13. Air Quality

13.1 INTRODUCTION

The Proposed Action, under the reasonable worst-case development scenario (RWCDS), would affect residential/commercial buildings on 39 identified development sites that include 19 projected and 20 potential development sites.

Air quality, which is a general term used to describe pollutant levels in the atmosphere, has the potential to be affected by the Proposed Action. The following key issues are assessed in this chapter:

- The potential for changes in vehicular travel associated with the Proposed Action to result in significant mobile source (vehicular related) air quality impacts.
- The potential for emissions from vehicles using parking facilities associated with the Proposed Action to cause significant mobile source air quality impacts.
- The potential of the heating, ventilation, and air conditioning (HVAC) emissions of the proposed RWCDS development sites to significantly impact other proposed development sites (project-on-project impacts).
- The potential for HVAC emissions of the proposed RWCDS development sites to significantly impact existing land uses (project-on-existing impacts).
- The potential for HVAC emissions from existing large emission sources with 20 or more million Btu (MMBtu)/hour of heat rate input to significantly impact proposed RWCDS development sites.
- The potential from the HVAC systems of existing emission sources that have Title V or State Facility Permits to significantly impact proposed RWCDS development sites.
- The potential from air toxic emissions generated by existing industrial/commercial sources to significantly impact proposed RWCDS development sites.

13.2 PRINCIPAL CONCLUSIONS

There are no significant impacts from mobile and/or air toxic sources with the Proposed Action. With the proposed (E) designations (E-310), the development sites' HVAC's system emissions would not significantly impact either other development sites (project-on-project impacts) or existing land uses (project-on-existing impacts). In addition, the potential impacts from existing HVAC sources on the proposed buildings are not projected to be significant.

13.3 POLLUTANTS OF CONCERN

13.3.1 Criteria Pollutants

The following air pollutants, known as criteria pollutants, have been identified by the U.S. Environmental Protection Agency (EPA) as being of concern nationwide: carbon monoxide (CO), nitrogen dioxide (NO_2), ozone, particulate matter (PM_{10} and $PM_{2.5}$), sulfur dioxide (SO_2), and lead. National Ambient Air Quality Standards (NAAQS) are concentrations set for each of the criteria pollutants specified by the EPA that have been developed to protect human health and welfare. New York has adopted the NAAQS as state ambient air quality standards. These standards, together with their health-related averaging periods, are presented in Table 13-1.

TABLE 13-1: APPLICABLE NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	National and NYState Standards	
		Primary	Secondary
Ozone (O_3)	8 Hour [3]	0.075 ppm (147 µg/m^3)	Same as Primary Standard
Carbon Monoxide [1]	8 Hour	9 ppm (10 mg/m^3)	Same as Primary Standard
	1 Hour	35 ppm (40 mg/m^3)	Same as Primary Standard
Nitrogen Dioxide (NO_2)	Annual Average	0.053 ppm (100 µg/m^3)	Same as Primary Standard
	1 Hour Average [2]	0.10 ppm (188 µg/m^3)	—
Sulfur Dioxide (SO2)[5]	1 Hour [6]	0.075 ppm (196 µg/m^3)	—
	Maximum 3-hour average		0.5 ppm (1,300 µg/m3)
Suspended Particulate Matter (PM_{10})	24 Hour	150 µg/m^3	Same as Primary Standard
Suspended Fine Particulate Matter ($PM_{2.5}$)	24 Hour [4]	35 µg/m^3	Same as Primary Standard
	Annual Arithmetic Mean	12 µg/m^3	Same as Primary Standard
Lead	Rolling 3-Month Average	0.15 µg/m^3	Same as Primary Standard

Source: www.epa.gov/air/criteria.html

Notes:
(1) Not to be exceeded more than once a year.
(2) 3-year average of the annual 98th percentile daily maximum 1-hour average concentration. Effective April 12, 2010.
(3) 3-year average of the annual fourth highest daily maximum 8-hour average concentration.
(4) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
(5) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard, effective August 23, 2010.
(6) 3-year average of the annual 99th percentile daily maximum 1-hour average concentration.

ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable
All annual periods refer to calendar year.

13.3.2 Toxic Air Pollutants

In addition to criteria pollutants, small quantities of a wide range of the non-criteria air pollutants, known as toxic air pollutants, which are emitted from nearby industrial and commercial facilities, are also of concern. These pollutants can be grouped into two categories: carcinogenic and non-carcinogenic air pollutants. These include hundreds of pollutants, ranging from high to low toxicity. While no federal standards have been promulgated for toxic air pollutants, the EPA and NYSDEC have issued guidelines that establish acceptable ambient levels for these pollutants based on human exposure criteria. The procedures to estimate inhalation exposure concentration, hazard index, and cancer risk of toxic pollutants are outlined in the EPA Human Health Risk Assessment Protocol (HHRAP) (EPA 520-R-05-006) and described in the toxic analysis section of this Chapter.

13.3.3 Pollutants for Analysis

Ambient air quality is affected by air pollutants produced by both motor vehicles and fixed 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 ($PM_{2.5}$) is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Coarse PM (PM_{10}) is mostly the product of fugitive dust and construction activities. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and sources utilizing non-road diesel (high sulfur diesel) such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs.

CO, PM_{10} and $PM_{2.5}$ were considered for the mobile source analysis of project-related vehicle trips; PM_{10}, $PM_{2.5}$, SO_2 and NO_2 were considered for analysis of potential impacts of project-related HVAC emissions for fuel oil and natural gas systems.

Total estimated concentrations are to be compared to corresponding NAAQS to determine whether estimated impacts should be considered to be potentially significant. However, the City requires, for the evaluation of potential $PM_{2.5}$ impacts for projects subject to CEQR, the use of their interim guidance criteria to determine the potential for significant $PM_{2.5}$ impacts as per CEQR guidance. For this project a prototypical analysis with an increase in 24-hour $PM_{2.5}$ levels greater than 5 $\mu g/m^3$ was considered to be a significant project impact. The protocol, developed by DCP in conjunction with New York City Department of Environmental Protection (DEP), includes assumptions in the HVAC analysis that are

unique for boiler systems in this area of the City and that may not be appropriate for other proposed actions.

The NAAQS for the 1-hour NO_2 standard of 0.100 ppm (188 $\mu g/m^3$) is the 3-year average of the 98th percentile of daily maximum 1-hour average concentrations in a year. The total 1-hour NO_2 concentrations are estimated by adding the hourly modeled 8th highest NO_2 impacts (i.e., the 98th percentile) concentrations to the 3-year average of hourly ambient NO_2 concentrations. Total estimated concentrations were compared with the 1-hour NO_2 NAAQS standard.

13.4 ANALYSIS OF MOBILE SOURCES

13.4.1 Impacts near Congested Intersections

According to the *CEQR Technical Manual* screening threshold criteria for this area of the City, if 140 or more project-generated vehicles pass through a signalized intersection within the project area of concern in any given peak period, there is a potential for mobile source air quality impacts for CO and a detailed analysis is required. For $PM_{2.5}$, the threshold for potential impacts is 23 heavy duty diesel truck equivalents for streets which are principal and minor arterials.

The travel demand forecast and vehicle trip assignments conducted for the Proposed Action indicates that the number of project-generated vehicles would be above CEQR screening threshold values during the AM/MD/PM peak period(s) at the following intersections for CO:

Site	Location
1	Fifth Avenue & 47th Street
2	Madison Avenue & East 39th Street
3	Madison Avenue & East 46th Street
4	Madison Avenue & East 42nd Street
5	Park Avenue & East 46th Street
6	Park Avenue & East 40th Street
7	Lexington Avenue & East 46th Street
8	Second Avenue & East 46th Street
9	Second Avenue & East 53rd Street

Therefore, a detailed microscale modeling analysis was conducted that estimated CO levels near these intersections. CO levels were estimated for existing conditions and for future (2033) conditions with and without the Proposed Action.

All intersections are considered principal and minor arterials and passed the screening criteria for $PM_{2.5}$. Therefore, no detailed particulate matter (PM_{10} or $PM_{2.5}$) analysis is required.

13.4.1.1 Carbon Monoxide (CO) Analysis Parameters

a. Receptors

The locations at which pollutant concentrations are estimated are known as "receptors." Following guidelines established by the EPA, receptors were located where the maximum concentration is likely to occur and where the general public is likely to have access. For this analysis, receptors were distributed along sidewalks near the intersections selected for analysis.

b. Traffic Data

Traffic data for the air quality analysis were derived from traffic counts and other information developed as part of the traffic study analysis, using CEQR guidelines.

c. Vehicle Classification Data

Vehicle classification data required to determine composite emission factors were based on estimates for the following categories: light-duty gasoline vehicles (LDGVs), sport utility vehicles (SUVs), medallion taxis, light-duty trucks, heavy-duty trucks, and buses.

d. Vehicular Emissions

CO emission factors were estimated using the EPA's MOBILE 6.2.03 (EPA420-R-03-010), EPA's emission factor algorithm. This version includes the effects of the vehicle standards and vehicle turnover. The latest NYSDEC modeling inputs and assumptions were applied.

e. Dispersion Analysis

Mobile source dispersion models are the basic analytical tools used to estimate pollutant concentrations from the emissions generated by motor vehicles as expected under given conditions of traffic, roadway geometry, and meteorology. CAL3QHC Version 2 is a line-source dispersion model that predicts pollutant concentrations near congested intersections and heavily traveled roadways. CAL3QHC input variables include free flow and calculated idle emission factors, roadway geometries, traffic volumes, site characteristics, background pollutant concentrations, signal timing, and meteorological conditions. CAL3QHC predicts inert pollutant concentrations, averaged over a one-hour period near roadways. This model was used to predict concentrations at the intersections.

CAL3QHC predicts peak one-hour pollutant concentrations using assumed meteorology and peak-period traffic conditions. Different emission rates occur when vehicles are stopped (idling), accelerating, decelerating, and moving at different average speeds. CAL3QHC simplifies these different emission rates into the following two components:

- Emissions when vehicles are stopped (idling) during the red phase of a signalized intersection.
- Emissions when vehicles are in motion during the green phase of a signalized intersection.

The analyses followed the EPA's Intersection Modeling Guidelines (EPA-454/R-92-005) for CO modeling methodology and receptor placement. All major roadway segments (links) within approximately 1,000 feet from each analysis site (i.e., congested intersection) were considered.

f. Background Concentration

An 8-hour CO background concentration of 1.7 ppm, which was obtained from NYSDEC Air Quality Monitor at CCNY site in 2011, was added to modeled concentrations to account for the affects of other emission sources in the area.

g. Persistence Factor

Peak 8-hour mobile source CO concentrations were obtained by using a persistence factor of 0.77, as provided in *CEQR Technical Manual*, to the maximum predicted one-hour values. This persistence factor takes account of the fact that over eight hours (as distinct from a single hour) vehicle volumes will fluctuate downward from the peak, vehicle speeds may vary, and meteorological conditions including wind speeds and wind direction will change to some degree as compared to the conservative assumptions used for the single maximizing hour.

13.4.1.2 Mobile Source Analysis Results

A summary of the results of the mobile source air quality modeling analysis for the Existing (2012) and Future (2033) without and with the Proposed Action is provided in Table 13-2 and Table 13-3, respectively. The values shown are the maximum CO concentrations estimated near analysis.

TABLE 13-2: MAXIMUM ESTIMATED EXISTING (2012) 8-HOUR CO LEVELS

Analysis Site	8-hour CO Level (ppm)
Fifth Avenue & 47th Street	3.09
Madison Avenue & East 39th Street	2.62
Madison Avenue & East 46th Street	2.55
Madison Avenue & East 42nd Street	2.62
Park Avenue & East 46th Street	3.47
Park Avenue & East 40th Street	2.62
Lexington Avenue & East 46th Street	2.62
Second Avenue & East 46th Street	3.16
Second Avenue & East 53rd Street	3.47

Note: All values are the maximum estimated concentrations under all time periods considered and include an 8-hour background concentration of 1.7 ppm.

Persistence Factor =0.77

NAAQS: CO = 9 ppm

TABLE 13-3: MAXIMUM ESTIMATED FUTURE (2033) 8-HOUR CO LEVELS WITH AND WITHOUT THE PROPOSED ACTION

Analysis Site	8-hour CO No Build Level (ppm)	8-hour CO Build Level (ppm)	8-hour CO Increment (ppm)
Fifth Avenue & 47th Street	3.24	4.78	1.54
Madison Avenue & East 39th Street	2.55	2.62	0.08
Madison Avenue & East 46th Street	2.47	2.86	0.39
Madison Avenue & East 42nd Street	2.62	2.86	0.23
Park Avenue & East 46th Street	2.78	3.16	0.39
Park Avenue & East 40th Street	2.47	3.01	0.54
Lexington Avenue & East 46th Street	2.55	2.55	0.00
Second Avenue & East 46th Street	3.01	3.16	0.15
Second Avenue & East 53rd Street	3.24	3.32	0.08

Note: All values are the maximum estimated concentrations under all time periods considered and include an 8-hour background concentration of 1.7 ppm.

Persistence Factor =0.77

NAAQS: CO = 9 ppm

The results of this analysis are summarized as follows:

- CO levels would not exceed the 8-hour standard. The maximum estimated concentration of 4.78 ppm with the Proposed Action is below the NAAQS of 9 ppm.
- The DEP CO *de minimis* criteria would not be exceeded, indicating that the Proposed Action would not have the potential to cause CO impacts that are considered to be significant (2.88 ppm).

The result of this analysis is that the mobile source impacts of the Proposed Action would not significantly impact local air quality levels.

13.4.2 Garage Analysis

An air quality analysis was conducted, following guidelines provided in the *CEQR Technical Manual* for an enclosed garage, to estimate the potential impacts of a proposed 201-space below-grade parking garage at East 50th Street between Third Avenue and Lexington Avenue at Site 17, which is the largest parking facility associated with the Proposed Action. Emissions from the garage were assumed to be discharged through one garage vent. Because the garage would be used almost exclusively by gasoline-powered automobiles and not diesel-fueled trucks, CO was the only pollutant considered for this analysis. Potential PM_{10} and $PM_{2.5}$ impacts were not considered because the concentrations of these pollutants would not be materially affected by the operation of this facility.

CO emission factors for the various vehicles operating modes (cold/hot start/idle) under the future (2033) Build scenario were estimated using EPA's MOBILE 6.2.03 emission factor algorithm. Maximum hourly CO emission rates were calculated for the time period with the maximum number of departing autos in an hour, since departing autos are assumed to be "cold" and arriving cars are assumed to be "hot" ("cold" autos emit CO at considerably higher rates than "hot" autos). Maximum hourly CO emission rates over a consecutive 8-hour period were computed for the 8-hour time period that averages the largest number of departing autos per hour with a 100% parking accumulation. The maximum emission rate was determined based on the ins/outs for the 8-hour time period and the mean traveling distance within the garage. The analysis assumed that all departing autos would idle for one minute before traveling to the exits of the garage, and all arriving and departing autos would travel at 5 miles per hour within the garage.

Estimates of off-site CO impacts are based on the EPA's equation for dispersion of pollutants from a stack as describe in *CEQR Technical Manual* Appendix: Air Quality. The garage vent was converted into a "virtual point source" and the concentrations within the garage were used to estimate the initial dispersion at the garage vents. The initial horizontal and vertical distributions are assumed to be equal and calculated by setting CO concentrations at the exit of the vent equal to the CO level within the facility. One vent was assumed for this analysis. Eight-hour CO impacts are estimated at a receptor near the vent (5 feet from the vent, 6 feet below the midpoint height of the vent) and at a receptor across a street on the far sidewalk from the vent (50 feet away, also 6 feet below the vent midpoint). Cumulative CO impacts on the near and far sidewalks adjacent to the garage vents were calculated by adding the impact from the garage exhaust to on-street sources, and background levels.

A maximum total 8-hour CO concentration of 4.0 ppm was estimated at a receptor located 5 feet from the vent by adding the estimated garage impact and the background concentration of 1.7 ppm; a maximum total 8-hour CO concentration of 3.1 ppm was estimated at the receptor located 50 feet from the vent by adding the garage impact (at East 50th Street between Third Avenue and Lexington Avenue), street traffic impacts, and the background concentration of 1.7 ppm. The maximum total estimated 8-hour CO concentrations are therefore below the 8-hr CO NAAQS of 9.0 ppm.

13.5 ANALYSIS OF HEATING SYSTEM EMISSIONS

13.5.1 HVAC Analysis

13.5.1.1 Screening-Level Analysis

An initial screening analysis was performed using the methodology described in Section 322.1 of Chapter 17 of the *CEQR Technical Manual*. This methodology determines the threshold of development size below which the action would not have a significant impact. The screening procedure utilizes information

regarding the type of fuel to be burned, the maximum development size, and the HVAC exhaust stack height, to evaluate whether or not a significant impact is possible.

Based on the distance from the development 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*, then there is the potential for significant air quality impacts and additional analysis would be required. Otherwise, the source passes the screening analysis and no further analysis is required.

Any nearby development of similar or greater height was analyzed as a potential receptor. It was assumed that either natural gas or No. 2 fuel oil would be used in the boiler systems based on City regulations. The primary pollutants of concern are NO_2 and SO_2 from natural gas and fuel oil combustion, respectively.

Based on the screening-level analysis, the following development sites would screen out and therefore would not require any restrictions as it relates to their HVAC systems:

- Projected Development Site 12
- Projected Development Site 19
- Potential Development Site 11

In addition, Potential Development Site 6 would screen out if restricted to the use of natural gas (i.e., no fuel oil) for its HVAC system. The other 35 development sites would not screen out and therefore further analysis for those sites are required.

13.5.1.2 Prototypical Analysis

Many buildings in the study area use steam (supplied by Con Edison) for their HVAC needs, and the steam utility system is readily available throughout the study area. There would be no local HVAC impacts from these building because no stack is needed for space heating and/or heat water systems. However, for this analysis, it was initially assumed that Proposed Action development sites would have their own heating systems that would burn natural gas. Proposed Action sites that fail the analysis using natural gas (i.e., caused potentially significant impacts) would be required, via an (E) designation, to use steam. The pollutants associated with natural gas—$PM_{2.5}$ and NO_2—were considered for this analysis.

a. $PM_{2.5}$ Impact Threshold

The city's 24-hour $PM_{2.5}$ increment of 5 $\mu g/m^3$ served as a basis for determining the threshold distance for each development site (i.e., the minimum distance that each building should be from any other building to avoid the potential for significant impacts).

b. 1-hour NO_2 Modeling Approach

Nitrogen oxide (NO_x) emissions from gas combustion consist predominantly of nitric oxide (NO) at the source. The mechanism of the formation of NO_2 is the oxidation of the NO in the presence of ozone and sunlight in the atmosphere. For the analysis of 1-hour NO_2 impacts, the EPA developed and incorporated into the AERMOD model the Plume Volume Molar Ratio Method (PVMRM) module that accounts for the chemical transformation of NO emitted from the stack to NO_2 at the receptor location. Amount of NO_2 converted from NO_x is considered to be proportional to the ozone concentration within the plume. The PVMRM module accepts single or hourly background ozone concentrations to estimate NO_x transformation within the source plume. The PVMRM module was used to estimate 1-hour NO_2 concentrations for project-on-project and project-on-existing impacts.

c. Dispersion Analysis

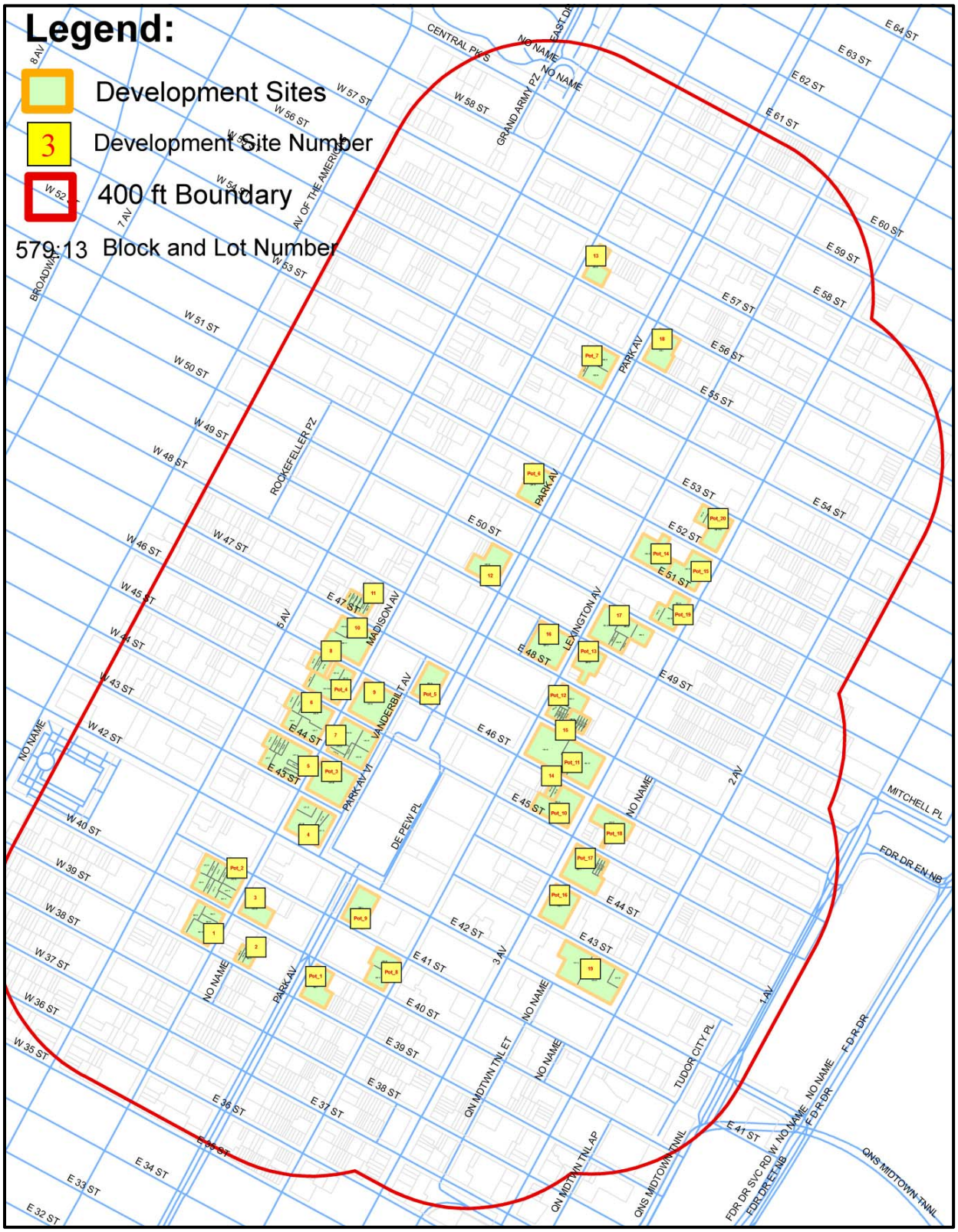
Following the modeling protocol, a prototypical analysis was employed for the Proposed Action. Figure 13-1 shows the location of the proposed development sites considered for this analysis as well as a 400-foot study area boundary.

It was conservatively assumed that development sites of the same floor area ratio (FAR) would be the same height and that the HVAC emissions from each site can affect nearby same height buildings. This prototypical dispersion analysis, therefore, considered impacts at receptors on buildings located in all directions around each development site and is more conservative than estimating impacts only on actual nearby taller buildings because actual taller building may not exist under all wind angles.

This analysis estimated the minimum distance (e.g., threshold distance) that each development site should be from the nearest building of the same height to avoid a potential significant impact from HVAC emissions. The distance at which an estimated 24-hour $PM_{2.5}$ impact reached 5 $\mu g/m^3$ was considered as the threshold distance between that site and any building that is the same height or taller. A distance between buildings that is greater than this threshold distance would therefore preclude a significant impact.

The dispersion analysis was conducted using EPA's AERMOD dispersion model version 7.6 (12060). Regulatory default options of the AERMOD model were used. Following CEQR guidelines, analyses were conducted assuming stack tip downwash, urban dispersion surface roughness length, and the elimination of calms. The AERMOD PVMRM module was utilized to estimate 1-hour NO_2 concentrations.

FIGURE 13-1: AIR QUALITY – DEVELOPMENT SITES



d. Emission Rates

Natural gas pollutant emission rates were estimated based on emission factors and energy usage rates for prototypical boiler sizes for both heating and domestic hot water demands from DEP's combustion application (CA) permit database. A DCP template (matrix) developed in conjunction with DEP was used for estimating emission rates based on annual energy use per building square foot (Btu/square foot/year).

The following emission factors were used:

- $PM_{2.5}$: 7.6 lb/10^6 standard cubic feet (scf), which includes filterable (1.9 lb/10^6scf) and condensable (5.7 lb/10^6 scf) particles from natural gas combustion, was obtained from the EPA's "Compilation of Air Pollutant Emission Factors," (AP-42).
- NO_x: 36 lb/10^6 scf for low condensing boilers with low NO_x burners was estimated assuming a concentration 30 ppm NO_x in the exhaust gas.

Estimated 1-hour NO_2 and 24-hour $PM_{2.5}$ emission rates for all development sites are presented in Table 13-4.

e. Stack Parameters

One set of prototypical stack parameters was developed for the generic dispersion analysis based on boiler size and fuel usage for large commercial office buildings, as follows:

- Height of 500 feet (152.4 m)
- Diameter of 2.65 feet (0.81 m)
- Exit velocity of 31.4 feet/sec (9.57 m/sec)
- Exit temperature of 373°K.

The boiler stack of the prototypical building was assumed to be located on the lot line of each proposed development site facing a nearby building of the same height or taller.

f. Meteorological Data

Analyses were conducted using the five consecutive years of meteorological data (2006-2010). Surface data were obtained from La Guardia Airport and upper air data were obtained from Brookhaven station, New York. These meteorological data provide hour-by-hour wind speeds and directions, stability states, and temperature inversion elevations over the 5-year period.

g. Background Concentrations

One-hour NO_2, 24-hour $PM_{2.5}$, and hourly ozone (for use in estimating NO_x conversion rates to NO_2) background concentrations were obtained from 3-years of monitoring data collected by the NYSDEC at Queens College monitoring station.

TABLE 13-4: POLLUTANT EMISSION RATES

RWCDS Site Number	Total Building Area	Annual Energy Usage *			Emission Rate		Emission Rate	
		Heating	Domestic Hot Water	Total	1-hr NO_x	24-hr $PM_{2.5}$	1-hr NO_x	24-hr $PM_{2.5}$
	gsf	MMBtu/year			lb/hr	lb/hr	g/sec	g/sec
Projected Development Sites								
Proj-1	831,395	27,603	6,667	34,270	0.519	0.109	0.0654	0.0137
Proj-2	142,612	4,735	1,144	5,878	0.089	0.019	0.0112	0.0023
Proj-3	445,901	14,804	3,576	18,380	0.278	0.058	0.0351	0.0073
Proj-4	1,194,832	39,670	9,581	49,251	0.746	0.156	0.0940	0.0197
Proj-5	1,260,605	41,853	10,108	51,962	0.787	0.165	0.0991	0.0207
Proj-6	1,232,064	40,906	9,879	50,785	0.769	0.161	0.0969	0.0203
Proj-7	1,194,004	39,642	9,574	49,216	0.745	0.156	0.0939	0.0196
Proj-8	157,630	5,233	1,264	6,497	0.098	0.021	0.0124	0.0026
Proj-9	1,195,439	39,690	9,586	49,276	0.746	0.156	0.0940	0.0197
Proj-10	1,147,186	38,088	9,199	47,287	0.716	0.150	0.0902	0.0189
Proj-11	213,171	7,077	1,709	8,787	0.133	0.028	0.0168	0.0035
Proj-13	422,047	14,012	3,384	17,397	0.263	0.055	0.0332	0.0069
Proj-14	89,094	2,958	714	3,672	0.056	0.012	0.0070	0.0015
Proj-15	167,349	5,556	1,342	6,898	0.104	0.022	0.0132	0.0028
Proj-16	805,419	26,741	6,458	33,199	0.503	0.105	0.0633	0.0132
Proj-17	924,893	30,707	7,416	38,124	0.577	0.121	0.0727	0.0152
Proj-18	694,278	23,051	5,567	28,618	0.433	0.091	0.0546	0.0114

Source: ASHRAE 90.1-2007, Model Description ASH7G, Energy Use Statistics of 227,664 standard cubic feet for heating and 54,985 standard cubic feet for domestic hot water

TABLE 13-4: POLLUTANT EMISSION RATES (CONTINUED)

RWCDS Site Number	Total Building Area	Annual Energy Usage			Emission Rate		Emission Rate	
		Heating	Domestic Hot Water	Total	1-hr NO_x	24-hr $PM_{2.5}$	1-hr NO_x	24-hr $PM_{2.5}$
	gsf	MMBtu/year			lb/hr	lb/hr	g/sec	g/sec
Potential Development Sites								
Pot-1	581,462	19,305	4,663	23,968	0.363	0.076	0.0457	0.0096
Pot-2	1,239,864	41,165	9,942	51,107	0.774	0.162	0.0975	0.0204
Pot-3	1,195,439	39,690	9,586	49,276	0.746	0.156	0.0940	0.0197
Pot-4	848,137	28,159	6,801	34,960	0.529	0.111	0.0667	0.0139
Pot-5	486,974	16,168	3,905	20,073	0.304	0.064	0.0383	0.0080
Pot-7	655,180	21,753	5,254	27,006	0.409	0.086	0.0515	0.0108
Pot-8	674,928	22,408	5,412	27,820	0.421	0.088	0.0531	0.0111
Pot-9	567,971	18,857	4,554	23,412	0.354	0.074	0.0447	0.0093
Pot-10	735,562	24,421	5,898	30,320	0.459	0.096	0.0578	0.0121
Pot-12	670,920	22,275	5,380	27,655	0.419	0.088	0.0528	0.0110
Pot-13	406,261	13,488	3,258	16,746	0.254	0.053	0.0319	0.0067
Pot-14	640,089	21,252	5,133	26,384	0.399	0.084	0.0503	0.0105
Pot-15	627,210	20,824	5,029	25,853	0.391	0.082	0.0493	0.0103
Pot-16	644,370	21,394	5,167	26,561	0.402	0.084	0.0507	0.0106
Pot-17	889,007	29,516	7,129	36,645	0.555	0.116	0.0699	0.0146
Pot-18	444,008	14,742	3,560	18,302	0.277	0.058	0.0349	0.0073
Pot-19	479,788	15,929	3,847	19,777	0.299	0.063	0.0377	0.0079
Pot-20	592,434	19,669	4,751	24,420	0.370	0.077	0.0466	0.0097

* gsf = gross square foot

h. Receptor Locations

A source-receptor configuration were developed using a Polar grid system—receptors were placed around each roof-top exhaust stack (from 0 to 360 degrees in 10-degree increments) at various distances (from 20 to 350 feet, with 2- to 5-foot increments) from the stack.

i. Modeling and Computation Procedure

The following procedure was followed for each building:

- Step 1. AERMOD modeling was conducted using an emission rate of 1 gram per second, and concentrations were estimated at each grid receptor. The highest AERMOD-predicted concentration at any of the receptors was then used to estimate the threshold distance for each development site;
- Step 2. The maximum concentrations estimated in Step 1 were tabulated and presented in a form that depicts concentrations based on 1 gram per second emissions at various distances. The results show the relationship between emission rate and the distance where exceedances of the $PM_{2.5}$ 24-hour concentration increment of 5 $\mu g/m^3$ are estimated to occur;
- Step 3. The actual emission rate for each development site (based on the square footage of the site) was then multiplied by the concentrations estimated in Step 1 (and depicted in Step 2) to determine the distance where the maximum 24-hour $PM_{2.5}$ concentration would be equal to 5 $\mu g/m^3$.
- Step 4. In order to find whether the distance between the sites is below or above the threshold, the following iterative analysis was conducted for each development site:
  - The minimum (or threshold) distance determined in Step 3 was compared to the actual distance between each site and the nearest site/building.
  - If the actual distance between development sites is found to be less than the estimated threshold distance, then the site fails the 24-hour $PM_{2.5}$ analysis; if the actual distance between sites is found to be greater than the estimated threshold distance, then the site passes the $PM_{2.5}$ analysis.

This process was completed for each of the 35 developments sites under the RWCDS that were not screened out.

13.5.1.3 Detailed Dispersion Analysis

If warranted by the results of the screening-level and/or prototypical analysis, a detailed dispersion analysis would be conducted. The analysis would examine whether the HVAC emissions of any of the projected and potential development sites would have the potential to significantly affect air quality levels at any of the other nearby projected and potential development sites (i.e., project-on-project impacts) and on other existing or planned sensitive uses within the surrounding area. Nitrogen dioxide (NO_2), sulfur dioxide (SO_2) and particulate matter (PM_{10} and $PM_{2.5}$) emissions will be analyzed. The analysis will be performed using the EPA-developed AERMOD model, based on the latest appropriate EPA guidance, and

will consider plume impingement conditions (i.e., when the wind blows from the stacks toward buildings) and wake effects (i.e., when the wind blows from buildings toward the stacks). The recent five years of meteorological data will be used for these simulation analyses. Project-on-existing and project-on-project impacts will be determined. Predicted values will be compared with NAAQS for NO_2, SO_2, $PM_{2.5}$ and PM_{10}, and the City's interim guidance criteria for $PM_{2.5}$.

13.5.2 HVAC Impacts

13.5.2.1 Impacts of the Proposed Development Sites on other Proposed Development Sites (project-on-project)

a. 24-hour $PM_{2.5}$ Impacts

As noted above, 35 of the Proposed Action's 39 development sites did not pass the screening-level analysis and therefore require further analysis.

Results for the development sites that failed the 24-hour $PM_{2.5}$ prototypical analysis are presented in Table 13-5 and those that passed the analysis are shown in Table 13-6. As shown in Table 13-5, 30 of 35 development sites failed the analysis because the actual distances between these sites and nearby buildings were estimated to be less than the 24-hour $PM_{2.5}$ threshold distance. Five of these sites failed because they are immediately adjacent to other sites; the other sites failed because they are large buildings with threshold distances from 100 to 250 feet while actual distances between buildings are much smaller (50 to 70 feet).

As a result of the building-on-building analysis, the 30 buildings that failed the analysis could avoid a potential significant air quality impact by imposing (E) designations that would specify the use of steam for each building's HVAC needs.

b. NO_2 Analysis

In accordance with the prototypical analysis protocol, a second analysis was conducted for the five development sites that passed the 24-hour $PM_{2.5}$ analysis to estimate potential for significant 1-hour NO_2 impacts. The AERMOD PVMRM module, together with hourly ozone background data, was utilized for this analysis. Hourly ozone background concentrations for 2006–2010 from Queens College monitoring station, together with meteorological data for the same time period, were used in this analysis. A default in-stack NO_2/NO_x ratio of 0.1 (10% on NO_2)—which is appropriate for boilers—was assumed.

Because no threshold increment exists for determining potentially significant NO_2 impacts, the difference between the 1-hour NO_2 NAAQS and the 1-hour NO_2 background concentrations was used as level below which no significant 1-hour impacts will occur. The estimated 1-hour NO_2 concentrations at various distances for each site were compared to this level, with results presented in Table 13-7. These results show that all five sites that passed the 24-hour $PM_{2.5}$ building-on-building analysis also passed analysis for 1-hour NO_2.

TABLE 13-5: DEVELOPMENT SITES THAT FAILED BUILDING-ON-BUILDING DISPERSION ANALYSIS FOR 24-HOUR $PM_{2.5}$

RWCDS Site Number	Source and Receptor Site	Proposed Development Size (ft^2)	24-hr $PM_{2.5}$ Emission Rate (g/sec)	Estimated Threshold Distance* (feet)	Measured Distance b/w Buildings (feet)
Projected Development Sites					
Proj-1	Projected 1 on Potential 2	831,395	0.01367	188	52
Proj-3	Site 3 on Potential 2	445,901	0.00733	105	70
Proj-4	Projected 4 on Potential 3	1,194,832	0.01965	237	59
Proj-5	Projected 5 on Projected 6	1,260,605	0.02073	246	55
Proj-6	Projected 6 on Projected 5	1,232,064	0.02026	240	55
Proj-7	Projected 7 on Projected 9	1,194,004	0.01964	237	50
Proj-8	8 on Potential 4	157,630	0.00259	35	adjacent
Proj-9	Projected 9 on Projected 7	1,195,439	0.01966	237	50
Proj-10	Projected 10 on Potential 4	1,147,186	0.01887	230	55
Proj-14	14 on Potential 10	89,094	0.00147	21	adjacent
Proj-15	15 on Potential 12	167,349	0.00275	37	adjacent
Proj-16	Projected 16 on Potential 13	805,419	0.01325	182	72
Proj-17	Projected 17 on Potential 13	924,893	0.01521	200	56
Proj-18	Projected 18 on Potential 7	694,278	0.01142	162	151

TABLE 13-5: DEVELOPMENT SITES THAT FAILED BUILDING-ON-BUILDING DISPERSION ANALYSIS FOR 24-HOUR $PM_{2.5}$ (CONTINUED)

RWCDS Site Number	Source and Receptor Site	Proposed Development Size (ft^2)	24-hr $PM_{2.5}$ Emission Rate (g/sec)	Estimated Threshold Distance* (feet)	Measured Distance b/w Buildings (feet)
Potential Development Sites					
Pot-2	Potential 2 on Projected 1	1,239,864	0.02039	240	52
Pot-3	Potential 3 on Projected 4	1,195,439	0.01966	237	59
Pot-4	Potential 4 on Projected 6	848,137	0.01395	188	50
Pot-5	Potential 5 on Projected 9	486,974	0.00801	110	85
Pot-7	Potential 7 on Projected 18	655,180	0.01078	155	150
Pot-8	Potential 8 on Potential 9	674,928	0.01110	159	137
Pot-10	Potential 10 on Potential 11	735,562	0.01210	172	59
Pot-12	Potential 12 on Potential 13	670,920	0.01103	159	60
Pot-13	Potential 13 on Projected 17	406,261	0.00668	96	62
Pot-14	Potential 14 on Potential 15	640,089	0.01053	153	adjacent
Pot-15	Potential 15 on Potential 14	627,210	0.01032	150	adjacent
Pot-16	Potential 16 on Potential 17	644,370	0.01060	153	55
Pot-17	Potential 17 on Potential 16	889,007	0.01462	196	55
Pot-18	Potential 18 on Potential 10	444,008	0.00730	105	95
Pot-19	Potential 19 on Potential 15	479,788	0.00789	110	58
Pot-20	Potential 20 on Potential 15	592,434	0.00974	143	58

*Distance where the 24-hour $PM_{2.5}$ concentration reached 5 $\mu g/m^3$

TABLE 13-6: DEVELOPMENT SITES THAT PASSED BUILDING-ON-BUILDING DISPERSION ANALYSIS FOR 24-HOUR $PM_{2.5}$

RWCDS Site Number	Source and Receptor Site	Proposed Development Size (ft^2)	24-hr $PM_{2.5}$ Emission Rate (g/sec)	Estimated Threshold Distance* (feet)	Measured Distance b/w Buildings (feet)
Projected Development Sites					
Proj-2	Projected 2 on Projected 3	142,612	0.00235	32	152
Proj-11	Projected 11 on Projected 10	213,171	0.00351	47	58

Proj-13	Projected Development Site 13 on Potential 7	422,047	0.00694	100	350
Potential Development Sites					
Pot-1	Potential 1 on Potential 8	581,462	0.00956	139	182
Pot-9	Potential 9 on Potential 8	567,971	0.00934	100	137

*Distance where the 24-hour $PM_{2.5}$ concentration reached 5 µg/m^3

TABLE 13-7: DEVELOPMENT SITES THAT PASSED BUILDING-ON-BUILDING DISPERSION ANALYSIS FOR 1-HOUR NO_2

RWCDS Site Number	Source and Receptor Site	Proposed Development Size (ft^2)	1-hr NO_2 Emission Rate (g/sec)	Total Estimated 1-hr NO_2 Conc.* (µg/m^3)	Estimated Threshold Distance (feet)	Measured Distance b/w Buildings (feet)
Projected Development Sites						
Proj-2	Projected 2 on Projected 3	142,612	0.00235	133	10	152
Proj-11	Projected 11 on Projected 10	213,171	0.00351	137	10	58
Proj-13	Projected Development Site 13 on Potential 7	422,047	0.00694	147	10	350
Potential Development Sites						
Pot-1	Potential 1 on Potential 8	581,462	0.00956	155	10	182
Pot-9	Potential 9 on Potential 8	567,971	0.00934	154	10	137

* Total estimated concentrations, which include 1-hour background values, are all less than the NAAQS of 188 ug.m3.

Based on the results of the project-on-project impact analysis, (E) designations will be required for the 30 development sites that failed the prototypical analysis to ensure that no adverse air quality impacts from HVAC emissions of each of development sites on other proposed development sites would occur. These sites would be restricted, as a part of these (E) designations, to use steam for its HVAC needs so that there would be no local HVAC-related emissions.

The language specifying (E) designations and the appropriate HVAC restrictions for the applicable development sites is provided at the end of HVAC analysis section and in Appendix 10.

13.5.2.2 Impacts of the Proposed Development Sites on Existing Land Uses (project-on-existing)

The following five development sites that passed analyses for both 24-hour $PM_{2.5}$ and 1-hour NO_2 impacts were evaluated for their potential impacts on nearby existing land uses:

- **Projected Development Site 2** (height 260 feet) is shorter than the nearby 513 feet existing building on Block 869, Lot 34, being also attached to it, and, as such, could potentially affect taller existing building. As a result, Projected Development Site 2 fails the analysis and should be restricted in the type of fuel by imposing an (E) designation to require the use of Con Edison utility steam for its heating and hot water systems needs to avoid any potential significant impacts.
- **Projected Development Site 11** (height 270 feet) is shorter than the nearby 299 feet existing building on Block 1283, Lot 58, being also attached to it and, as such, could potentially affect taller existing building. As a result, Projected Development Site 11 fails the analysis and should be restricted in the type of fuel by imposing an (E) designation to require the use of Con Edison utility steam for its heating and hot water systems needs to avoid any potential significant impacts.
- **Projected Development Site 13** (height 500 feet) is shorter than the nearby 586 feet existing building on Block 1292, Lot 15, and, as such, could potentially affect taller existing building. However, the distance between Projected Development Site 13 and the existing building (75 feet) is smaller than the estimated threshold distance (100 feet). As a result, Projected Development Site 13 fails the analysis and should be restricted in the type of fuel by imposing an (E) designation to require the use of Con Edison utility steam for its heating and hot water systems needs to avoid any potential significant impacts.
- **Potential Development Site 1** (height 500 feet) is shorter than the nearby 628-foot-tall existing building on Block 1295, Lot 1, and as such, could potentially affect taller existing building. However, the distance between Potential Development Site 1 and the existing building (52 feet) is smaller than the estimated threshold distance (139 feet). As a result, Potential Development Site 1 fails the analysis and should be restricted in the type of fuel by imposing an (E) designation to require the use of Con Edison utility steam for its heating and hot water systems needs to avoid any potential significant impacts.

- **Potential Development Site 9** (height 500 feet) is shorter than the nearby 628 feet existing building on Block 1295, Lot 1, and, as such, could potentially affect taller existing building. However, the distance between Potential Development Site 9 and the existing building (137 feet) is smaller than the estimated threshold distance (139 feet). As a result, Potential Development Site 9 fails the analysis and should be restricted in the type of fuel by imposing an (E) designation to require the use of Con Edison utility steam for its heating and hot water systems needs to avoid any potential significant impacts.

The five development sites that passed the building-on-building analysis for both 24-hour $PM_{2.5}$ and 1-hour NO_2 as per Tables 13-6 and 13-7 (Projected Development Sites 2, 11, and 13, and Potential Development Sites 1 and 9) failed the above analysis for impacts on existing land uses (project on existing impacts). As a result, all 35 development sites analyzed under the prototypical analysis would require an (E) designation that will impose use of Con Edison utility steam to avoid any potential significant impacts.

13.5.2.3 Impacts of Existing Emission Sources on the Proposed Development Sites

A survey of existing land uses within 400 feet of the proposed development sites was conducted using the New York City OASIS mapping network system to identify large existing emission sources within or near the rezoning area. Heights for existing buildings were provided by the DCP. The survey found a sizable number (more than 500) of tall existing residential, commercial and institutional buildings located within 400 feet of the proposed development sites.

DEP's records of existing buildings in the immediate vicinity of each of development site were reviewed to determine whether an existing boiler permit existed and then, if one existed, whether the facility should be considered as a large emissions source (i.e., with a heat input 20 MMBtu/hour or greater). For sites where no DEP boiler records were found to exist (i.e., the boiler record states that "No Boiler Records Found for This Property"), it was initially assumed that No. #2 fuel oil is being used to supply the building's HVAC needs. For several existing sites where no DEP boiler records were initially found, a more detailed investigation was conducted by DCP (including a site visit) to determine whether or not steam is being used.

If a large existing building with a DEP permit for its HVAC system is found to be shorter than one of the nearby development sites, its potential to impact the development site was evaluated. The following are the results of this analysis:

- **Projected Development Site 14** (height 260 feet) – The nearby 168-foot-tall existing building on Block 1300, Lot 50 is shorter than Projected Development Site 14. The existing building has a DEP permit and since it has a heat input of less than 20 MMBtu/hr no assessment is needed. As such, no significant impacts on Projected Development Site 14 would occur.

- **Potential Development Site 10** (height 500 feet) – The nearby 168-foot-tall existing building on Block 1300, Lot 50 is shorter than Potential Development Site 10. The existing building has a DEP permit and since it has a heat input of less than 20 MMBtu/hr no assessment is needed. As such, no significant impacts on Potential Development Site 10 would occur.
- **Potential Development Site 17** (height 470 feet) – The nearby 215-foot-tall existing building on Block 1318, Lot 38 is shorter than Potential Development Site 17. The existing building has a DEP permit and, since it has a heat input of less than 20 MMBtu/hr no assessment is needed. As such, no significant impacts on Potential Development Site 17 would occur.
- **Potential Development Site 18** (height 460 feet) – The nearby 441 feet existing building on Block 1320, Lot 46, is shorter than Potential Development Site 18. The existing building has no DEP permit and since it has a heat input of less than 20 MMBtu/hr no assessment is needed As such, no significant impacts on Potential Development Site 18 would occur.

The result of this analysis is that the HVAC emissions from existing buildings would not significantly impact the Proposed Action's development sites.

13.5.2.4 Potential Impacts from Large Existing Emission Sources that have Title V or State Facility Permits

In accordance with *CEQR Technical Manual* guidance, the only large existing emission sources (power plants, co-generation facilities, etc.) that have to be included in the existing-on-project impact analysis are those sources that have current Title V Permits or State Facility Permits issued by NYSDEC. Emission sources with Title V Permits that are currently operating within 1,000 feet of any of the proposed development sites and emission sources with State Facility Permits that are currently operating within 400 feet of any of the proposed development sites have to be evaluated.

A search of the NYSDEC permit database found no emission sources with Title V Permits currently operating within 1,000 feet of any of the proposed development sites or emission sources with State Facility Permits currently operating within 400 feet of any of the proposed development sites. Therefore, no significant air quality impacts from large existing emission sources on the proposed development sites are anticipated

13.5.2.5 Cluster Analysis

The result of the stationary source analysis is that the HVAC needs of 35 of the 39 Proposed Action buildings would be met with Con Edison steam. As such, as only one of the Proposed Action developments could have local HVAC emissions, a cluster analysis is not warranted because such an analysis requires the consideration of the HVAC emissions from two or more buildings.

13.5.2.6 Summary of Results of HVAC Analysis

Thirty-five of the 39 proposed development sites require an (E) designation that will impose use of Con Edison utility steam to avoid any potential significant impacts. The (E) designation for Potential Development Site 6 would require the use of natural gas only to supply the HVAC needs of this site.

With the proposed (E) designations (E-310), the development sites' HVAC's system emissions would not significantly impact either the other development sites (project-on-project impacts) or existing land uses (project-on-existing impacts).

13.6 (E) DESIGNATION REQUIREMENTS

As discussed above, the stationary source analysis determined that at 36 projected and potential development sites, environmental requirements would be necessary to ensure that emissions from heat and hot water systems would not result in a significant adverse impact. At these sites, (E) designations (E-310) would be mapped as part of the Proposed Action to ensure that the developments would not result in any significant air quality impacts from heat and hot water systems emissions due to individual or groups of development sites. All but one of the 36 development sites would be restricted to use steam for its heat and hot water systems. Potential Development Site 6 would be restricted to use natural gas only.

The (E) designations as set forth in Appendix 10 would apply to a development on a projected or potential development site which utilizes the provisions of the Proposed Action which allow for increases in the maximum base floor area ratio for qualifying sites pursuant to the District Improvement Bonus (ZR Section 81-62), the demolition and reconstruction of non-complying floor area on a site which is not a qualifying site (ZR Section 81-614(b)), or the transfer of development rights from landmarks by certification in the Grand Central Subarea (ZR Section 81-651), as applicable. For purposes of these (E) designations, the term "building permit" under Section 11-15(a) of the Zoning Resolution shall be a New Building Permit, except in the event a transfer under Section 81-651 is used for purposes of enlargement, extension or change of use of an existing building. A Notice to Proceed from the Office of Environmental Remediation would be required prior to issuance of a New Building Permit and a Notice of Satisfaction would be required prior to issuance of a temporary or permanent certificate of occupancy.

To the extent permitted under ZR Section 11-15, the requirements of the (E) designation may be modified, or determined to be unnecessary, based on new information or technology, additional facts or updated standards that are relevant at the time the site is ultimately developed.

13.7 ANALYSIS OF TOXIC AIR EMISSIONS FROM EXISTING INDUSTRIAL SOURCES

Emissions of toxic pollutants from the operation of nearby existing industrial emission sources could affect the proposed projected and potential development sites. An analysis was therefore conducted to determine whether the potential impacts of these emissions would be significant.

Data necessary to perform this analysis, which include facility type, source identification and location, pollutant emission rates, and exhaust stack parameters, were obtained from regulatory agencies (e.g., from existing air permits) and/or developed using information for prototypical facilities.

Emissions from existing industrial facilities located within 400 feet of the development sites that are permitted to exhaust toxic pollutants were considered in this analysis.

13.7.1 Data Sources

Information regarding emissions of toxic air pollutants from existing industrial sources was developed using the following procedure:

- The rezoning area boundary was used to identify the extent of the study area for determining the toxic air quality impacts associated with the Proposed Action.
- A study area was developed that includes all air toxic emission sources located within 400 feet of all of the affected development sites.
- A search was performed to identify NYSDEC Title V permits and permits listed in the EPA Envirofacts database in this study area.
- The OASIS mapping and data analysis application was used to identify industrial uses within the study area and develop buildings parameters for the existing emission sources;
- Air permits for active permitted industrial facilities within the study area that are included in the DEP Clean Air Tracking System database or permit applications were acquired and reviewed to obtain the information necessary to conduct the toxic air analysis.

  The data on these permits or permit applications, which include facility source type and locations, stack parameters, pollutant type and its emission rates, etc., are considered the most current and served as the primary basis of data for this analysis.
- Field observations were conducted to identify and validate the existence of the permitted facilities and determine if there are any non-permitted facilities currently operating within the study area.

13.7.2 Health Risk Assessment Methodology

Toxic air pollutants can be grouped into two categories: carcinogenic air pollutants, and non-carcinogenic air pollutants. The EPA developed cancer risk inhalation guideline values based on compound-specific inhalation unit risk factors *(*URFs*)* for carcinogenic pollutants and chronic non-cancer (annual) and short-term acute (1-hour) inhalation guideline values for toxic pollutants that are defined as *RfCs* (reference dose concentrations) and AIECs (acute inhalation exposure concentrations), respectively. These data are contained in the EPA IRIS (Integrated Risk Information System) database and/or EPA Prioritized Chronic Dose-Response Values and Acute Dose-Response Values for Screening Risk Assessment.

In order to evaluate short-term and annual impacts of non-carcinogenic and carcinogenic toxic air pollutants, the NYSDEC, following EPA guidelines, has also established short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) for exposure limits. AGCs for the carcinogenic pollutants is based on cancer risk threshold of one per million. These are allowable guideline concentrations that are considered acceptable concentrations below which there should be no adverse effects on the health of the public. This value could be increased to ten-in-one million, as per NYSDEC's Guidelines for the Control of Toxic Ambient Air Contaminants (DAR-1) with DEP concurrence, if the emissions from the facility or facilities causing this increase are controlled using Best Available Control Technology.

Once the risk of each carcinogenic compound is estimated, they are summed together. If the total incremental cancer risk is estimated to be less than or equal to one in one million (1.0 E-06), the risk due to all carcinogenic pollutant releases is considered to be insignificant. Once the chronic non-cancer hazard quotient (HQ) of each compound is established, they are summed together to arrive at the total hazard index (HI). HQs are also estimated for the carcinogenic pollutants where they have an appropriate guideline values *RfCs*). If the HI is less than or equal to one, then the non-carcinogenic risk is considered to be insignificant. Similar to this, once the acute hazard quotient (AHQ) of each compound is established, they are summed together to arrive at the total acute hazard index (AHI). If the AHI is less than or equal to one, then the acute non-carcinogenic risk is considered to be insignificant.

The procedures to estimate cancer risk and chronic non-cancer and acute hazard indexes of toxic pollutants are outlined in the EPA Human Health Risk Assessment Protocol (HHRAP). The HHRAP is a guideline that can be used to perform health risk assessment for individual compounds with known health effects to determine the level of health risk posed by an increased ambient concentration of that compound at a potentially sensitive receptor. The derived health risk values from the HHRAP are used in this analysis to determine the total risk posed by the release of multiple air toxic contaminants.

13.7.2.1 Carcinogens

Individual lifetime cancer risk through direct inhalation of carcinogen is estimated using the following equation (HHRAP, Table B-5-1 and C-2-1):

$$\text{Cancer Risk (CR)} = \text{EC} \times \text{URF and EC} = C_a \times \text{EF} \times \text{ED/AT} \times 365 \text{ days/year}$$

Where:

EC = annual exposure concentrations of compound, $\mu g/m^3$
C_a = annual ambient air concentration of specific pollutant (estimated by the dispersion model), $\mu g/m^3$
URF = compound-specific inhalation unit risk factor in $(\mu g/m^3)^{-1}$
EF = exposure frequency, days/year (EPA recommends to use 350)
ED = exposure duration, year (EPA recommends value of 30 for adult resident)
AT = averaging time, year (EPA assumes 70 years of lifetime exposure)

Once the individual CR of each compound is established, these values are summed together to estimate the total cancer risk of all carcinogens. If the total risk of all carcinogenic pollutants combined is less than or equal to one in one million (1.0 E-06), the carcinogenic risk is not considered to be significant.

13.7.2.2 Non-Carcinogens

Chronic non-cancer hazard quotients (HQ) through inhalation are estimated using the following equation (HHRAP, Table B-5-1 and C-2-2):

$$\text{HQ} = \text{EC} \times 0.001/\text{RfC and EC} = C_a \times \text{EF} \times \text{ED/AT} \times 365 \text{ days/year}$$

Where:

EC = exposure concentrations of compound, $\mu g/m^3$
C_a = total ambient air concentration of specific pollutant (estimated by the dispersion model), $\mu g/m^3$
RfC = reference dose concentration, established by the EPA, mg/m^3
EF = exposure frequency, days/year (EPA recommends to use 350)
ED = exposure duration, year (EPA recommends value of 30 for adult resident)
AT = averaging time, year (EPA recommends value of 30 for non-carcinogens)
0.001 = units conversion factor, $mg/\mu g$

Acute hazard quotients through inhalation (AHQ) are estimated using the following equation (HHRAP, Table C-2-3):

$$\text{AHQ} = C_{acute} \times 0.001/\text{AIEC}$$

Where:

C_{acute} = 1-hour air concentration, (estimated by the dispersion model), μg/m^3
AIEC = 1-hour acute inhalation exposure guideline value, mg/m^3
0.001 = units conversion factor, mg/μg

Once the chronic non-cancer (HQ) or acute hazard quotients (AHQ) of each compound are established, they are summed together to arrive at the total chronic non-cancer (HI) or acute hazard index (AHI). If the total chronic non-cancer or acute hazard indexes are less than or equal to one, then the non-cancer or acute risk is not considered to be significant.

13.7.2.3 Dispersion Analyses

A dispersion modeling analysis of toxic pollutants that may affect the proposed developments was conducted using the current version of the EPA AERMOD dispersion model. The exposure concentrations produced from the AERMOD model are then used to estimate cancer risk thru inhalation and chronic non-cancer and acute hazard indexes for each pollutant utilizing guideline values.

The methodology to conduct dispersion analysis was similar to those used for the detailed HVAC analysis with actual buildings and receptor locations. Input data for AERMOD (stack parameters, pollutant emission rates, source location and elevation) are those that are contained in the DEP permits or permit applications. Emission sources for the dispersion analysis were located using geographical information system (GIS) shape files with the Universal Transverse Mercator coordinate projected system information (Datum NAD83, UTM Zone 18).

A receptor grid that includes both elevated and ground level receptors was developed where ground level elevated receptors were placed on the affected development sites located near each emission source at multiple elevations depending on the location and height of the emission sources. Preliminary tests were conducted for each source-receptor configuration, with receptors placed at multiple elevations on the faces of the nearby proposed buildings, to evaluate the locations and elevations where the highest impacts would occur.

Highest AERMOD-predicted concentrations found at any receptors were used in the health risk assessment. Five consecutive years of meteorological data from the LaGuardia Airport (2006-2010) were used.

a. Emission Data and Stack Parameters

Emission data and stack parameters for the facilities included in the analysis were obtained and/or developed as follows:

- Directly from the permit for each facility; or
- When emission data were not included in a permit listed in the DEP database, the necessary data were obtained from the permit application for this facility that is on file at DEP.

b. Industrial Facilities and Air Toxic Emissions Evaluated

Three hundred and seventeen (317) permits were identified from the DEP Clean Air Tracking System database as being within 400 feet of the rezoning study area. Based on a review of these permits:

- One hundred thirty-four (134) of these permits were invalidated due to expiration of the certification date.
- Eighty-two (82) permits were for the facilities with emergency generators.
- Seventy-three (73) permits were for the facilities located beyond 400 feet distance from any development site.

As a result, 28 permits were left for consideration. However, three permits (Permit PA014594, PA054293, and PA044895) were eliminated from further consideration because these facilities are, based on field survey results, not operating. In addition, the survey found one non-permitted facility—a dry cleaners (Polaris Cleaners)—operating near one of development site.

As a result, the potential impacts from the emissions identified in 25 permits and 1 non-permitted facility were estimated. Of these, 18 permits are for Jewelry Manufacturing facilities (Richement North America; Jewels by Star, Express Metal Refining Inc., Oscar Heyman & Bros Inc, Barber Bros Inc, and Yacoubian Jewelry Inc); 5 permits are for dry cleaners (Methinks Cleaners, Green & White Cleaners, New York Palace Hotel, Symphony 44 Cleaners, and Lord & Taylor Dept.); 1 permit is for a laundry (Amedeo Hotel Limited); and 1 permit is for a gas sterilization facility (Bosley Medical Institute).

One non-permitted dry cleaner was also included in the analysis.

c. Pollutants and Emission Rates

Seventeen pollutants are released from the thirteen identified facilities, three of which are carcinogens—tetrachloroethylene (PERC) from the dry cleaners; trichloethylene from jewelry cleaning; and ethylene oxide from gas sterilization at the medical facility.

All dry cleaning facilities in New York City are equipped with 4th generation emission control systems—with built-in carbon absorber and refrigeration units, as required by the New York State's PERC Dry

Cleaning Facilities Regulation (Part 232). These facilities are considered dry-to-dry type non-vented refrigerated totally enclosed systems with, presumably, no emissions. However, according to the permits for these facilities, the efficiency of these control systems is listed as 98 percent, which indicates that 2 percent of the PERC may still be released into the atmosphere from doors, windows, roof vents, and other openings throughout the facility as fugitive emissions. Therefore, 98 percent control efficiency was applied to estimate PERC emissions from these dry cleaning facilities and the remaining 2 percent were treated as fugitive emissions that were modeled as volume sources. Lateral and vertical dispersion parameters of the volume sources were developed based on the configuration and dimensions of a typical dry cleaning facility with natural ventilation. The PERC emission rate from the one non-permitted dry cleaner facility was assumed to be equal to the highest PERC rate found among the permitted facilities.

Some of the pollutants, such as Tetrasodium Pyrophos(phate) (CAS 7722-88-55), Gold (CAS 7440-57-5), Rhodium Sulfate (CAS10489-46-0), Sodium Hydrosulphite (CAS7681-38-1), and Potassium Carbonate (CAS 584-08-7), have no guideline health values available, and were not included in the analysis. A total of 12 pollutants were considered.

A detailed dispersion modeling analysis was conducted to estimate the potential impact of the toxic pollutants released from identified facilities on the projected and potential development sites.

13.7.2.4 Results of the Cancer Risk and Hazard Index Evaluation

Table 13-8 provides permit information for the existing permitted and non-permitted industrial sources considered in the analysis, including type and location of each facility, permit number, emission point(s), contaminant name, CAS registry number, and hourly and annual emission rates for each pollutant.

Table 13-9 provides estimated annual (long-term) exposure concentrations, cancer risks for each pollutant and total incremental cancer risk (CR), and chronic non-cancer quotients for each pollutant and total non-cancer hazard index (HI). Chronic non-cancer quotients (HQ) are also estimated for the carcinogenic pollutants where they have an appropriate guideline values (e.g., *RfC*). The pollutant concentrations shown in table are the maximum values estimated at any of receptor locations. The full set of exposure concentrations, cancer risk values at each receptor locations and source group, and non-cancer chronic and acute quotients for each pollutant are provided in the backup documentation for this analysis. Also provided are the assumptions, parameters, and equations used in estimating these values.

As shown on Table 13-9, the total individual cancer risk and the total cancer risk caused by the identified facilities (0.03 in-a-million) are below the conservative one-in-a-million threshold established by EPA. Therefore, the cancer risk increase under the Proposed Action is not considered to be significant.

As also shown in Table 13-9, the total chronic non-cancer quotients (HQ) and total hazard index (HI) caused by both the carcinogenic and non-carcinogenic pollutants emitted from all of sources combined is estimated to be 0.05. This value is below the level (of 1) that is considered by the EPA to be significant.

Table 13-10 provides estimated 1-hour (short-term) exposure concentrations and acute hazard quotients (AHQ) for each pollutant and the total acute hazard index (AHI). As shown in this table, the total acute hazard index caused by all the pollutants emitted from all of sources combined is estimated to be 0.18. This value is below the level (of 1) that is considered by the EPA to be significant.

13.7.3 Summary of Air Toxics Results

The result of this analysis is that no exceedances of EPA/NYSDEC/DEP guideline thresholds values for both carcinogenic and non-carcinogenic toxic pollutants are predicted under the Proposed Action.

TABLE 13-8: EXISTING ACTIVE INDUSTRIAL SOURCE PERMIT INFORMATION

	Facility Location			Permit Information					
Facility Name	**Block**	**Lot**	**Address**	**Permit**	**Facility Type**	**Pollutant**	**CAS No.**	**Hourly Rate**	**Annual Rate**
Methinks Cleaners	895	27	337 Lexington Avenue	PB049703	Dry Cleaning	PERC	00127-18-4	0.001288	0.000220
Yacoubian Jewelry Co.	1260	42	2 West 45 Street	PB476203	Jewelry MFG	Aluminum Oxide	01344-28-1	0.000126	0.000015
						Iron Oxide	01309-37-1	0.000101	0.000009
						Ethanolamine	00141-43-5	0.000113	0.002402
Richement North America	1287	69	649 5 Avenue	PB008409	Jewelry MFG	Sulfuric Acid	07664-93-9	0.000126	0.000042
				PB008309		Silver	07440-22-4	0.000005	0.000016
						Particulate	NY075-00-0	0.000958	0.000319
				PB008209		Potassium Hydroxide	01310-58-3	0.000630	0.000210
						Sodium Bifluoride	01333-83-1	0.000126	0.000042
						Ethanolamine	00141-43-5	0.000252	0.000084
Richement North America	1287	63	10 East 52 Street	PB000909	Jewelry MFG	Platinum	07440-06-4	0.000126	0.000028
				PB000809		Silver	07440-22-4	0.000005	0.000001
						Particulate	NY075-00-0	0.000958	0.000210
				PB000709		Silver	07440-22-4	0.000000	0.000000
						Particulate	NY075-00-0	0.000093	0.000020
				PB000609		Rhodium Sulfate	10489-46-0	0.000000	0.000000
				PB000509		Sulfuric Acid	07664-93-9	0.000126	0.000042
						Ethanolamine	00141-43-5	0.000252	0.000055
						Sodium Hydroxide	01310-73-2	0.000006	0.000001
				PB000409		Ethanolamine	00141-43-5	0.000252	0.000055
						Sodium Hydroxide	01310-73-2	0.000006	0.000001
				PB000309	Watch Cleaning	Ethanolamine	00141-43-5	0.000252	0.000055
						Stoddard Solvent	08052-41-3	0.000252	0.000055
Green & White Cleaners	1318	30	839 2 Avenue	PA044299	Dry Cleaning	PERC	00127-18-4	0.001535	0.000294
Amedeo Hotel Limited	1286	21	451 Madison Avenue	PA016399	Laundry	Particulate	NY075-00-0	0.001890	0.000079
New York Palace Hotel	1286	21	451 Madison Avenue	PB010600	Dry Cleaning	PERC	00127-18-4	0.000922	0.000164
Symphony 44 Cleaners Inc	1318	19	245 East 44 Street	PA022199	Dry Cleaning	PERC	00127-18-4	0.008311	0.001233

TABLE 13-8: EXISTING ACTIVE INDUSTRIAL SOURCE PERMIT INFORMATION (CONTINUED)

	Facility Location			Permit Information					
Facility Name	**Block**	**Lot**	**Address**	**Permit**	**Facility Type**	**Pollutant**	**CAS No.**	**Hourly Rate**	**Annual Rate**
BarBer Bros. Jewelry Inc.	1263	34	580 5 Avenue	PA127287	Jewelry MFG	Particulate	NY075-00-0	0.014490	0.000123
						Trichloetylene	68527-16-2	0.001890	0.000016
						Sulfuric Acid	07664-93-9	0.000126	0.000029
						Sodium cyanide	00143-33-9	0.000126	0.000029
Jewels By Star	1283	1	579 5 Avenue	PA021493	Jewelry Polishing	Particulate	NY075-00-0	0.000126	0.000029
				PA021393	Jewelry Cleaning	Sodium cyanide	00143-33-9	0.000126	0.000029
						Ammonia	07664-41-7	0.000126	0.000029
						Sodium Hydroxide	01310-73-2	0.000126	0.000029
						Hydrogen Cyanide	00074-90-8	0.000126	0.000029
Bosley Medical Institute	895	1	99 Park Avenue	PA038295	Gas Sterilization	Ethylene Oxide	00075-21-8	0.000504	0.000032
Express Metal Refining Inc.	1262	42	2 West 47 Street	PB011905	Jewelry MFG	Particulate	NY075-00-0	0.000126	0.000003
				PB011205		Hydrogen Chloride	07647-01-0	0.000126	0.000003
Oscar Heyman & Bros	1288	21	503 Madison Avenue	PA034688	Jewelry MFG	Hydrogen Chloride	07647-01-0	0.000126	0.000029
						Nitric Acid	07697-37-2	0.000126	0.000029
				PA034488	Jewelry Cleaning	Trichloetylene	68527-16-2	0.001890	0.000431
						Ammonia	07664-41-7	0.000126	0.000029
Lord & Taylor Dept.	840	42	424 5 Avenue	PA013099	Dry Cleaning	PERC	00127-18-4	0.001613	0.000139
Polaris Cleaners	895	10	109 East 39 Street	No Permit	Dry Cleaning	PERC	00127-18-4	0.008311	0.001233

Note:
PERC= Tetrachloroethylene

TABLE 13-9: CANCER RISK (CR) AND CHRONIC NON-CANCER QUOTIENTS (HQ) AND TOTAL HAZARD INDEX (HI) OF THE TOXIC POLLUTANTS

Chemical Name	CAS No,	Max Estimated Concentration ($\mu g/m^3$)	URF $(\mu g/m^3)^{-1}$ (1)	Estimated Cancer Risk (CR) per million	RfC (mg/m^3) (2)	Source	Hazard Quotients (HQ)
Aluminum Oxide	1344-28-1	2.39E-04			4.50E-03	DAR-1 (5)	5.10E-05
Ammonia	7664-41-7	3.55E-02			1.00E-01	DAR-1 (5)	3.40E-04
Sodium Bifluoride	1333-83-1	3.10E-04			6.70E-05	DAR-1 (5)	4.44E-03
PERC	127-18-4	8.82E-02	2.60E-07	9.42E-09	4.00E-02	EPA (3, 4	2.11E-03
Ethylene Oxide	75-21-8	9.55E-05	8.80E-05	3.45E-09	3.00E-02	EPA (4)	3.05E-06
Trichloroethylene	79-01-6	1.90E-02	2.00E-06	1.56E-08	6.00E-01	EPA (3, 4)	3.04E-05
Hydrochloric acid	7647-01-0	9.92E-04			2.00E-02	EPA (3, 4)	4.76E-05
Hydrogen Cyanide	74-90-8	3.55E-02			3.00E-03	DAR-1 (5)	1.13E-02
Iron Oxide	1309-37-1	1.48E-04			1.20E-02	DAR-1 (5)	1.18E-05
Particulate	NY 75-00-0	1.20E-02			4.50E-02	DAR-1 (5)	2.55E-04
Platinum	7440-06-4	1.62E-04			4.80E-06	EPA (3, 4)	3.23E-02
Silver	7440-22-4	1.09E-06			1.80E-02	EPA (3, 4)	5.83E-08
Ethanolamine	141-43-5	3.81E-02			1.80E-02	EPA (3, 4)	2.03E-03
Sodium Cyanide	143-33-9	3.55E-02			4.50E-02	EPA (3, 4)	7.56E-04
Stoddard Solvent	8052-41-3	5.22E-04			9.00E-01	DAR-1 (5)	5.56E-07
Sulfuric Acid	7664-93-9	5.99E-04			1.00E-03	DAR-1 (5)	5.74E-04
Total Estimated Cancer Risk (per million)				**0.03**			
Cancer Risk Threshold (per million)				**1.0**			
Total Estimated Non-Cancer Hazard Index (HI)							**0.05**
Non-Cancer Hazard Index Threshold							**1**

Source: Parsons Brinckerhoff, 2013

Notes:
1. URF = compound specific inhalation unit risk factor in $(\mu g/m^3)^{-1}$
2. RfC = reference dose concentration, established by the EPA or NYSDEC, mg/m^3
3. EPA IRIS = Integrated Risk Information System
4. EPA = EPA Prioritized Chronic Dose-Response Values
5. DAR-1 = NYSDEC Policy DAR-1 "Guidelines for the Control of Toxic Ambient Air Contaminants"

TABLE 13-10: ACUTE QUOTIENTS (AHQ) AND TOTAL HAZARD INDEX (AHI) OF THE TOXIC POLLUTANTS

Chemical Name	CAS No.	Max Estimated Concentration (µg/m³)	AIEC (mg/m³) (1)	Source	Acute Hazard Quotients (AHQ)
Ammonia	7664-41-7	6.9418	2.4	DAR-1 (3)	2.89E-03
Ethylene Oxide	75-21-8	0.5943	81	EPA (2)	7.34E-06
Sodium Bifluoride	1333-83-1	0.0145	0.0053	DAR-1 (3)	2.73E-03
Trichloethylene	79-01-6	3.0570	14	EPA (2)	2.18E-04
Hydrochloric acid	7647-01-0	0.1812	2.1	DAR-1 (3)	8.63E-05
Hydrogen Cyanide	74-90-8	6.9336	0.075	DAR-1 (3)	9.24E-02
Particulate	NY 75-00-0	8.7980	0.38	DAR-1 (3)	2.32E-02
PERC	127-18-4	7.6585	20	EPA (2)	3.83E-04
Potassium Hydroxide	1310-58-3	0.0724	0.2	DAR-1 (3	3.62E-04
Silver	7440-22-4	0.0000	0.3	DAR-1 (3	2.95E-08
Ethanolamine	141-43-5	0.0967	1.5	DAR-1 (3	6.45E-05
Sodium Cyanide	143-33-9	6.9390	0.38	DAR-1 (3	1.83E-02
Sodium Hydroxide	1310-73-2	6.9375	0.2	DAR-1 (3	3.47E-02
Sulfuric Acid	7664-93-9	0.0713	0.12	DAR-1 (3	5.94E-04
				Total Estimated Acute Hazard Index (AHI)	**0.18**
				Total Acute Hazard Index Threshold	**1**

Source: Parsons Brinckerhoff, 2013

Notes:
1. AIEC = Acute Inhalation Exposure Concentrations, mg/m³
2. EPA = Acute Dose-Response Values for Screening Risk Assessment
3. DAR-1 = NYSDEC Policy DAR-1 "Guidelines for the Control of Toxic Ambient Air Contaminants"