Appendix I.1
Air Quality

1. POLLUTANTS FOR ANALYSIS

Air quality is affected by air pollutants produced by motor vehicles, which are referred to as mobile sources of emissions and fixed facilities, which are referred to as stationary sources. Ambient concentrations of CO are predominantly influenced by mobile source emissions. PM, volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide [NO] and NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of 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. 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 (CAA) and are referred to as criteria pollutants; emissions of VOCs, NO_x, and other precursors to criteria pollutants from certain source categories are also regulated by EPA.

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. As referenced in the *CTM*, in urban areas, approximately 80 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 Project would not result in an increase in vehicle trips greater than the *CTM* screening threshold of 170 trips at any intersection. Therefore, a mobile source analysis was not required to evaluate future CO concentrations with and without the Proposed Project at intersections in the study area under any of the four alternatives. The Proposed Project would include an 96-space below-grade parking garage at proposed Fulton 2 building. Therefore, an analysis was conducted to evaluate future CO concentrations with the operation of the proposed parking facility under the No-Action and Preferred Alternatives (potential air quality impacts under the Midblock Bulk Alternative and COY Alternative would be almost identical).

Nitrogen Oxides, VOCs, and Ozone

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions.

The Proposed Project would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels is predicted. An analysis of project-related emissions of these pollutants from mobile sources was therefore not warranted.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source). With the promulgation of the 1-hour average standard for NO_2, local sources such as vehicular emissions may be of greater concern. However, any increase in NO_2 associated with the Proposed Project would be relatively small, due to the very small increases in the number of vehicles. This increase would not be expected to significantly affect levels of NO_2 experienced near roadways.

The Proposed Project would not utilize any fossil fuel-fired heating and hot water systems. However, potential temporary impacts of NO_2 emissions on the Proposed Project from the existing fossil fuel-fired boiler plants at the Elliott-Chelsea Houses Project Site were evaluated for the Preferred Alternative and the Non-Rezoning Alternative. Potential impacts of NO_2 emissions from the existing large and major sources were evaluated to determine their potential effects on the Proposed Project for the Preferred Alternative, Non-Rezoning Alternative and Midblock Bulk Alternative (potential impacts for the COY Alternative were studies qualitatively). The cumulative effects of NO_2 emissions from the temporary air quality effects on the proposed Elliott-Chelsea Houses buildings from the existing NYCHA boiler plants and the Mutual Redevelopment Houses were determined for the Preferred Alternative and the Non-Rezoning Alternative (potential impacts for the COY Alternative were studies qualitatively).

Lead

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the CAA effective January 1, 1996, and would not be emitted from any other component of the Proposed Project. Since, the Proposed Project does not include any industrial sources, an analysis of this pollutant was not warranted.

Respirable Particulate Matter—PM_{10} and $PM_{2.5}$

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include: the condensed and reacted forms of naturally occurring VOCs; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and 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 such as metals, 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 adhere 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. Since the traffic generated under the Preferred Alternative would exceed the PM emission screening thresholds discussed in Chapter 17, Sections 210 and 311 of the *CTM*, a quantified assessment of emissions from traffic generated by the Proposed Project was performed for PM for the No-Action and Preferred Alternative (potential air quality impacts under the Midblock Bulk Alternative would be almost identical). An analysis was also conducted to evaluate future PM concentrations with the operation of the proposed below-grade parking garage for the Proposed Project under the No-Action and Preferred Alternative (potential air quality impacts under the Midblock Bulk Alternative and COY Alternative would be almost identical).

Potential temporary impacts of PM emissions from the existing boiler plants at the Elliott -Chelsea Houses Project Site were evaluated for the Preferred Alternative, Non-Rezoning Alternative and Midblock Bulk Alternative. Potential impacts of PM emissions from the existing large and major sources were evaluated to determine their potential effects on the Proposed Project for the Preferred Alternative, Non-Rezoning Alternative and Midblock Bulk Alternative(potential impacts for the COY Alternative were studies qualitatively). The cumulative effects of PM emissions from the temporary air quality effects on the proposed Elliott-Chelsea Houses buildings from the existing NYCHA boiler plants and the Mutual Redevelopment Houses were determined for the Preferred Alternative and the Non-Rezoning Alternative (potential impacts for the COY Alternative were studies qualitatively).

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 EPA New Source Review permitting program for large sources. Due to the federal restrictions on the sulfur content in diesel fuel for on-road and non-road vehicles, no significant quantities are emitted from vehicular sources and therefore analysis of SO_2 from mobile sources was not warranted. Potential impacts of SO_2 emissions on the Proposed Project from the existing large and major sources were evaluated to determine their potential effects on the Proposed Project for the Preferred Alternative, Non-Rezoning Alternative and Midblock Bulk Alternative. Potential impacts of SO_2 emissions from the existing large and major sources were evaluated to determine their potential effects on the Proposed Project for the Preferred Alternative, Non-Rezoning Alternative and Midblock Bulk Alternative (potential impacts for the COY Alternative were studies qualitatively). The cumulative effects of SO_2 emissions from the temporary air quality effects on the proposed Elliott-Chelsea Houses buildings from the existing NYCHA boiler plants and the Mutual Redevelopment Houses were determined for the Preferred Alternative and the Non-Rezoning Alternative (potential impacts for the COY Alternative were studies qualitatively).

2. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

Mobile Sources

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

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

Intersection Analysis

Vehicle Emissions

Engine Emissions

Vehicular PM engine emission factors were computed using the EPA mobile source emissions model, Motor Vehicle Emission Simulator (MOVES4).[1] This emissions model is capable of calculating engine, break wear, and tire wear emission factors for various vehicle types, based on the fuel type (e.g., gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds,

[1] EPA. Motor Vehicle Emission Simulator (MOVES): User Guide for MOVES2014a. EPA420B15095. November 2015. Overview of EPA's Motor Vehicle Emission Simulator (MOVES4). EPA-420-R-23-019. August 2023. There is no stand-alone user's guide for MOVES4 as information is incorporated into the interface.

vehicle age, roadway type and grade, 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 data. Appropriate credits were used to accurately reflect the inspection and maintenance program.[2] 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 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[3] and the *CTM*.

Traffic Data

Traffic data for the intersection analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the Proposed Project (see **Chapter 05.13**). Traffic data for the future without the project (the No-Action condition) and the With-Action condition were employed in the respective air quality modeling condition. The weekday AM, midday, and PM, and Saturday midday/afternoon day peak periods were analyzed.

The peak period traffic volumes were used as a baseline for determining off-peak volumes. Off-peak traffic volumes in the No-Action condition were determined by adjusting the peak period volumes by the 24-hour distributions of actual vehicle counts collected at appropriate locations, and off-peak increments from the Proposed Project were estimated based on the parking demand for the Proposed Project. 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

The PM concentrations due to vehicular emissions adjacent to the analysis sites were predicted using the American Meteorological Society/Environmental Protection Agency Regulated Model (AERMOD) Version 23132.[4] 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

[2] 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.
[3] EPA. Compilations of Air Pollutant Emission Factors AP-42. Fifth Edition, Volume I: Stationary Point and Area Sources, Ch. 13.2.1. NC. http://www.epa.gov/ttn/chief/ap42. January 2011.
[4] EPA. User's Guide for the AMS/EPA Regulatory Model (AERMOD). Office of Air Quality Planning and Standards. EPA-454/B-23-008. Research Triangle Park, North Carolina. October 2023.

handling of terrain interactions. AERMOD is a recommended model for transportation air quality analyses and EPA has mandated its use for transportation conformity purposes after a three-year transition period.[5] Following EPA guidelines, the analysis was performed using an area source representation of emission sources in order to simulate traffic-related air pollutant dispersion.[6] In addition, the weighted average release height and initial vertical source parameters were calculated for each modeled roadway. Hourly traffic volumes and associated emission factors were used to estimate hourly emission rates from each modeled roadway segment and predict traffic-related air pollutant concentrations at receptor locations.

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).

The AERMOD model includes the modeling of hourly concentrations based on hourly traffic data and five years of monitored hourly meteorological data. The data consists of surface data collected at LaGuardia Airport and upper air data collected at Brookhaven, New York for the period 2015–2019. The meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevation over the five-year period. This data is processed using the EPA AERMET program to develop data in a format which can be readily processed by the AERMOD model. The land uses around the site where meteorological surface data were available were classified using categories defined in digital United States Geological Survey (USGS) maps. The meteorological dataset processed with the AERMET Version 19191 processor, provided by NYSDEC, was used for the analysis.[7]

Analysis Year

The microscale analyses were performed for the 2041 analysis year, the year by which the Proposed Project is anticipated to be completed and in operation. The analysis was performed for both the No-Action condition and 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 an analysis site. Background

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[5] EPA. Revisions to the Guideline on Air Quality Models: Final rule. Federal Register, Vol. 82, No. 10, January 2017.
[6] EPA. Project-Level Conformity and Hot-Spot Analyses, available at: https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses#pmguidance
[7] NYSDEC staff communicated in an email to AKRF that the met data provided by NYSDEC and processed with earlier versions is acceptable for use with AERMOD Version23132. NYSDEC does not have immediate plans to update the met data using the new version of AERMET (Version 23132).

concentrations must be added to modeling results to obtain total pollutant concentrations at an analysis site.

The background concentration for the nearest monitored location currently in operation is 17.8 $\mu g/m^3$, measured at JHS 126 in Brooklyn. The 24-hour $PM_{2.5}$ concentrations is based on three recent years of monitored data (2017–2019)[8] consistent with the statistical format of the NAAQS. This value was used as the background concentration for the mobile source analysis.

Analysis Site

Intersections in the traffic study area (see **Figure 05.13-11a** in **Chapter 05.13**) were reviewed for microscale analysis based on the *CTM* guidance. Of those intersections, one exceeded the threshold based on heavy-duty truck equivalents, at 10th Avenue and W. 17th Street for the Preferred Alternative and Midblock Bulk Alternative. Therefore, this site was selected for analysis of $PM_{2.5}$.

Note that the project-generated traffic volumes for the Preferred Alternative and Midblock Alternative are almost identical. Therefore, the mobile source analysis performed for the Preferred Alternative would effectively cover the Midblock Bulk Alternative. The COY Alternative would result in less project-generated traffic than the Preferred Alternative and Midblock Bulk Alternative; therefore, no analysis of the COY Alternative was performed.

Receptor Placement

Multiple receptors (i.e., precise locations at which concentrations are evaluated) were modeled at the selected site; receptors were placed along the approach and departure links and roadway segments at regularly spaced intervals. Ground-level receptors were placed at sidewalk or roadside locations with continuous public access near the selected intersection, at a pedestrian height of 1.8 meters. Receptors in the analysis models for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters, from the nearest moving lane at each analysis location, based on the *CTM* procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

Parking Analysis

The Proposed Project would include a total of 96 accessory parking spaces located at the Fulton Houses. Under the Preferred Alternative, Midblock Bulk Alternative and COY Alternative, this would consist of a below-grade parking garage with a capacity of 96 spaces located at proposed Fulton 2 building. Under the Non-Rezoning Alternative parking would be distributed within three surface parking lots, ranging in capacity from 18 spaces to 43 spaces. Based on the size of the surface parking lots, they are not likely to cause an air quality impact, therefore no detailed assessment of air quality impacts from parking was performed for the Non-Rezoning Alternative.

Potential air quality impacts from the proposed 96-space below-grade parking garage under the Preferred Alternative were analyzed (potential air quality impacts under the Midblock Bulk Alternative and COY Alternative would be identical). Emissions from vehicles using the proposed

[8] More recent background data were not used because of uncertainties in the representativeness of background concentrations for these years due to effects of COVID-19, as per DEP guidance.

parking garage could potentially affect levels of CO and PM concentrations in the immediate vicinity of the ventilation outlets. For the parking garage, the emissions from the outlet vent and their dispersion were analyzed using the methodology defined in the *CTM*. Maximum 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. PM increments were determined for peak daily (24-hour) use. The number of vehicles entering and exiting the garage were derived from the trip generation analysis described in **Chapter 05.13, "Transportation**.**"**

Emissions from vehicles entering, parking, and exiting the garage were determined using the EPA MOVES4 mobile source emission model as described in detail above for the analysis of emissions at intersections. For all arriving and departing vehicles, an average speed of five miles per hour was conservatively assumed for travel within the parking garage. In addition, all departing vehicles were assumed to idle for 60 seconds before proceeding to the exit. Although the project is still in the preliminary stage of design and details on the ventilation system have not yet been defined, the concentrations within the system were conservatively 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.

For the parking garage, 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 concentrations at various distances from an outlet vent by assuming that the concentration at the vent represents the emission rate divided by the fresh air ventilation rate and determining the appropriate initial horizontal and vertical dispersion coefficients at the vent faces. The air from the analyzed parking garage was conservatively assumed to be vented through a single outlet at a height of approximately 10 feet above grade. The closest receptors to the potential vent location were assumed to be on the sidewalk receptors along W. 18th Street; therefore, "near" and "far" receptors were placed along the sidewalks at a pedestrian height of 6 feet and at distances of 5 feet and 55 feet. A receptor was also modeled at the vent height, 10 feet from the vent, to conservatively assess the air quality impacts on the Proposed Project building window or other air intake location. A persistence factor of 0.79 was used to convert the maximum 1-hour average CO concentrations to 8–hour averages, per *CTM* guidance, and factors of 0.6 and 0.1 to convert maximum 1-hour $PM_{2.5}$ concentrations to 24-hour and annual averages, respectively, per EPA guidance,[9] accounting for meteorological variability over the longer averaging periods. Maximum 1-hour and 8-hour average CO background concentrations of 1.7 $\mu g/m^3$ and 1.2 $\mu g/m^3$ measured at CCNY between 2017-2019 were used for the analysis, respectively.

Background and on-street concentrations were added to the modeling results to obtain the total ambient levels. The on-street pollutant concentrations were determined using the methodology in the Air Quality Appendix of the *CTM*, utilizing No-Action and With-Action traffic volumes from the traffic survey conducted in the study area.

[9] EPA. AERSCREEN User's Guide. EPA-454/B-21-005. April 2021.

Stationary Sources

Heating and Hot Water Systems

Heating and hot water services for the Fulton Houses Project Site are currently provided by the Con Edison steam system, while the Elliott-Chelsea Houses Project Site are served by two fossil fuel-fired boiler plants. Under Local Law 97, NYCHA must make efforts to reduce greenhouse gas emissions on a portfolio-wide basis by 40 percent by 2030 and 80 and by 2050. To comply with Local Law 154 of 2021, all future buildings would be designed with electric-powered systems for space heating and domestic hot water. Therefore, for the Proposed Project, no fossil fuels would be used for heating and hot water systems. One or more natural gas-fired generators would be installed to provide power in the event of a loss of utility electric power. The emergency generators would be tested each week for a few minutes to ensure the equipment is operating properly. In addition, three times per year, the equipment would operate for 10-15 minutes for inspection, and once per year, the equipment would operate under load for 30 minutes to 1 hour. Since the generators would only be used for very limited periods of time for testing outside of an actual emergency, no analysis of this equipment is considered to be necessary.

General Conformity

Since all future buildings would be designed with electric-powered systems for space heating and domestic hot water, no fossil fuels would be used for heating and hot water systems. Additionally, natural gas-fired generators would be installed to provide power in the event of a loss of utility electric power and would only be used for very limited periods of time for testing outside of an actual emergency. The emergency generators would be tested each week for a few minutes to sure the equipment is operating properly. In addition, three times per year, the equipment would operate for 10-15 minutes for inspection, and once per year, the equipment would operate under load for 30 minutes to 1 hour. Consequently, operation of the development facilitated by the Proposed Project is anticipated to be well below any of the federal *de minimis* thresholds. Therefore, the Proposed Project is assumed to conform to the SIP and would not require a full conformity determination.

Existing NYCHA Boiler Plants

Heating and hot water services for the Fulton Houses Project Site is currently provided by the Con Edison steam system, while the Elliott-Chelsea Houses Project Site are served by two fossil fuel-fired boiler plants operated by NYCHA. The existing boiler plants at the Elliott-Chelsea Houses Project Site would continue to operate for a period of time until all buildings connected to the plants are vacant. Therefore, potential air quality impacts on the Proposed Project from the existing boiler plants were evaluated for the period of time until they are permanently shutdown.

Elliott/Chelsea Addition

The boiler plant located at 427 W. 26th Street (i.e., existing Elliott Houses 4) serves the five Elliott Houses buildings as well as the Chelsea Addition. The plant consists of three (3) dual fuel (No. 2 oil and natural gas) boilers, each rated at 13.7 million British Thermal Units per hour (MMBtu/hr), which provides steam for space heating and domestic hot water to the Elliott and Chelsea Addition buildings. The Elliott/Chelsea Addition boiler plant is located at the site of proposed Elliott-Chelsea 7 building.

Chelsea Houses

The boiler plant located at 430 W. 26th Street (i.e., existing Chelsea Houses 1) serves the two Chelsea Houses buildings. The plant consists of two (2) dual fuel (No. 2 oil and natural gas) boilers, each rated at 14.7 MMBtu/hr, which provides steam for space heating and domestic hot water to the two Chelsea Houses buildings. The Chelsea Houses boiler plant is located at the site of proposed Elliott-Chelsea 6 building.

A review of the construction phasing schedules and proposed NYCHA tenant relocation plan was performed to estimate the duration of time that the new buildings on the Elliott-Chelsea Project Site would be in operation while the existing boiler plants would still be in use. **Tables 05.19-10b** and **05.19.11b** of **Chapter 05.19, "Construction,"** summarize the proposed construction schedules under the Preferred Alternative and Non-Rezoning Alternative, respectively (the NYCHA boiler plants would not affect the Fulton Houses; therefore, the Midblock Bulk Alternative was not analyzed as the construction schedule for the Elliott-Chelsea Houses under the Midblock Bulk Alternative is the same as the Preferred Alternative).

As shown in the tables, proposed Elliott-Chelsea 2 and 3 buildings are projected to start demolition after only one and two calendar quarters following completion of proposed Elliott-Chelsea 1. Therefore, emissions from the existing NYCHA boiler plants were analyzed assuming the existing NYCHA buildings at the location of proposed Elliott-Chelsea 2 and 3 would not be occupied. Following completion of proposed Elliott-Chelsea 2 and 3, all other existing buildings at the Elliott-Chelsea houses would be vacated, and therefore, the existing NYCHA boiler plants would be permanently shutdown. Given this, an analysis of the above-referenced NYCHA boiler plants on proposed Elliott-Chelsea 2 and 3 was not warranted. An analysis of proposed Elliott-Chelsea 4, 5, 6 and 7 building is also not required since both boiler plants would no longer be operating when these buildings would be completed.

Accordingly, potential air quality effects of the Chelsea Houses boiler plant and Elliott/Chelsea Addition boiler plant were analyzed on proposed Elliott-Chelsea 1 only.

A stationary source analysis of the existing boiler plants at the Elliott-Chelsea Houses Project Site was conducted to assess potential air quality impacts on proposed Elliott Chelsea 1 under the Preferred Alternative and Non-Rezoning Alternative (for the COY Alternative, potential impacts were evaluated qualitatively, since the proposed Elliott-Chelsea 1 building would have the same program and massing as the other alternatives, and would represent the tallest building on the site, consistent with the other project alternative; therefore, pollutant concentrations would be anticipated to be similar to the analyses performed for the Preferred Alternative and Non-Rezoning Alternative). The analysis was performed using the EPA AERMOD model. AERMOD is EPA's preferred regulatory stationary source model.

AERMOD calculates pollutant concentrations from simulated sources (e.g., exhaust stacks) based on hourly meteorological data and surface characteristics, 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 analysis of potential impacts from exhaust stacks assumed stack tip downwash, urban dispersion and surface roughness length, and elimination of calms.

AERMOD incorporates the Plume Rise Model Enhancements (PRIME) downwash algorithm, which is designed to predict concentrations in the "cavity region" (i.e., the area around a structure which under certain conditions may affect an exhaust plume, causing a portion of the plume to become entrained in a recirculation region). AERMOD also uses the Building Profile Input Program for PRIME (BPIPPRM) to provide a detailed analysis of downwash influences on a direction-specific basis. BPIPPRM determines the projected building dimensions for modeling with the building downwash algorithm enabled. The modeling of plume downwash accounts for all obstructions within a radius equal to five obstruction heights of the stack.

The exhaust stacks for the Elliott-Chelsea Addition and Chelsea Houses boiler plants are approximately 135 and 230 feet above grade, respectively. There are no intervening buildings between each of the stacks and the nearest building proposed at the Elliott-Chelsea Project Site that would restrict or otherwise affect the plume exhausts in such a way as to limit the dispersion of the plume downwind from the stack. Therefore, the AERMOD model was run with downwash only, rather than with and without downwash as per the *CTM*.

Modeled pollutant concentrations, added to representative background concentrations in the area, were compared with the NAAQS. For the analysis of the 1-hour average NO_2 concentration from the NYCHA Plants' boilers, the AERMOD Plume Volume Molar Ratio Method (PVMRM) module was used to analyze chemical transformation within the model. PVMRM incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. The model applied ozone concentrations measured in 2015–2019 at the nearest available NYSDEC ozone monitoring station—the IS 52 monitoring station in the Bronx. An initial NO_2 to NO_x ratio of 10 percent at the source exhaust stack was assumed for boilers, which is considered representative.

Five years of surface meteorological data collected at LaGuardia Airport for $PM_{2.5}$ from 2015–2019 and concurrent upper air data collected at Brookhaven, New York were used in the analysis, due to uncertainties in the representativeness of more recent background concentrations because of COVID-19.

Emission Rates and Stack Parameters

The NYCHA Elliott-Chelsea and Chelsea Houses boiler plants are capable of burning natural gas or No. 2 fuel oil. The plants operate on natural gas as the primary fuel with No. 2 fuel oil as a back-up. Based on a review of the fuel usage at these facilities, the use of No. 2 oil from 2018 to 2023 has been very limited at the Chelsea Houses boiler plant, and no fuel oil has been used at the Elliott-Chelsea Addition boiler plant. Therefore, the analysis was performed assuming natural gas only.

EPA emission factors for natural gas-fired boilers were used, with the exception of NO_x emissions for the Elliott-Chelsea Boiler Plant, which were modeled assuming a maximum emission rate of

45 ppm. Annual NO_2 concentrations from heating and hot water sources were conservatively estimated assuming full conversion of NO_2 to NO_x. $PM_{2.5}$ emissions include both the filterable and condensable components.

Annual average emissions rates were determined based on the maximum total annual natural gas usage from several recent years of available operating data. Short-term emission rates were initially calculated based on a review of monthly fuel usage. Based on this, it is projected that a maximum of two boilers at each boiler plant would be used during the peak winter demand conditions, while one boiler would be used during other months of the year. However, in the future with the Proposed Project, the NYCHA boiler plants would operate at reduced capacity compared to existing conditions as existing NYCHA buildings are vacated and demolished. The Elliott/Chelsea Addition boiler plant currently serves a total of six NYCHA buildings, while the Chelsea Houses boiler plant serves two NYCHA buildings. For the purpose of this analysis, the maximum short-term and annual average emission rates were adjusted based on the NYCHA buildings that would be demolished either before or in the initial 24-month period after a new building is completed. The adjustments were based on the total floor area of the buildings removed from service, compared to the total floor area of the existing buildings currently served by the boiler plant.

Tables I.1-1 and **I.1-2** present the stack parameters used in the AERMOD analysis for the Preferred Alternative and Non-Rezoning Alternative, respectively. As discussed above, the maximum short-term and annual average emission rates were adjusted based on the NYCHA buildings that would be demolished either before or in the initial 24-month period after a new building is completed. Specifically, the analysis was performed following completion of proposed Elliott-Chelsea 1 building, while proposed Elliott-Chelsea 1 and 2 are under construction. The emissions are shown in **Table I.1-1**, would be the same under each of the alternatives. The floor area percentages are also shown in the table.

Table I.1-1: Stack Parameters and Emission Rates – NYCHA Boiler Plants

Parameter	Elliott/Chelsea Addition	Chelsea Houses
No. of Boilers	3	2
Fuel Type	Natural Gas	Natural Gas
Max Heat Input/unit (MMBtu/hr)	13.7	14.7
Current Max Annual Heat Input (MMBtu/yr)	68,754	41,625
Stack Height (ft)[(1) (7)]	135	230
Stack Diameter (ft)[(1)]	4.89	3.98
Exhaust Flow Rate (acfm)[(2)]	5,295	4,163
Exhaust Temperature (°F)[(1)]	260	307.8
Floor Area Percentage[(3)]	60%	50%

Annual Average Emissions (g/s)

Pollutant	Elliott/Chelsea Addition Boiler Plant	Chelsea Houses Boiler Plant
NO_x	0.032 [(4)]	0.029 [(5)]
$PM_{2.5}$ [(6)]	0.0044	0.0022

Short -Term Emissions by Month (g/s)

Month	NO_x [(4)]	$PM_{2.5}$	NO_x	$PM_{2.5}$
Jan	0.113	0.015	0.182	0.014
Feb	0.113	0.015	0.182	0.014
March	0.113	0.015	0.091	0.0069
April	0.056	0.0077	0.091	0.0069
May	0.056	0.0077	0.091	0.0069
June	0.056	0.0077	0.091	0.0069
July	0.056	0.0077	0.091	0.0069
August	0.056	0.0077	0.091	0.0069
September	0.056	0.0077	0.091	0.0069
October	0.056	0.0077	0.091	0.0069
November	0.056	0.0077	0.091	0.0069
December	0.113	0.015	0.182	0.014

Notes:

Estimated emissions from the NYCHA boiler plants following completion of proposed Elliott-Chelsea 1 and start of demolition at proposed Elliott-Chelsea 2 and 3.

1 Obtained from the DEP Air Permit.

2 Per boiler.

3 The FAR percentage is determined based on the ratio of the total floor area that is estimated to be served by the existing boiler plant compared to the total floor area currently served by the boiler plant.

4 Based on an emission rate of 45 ppm NO_x.

5 Emission factor based on AP-42 Table 1.4-1.

6 Emission factors based on AP-42 Table 1.4-2.

7 The existing stack height is 135 feet. The proposed stack was modeled at a height of 145 feet.

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 I.1-2**).

Table I.1-2: Maximum Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration (µg/m³)	NAAQS (µg/m³)
NO_2	1-hour	IS 52	110.6	188
NO_2	Annual	IS 52	32.8	100
PM_{10}	24-hour	IS 52	36.0	150
$PM_{2.5}$	24-hour	JHS 126	17.8	35
$PM_{2.5}$	Annual	JHS 126	7.6	9 (1)

Notes:
1 EPA has lowered the NAAQS from 12 µg/m³, effective March 6, 2024.
Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2017–2019.

To develop background levels for each pollutant, concentrations measured at the most representative ambient monitoring station operated by NYSDEC over a three-year period (2017–2019) were used consistent with NYSDEC guidance. More recent data were not used because of uncertainties in the representativeness of background concentrations for these years because of COVID-19, consistent with DEP guidance.

Total 1-hour NO_2 concentrations were refined following a more detailed approach (EPA "Tier 3"). The Tier 3 methodology used to determine the total 1-hour NO_2 concentrations from the facility was based on adding the monitored background to modeled concentrations, as follows: hourly modeled concentrations from the boilers were first added to the seasonal hourly background monitored concentrations; then the highest combined daily 1-hour NO_2 concentration was determined at each location and the 98th percentile daily 1-hour maximum concentration for each modeled year was calculated within the AERMOD model; finally the 98th percentile concentrations were averaged over the latest five years.

Receptor Placement

Discrete receptors were modeled along proposed Elliott-Chelsea 1 building façades to represent potentially sensitive locations such as operable windows and intake vents. Rows of receptors at spaced intervals on the modeled buildings were analyzed at multiple elevations.

Industrial Sources

The potential impacts of existing industrial operations on pollutant concentrations at the development site were evaluated. Potential industrial air pollutant emission sources within 400 feet of the proposed development sites were surveyed for inclusion in the air quality impact analyses, as recommended in the *CTM*.

Land use maps were reviewed to identify potential sources of emissions from manufacturing/industrial operations. A search of federal- and state- facilities with air permits or registrations within the study area was conducted using NYSDEC's air permit and registration website.[10] DEP's online permit database was also searched to identify any permitted industrial uses in the study area.[11]

Based on a review of land uses around these sites, only one property is identified as industrial within the study areas, at 510 W. 27th Street. This site was determined to be a textile warehouse. No active DEP permits for manufacturing or processing sources were identified at this or any other property within the study area. One NYSDEC permit or registration was identified for a process source, a dry cleaner on 232 9th Avenue, which is more than 300 feet from the Elliott-Chelsea Houses Project Site. Dry cleaners are highly regulated and use control technologies and operating practices to minimize emissions of dry cleaning chemicals. Based on this information it was determined that no analysis of this emission source was necessary.

Based on the results of the industrial source evaluation, no potential for significant adverse air quality impacts on the Proposed Project are anticipated from industrial source emissions.

Large and Major Sources

A review of NYSDEC Title V and State Facility Air permits was performed to identify any federal or state-permitted facilities. Existing large and major sources of emissions (i.e., sources having a Title V or State Facility Air Permit) within 1,000 feet of the development sites were surveyed. One facility was identified within 1,000 feet of the Fulton Houses Project Site: the Starbucks Roastery, which has a State Facility Permit. One facility was identified within 1,000 feet of the Elliott-Chelsea Houses Project Site: Mutual Redevelopment Houses, which has a Title V Permit. **Figure I.1-1** shows the location of these facilities.

Therefore, an analysis of these sources was performed to assess their potential effects on the Proposed Project. The analysis was performed using the EPA AERMOD dispersion model using the same general methodology and assumptions outlined above for the existing NYCHA boiler plants.

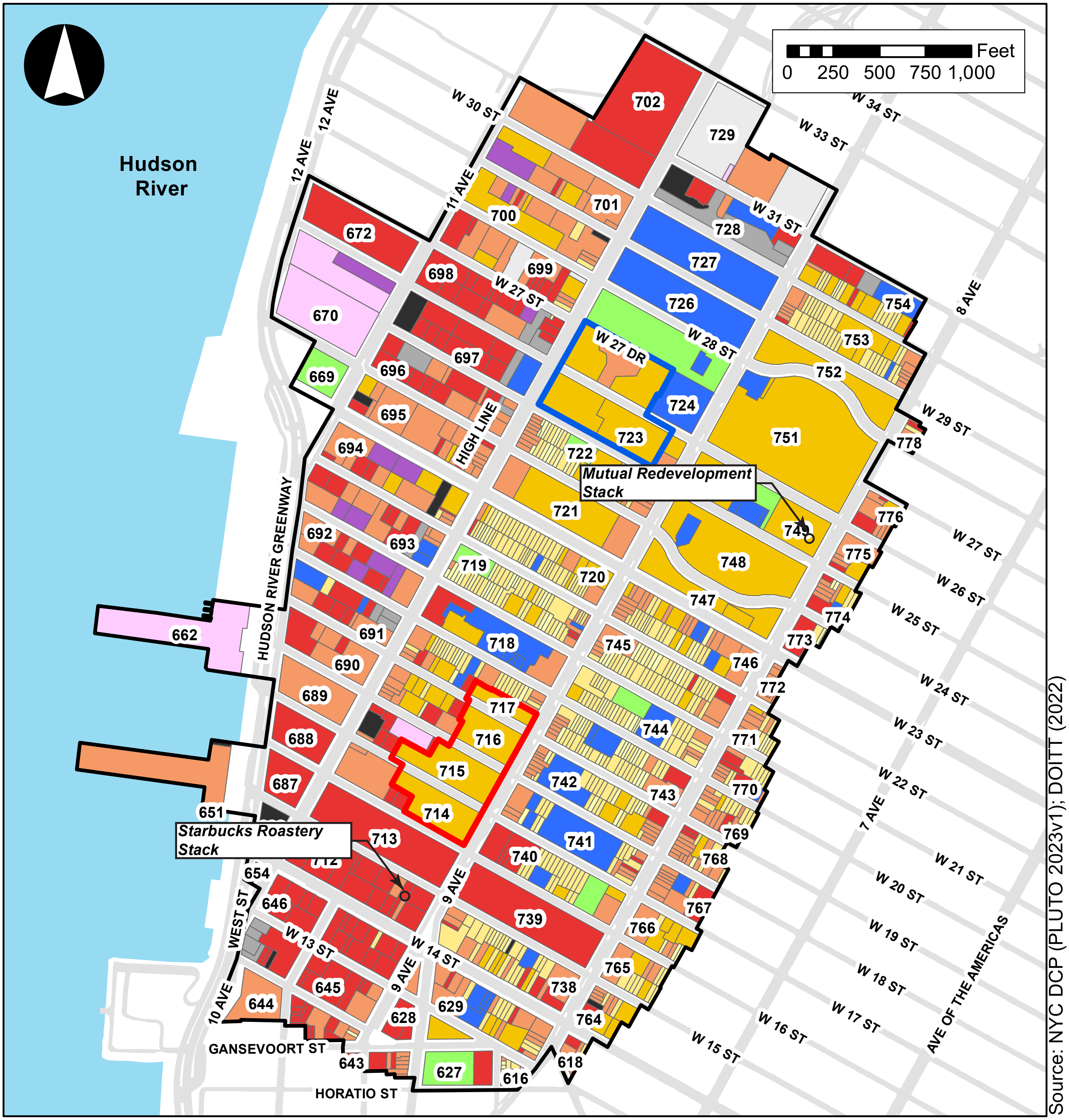
Emission Rates and Stack Parameters

The Starbucks Roastery is a commercial coffee roasting facility that operates two natural gas-fired coffee roasters, rated at 0.205 million British thermal units (MMBtu/hr) and 2.5 MMBtu/hr. The State Facility Permit contains conditions for each roaster on the maximum quantities of coffee beans that can be roasted on an hourly and annual basis. These limits were used to derive the short-term and annual emission rates.

Mutual Redevelopment Houses provides heating, cooling, hot water and electricity to a residential apartment complex consisting of ten (10) twenty-two story residential buildings. Electricity and heating needs are currently supplied by four natural gas-fired reciprocating engines rated at 820 kilowatts (kW), three diesel-fired engines rated at 1,150 kW and three diesel-fired engines rated at 820 kW. Supplemental heating is provided by two dual fuel-fired boilers (natural gas and No. 2 oil), each rated at 39.11 MMBtu/hr. All emissions sources vent to a common stack. An application

[10] NYSDEC. Access to NYSDEC Air Permits. https://www.dec.ny.gov/chemical/8569.html.
[11] DEP. NYC DEP CATS Information. https://a826-web01.nyc.gov/dep.boilerinformationext. New York City Open Data https://data.cityofnewyork.us/Environment/CATS-Permits/f4rp-2kvy.

Location of Existing Large and Major Emission Sources



Legend

- Elliott-Chelsea Houses
- Fulton Houses
- Land Use Study Area
- 687 Block Number

Land Use

- One & Two Family Buildings
- Multi-Family Walkup Buildings
- Multi-Family Elevator Buildings
- Mixed Commercial/Residential Buildings
- Commercial/Office Buildings
- Industrial/Manfuacturing
- Transportation/Utility
- Public Facilities & Institutions
- Open Space
- Parking Facilities
- Vacant Land
- All Others or No Data

to modify the existing Title V Air Permit was submitted to NYSDEC. The modifications include restricting two of the 820 kW diesel engines and one of the 1,150 kW diesel engines to emergency back-up use, and installing one new natural gas-fired reciprocating engine rated at 1,035 kW. The air quality analysis was performed using these assumptions.

Short-term emissions were calculated based on the maximum capacity of the equipment, and assuming the boilers operate on backup fuel (No. 2 fuel oil) during the winter months and the primary fuel (natural gas) for the rest of the year. Annual emissions were based on the maximum total annual fuel usage from several years of available operating data.

Facility emissions were estimated using information obtained from the air permits and applying the EPA's Compilations of Air Pollutant Emission Factors (AP-42)[12] emission factors for boilers and engines used to generate combined heat and power (CHP). **Tables I.1-3 and I.1-4** present the emission rates and stack parameters used in the AERMOD analysis for the Starbucks Roastery and Mutual Redevelopment Houses facilities, respectively.

Table I.1-3: Stack Parameters and Emission Rates - Starbucks Roastery

Parameter	**SBG25**	**SBG120**
No. of Modeled Units	1	1
Fuel Type	Natural Gas	Natural Gas
Heat Input (MMBtu/hr)	3.71	11.2
Annual Heat Input (MMBtu/yr)	32,456	98,112
Stack Height (ft)(1)	181	181
Stack Diameter (ft)(1)	1.5	2.5
Exhaust Flow Rate (acfm)(1)	12,063	17,223
Exhaust Temperature (°F)(1)	393	339
Short-Term Emissions (g/s)		
NO_x(2)	0.013	0.050
PM_{10} (3)	0.0011	0.0041
$PM_{2.5}$ (3)	0.0011	0.0041
SO_2(4)	0.00027	0.00083
Acrolein	0.00041	0.0005
Formaldehyde	0.0019	47
Acetaldehyde	0.00034	0.0012
Annual Emissions (g/s)		
NO_x(2)	0.011	0.040
$PM_{2.5}$ (3)	0.001	0.003
Acrolein	0.00033	0.00038
Formaldehyde	0.0015	0.0037
Acetaldehyde	0.00027	0.0010

Notes:
1 Obtained from the NYSDEC Title V Permit.
2 Emission factors based on stack test data.
3 Emission factors based on AP-42 Table 9.13.2-1.
4 Emission factors based on AP-42 Table 1.4-2.

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

Table I.1-4: Stack Parameters and Emission Rates – Mutual Redevelopment Houses

Parameter	**Value**			
Equipment	Boilers	Gas-fired Engines (820 KW)	Diesel Engines	New Gas-fired Engine (1,035 KW)
Fuel Type	Fuel Oil	Natural Gas	Fuel Oil	Natural Gas
Heat Input (MMBtu/hr)	78.22	30.4	23.8	10.3
Annual Heat Input (MMBtu/yr)	12,023.3 (Fuel Oil); 48,219.7 (Natural Gas)	119,023.4	52,735	82,400
Stack Height (ft)(1)	220			
Stack Diameter (ft)(1)	7			
Exhaust Flow Rate (acfm)(1)	71,442			
Exhaust Temperature (°F)(1)	500			
Pollutant	**Winter**		**Non-Winter**	
Short-Term Emissions (g/s)				
NO_x(2)	8.358		7.767	
PM_{10} (3)	0.391		0.296	
$PM_{2.5}$ (3)	0.368		0.291	
SO_2(3)	0.023		0.013	
Annual Emissions (g/s)				
NO_x (2)	2.491		2.491	
$PM_{2.5}$ (3)	0.079		0.079	

Notes:
1 Obtained from the NYSDEC Title V Permit.
2 Emission factor for boilers, 820 kW gas-fired engines and diesel engines based on Title V RACT limits. Emission factor for the new natural gas-fired reciprocating engine based on AP-42 Table 3.2-2.
3 Emission factors based on AP-42 Tables 1.3-1 and 1.3-7 for fuel oil-fired boilers, Table 1.4-2 for natural gas-fired boilers, and Table 3.2-2 for natural gas-fired reciprocating engines and Table 3.4-2 for diesel fuel-fired engines.

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 I.1-5**).

To develop background levels for each pollutant, concentrations measured at the most representative ambient monitoring station operated by NYSDEC over a three-year period (2017–2019) were used consistent with NYSDEC guidance.[13] More recent data were not used because of uncertainties in the representativeness of background concentrations for these years because of COVID-19, consistent with DEP guidance.

13 DAR-10: NYSDEC Guidelines on Dispersion Modeling Procedures for Air Quality Impact Analysis, September 1, 2020.

Table I.1-5: Maximum Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1-hour	IS 52	110.6	188
NO_2	Annual	IS 52	32.8	100
SO_2	1-hour	IS 52	14.6	196
PM_{10}	24-hour	IS 52	36.0	150
$PM_{2.5}$	24-hour	JHS 126	17.8	35
$PM_{2.5}$	Annual	JHS 126	7.6	9 (1)

Notes:
1 EPA has lowered the NAAQS from 12 $\mu g/m^3$, effective March 6, 2024.
Source: New York State Air Quality Report Ambient Air Monitoring System, NYSDEC, 2017–2019.

Cumulative Emissions Analysis

The cumulative effects of emissions from the temporary air quality effects on the proposed Elliott-Chelsea buildings from the existing NYCHA boiler plants and the Mutual Redevelopment Houses were analyzed. These cumulative effects would be temporary, as described above, and would potentially impact proposed Elliott-Chelsea 1 only.

The EPA's AERMOD refined dispersion model was used to estimate the short-term and annual concentrations of critical pollutants at sensitive receptor locations under the Preferred Alternative and Non-Rezoning Alternative (the COY Alternative would be of a lesser bulk and density compared to the Preferred Alternative, and consequently, potential cumulative effects of emissions from the temporary air quality effects on the proposed Elliott-Chelsea Houses buildings from the existing NYCHA boiler plants and the Mutual Redevelopment Houses would be similar or less compared to the Preferred Alternative and Non-Rezoning Alternative). The analysis was performed using the same model options described above for the analysis of the large source analysis.