was conducted to evaluate the potential air quality impact from the proposed parking facilities.

Portions of the development sites are within areas zoned for small industrial/manufacturing uses. The potential effects were assessed for existing nearby industrial facilities that will not be developed. Potential effects were assessed for one small industrial facility (a) that would be included in the With Action Scenario.

There are no major (Title V) or large stationary sources on or within 1,000 feet of the Projected or Potential Development Sites. The closest major or large source found was the Pouch Terminal generating station, operated by the New York Power Authority that is over 3,000 feet from the development. Therefore, no major or large stationary sources were included in the air quality analysis.

B. PRINCIPAL CONCLUSIONS

The analyses conclude that the Proposed Actions would not result in any significant adverse air quality impacts on sensitive uses in the surrounding community, and the Proposed Actions would not be adversely affected by existing sources of air emissions in the rezoning area. A summary of the general findings is presented below.

The stationary source analyses determined that there would be no potential significant adverse air quality impacts from fossil fuel-fired heat and hot water systems at the Projected and Potential Development Sites. At certain sites, an (E) designation would be mapped as part of the zoning proposal to ensure the developments would not result in any significant air quality impacts from fossil fuel-fired heat and hot water systems emissions due to individual or groups of Development Sites. For City-owned site, the implementation of the restrictions would be required through the

disposition agreement the New York City Economic Development Corporation (EDC) and future developer.

An analysis of the potential impacts of industrial sources on Projected and Potential Development Sites was performed. Maximum concentration levels at Projected and Potential Development Sites were mostly found to be below the air toxic guideline levels and health risk criteria established by regulatory agencies, and below National Ambient Air Quality Standards (NAAQS). In cases where there may be potential for an adverse impact, an (E) designation is placed on the affected development site to ensure no adverse air quality impacts from the existing industrial sources.

The mobile source analyses determined that concentrations of CO and fine particulate matter less than ten microns in diameter (PM_{10}) due to project-generated traffic at intersections would not result in any violations of NAAQS and, furthermore, CO concentrations were predicted to be below CEQR *de minimis* criteria. The results show that the daily (24-hour) and annual $PM_{2.5}$ increments are predicted to be below the *de minimis* criteria. Therefore, traffic generated with the Proposed Actions would not result in any adverse air quality impacts.

The parking facilities assumed to be developed as a result of the Proposed Actions would not result in any significant adverse air quality impacts.

C. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions.

Ambient concentrations of carbon monoxide (CO) are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide (NO) and nitrogen dioxide (NO_2), collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NOx, 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 some sources utilizing non-road diesel such as large international marine engines. On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Likewise, SO_2 emissions are also very low for fuel oil combustion for stationary sources due to the recent switch to ultra-low-sulfur fuel oil.

Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs.

Ambient concentrations of CO, PM, NO_2, SO_2, ozone, and lead are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act, and are referred to as 'criteria pollutants'. Emissions of VOCs, NO_x, and other precursors to criteria pollutants are also regulated by EPA.

Numerous non-criteria air toxics are regulated by the state of New York. These air toxics primarily arise from industrial sources.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. CO concentrations can diminish rapidly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be analyzed on a local (microscale) basis.

The Proposed Actions would increase traffic volumes on streets within and surrounding the rezoning area and could result in localized increases in CO levels. Therefore, a mobile source analysis was conducted at the most critical intersection in the study area to evaluate future CO concentrations with and without the proposed actions. An analysis was also conducted to evaluate future CO concentrations with the operation of the parking facilities assumed to be developed as a result of the Proposed Actions.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x compounds 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 travel downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, 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.) While NO_2 emissions are a concern from stationary sources of combustion, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may also become of greater concern for this pollutant in the future. However, any increase in NO_2 from mobile sources associated with the Proposed Actions would be relatively small, and would not be expected to significantly affect levels of NO_2 experienced near roadways. Potential impacts on local NO_2 concentrations from the fuel combustion for Projected and Potential Development Sites' heat and hot water systems were evaluated.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the Clean Air Act and would not be emitted from any other component of Proposed Actions. Therefore, an analysis of this pollutant from non-industrial sources was not included.

Lead may be emitted from industrial sources. Lead emissions were found to be not present at the industrial sources addressed in this analysis.

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) or from precursor gases reacting in the atmosphere to form secondary PM. Gasoline-powered and diesel-powered vehicles, especially heavy duty trucks and buses operating on diesel fuel, are a significant source of respirable PM, most of which is $PM_{2.5}$; PM concentrations may, consequently, be locally elevated near roadways.

The Proposed Actions 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-based $PM_{2.5}$ emissions were analyzed. An analysis of the potential impacts from PM_{10} vehicle emissions at the most critical intersection was also included. An analysis was also conducted to evaluate future PM concentrations with the operation of the parking facilities assumed to be developed as a result of the Proposed Actions.

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*.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). SO_2 is also of concern as a precursor to $PM_{2.5}$ and is regulated as a $PM_{2.5}$ precursor under the New Source Review permitting program for large sources. Due to the federal restrictions on the sulfur content in diesel fuel for on-road and nonroad 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/or non-road sources was not warranted.

As part of the Proposed Actions, No. 2 fuel oil could be burned in heat and hot water systems of the Projected and Potential Development Sites. Therefore, potential future levels of SO_2 from these sources were examined. Due to the recent use of ultra-low sulfur fuel oil, SO_2 levels are not expected to be significant, but were included for this analysis.

NONCRITERIA POLLUTANTS

In addition to the criteria pollutants discussed above, noncriteria pollutants may be of concern. Noncriteria pollutants are emitted by a wide range of man-made and naturally occurring sources. These pollutants are sometimes referred to as hazardous air pollutants (HAP) and when emitted from mobile sources, as Mobile Source Air Toxics (MSATs). Emissions of noncriteria pollutants from industries are regulated by EPA.

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 (August 2016)[2] contains a compilation of annual and short term (1-hour) guideline concentrations for these compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure. EPA has also developed guidelines for assessing exposure to noncriteria pollutants. These exposure guidelines are used in health risk assessments to determine the potential effects to the public.

The project area contains existing industrial/manufacturing-zoned areas, some of which would remain with the Proposed Actions. Therefore, an analysis to examine the potential for impacts to the proposed actions from the existing industrial emissions was performed. The existing sources of industrial emissions to be considered were reviewed and confirmed with the Department of City Planning (DCP).

The new development also includes one small industrial facility, a brewery. Several criteria and noncriteria pollutants were included in the analysis of this future industrial source.

D. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

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

[2] DAR-1. Guidelines for the Evaluation and Control of Ambient Air Contaminants Under Part 212. New York State Department of Environmental Conservation. August 2016.

materials, vegetation, and other aspects of the environment. The primary standards are generally either the same as the secondary standards or more restrictive. The NAAQS are presented in Table 15-1.

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

Pollutant	Primary		Secondary	
	ppm	µg/m^3	ppm	µg/m^3
Carbon Monoxide (CO)				
Eight-Hour Average[1]	9	10,000	None	
One-Hour Average[1]	35	40,000		
Lead				
Rolling Three-Month Average	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
One Hour Average[2]	0.100	188	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
Eight-Hour Average[3,4]	0.070	140	0.070	140
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	NA	15
24-Hour Average[6]	NA	35	NA	35
Sulfur Dioxide (SO_2)				
One-Hour Average[7,8]	0.075	196	NA	NA
Maximum Three-Hour Average[1]	NA	NA	0.500	1,300

Source: *40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards and dec.ny.gov/chemical/8542.html*

Notes:

ppm – parts per million (unit of measure for gases only)
µg/m^3 – micrograms per cubic meter (unit of measure for gases and particles, including lead)
NA – not applicable

All annual periods refer to the calendar year.

Standards are not defined in ppm. Approximately equivalent concentrations in µg/m^3 are presented.

1 Not to be exceed more than once a year.
2 Three-year average of the annual 98th percentile daily maximum one-hour average concentration.
3 Three-year average of the annual fourth highest daily maximum eight-hour average concentration.
4 EPA lowered the NAAQS for ozone down to 0.070 from 0.075 ppm, effective December 2015.
5 Consecutive Three-year average of annual mean.
6 98th percentile, averaged over three years.
7 99th percentile of 1-hour daily maximum concentrations, averaged over 3 years.
8 Previous SO_2 standards (0.14 ppm 24-hour and 0.03 ppm annual) will remain in certain areas.

The NAAQS for CO, annual NO_2, and SO_2 (with the exception of the 1-hour NAAQS) have also been adopted as the ambient air quality standards for New York State. New York State also has standards for total suspended particles, settleable particles, non-methane hydrocarbons, 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 which are typically only pollutants of concern for major industrial projects.

EPA has revised several of the NAAQS in the last decade. The most recent changes include decreasing the primary annual $PM_{2.5}$ average standard from 15 µg/m3 to 12 µg/m3, effective March 2013. Effective December 2015, EPA reduced the ozone NAAQS, lowering the primary and secondary NAAQS to 0.070. EPA established a one-hour average NO_2 standard of 0.100 ppm, effective April 12, 2010, in addition to the annual standard. The statistical form is the three-year average of the 98th percentile of daily maximum one-hour average concentration in a year. This change for NO_2 affects numerous stationary sources for this project.

Federal ambient air quality standards do not exist for non-criteria pollutants; however, as mentioned above, the NYSDEC has issued standards for three non-criteria compounds. As discussed above, NYSDEC has also developed a guidance document DAR-1 (August 2016), which contains a compilation of annual and short term (one-hour) guideline concentrations for numerous other noncriteria compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure.

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

In 2002, EPA re-designated New York City as in attainment for CO. The NYSDEC has submitted a letter to EPA requesting approval of a limited maintenance plan for CO in the New York Metropolitan area to cover the years 2012-2022.

The five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties, which had been designated as a $PM_{2.5}$ non-attainment area since 2004 under the CAA due to exceedance of the 1997 annual average standard, were re-designated as in attainment for that standard on April 18, 2014, and are now under a maintenance plan. EPA lowered the annual average primary standard to 12 µg/m3, effective March 2013. EPA designated the area as in attainment for the new 12 µg/m3 NAAQS effective April 15, 2015.

EPA has currently designated five New York City counties as moderate non-attainment area for the 2008 eight-hour average ozone standard. Based on recent monitoring data EPA determined that the area is a moderate non-attainment area. On July 19, 2017 NYSDEC announced that the NYMA is not projected to meet the July 20, 2018 attainment deadline and NYSDEC is therefore requesting that EPA reclassify the NYMA to "serious" nonattainment, which would impose a new attainment deadline

of July 20, 2021 (based on 2018-2020 monitored data). On November 18, 2018, EPA proposed reclassifying the NYMA from moderate to serious nonattainment. On April 30, 2018, EPA designated the same area as a moderate NAA for the revised 2015 ozone standard.

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" of the one-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the one-hour standard, areas will be reclassified once three years of monitoring data are available.

EPA has established a one-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 one-hour standard. In December 2017, EPA designate the entire State of New York as in attainment for this standard, with the exception of Monroe County which was designated 'unclassifiable'.

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.[3] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see Table 15-1) would be deemed to have a potential significant adverse impact.

Similarly, for non-criteria pollutants, predicted exceedance of the DAR-1 guideline concentrations would be considered a potential significant adverse impact. In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

CO DE MINIMIS CRITERIA

New York City has developed de minimis criteria to assess the significance of the incremental increase in CO concentrations that would result from the impact of mobile source emissions from proposed projects or actions, 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 eight-hour average CO concentration at a location where the predicted No-Action eight-hour concentration is equal to or between eight and nine ppm; or (2) an increase of more than

[3] New York City. CEQR Technical Manual. Chapter 1, Section 222. March 2014, and New York State Environmental Quality Review Regulation, 6 NYCRR § 617.7

half the difference between baseline (i.e., No-Action) concentrations and the eight-hour standard, when No-Action concentrations are below eight ppm.

$PM_{2.5}$ DE MINIMIS CRITERIA

New York City uses de minimis criteria to determine the potential for significant adverse $PM_{2.5}$ incremental impacts for projects subject to CEQR as follows:

- Predicted 24-hour maximum $PM_{2.5}$ concentration increase of more than half the difference between the 24-hour background concentration and the 24-hour standard;

- Annual average $PM_{2.5}$ concentration increments which are predicted to be greater than 0.1 µg/m3 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 for mobile sources, at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or

- Annual average $PM_{2.5}$ concentration increments which are predicted to be greater than 0.3 µg/m3 at a discrete receptor location (elevated or ground level) for stationary sources.

Actions under CEQR predicted to increase $PM_{2.5}$ concentrations by more than the above de minimis criteria will be considered to have a potential significant adverse impact. The above de minimis criteria have been used to evaluate the significance of predicted impacts of the Proposed Actions on $PM_{2.5}$ concentrations.

NON-CRITERIA POLLUTANT THRESHOLDS

Non-criteria, or toxic, air pollutants include a multitude of pollutants of ranging toxicity. No federal ambient air quality standards have been promulgated for toxic air pollutants. However, the EPA and the NYSDEC have issued guidelines that establish acceptable ambient levels for these pollutants based on human exposure.

The NYSDEC DAR-1 guidance document presents guideline concentrations in micrograms per cubic meter for the one-hour and annual average time periods for various air toxic compounds. These values are provided in Table 15-2 for the compounds affecting receptors located at Projected and Potential Development Sites. The compounds listed are those emitted by existing and future industrial sources of air toxics in the rezoning area.

In order to evaluate impacts of non-carcinogenic toxic air emissions, EPA developed a methodology called the "Hazard Index Approach." The acute hazard index is based on short-term exposure, while the chronic noncarcinogenic hazard index is based on annual exposure limits. If the combined (summed) ratio of pollutant concentration divided by its respective short-term or annual exposure threshold for each of the toxic pollutants is found to be less than 1, no significant air quality impacts are predicted to occur due to these pollutant releases. The hazard index is also described in the NYSDEC DAR-1 guidance.

Table 15-2: Industrial Source Analysis: Relevant New York State Department of Environmental Conservation (NYSDEC) Air Guideline Concentrations

Pollutant	CAS Number	SGC (µg/m³)	AGC (µg/m³)
Acetone	67-64-1	180,000	30,000
Aromatic Petroleum Distillates (naptha heavy aromatic)	64742-94-5	N/A	100
Butane	106-97-8	238,000	N/A
Ethanol	64-17-5	N/A	45,000
Ethyl 3-ethoxypropianate	763-69-9	140	64
Ethylbenzene	100-41-4	N/A	1000
Isopropyl alcohol	67-63-0	98,000	7000
Methyl ethyl ketone	78-93-3	13000	5000
N-butyl acetate	123-86-4	95,000	17,000
Propane	74-98-6	N/A	43,000
Stoddard Solvents	8052-41-3	N/A	900
Toluene	108-88-3	37,000	5,000
Xylene	1330-20-7	22,000	100
Generic $PM_{2.5}$ solids (auto body)[1,2]	NY075-02-5	35 (24-hour Federal)	12 (Federal)

Source: *NYSDEC, DAR-1 AGC/SGC Tables, August 2016.*
Notes: [1] Pollutant includes emissions from both Particulates (NY075-00-0) and Total Solid Particulate (NY079-00-0)
[2] Conservatively assumes all particulate emissions would be $PM_{2.5}$. SGC and AGC from Particulate ($PM_{-2.5}$) used.

In addition, the EPA has developed unit risk factors for carcinogenic pollutants. The EPA considers an overall incremental cancer risk from a proposed action of less than one-in-one million to be insignificant. Using these factors, the potential cancer risk associated with each carcinogenic pollutant, as well as the total cancer risk of the releases of all of the carcinogenic toxic pollutants combined, can be estimated. If the total incremental cancer risk of all of the carcinogenic toxic pollutants combined is less than one-in-one million, no significant air quality impacts are predicted to occur due to these pollutant releases. None of the air toxics identified for the existing or future industrial source emissions affecting the proposed actions are defined as carcinogenic pollutants.

E. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

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

The mobile source analyses for the Proposed Actions employ models approved by EPA that have been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the Proposed Actions.

VEHICLE EMISSIONS

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, Motor Vehicle Emission Simulator, or MOVES.[4] This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOVES incorporate the most current guidance available from NYSDEC.

Vehicle classification data were based on field studies. Appropriate credits were used to accurately reflect the inspection and maintenance program.[5] County-specific hourly temperature and relative humidity data obtained from NYSDEC were used.

Road Dust

$PM_{2.5}$ emission rates were determined with fugitive road dust to account for their impacts in local microscale analyses. However, fugitive road dust was not included in the neighborhood scale $PM_{2.5}$ microscale analyses, since the New York City Department of Environmental Protection (DEP) considers it to have an insignificant contribution on that scale. Road dust emission factors were calculated according to the latest procedure delineated by EPA[6] and the *CEQR Technical Manual*.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the Proposed Actions (see Chapter 14, "Transportation"). Traffic speed data, existing vehicle distribution, and lane configuration for the future without and with the Proposed Actions were employed in the respective air quality modeling scenarios.

Traffic conditions for each of the peak periods (weekday morning [8 to 9 AM], midday [2 to 3 PM], evening [5 to 6 PM], and Saturday midday [2 to 3 PM]) were used to describe traffic conditions for both the daily and weekly time scales. In addition, traffic volumes for these peak periods were used

[4] EPA MOVES Model, Version MOVES2014a. Users Guide, EPA-420-B-15-095. November 2015

[5] The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system are lower than emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State.

[6] EPA, Compilations of Air Pollution Emission Factors AP-42, Fifth Edition. Volume 1: Stationary Point and Area Sources, Chapter 13.2.1, https://www.epa.gov/air-emissions-factors-and-quantification/ap-42-compilation-air-emission-factors. January 2011

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

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO and PM concentrations adjacent to streets within the surrounding area, resulting from vehicle emissions were predicted using the refined (Tier 2) version of the CAL3QHC model, CAL3QHCR[7]. The CAL3QHCR model employs a Gaussian (normal distribution) dispersion assumption. CAL3QHCR calculates emissions and dispersion of pollutants from idling and moving vehicles. The CAL3QHCR model has been updated with an extended module, which allows for the incorporation of hourly traffic and meteorological data into the modeling, instead of using worst-case assumptions. This refined (Tier 2) version of the model, CAL3QHCR, was employed for evaluation of all pollutants both without the Proposed Actions (the No-Action condition) and with the Proposed Actions (the With-Action condition).

A gridded analysis developed by DCP and approved by DEP was employed for evaluation of annual average $PM_{2.5}$ at three sites located in close proximity to one another. The analysis was performed using the CAL3QHCR model, with receptors in a 1 km by 1 km area centered on the three sites. For roadways with traffic information, the same traffic volume and emission rates were used in the analysis. For roadways without traffic information, traffic volume and emission rates are selected based on the nearest roadway with traffic. The combined geometry of roadways and receptors exceed the input capacity of the CAL3QHCR model; therefore, roadways were separated into four model scenarios using the same set of receptors, and the annual neighborhood $PM_{2.5}$ concentration value was calculated using the sum of concentrations of the four scenarios.

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).

CAL3QHCR

A Tier II analysis performed with the CAL3QHCR model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consist of surface data collected at Newark Liberty International Airport and upper air data collected at Brookhaven, New York for the period 2011–2015. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

[7] EPA, User's Guide to CAL3QHCR. Addendum to the User's Guide to CAL3QHC Version 2.0. Office of Air Quality Planning, and Standards. Research Triangle Park, NC. https://www3.epa.gov/scram001/userg/regmod/cal3qhcrug.pdf.

ANALYSIS YEAR

The microscale analyses were performed for existing conditions and 2030, the year by which the Proposed Actions are likely to be completed. The future analysis was performed both without the Proposed Actions (the No-Action condition) and with the Proposed Actions (the With-Action condition).

BACKGROUND CONCENTRATIONS

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

The background concentrations used in the mobile source analysis were based on concentrations recorded at a monitoring station representative of the county or from the nearest available monitoring station and in the statistical format of the NAAQS (see Table 15-1), as provided in the *CEQR Technical Manual*. These represent the most recent 3-year average for 24-hour average $PM_{2.5}$ and 1-hour average NO_2 and SO_2, the highest value from the three most recent years of data available for PM_{10}, and the highest value from the five most recent years of data available for all other pollutant and averaging period combinations. The background concentrations are presented in Table 15-3.

Table 15-3: Maximum Background Pollutant Concentrations for Mobile Source Analysis

Pollutant	Average Period	Location	Concentration	NAAQS
CO(1)	1-hour	CCNY / New York County	2.70 ppm	35 ppm
	8-hour	CCNY / New York County	1.90 ppm	9 ppm
PM_{10}(1)	24-hour	DIVISION ST / New York County	44.0 µg/m^3	150 µg/m^3
$PM_{2.5}$(2)	24-hour	Richmond Post Office / Richmond County	19.2 µg/m^3	35 µg/m^3

Source: *CEQR Technical Manual 2014.*
Note: [1] CO and PM_{10} are not measured in Staten Island (Richmond County), so the nearest available monitoring station was used.
[2] $PM_{2.5}$ is based on the 98th percentile averaged over a 3-year period from 2015—2017.

ANALYSIS SITES

Intersections in the study area were reviewed for analysis based on the *CEQR Technical Manual* guidance. The incremental traffic volumes for the weekday AM, midday, PM, and Saturday midday periods were reviewed and intersections with increments exceeding the CO and PM volume thresholds were identified. Of those intersections, four were selected for microscale analysis (see Figure 15-1 and Table 15-4). Consistent with the *CEQR Technical Manual*, each of these sites were selected initially for analysis because the projected number of vehicles generated due to the Proposed Actions would exceed the *CEQR Technical Manual* threshold of 170 vehicles for CO.



FIGURE 15-1: AIR QUALITY MOBILE SOURCE ANALYSIS SITES

BAY STREET REZONING AND RELATED ACTIONS
TOMPKINSVILLE/STAPLETON
STATEN ISLAND, NY

- Bay Street Corridor Project Area
- Canal Street Corridor Project Area
- City Disposition Sites
- Stapleton Waterfront Phase III Sites

Map Reference: Basemap: ESRI; Shapefile: NYC Dept of City Planning, MapPLUTO Data
Prepared by Langan

In addition, Sites 1, 2, and 3 were selected as they have the overall highest number of project-generated vehicles and each of these sites has an overall high level of total With-Action volumes, truck equivalents, and high levels of congestion (based on the projected Level of Service). Site 4 was selected based on overall high levels of total With-Action volumes, and project-generated vehicles.

Site 1 assessed the potential impact from vehicle emissions of CO, PM_{10}, and $PM_{2.5}$ since this site contained the overall highest project-generated vehicles. Sites 2, 3, and 4 assessed the potential impact from $PM_{2.5}$ only.

Table 15-4: Mobile Source Analysis Sites

Analysis Site	Location
1	Bay Street & Canal Street
2	Bay Street & Hannah Street
3	Bay Street & Wave Street
4	Bay Street & Hylan Boulevard

Receptor Placement

Multiple receptors (i.e., precise locations at which concentrations are predicted) were modeled at each of the selected sites; receptors were placed along the approach and departure links at spaced intervals. Receptors were placed at sidewalk or roadside locations near intersections with continuous public access. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations at Site 4 were placed at a distance of 15 meters from the nearest moving lane at each analysis location based on the *CEQR Technical Manual* procedure for neighborhood-scale corridor $PM_{2.5}$ modeling. Receptors in the annual average neighborhood-scale $PM_{2.5}$ concentrations analysis of were placed in an array of 25 m by 25 m spacing within the 1 km by 1 km grid area for assessment of Sites 1, 2 and 3 concurrently (see Figure 15-2). Receptors located on streets were removed as prescribed by DCP and DEP.

PARKING FACILITIES

The Proposed Actions would include parking facilities to account for the new parking demand and supply. Emissions from vehicles using the parking areas could potentially affect ambient levels of CO and PM at the project intersections analyzed in the With-Action conditions. Of the parking associated with the Projected Development Sites, the prototypical parking garages at Projected Development Site B2 were analyzed. Projected Development Site B2 was analyzed because it has the maximum overall capacity (266 parking spaces) and the maximum predicted number of vehicle ins/outs, and, therefore, the highest potential incremental concentrations of pollutants.

An analysis of the emissions from the outlet vents and their dispersion in the environment was performed, calculating pollutant levels in the surrounding area, using the methodology set forth in the *CEQR Technical Manual*. Emissions from vehicles entering, parking, and exiting the garages were estimated using the EPA MOVES mobile source emission model, as referenced in the *CEQR Technical Manual*. For all arriving and departing vehicles, an average speed of five miles per hour was conservatively assumed for travel within the parking garages. In addition, all departing vehicles were assumed to idle for one minute before proceeding to the exit.


Bay and Hannah
Bay and Wave
Bay and Canal
2010 CB BOUNDARY
2010 CB BOUNDARY
PIER
PIER
PIER
PIER
DISTRICT BOUNDARY
DISTRICT BOUNDARY
DISTRICT BOUNDARY

The concentrations of CO and PM within the garages were calculated assuming a minimum ventilation rate, based on New York City Building Code requirements, of one cubic foot per minute of fresh air per gross square foot of garage area. To determine compliance with the NAAQS, CO concentrations were determined for the maximum eight-hour average period. (No exceedances of the one-hour standard would occur, and the eight-hour values are the most critical for impact assessment.)

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

The CO concentrations were determined for the time periods when overall garage usage would be the greatest, considering the hours when the greatest number of vehicles would exit the facility (24-hour and annual PM concentrations were determined based on 24-hour averages of vehicles entering and leaving the parking facility). Traffic data for the parking garage analysis was derived from the trip generation analysis described in the traffic section of this DEIS. Background and on-street concentrations were added to the modeling results to obtain the total ambient levels for CO. The 24-hour average $PM_{2.5}$ background concentration was used to determine the de minimis criteria threshold.

Stationary Sources

A stationary source analysis was conducted to evaluate potential impacts from the Projected and Potential Development Sites' heat and hot water systems. In addition, an assessment was conducted to determine the potential for impacts due to industrial activities within the affected area, and from any nearby large or major emission sources.

INDIVIDUAL HEAT AND HOT WATER SYSTEMS

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. Variations in building base elevations due to terrain were accounted for.

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, along with factors predicting fuel usage as a function of floor area.

It was assumed that ultra-low sulfur No. 2 fuel oil or natural gas would be used in the Projected and Potential Development Sites' heat and hot water systems, and that exhaust stacks would be located three feet above roof height (as per the *CEQR Technical Manual*). For sources that did not pass the screening analyses using the *CEQR Technical Manual* procedures, a refined modeling analysis was performed. For fuel oil and natural gas, the primary pollutants of concern are NO_2 and PM. With the use of ultra-low sulfur fuel oil, the concern for SO_2 is greatly reduced and is a lesser concern. SO_2 was only modeled for the fuel oil option.

Refined Dispersion Analysis

Projected and Potential Development Sites that did not pass the screening analysis were further analyzed using a refined dispersion model, the EPA/AMS AERMOD dispersion model[8]. 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 urban dispersion. Surface roughness was determined with the AERSURFACE model as allowed by the *CEQR Technical Manual.*

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 using AERMOD is expected to produce higher estimates of pollutant concentrations when assessing the impact of elevated sources on elevated receptor locations. In addition, for the heat and hot water system exhausts in question, the stacks are all located at roof level and therefore, the highest pollutant concentrations are expected near the elevation of the stack exit and not at ground level. Therefore, the analysis for stationary heat and hot water system exhausts 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 massing closest to the receptor, unless the source and

[8] EPA, AERMOD: Description of Model Formulation, 454/R-03-004, September 2004; and EPA, AERMOD Implementation Guide, August 3, 2015.

receptor were immediately adjacent to each other. In these cases, the stack was assumed to be located at a minimum initial horizontal separation distance of 10 feet from the nearest receptor.

The refined dispersion modeling analysis was performed for $PM_{2.5}$, NO_2 and SO_2 (fuel oil only). The analysis was then performed using calculated emission rates for fuel oil and natural gas combustion. If a source could not meet the NAAQS or $PM_{2.5}$ de minimis criteria using fuel oil, natural gas emissions were used. If the natural gas emissions still resulted in a failure of the NAAQS or de minimis criteria, further refined analysis was conducted with natural gas emissions and increased stack setback (i.e., the stack would be set back in 5 foot increments) or a taller stack considered until the source met the respective criteria.

The refined analysis for $PM_{2.5}$ and NO_2 assumed that all particulate matter is in the form of $PM_{2.5}$ (for both fuel oil and natural gas). In addition, emission rates for 1-hour and 24-hour averaging periods were calculated, following DEP and DCP guidance, to assume that all HVAC source emissions would occur over a 100-day period in the winter months.

Receptor Placement

Discrete receptors (i.e., locations at which concentrations are calculated) were modeled along the existing and proposed building façades to represent potentially sensitive locations such as operable windows and intake vents. Columns of receptors at spaced intervals on the modeled buildings were analyzed at several elevations on each building. Receptors were also oriented to be downwind of sources according to prevailing wind directions to estimate maximum annual average concentrations.

Receptors were not placed at ground level for the hot water and heat exhausts, due to the expected maximum concentrations being near the elevations of the new stacks. The lowest projected or potential building height is 55 feet, high enough above grade that ground level concentrations will not be the maximum.

Emission Estimates and Stack Parameters

Fuel consumption was estimated based on procedures outlined in the *CEQR Technical Manual* as discussed above. Emission factors from the fuel oil and natural gas combustion sections of EPA's AP-42 were used to calculate emission rates for the Projected and Potential Development Site's heat and hot water systems. Fuel usage factors were as follows: for natural gas 58.5 ft^3/ft^2/year for residential and 45.2 ft^3/ft^2/year for commercial. For fuel oil the fuel usage factors were 0.43 gal/ft^2/year for residential and 0.21 gal/ft^2/year for commercial.

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 one-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.

One-hour average NO_2 concentrations associated with the Projected and Potential Development Sites' 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 NYSDEC 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 ten percent at the source exhaust stack was assumed, which is considered representative for boilers. Annual NO_2 concentrations from heating and hot water sources were calculated from the hourly results.

The methodology used to determine the compliance of total one-hour NO_2 concentrations from the proposed sources with the one-hour NO_2 NAAQS was based on adding the monitored background to modeled concentrations, as follows: hourly modeled concentrations from proposed sources were first added to the seasonal hourly background monitored concentrations; then the highest combined daily one-hour NO_2 concentration was determined at each receptor location and the 98th percentile daily one-hour maximum concentration for each modeled year was calculated within the AERMOD model; finally, the 98th percentile concentrations were averaged over the latest five years. This methodology is recognized by EPA and the City and is referenced in EPA modeling guidance[9].

Background Concentrations

To estimate the maximum expected pollutant concentration at a given location (receptor), the predicted impacts must be added to a background value that accounts for existing pollutant concentrations from other sources that are not directly accounted for in the model (see Table 15-5). To develop background levels, concentrations measured at the most representative NYSDEC ambient monitoring station over the latest available five-year period (2013-2017) were used for annual average NO_2 and three-hour average SO_2 background (consistent with DEP guidance), while the latest available three-year period was used for the 1-hour NO_2, the 1-hour SO_2, 1-hour $PM_{2.5}$, and 24-hour PM_{10} background concentration.

Table 15-5: Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration(µg/m³)	NAAQS (µg/m³)
NO_2	Annual[1]	Queens College 2	32.9	100
	1-hour[2]		112.3	188
SO_2	1-hour[3]	Queens College 2	18.1	196
	3-hour[4]	Queens College 2	77.8	130
$PM_{2.5}$	24-hour[5]	Richmond Post Office / Richmond County	19.2	35
PM_{10}	24-hour[6]	DIVISION ST / New York County	44.0	150

Source: *New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2011-2017*

Note: [1] Annual average NO_2 background concentration is based on the 5-year highest value from 2013-2017.
[2] The 1-hour NO_2 background concentration is based on the maximum 98th percentile 1-Hour NO_2 concentration averaged over 3 years of data, from 2015—2017.
[3] The 1-hour SO_2 background concentration is based on the maximum 99th percentile averaged over 3 years of data, from 2015—2017.
[4] The 3-hour SO_2 background concentration is based on 5-year highest second-highest measured value from 2011—2015.
[5] $PM_{2.5}$ is based on the 98th percentile averaged over a 3-year period from 2015—2017.
[6] PM_{10} is based on the 3-year highest second-highest value from 2015—2017.

[9] http://www.epa.gov/ttn/scram/guidance/clarification/NO_2_Clarification_Memo-20140930.pdf

$PM_{2.5}$ annual average impacts are assessed on an incremental basis and compared with the $PM_{2.5}$ de minimis criteria, without considering the annual background. Therefore, the annual $PM_{2.5}$ background is not presented in the table. The $PM_{2.5}$ 24-hour average background concentration of 19.2 µg/m3 (based on the 2015 to 2017 average of 98th percentile concentration measured at the Richmond Post Office monitoring station) was used to establish the de minimis value for the 24-hour increment, consistent with the guidance provided in the *CEQR Technical Manual*.

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, to address the cumulative impacts of multiple sources. The affected area was reviewed to determine areas where clusters with high density 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. A total of four clusters were selected for analysis. The Development Sites associated with each cluster and their location are presented in Table 15-6 and Figures 15-3a and 15-3b.

Table 15-6: Cluster Analysis Sites

Cluster	Development Sites
1	1, 11, 12, 13, 14, M, N (Projected and Potential)
2	6, B, C, D, E, F (Projected and Potential)
3	8, H, I (Projected and Potential)
4	22, 23 (Canal Street, projected)
Source: *DCP Email Nov 14, 2016*	

The cluster analysis was performed using the AERMOD model, the same as for the individual sources. The same emission rates were also used.

Emission factors for each fuel were obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*. The SO_2 emissions rates were calculated based on a maximum fuel oil sulfur content of 0.0015 percent (based on use of ultra-low sulfur No. 2 oil) the fuel using the appropriate AP-42 formula.

The minimum distance from the sites for each source with the source clusters to the nearest buildings were used in the modeling analysis. In some cases, individual sources within each cluster were shifted laterally to align the stacks to maximize concentration impacts. The analysis focused on receptors at existing buildings or other Projected or Potential Development Sites which are of a similar or greater height than the source cluster.

To estimate the maximum expected pollutant concentration at a given receptor, the calculated impact must be added to a background value that accounts for existing pollutant concentrations from other sources (see Table 15-5).



FIGURE 15-3A: BAY STREET HVAC CLUSTER LOCATIONS

BAY STREET CORRIDOR REZONING AND RELATED ACTIONS TOMPKINSVILLE/STAPLETON STATEN ISLAND, NY

Map Reference:
Basemap: ESRI
Shapefile: NYC DCP; MapPLUTOData; NYC DPR

0 145 290 580 Feet

N

Potential Development Sites
Projected Development Sites
Affected Lots
Bay Street Corridor Project Area



FIGURE 15-3B : CANAL STREET HVAC CLUSTER LOCATIONS

BAY STREET REZONING AND RELATED ACTIONS
TOMPKINSVILLE/STAPLETON
STATEN ISLAND, NY

Map Reference: Basemap: ESRI; Shapefile: NYC Dept of City Planning, MapPLUTO Data
Prepared by Langan

0 40 80 160 Feet

N

Potential Development Sites
Projected Development Sites
Affected Lots
Canal Street Corridor Project Area

INDUSTRIAL SOURCES

Existing Industrial Sources

Pollutants emitted from the exhaust vents of existing permitted and future industrial facilities were examined to identify potential adverse impacts on future residents of the Projected and Potential Development Sites. All existing industrial air pollutant emission sources within 400 feet of a Projected or Potential Development Site boundary were considered for inclusion in the air quality impact analyses. The proposed industrial source associated with the proposed actions (brewery use) was also considered.

A field survey was conducted on July 14, 2016 to determine the operating status of existing permitted industries and identify any potential industrial sites not included in the original permit request or the permit databases. The field survey indicated no existing industrial sites were operating. This survey was conducted for all four project sub-areas. The survey identified 17 industrial/manufacturing lots within a 400-foot radius of three of the project sub-areas at which existing operating permits may exist. A review of the New York City DEP Clean Air Tracking System (CATS) data base indicated that only one of the lots had an air quality permit for a boiler, further confirming that there are no industrial sources operating without permits on these 17 sites.

To further confirm the presence of operating air toxics sources, a request was made to DEP's Bureau of Environmental Compliance (BEC) and NYSDEC through the DCP for information regarding the release of air pollutants from industrial sources within the entire study area. Through this request, an additional six sites were identified in the development area, of which five do not have permits. The sources identified consisted of auto body shops with operating paint spray booths. For those sites that do have permits, the DEP 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.[10]

Under the Proposed Actions, it is assumed that all of the projected developments would be completed by the 2030 build year. Therefore, any of the identified industrial sources located on a Projected Development Site were not included in the assessment since a developed site would not continue to be a source of industrial emissions.

Existing industrial sources that are located on Potential Development Sites under the proposed actions were evaluated for the scenario where the Potential Development Site is not developed. If the Potential Development Site is developed, it is assumed it would be completed by the 2030 build year and this scenario does not require further assessment as the existing industrial source would no longer exist.

Further information from DCP indicated that some of the sites were not operating spray booths. The following list summarizes the existing industrial sources that were found through requests to DCP and shows which sources were modeled or not modeled, including reasons for not modeling:

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

Not modeled:

- 8 Grant Street-K&J Auto Collision and Painting (not operating a spray booth; email DCP January 10, 2017)
- 24 William Street-Taub's Floor Covering (not operating a spray booth; email DCP January 10, 2017)
- 250 Victory Blvd-The Ferry Collision (not operating a spray booth; email DCP January 10, 2017)
- 396 Bay Street Block 505 Lot 12 – Dema's Auto Center (originally noted by DCP October 11, 2016, to be replaced by Bay Street Projected Development Site 12)
- 52 Van Duzer Street; Block 499 Lot 13 (originally noted by DCP October 11, 2016, but no building at site according to Google Earth, and no permit listed by DCP January 10, 2017)
- 191 Bay Street; Block 497 Lot 9, Angiuli's Buick (originally noted by DCP October 11, 2016, but store is out of business, no permit listed by DCP January 10, 2017)

Modeled:

- 33 Wave Street – Wave Street Auto Body (no permit but operating a spray booth, email DCP January 10, 2017, emission information was assumed to be similar to 65 Hannah Street)
- 65 Hannah Street Block 499 Lot 35 – A & B Collision Center (originally noted by DCP October 11, 2016 Permit confirmed January 10, 2017; permitted spray booth)

Of the two existing industrial sources listed above that were modeled, only the 65 Hannah Street facility had a permit. Source and emissions information from the permit was used for the non-permit facility at 33 Wave Street. Stack locations were found from Google Earth.

For sources that perform paint spraying, such as auto body shops, standard emission chemical profiles for a generic assessment were provided by the DCP. The information provides maximum percentage by weight for individual air toxics that are commonly found in coatings used in paint spraying operations. The solvent usage from the source permit (for the auto body shop that had a permit 65/67 Hannah Street) was multiplied by the weight percentage for each air toxic to estimate the maximum emission rate for the air toxics, by source. For the auto body without a permit (31/33 Wave Street), the same emissions and stack parameters were applied. An online search indicated that this facility had a large stack similar to that found at the permitted facility, and that stack location was used in the analysis.

Proposed Industrial Sources

The Bay Street development will include one proposed small industrial source as part of the projected development, a 35,000 square foot (sf) brewery at Projected Development Site 7. Brewery emissions were calculated using EPA AP-42, Chapter 9, Section 12-1. "Malt Beverages". The emission factors are based on the number of barrels produced per year. Because only the square footage is known at this time, an internet survey was conducted to estimate a maximum production. The survey indicated an upper bound of 2 barrels/sf, so a production rate of 70,000 barrels per year was used. The emissions included ethanol, propane, and particulate matter. For the future industrial source, pollutants were assumed to be emitted from a rooftop stack in the same manner as the heating and ventilation sources.

Refined Dispersion Analysis

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 Projected and Potential Development Sites, were evaluated with a refined modeling analysis using the EPA/AMS AERMOD dispersion model. The AERMOD model was executed for the industrial sources, using the same methodology as described above for the Individual Heat and Hot Water Systems exhausts. As with the boiler analysis, since the highest concentrations were predicted to occur at nearby elevated locations, the AERMOD model was run without downwash—a procedure which produces the highest concentrations at elevated locations.

Predicted worst-case impacts on the Projected and Potential Development Sites were compared with the short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) recommended in NYSDEC's DAR-1 AGC/SGC Tables. These guidelines present the airborne concentrations which are applied as a screening threshold to determine if the Projected and Potential Development Sites could be significantly impacted by nearby sources of existing air pollution.

To assess the effects of multiple sources emitting the same pollutants, cumulative source impacts were determined. Concentrations of the same pollutant from industrial sources that were within 400 feet of an individual development site were combined and compared to the guideline concentrations discussed above.

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

Emission rates and stack parameters, obtained from the DEP permits, were input into the AERMOD dispersion model. As discussed above, for the facility with no permit, the same stack and emissions information was used from the permitted facility.

Health Risk Assessment

Potential cumulative impacts were evaluated based on EPA's Hazard Index Approach for non-carcinogenic compounds. EPA's Unit Risk Factors for carcinogenic compounds would also be used but none of the industrial sources were found to include compounds with EPA risk factors. 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-carcinogenic compounds, EPA considers a concentration-to-reference dose level ratio of less than 1.0 to be acceptable.

ADDITIONAL SOURCES

The *CEQR Technical Manual* requires an analysis of projects that may result in a significant adverse impact due to certain types of new uses located near a "large" or "major" emissions source. Major sources are defined as those located at facilities that have a Title V or Prevention of Significant Deterioration air permit, while large sources are defined as those located at facilities that require a

State Facility Permit. To assess the potential effects of these existing sources on the Projected and Potential Development Sites, a review of existing permitted facilities was conducted. Sources of information reviewed included the USEPA's Envirofacts database, the NYSDEC Title V and State Facility Permit websites[11], the New York City Department of Buildings website[12], and DEP permit data.

No major or large sources were found near the development site, and therefore no modeling of additional sources was warranted.

F. EXISTING CONDITIONS

The representative criteria pollutant concentrations measured in recent years at NYSDEC air quality monitoring stations nearest to the rezoning area are presented in Table 15-7. The values presented are consistent with the form of the NAAQS. For example, the eight-hour ozone concentration shown is the three-year average of the 4th highest daily maximum 8-hour average concentrations. As shown in Table 15-7, the recently monitored levels did not exceed the NAAQS, with the exception of ozone that is not modeled for this development. It should be noted that in a few cases these values are somewhat different from the background concentrations used in the stationary source and mobile source analyses if the NYSDEC only reported the last calendar year results.

Table 15-7: Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Average Period	Concentration	NAAQS
CO	CCNY	ppm	8-hour[1]	0.25	9
			1-hour[1]	0.20	35
SO_2	Queens College 2	ppb	Annual[2,3]	0.52	30
			1-hour[4]	6.93	75
PM_{10}	Division Street	($\mu g/m^3$)	24-hour[5]	28	50
PM_{25}	Port Richmond	($\mu g/m^3$)	Annual[6]	7.7	15
			24-hour[7]	19.2	35
NO_2	Queens College 2	($\mu g/m^3$)	Annual[3]	28.7	100
			1-hour[7]	112.3	188
Lead	IS 52	($\mu g/m^3$)	3-month[3]	0.0041	0.15
Ozone	Susan Wagner	ppm	8-hour[8]	0.076	0.070

Source: *NYSDEC, New York State Ambient Air Quality Report 2015*
Note:
[1] CO values are 2nd highest for Calendar Year 2017.
[2] SO_2 is transitioning from annual to 3 hour standard. Annual is shown from latest ambient air quality report.
[3] Value is for Calendar Year 2017 only.
[4] SO_2 1-hour value is 3 year average of 99th percentile of 1 hour values, 2015-2017.
[5] PM_{-10} value is 2nd highest 24-hour maximum for Calendar Year 2017 only.
[6] $PM_{-2.5}$ Annual value is average for 2015-2017.
[7] Values are 3 year average of 98th percentile 24 hour values, 2015-2017.
[8] Ozone value is 3 year average 4th highest daily maximum, 2015-2017.

[11] 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.

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

G. THE FUTURE WITHOUT THE PROPOSED ACTIONS (NO-ACTION CONDITION)

MOBILE SOURCES

INTERSECTION ANALYSIS

CO concentrations in the No-Action condition were determined using the methodology previously described. Table 15-8 shows future maximum predicted eight-hour average CO concentrations, including background concentrations, at the analysis intersections in the No-Action condition. The values shown are the highest predicted concentrations for the receptor locations for any of the time periods analyzed.

Table 15-8: Maximum Predicted Eight-Hour Average CO No-Action Concentrations

Analysis Site	Location	Eight-Hour Concentration (ppm)
3	Bay Street & Canal Street	2.5
Notes: Eight-hour standard (NAAQS) is nine ppm. Concentration includes a background concentration of 1.90 ppm.		

As shown in Table 15-8, No-Action values are predicted to be well below the eight-hour CO standard of nine ppm.

PM_{10} concentrations for the No- Action condition were determined using the methodology described above. Predicted future PM_{10} 24-hour concentrations, including background concentrations, at the analyzed intersections in the No-Action condition are presented in Table 15-9. The values shown are the highest predicted concentrations for the receptor locations.

Table 15-9: Maximum Predicted 24-Hour Average PM_{10} No-Action Concentrations

Analysis Site	Location	Concentration ($\mu g/m^3$)
3	Bay Street & Canal Street	82.6
Notes: 24-hour standard (NAAQS) is 150 $\mu g/m^3$. Concentration includes a background concentration of 44.0 $\mu g/m^3$.		

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

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

STATIONARY SOURCES

Some development within the study area would occur in the future without the Proposed Actions by 2030. The Proposed Actions would result in more development. The emissions from heat and hot water systems associated with the Proposed Actions would cumulatively be greater than the emissions from heat and hot water systems under the No-Action condition. Therefore, the No-Action condition was not studied for stationary sources.

H. THE FUTURE WITH THE PROPOSED ACTIONS (WITH-ACTION CONDITION)

MOBILE SOURCES

CO concentrations for future conditions in the With-Action condition were predicted using the methodology previously described. Table 15-10 shows the future maximum predicted 8-hour average CO concentrations at the intersection studied. (No 1-hour values are shown, since no exceedances of the NAAQS would occur and the de minimis criteria are only applicable to 8-hour concentrations; therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentrations. The results indicate that the proposed actions would not result in any violations of the 8-hour CO standard. In addition, the incremental increases in 8-hour average CO concentrations are very small, and consequently would not result in a violation of the CEQR de minimis CO criteria. Therefore, mobile source CO emissions the proposed actions would not result in a significant adverse impact on air quality.

Table 15-10: Maximum Predicted Eight-Hour CO With-Action Concentrations (ppm)

Analysis Site	Location	No-Action	With-Action	*De Minimis*
3	Bay Street & Canal Street	2.5	2.8	5.8
Notes: Eight-hour standard (NAAQS) is nine ppm. Concentration includes a background concentration of 1.90 ppm.				

PM_{10} concentrations for the With-Action condition were determined using the methodology previously described and used in the No Action Condition. Table 15-11 presents the predicted PM_{10} 24-hour concentrations at the analyzed intersections in the With-Action Condition. The values shown are the highest predicted concentrations for the modeled receptor locations and include background concentrations.

Table 15-11: Maximum Predicted 24-Hour Average PM_{10} With-Action Concentrations ($\mu g/m^3$)

Analysis Site	Location	No-Action	With-Action
3	Bay Street & Canal Street	82.6	92.4
Notes: 24-hour standard (NAAQS) is 150 $\mu g/m^3$. Concentration includes a background concentration of 44.0 $\mu g/m^3$.			

Using the methodology previously described, maximum predicted 24-hour and annual average $PM_{2.5}$ concentration increments were calculated so that they could be compared with the de minimis criteria. Based on this analysis, the maximum predicted localized 24-hour average and neighborhood-scale annual average incremental $PM_{2.5}$ concentrations are presented in Tables 15-12 and 15-13, respectively. Note that $PM_{2.5}$ concentrations in the No-Action condition are not presented, since impacts are assessed on an incremental basis.

Table 15-12: Maximum Predicted 24-Hour Average $PM_{2.5}$ With-Action Concentrations

Analysis Site	Location	Increment (μg/m³)	*De Minimis* (μg/m³)
1	Bay Street & Hannah Street	3.84	7.9
2	Bay Street & Wave Street	2.66	7.9
3	Bay Street & Canal Street	2.76	7.9
4	Bay Street & Hylan Boulevard	0.87	7.9

Notes:
The incremental 24-hour $PM_{2.5}$ concentration should not exceed the de minimis, defined as half the difference between the background concentration and the 24-hour standard (35 μg/m³).

Table 15-13: Maximum Predicted Annual Average $PM_{2.5}$ Incremental Concentrations

Analysis Site	Location	Increment (μg/m³)
1, 2 and 3	Bay Street & Hannah Street Bay Street & Wave Street Bay Street & Canal Street	0.03
4	Bay Street & Hylan Boulevard	0.06

Notes:
The incremental annual neighborhood scale concentration for Sites 1, 2 and 3 was calculated following the grid analysis methodology.
The incremental annual neighborhood scale concentration should not exceed the de minimis, defined as 0.1 μg/m³.

The results show that the daily (24-hour) $PM_{2.5}$ increments are predicted to be below the de minimis criteria. The maximum annual incremental $PM_{2.5}$ concentration is below the de minimis criteria at the intersection of Bay Street & Hylan Boulevard. Following the grid analysis methodology, the annual $PM_{2.5}$ maximum annual incremental concentration is predicted to not exceed the de minimis criteria at the intersections of Bay Street & Canal Street, Bay Street & Hannah Street, and Bay Street & Wave Street.

PARKING ANALYSIS

Based on the methodology previously described, the maximum predicted CO and PM concentrations from the proposed parking facilities at Projected Development Site B2 were analyzed, assuming a near side sidewalk receptor on the same side of the street (three feet) as the parking facility and a far side sidewalk receptor on the opposite side of the street (40 feet from the parking facility).

The maximum predicted eight-hour average CO concentration of all the receptors modeled at Projected Development Site B2 is 3.1 ppm. This value includes a predicted concentration of 0.21 ppm from emissions within the parking garage, on-street contribution of 1.02 ppm, and a background level of 1.9 ppm. The maximum predicted concentration is substantially below the applicable standard of nine ppm and the de minimis CO criteria.

The maximum predicted 24-hour and annual average $PM_{2.5}$ increments including increments associated with on-street traffic are 4.44 μg/m3 and 0.10 μg/m3, respectively. The maximum predicted $PM_{2.5}$ increments are well below the respective $PM_{2.5}$ de minimis criteria of 7.35 μg/m3 for the 24-hour average concentration and 0.3 μg/m3 for the annual concentration. Therefore, the proposed parking garage would not result in any significant adverse air quality impacts.

STATIONARY SOURCES

INDIVIDUAL 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 Sites could potentially impact other Projected and Potential Development Sites, or existing buildings.

Of the 53 sites analyzed, 44 failed the screening using No. 2 fuel oil (25 Projected and 19 Potential Development Sites). Therefore, each of these Projected or Potential Development Sites required a refined modeling analysis for the use of No. 2 fuel oil.

Of the 44 sites that failed the screening analysis for No. 2 oil, 41 sites (23 Projected Development Sites and 18 Potential Development Sites) were found to also fail the screening analysis using natural gas as the fuel source. Therefore, a refined modeling analysis for the use of natural gas was considered for these 41 sites (in cases where the refined analysis for fuel oil did not pass the NAAQS and de minimus criteria).

Refined Dispersion Analysis

As indicated above, 25 Projected and 19 Potential Development Sites required a refined modeling analysis to determine the potential for air quality impacts. The results of the refined modeling analysis determined the following:

- 20 (10 Projected and 10 Potential Development Sites) of the 44 sites analyzed using refined dispersion modeling passed the refined analysis for fuel oil; therefore, no restrictions are required for these sites. Twenty four sites remained that needed analysis using natural gas. (No setback, stack height, or low NO_x requirements were used for the fuel oil options).

- If the fuel type is restricted to natural gas, no significant adverse impacts are predicted at four of the remaining twenty four sites (4 Potential Development Sites).

- If the fuel type is restricted to natural gas only, and low NOx burners are required to address NO_2 emissions, no significant adverse impacts are predicted at one of the remaining twenty sites (1 Projected Development Site).

- If the fuel type is restricted to natural gas only, and heating and hot water system stacks are set back from the building edge to address $PM_{2.5}$ and NO_2 emissions, no significant adverse impacts are predicted at five of the remaining nineteen sites (3 Projected and 2 Potential Development Sites).

- If the fuel type is restricted to natural gas only, heating and hot water system stacks are set back from the building edge 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 seven of the remaining fourteen sites (4 Projected and 3 Potential Development Sites).

- If the fuel type is restricted to natural gas only, and the height of the exhaust stack is increased where feasible to address $PM_{2.5}$ and NO_2 emissions, no significant adverse impacts are predicted at six of the remaining seven sites (6 Projected Development Sites).

- If the fuel type is restricted to natural gas only, heating and hot water system stacks are set back from the building edge, and the height of the exhaust stack is increased where feasible to address $PM_{2.5}$ and NO_2 emissions, and low NOx burners are required to address NO_2 emissions, no significant adverse impacts are predicted at the remaining one Projected Development Site.

Table 15-14 presents a summary of the analysis results for individual HVAC stationary sources and their proposed restrictions, with additional detail provided in Tables 15-15 (Projected Development Sites) and 15-16 (Potential Development Sites). Note that SO_2 levels are not reported because the predicted concentrations are far below NAAQS levels due to the recent requirement of ultra-low-sulfur (15 ppm) fuel oil. Instead, NO_2 values are listed for both fuel oil and natural gas operations.

Overall, based on the analysis performed to date, to preclude the potential for significant adverse air quality impacts on other Projected and Potential Development Sites, or existing buildings, from the individual heat and hot water emissions, an (E) designation (or restrictions via a disposition agreement) would be assigned as part of the Proposed Actions for 24 Projected and Potential Development Sites (including 15 Projected and 9 Potential Development Sites) as determined from the individual site analysis. These designations would specify the various restrictions, such as type of fuel to be used and the distance that the vent stack on the building roof must be from its lot line(s).

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. Four clusters were identified.

Screening Analysis

No screening analysis was performed for the cumulative impacts from heat and hot water systems based on the assumption that a refined analysis would be necessary to demonstrate compliance with the applicable NAAQS and de minimis criteria. Four clusters were examined with refined modeling as discussed below.

Table 15-14: Heating and Hot Water System Analysis Summary

Analysis	Projected Development Sites		Potential Development Sites	
	Pass	**Fail**	**Pass**	**Fail**
#2 Fuel Oil Screening	5	25	4	19
#2 Fuel Oil Refined Analysis	10	15	10	9
Final Result #2 Fuel Oil Analysis	15	15	14	9
Sites Failing Fuel Oil Analysis (Individual)		***1, 2, 3, 4, 5, 9, 11, 12, 15, 17, 18, 19, 22, Stapleton A, B1***		***B, C, G, K, L, M, N, P, W***
Sites with Requirements	**Pass**	**Fail**	**Pass**	**Fail**
Natural Gas Screening (of the sites failing Fuel Oil analysis)	0	15	0	9
Sites for Natural Gas Screening		***1, 2, 3, 4, 5, 9, 11, 12, 15, 17, 18, 19, 22, Stapleton A, B1***		***B, C, G, K, L, M, N, P, W***
Natural Gas Refined Analysis	0	15	4	5
Sites for Natural Gas Refined Analysis		***1, 2, 3, 4, 5, 9, 11, 12, 15, 17, 18, 19, 22, Stapleton A, B1***	***G, L, M, W***	***B, C, K, N, P***
Natural Gas, and Low NO_x Requirement	1	14	0	5
Sites for Natural Gas Refined Analysis, and Low NO_x Requirement	***19***	***1, 2, 3, 4, 5, 9, 11, 12, 15, 17, 18, 22, Stapleton A, B1***		***B, C, K, N, P***
Natural Gas and Stack Setback Requirement	3	11	2	3
Sites for Natural Gas Refined Analysis and Stack Setback	***1, 9, 15***	***2, 3, 4, 5, 11, 12, 17, 18, 22, Stapleton A, B1***	***B, K***	***C, N, P***
Natural Gas, Stack Setback, and Low NO_x Requirement	4	7	3	0
Sites for Natural Gas Refined Analysis, Stack Setback, and Low NO_x Requirement	***2, 11, 12, 17***	***3, 4, 5, 18, 22, Stapleton A, B1***	***C, N, P***	
Natural Gas and Stack Height requirements	6	1	N/A	N/A
Sites for Natural Gas Refined Analysis and Stack Height requirements	***3, 4, 18, 22, Stapleton A, B1***	***5***	N/A	N/A
Natural Gas, Stack Setback, and Stack Height Requirement	N/A	N/A	N/A	N/A
Natural Gas, Stack Setback, Stack Height, and Low NO_x Requirement	1	0	N/A	N/A
Sites for Natural Gas Refined Analysis, Stack Setback, Stack Height, and Low NO_x Requirement	***5***		N/A	N/

Table 15-15: Heating and Hot Water System Analysis—Results for Projected Development Sites

Site	Ht	#2 Oil Modeled Concentrations (µg/m³)					Natural Gas Modeled Concentrations (µg/m³)					
		$PM_{2.5}$ 24hr	$PM_{2.5}$ Annual	NO_2 1 hour	$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO_2 1 hour Standards	Pass/ Fail[1]	$PM_{2.5}$ 24hr	$PM_{2.5}$ Annual	NO_2 1hour	$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO_2 1 hour Standards	Pass/ Fail[1]	Requires (E) Designation
1	85	6.76	0.138	>188	7.9/0.3/188	Fail	2.65	0.097	177	7.9/0.3/188	Pass	Yes
2	125	>7.9	>0.3	>188	7.9/0.3/188	Fail	7.01	0.226	186	7.9/0.3/188	Pass	Yes
3	125	>7.9	0.121	>188	7.9/0.3/188	Fail	2.15	0.040	148	7.9/0.3/188	Pass	Yes
4	125	7.72	0.103	>188	7.9/0.3/188	Fail	1.46	0.043	145	7.9/0.3/188	Pass	Yes
5	85	>7.9	>0.3	>188	7.9/0.3/188	Fail	7.13	0.209	170	7.9/0.3/188	Pass	Yes
6	75	1.63	0.033	130	7.9/0.3/188	Pass	0.79	0.024	120	7.9/0.3/188	Pass	No
7	145	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
8	75	2.43	0.052	149	7.9/0.3/188	Pass	1.18	0.039	131	7.9/0.3/188	Pass	No
9	55	7.59	0.143	>188	7.9/0.3/188	Fail	2.34	0.120	181	7.9/0.3/188	Pass	Yes
10	75	1.78	0.028	139	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
11	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	6.02	0.208	166	7.9/0.3/188	Pass	Yes
12	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	6.58	0.179	153	7.9/0.3/188	Pass	Yes
13	75	2.56	0.034	146	7.9/0.3/188	Pass	1.25	0.025	129	7.9/0.3/188	Pass	No
14	75	2.55	0.037	147	7.9/0.3/188	Pass	1.24	0.028	129	7.9/0.3/188	Pass	No
15	35	>7.9	0.015	>188	7.9/0.3/188	Fail	3.75	0.159	179	7.9/0.3/188	Pass	Yes
16	55	1.94	0.046	141	7.9/0.3/188	Pass	0.94	0.034	126	7.9/0.3/188	Pass	No
17	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	6.66	0.229	168	7.9/0.3/188	Pass	Yes
18	55	>7.9	>0.3	>188	7.9/0.3/188	Fail	1.15	0.045	129.6	7.9/0.3/188	Pass	Yes
19	55	>7.9	>0.3	>188	7.9/0.3/188	Fail	6.80	0.286	162	7.9/0.3/188	Pass	Yes
20	55	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
21	55	4.24	0.146	187	7.9/0.3/188	Pass	2.06	0.071	113	7.9/0.3/188	Pass	No
22	55	>7.9	>0.3	>188	7.9/0.3/188	Fail	3.28	0.101	178	7.9/0.3/188	Pass	Yes
23	55	3.55	0.135	169	7.9/0.3/188	Pass	6.69	0.258	144	7.9/0.3/188	Pass	No
24	55	3.67	0.124	130	7.9/0.3/188	Pass	1.78	0.060	177	7.9/0.3/188	Pass	No
25	55	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
CD1	52	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No

Table 15-15: Heating and Hot Water System Analysis—Results for Projected Development Sites (continued)

Site	Ht	#2 Oil Modeled Concentrations (µg/m³)					Natural Gas Modeled Concentrations (µg/m³)					
		$PM_{2.5}$ 24hr	**$PM_{2.5}$ Annual**	**NO_2 1 hour**	**$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO_2 1 hour Standards**	**Pass/ Fail[1]**	**$PM_{2.5}$ 24hr**	**$PM_{2.5}$ Annual**	**NO_2 1hour**	**$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO_2 1 hour Standards**	**Pass/ Fail[1]**	**Requires (E) Designation**
CD2	40	4.94	0.084	186	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
CD3	70	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
SA	125	>7.9	0.119	>188	7.9/0.3/188	Fail	2.83	0.004	169	7.9/0.3/188	Pass	Yes
SB1	125	>7.9	0.085	>188	7.9/0.3/188	Fail	2.45	0.068	171	7.9/0.3/188	Pass	Yes

Notes:
For the City-owned parcels located at Stapleton Waterfront Phase III Sites A and B, the implementation of the restrictions would be required through the disposition agreement EDC and the future developer. This agreement would require that any new residential and/or commercial development must exclusively use natural gas as the type of fuel for heating and hot water systems, with stack height restrictions as noted, to avoid any potential significant air quality impacts.

Table 15-16: Heating and Hot Water System Analysis—Results for Potential Development Sites

Site	Ht	#2 Oil Modeled Concentrations (µg/m³)					Natural Gas Modeled Concentrations (µg/m³)					
		$PM_{2.5}$ 24hr	$PM_{2.5}$ Annual	NO_2 1 hour	$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO2 1 hour Standards	Pass/ Fail[1]	$PM_{2.5}$ 24hr	$PM_{2.5}$ Annual	NO_2 1hour	$PM_{2.5}$ 24hr/ $PM_{2.5}$ Annual/ NO2 1 hour Standards	Pass/ Fail[1]	Requires (E) Designation
A	125	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
B	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	3.27	0.132	181	7.9/0.3/188	Pass	Yes
C	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	5.31	0.209	164	7.9/0.3/188	Pass	Yes
D	75	0.48	0.009	108	7.9/0.3/188	Pass	0.23	0.006	106	7.9/0.3/188	Pass	No
E	75	0.35	0.007	109	7.9/0.3/188	Pass	0.17	0.005	107	7.9/0.3/188	Pass	No
F	75	2.66	0.027	143	7.9/0.3/188	Pass	1.29	0.020	126	7.9/0.3/188	Pass	No
G	55	3.81	0.105	>188	7.9/0.3/188	Fail	1.85	0.078	166	7.9/0.3/188	Pass	Yes
H	75	1.78	0.036	132	7.9/0.3/188	Pass	0.87	0.027	121	7.9/0.3/188	Pass	No
I	75	3.93	0.082	174	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
J	55	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
K	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	3.34	0.091	185	7.9/0.3/188	Pass	Yes
L	75	6.21	0.069	>188	0.3/188	Fail	3.02	0.052	165	7.9/0.3/188	Pass	Yes[
M	75	6.12	0.0667	>188	7.9/0.3/188	Fail	2.97	0.05	160	7.9/0.3/188	Pass	Yes[
N	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	6.28	0.211	168	7.9/0.3/188	Pass	Yes
O	75	1.43	0.0222	127	7.9/0.3/188	Pass	0.69	0.017	118	7.9/0.3/188	Pass	No
P	75	>7.9	>0.3	>188	7.9/0.3/188	Fail	5.43	0.151	152	7.9/0.3/188	Pass	Yes
Q	75	1.92	0.023	133	7.9/0.3/188	Pass	0.93	0.017	120	7.9/0.3/188	Pass	No
R	75	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
S	75	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	Passed Screening	Passed Screening	Passed Screening	7.9/0.3/188	Pass	No
T	55	2.79	0.093	177	7.9/0.3/188	Pass	1.36	0.045	147	7.9/0.3/188	Pass	No
U	55	2.61	0.088	170	7.9/0.3/188	Pass	1.27	0.043	142	7.9/0.3/188	Pass	No
V	55	6.85	0.164	144	7.9/0.3/188	Pass	3.32	0.080	170	7.9/0.3/188	Pass	No
W	55	7.77	0.269	>188	7.9/0.3/188	Fail	3.77	0.131	161	7.9/0.3/188	Pass	Yes

Refined Dispersion Analysis

A refined analysis was performed for all pollutants using the AERMOD model. The analysis was performed using the EPA AERMOD model using the general assumptions and procedures outlined earlier for individual Development Sites. The results of the analysis to date determined that Clusters 1, 2, 3, and 4 would not result in significant adverse air quality impacts when two of the sites are converted from fuel oil to natural gas, one of the sites is restricted to low NO_x burners, the height of the exhaust stack for one of the site is increased, and when the individual stack for one of the sites included in the clusters was moved farther from the location of maximum impacts than necessary for the individual source analysis. Projected Development Sites 13, and 14 in Cluster 1 would require conversion to natural gas, and an additional (E) Designation will be placed on this site. The cumulative analysis increased the setback distance from the exhaust source for site11 in Cluster 1. The Projected Development Sites B and C in Cluster 2 would require low NO_x burners, and minimum 10-foot exhaust stack above the highest roof, respectively. The required changes to ensure there are no adverse impacts for the cumulative assessment are summarized in the (E)-Designations for these sites in Appendix H, "Proposed Air Quality (E) Designations." The $PM_{2.5}$, SO_2, and NO_2, concentrations predicted by the AERMOD model are presented in Table 15-17.

Table 15-17: Maximum Pollutant Concentration

Pollutant	Average Period	Total Concentration (µg/m³)				Standard
		Cluster 1	Cluster 2	Cluster 3	Cluster 4	
$PM_{2.5}$	24-hour	6.60	4.50	3.95	3.69	7.9[1]
	Annual	0.293	0.278	0.274	0.101	0.3[2]
SO_2	1-hour	19.7	19.1	19.2	18.6	196
NO_2	1-hour	168.2	158.0	178.3	163.6	188
	Annual	35.1	34.8	41.8	38.7	100

Notes:
1. Standard is the incremental value for $PM_{2.5}$

PROPOSED (E) DESIGNATION REQUIREMENTS

At affected Projected and Potential Development Sites, the proposed (E) designation (E-429) would specify the type of fuel to be used, whether low NO_x burners are required, the distance that the vent stack on the building roof must be from its lot line(s), and/or the minimum stack height. A summary of the proposed (E) designations is presented in Appendix H.

For each of the Projected and Potential Development 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. As discussed in the Section "NAAQS Attainment Status and Implementation Plan", EPA recently redesignated the New York City Metropolitan Area, which had been nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS since November 2009, as in attainment. Under the required maintenance plans, NYSDEC will continue to address the attainment of the 24-hour and annual 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 and No. 4 oil in new boiler installations, and is phasing out their use at existing installations, which will result in direct reductions of $PM_{2.5}$ emissions, and reductions in SO_2 emissions, which is a $PM_{2.5}$ precursor (since chemical reactions in the atmosphere convert some SO_2 to $PM_{2.5}$). Although these measures do not address the emissions of $PM_{2.5}$ associated with Proposed Actions, 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 Actions.

For the City-owned parcels located at Stapleton Waterfront Phase III Sites A and B1 (Block 487, Lot 100), the implementation of the restrictions would be required through a disposition agreement between EDC and the future developer. This agreement would require that any new residential and/or commercial development must exclusively use natural gas as the type of fuel for heating and hot water systems, with stack height restrictions as noted in Appendix H, to avoid any potential significant air quality impacts.

INDUSTRIAL SOURCE ANALYSIS

As discussed above in the methodology, two existing and one proposed industrial sources were analyzed. A study was conducted to analyze industrial uses within 400 feet of the Projected and Potential Development Sites, large sources or major sources within 1,000 feet of a Projected or Potential Development Site.

Comparison to Air Toxics Limits – Existing Industrial Sources

As shown in Table 15-18, for all Projected and Potential Development Sites, the refined modeling demonstrates that there would be no predicted significant adverse air quality impacts on these Development Sites from existing industrial sources (spray booths) in the area. The chemical ethyl 3-ethoxyproprianate had the impact closest to its SGC/AGC value.

Table 15-18: Maximum Predicted Impacts on Projected and Potential Development Sites from Existing Industrial Sources

Pollutant	Chemical Abstract Service (CAS) Number	AERMOD Model Short Term Impact ($\mu g/m^3$)	SGC ($\mu g/m^3$)	AERMOD Model Annual Impact ($\mu g/m^3$)	AGC ($\mu g/m^3$)
Acetone	67-64-1	555.7	180,000	1.6	30,000
Aromatic Petroleum Distillates (naptha heavy aromatic)	64742-94-5	N/A	N/A	0.19	100
Butane	106-97-8	142.2	238,000	N/A	N/A
Ethanol	64-17-5	N/A	N/A	0.07	45,000
Ethyl 3-ethoxypropianate	763-69-9	116.3	140	0.34	64
Ethylbenzene	100-41-4	N/A	N/A	0.19	1000
Methyl ethyl ketone	78-93-3	103.4	13000	0.30	5000
N-butyl acetate	123-86-4	64.6	95,000	0.19	17,000
Propane	74-98-6	N/A	N/A	0.41	43,000
Stoddard Solvents	8052-41-3	N/A	N/A	0.04	900
Toluene	108-88-3	12.9	37,000	0.04	5,000
Xylene	1330-20-7	12.9	22,000	0.04	100
Generic $PM_{2.5}$ solids (auto body)[1,2]	NY075-02-5	13.3	88 (Federal)	0.04	12 (Federal)

Source: *NYSDEC, DAR-1 AGC/SGC Tables, August 2016.*
Notes:
[1] Pollutant includes emissions from both Particulates (NY075-00-0) and Total Solid Particulate (NY079-00-0).
[2] Conservatively assumes all particulate emissions would be $PM_{2.5}$. SGC and AGC from Particulate ($PM_{-2.5}$) used.
"N/A" indicates that either the SGC or AGC does not exist for this pollutant.

Health Risk Assessment – Existing Industrial Sources

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 was calculated for each affected Projected and Potential Development Site associated with the Proposed Actions. The hazard index approach was used to determine the effects of multiple non-carcinogenic compounds. None of the compounds for the industrial sources were found to have carcinogenic unit risk factors, so only annual AGC values were used.

Table 15-19 presents the results of the assessment of cumulative non-carcinogenic effects on the proposed actions.

Table 15-19: Estimated Maximum Hazard Index from Existing Industrial Sources

Pollutant	CAS Number	Estimated Annual Pollutant Concentration (µg/m³)	AGC (µg/m³)	Ratio of Annual Concentration to AGC
Acetone	67-64-1	1.6	30,000	5.3E-5
Aromatic Petroleum Distillates (naptha heavy aromatic)	64742-94-5	0.19	100	0.0019
Butane	106-97-8	N/A	N/A	N/A
Ethanol	64-17-5	0.07	45,000	1.7E-6
Ethyl 3-ethoxypropianate	763-69-9	0.34	64	0.0052
Ethylbenzene	100-41-4	0.19	1000	0.00019
Methyl ethyl ketone	78-93-3	0.30	5000	6.0E-5
N-butyl acetate	123-86-4	0.19	17,000	1.1E-5
Propane	74-98-6	0.41	43,000	9.5E-6
Stoddard Solvents	8052-41-3	0.04	900	4.1E-5
Toluene	108-88-3	0.04	5,000	7.5E-6
Xylene	1330-20-7	0.04	100	0.0004
Generic $PM_{2.5}$ solids (auto body)[1,2]	NY075-02-5	0.04	12 (Federal)	0.0032
			Total Hazard Index	**0.0149**
			Hazard Index Threshold Value	**1.0**

Source: *NYSDEC, DAR-1 AGC/SGC Tables, August 2016.*
Notes: [1] Pollutant includes emissions from both Particulates (NY075-00-0) and Total Solid Particulate (NY079-00-0)
[2] Conservatively assumes all particulate emissions would be $PM_{2.5}$. SGC and AGC from Particulate ($PM_{-2.5}$) used.

As shown in Table 15-19, the results of this assessment indicated that there would be no significant adverse air quality impacts on the Projected and Potential Development Sites because the hazard index for any affected site would not exceed 1.0. Also none of the compounds have a cancer risk factor.

Comparison to Air Toxics Limits – Proposed Industrial Sources

For the proposed brewery industrial source at Project Development Site 7 as shown in Table 15-20, the refined modeling demonstrates that there would be no predicted significant adverse air quality impacts on these Development Sites from proposed industrial sources in the area.

For the $PM_{2.5}$ emissions, the results were combined with the individual HVAC system for the building 7.

For the proposed industrial source, dispersion modeling was not performed directly. Instead, dispersion results for the HVAC sources on Building 7 were used by normalizing the annual result for $PM_{2.5}$ with the $PM_{2.5}$ emission rate to obtain a normalized concentration with units of µg/m3 per g/s. Then the normalized concentration was multiplied by the actual emission rate of each pollutant of interest to obtain the annual concentration for each pollutant.

Table 15-20: Maximum Predicted Impacts on Projected and Potential Development Sites from Proposed Brewery Industrial Source, Building 7

Pollutant	Chemical Abstract Service (CAS) Number	AERMOD Model Short Term Impact (µg/m³)	SGC (µg/m³)	AERMOD Model Annual Impact (µg/m³)	AGC (µg/m³)
Ethanol	64-17-5	N/A	N/A	12.3	45,000
Propane	74-98-6	N/A	N/A	0.121	43,000
Generic $PM_{2.5}$ solids [1,2,3]	NY075-02-5	13.66	88 (Federal)	0.135	12 (Federal) 0.3 Increment

Source: *NYSDEC, DAR-1 AGC/SGC Tables, August 2016.*
Notes:
[1] Pollutant includes emissions from both Particulates (NY075-00-0) and Total Solid Particulate (NY079-00-0)
[2] Conservatively assumes all particulate emissions would be $PM_{2.5}$. SGC and AGC from Particulate ($PM_{-2.5}$) used.
[3] Includes PM emissions from HVAC stationary source for Building 7, co-located at same stack location.
"N/A" indicates that the SGC does not exist for this pollutant.

Health Risk Assessment – Proposed Industrial Sources

As shown in Table 15-21, the results of the health risk assessment for the proposed industrial source indicated that there would be no significant adverse air quality impacts on the Projected and Potential Development Sites because the hazard index for any affected site would not exceed 1.0. Also none of the compounds have a cancer risk factor.

Table 15-21: Estimated Maximum Hazard Index from Proposed Brewery Industrial Source, Building 7

Pollutant	CAS Number	Estimated Annual Pollutant Concentration (µg/m³)	AGC (µg/m³)	Ratio of Annual Concentration to AGC
Ethanol	64-17-5	12.3	43,000	2.9E-4
Propane	74-98-6	0.1	45,000	2.7E-6
Generic $PM_{2.5}$ solids[1,2]	NY075-02-5	0.135	12 (Federal)	0.0112
			Total Hazard Index	**0.0115**
			Hazard Index Threshold Value	**1.0**

Source: *NYSDEC, DAR-1 AGC/SGC Tables, August 2016.*
Notes: [1] Pollutant includes emissions from both Particulates (NY075-00-0) and Total Solid Particulate (NY079-00-0)
[2] Conservatively assumes all particulate emissions would be $PM_{2.5}$. SGC and AGC from Particulate ($PM_{-2.5}$) used.

In summary for the industrial sources, the analysis showed that their operations would not result in any predicted violations of the NAAQS nor any exceedances of the recommended SGC or AGC. Similarly, no cumulative toxic hazards are predicted. Therefore, based on the data available on the surrounding existing and proposed industrial uses, development resulting from the proposed Actions would not experience significant air quality impacts from these existing or proposed facilities.