Chapter 8: Air Quality

A. INTRODUCTION

The potential for air quality impacts from the proposed project is examined in this chapter. Air quality impacts can be either direct or indirect. Direct impacts result from emissions generated by stationary sources (e.g., from on-site fuel combustion for heat and hot water systems). The proposed project would include potential chemical spill ventilation, which was analyzed as a direct source. The heat, hot water, and steam needs of the proposed project would be met by Rockefeller University's existing energy system, operating within the currently approved air permit limitations. As an existing permitted source, no significant adverse air quality impacts would occur from the increased use of the existing system, and no analysis is required. Indirect impacts are impacts that are caused by the effect of a project on non-project sources (e.g., the effect of proposed projects on roadway traffic and/or emissions). Although the proposed project would not generate additional vehicle trips, the proposed new laboratory building and North Terrace spanning the Franklin Delano Roosevelt (FDR) Drive would change the dispersion of pollutants from the roadway and was also analyzed.

As discussed below, the maximum predicted pollutant concentrations and concentration increments with the proposed project would be below the corresponding guidance thresholds and ambient air quality standards. Thus, the proposed project would have no significant adverse impact on air quality.

PRINCIPAL CONCLUSIONS

The proposed project would not add any new sources of air pollutants. A quantitative analysis was performed to assess the potential effects of an accidental chemical spill in any of the proposed laboratory fume hoods and the ensuing emissions from the ventilation system on air quality in the laboratory building (near air intakes) and in the surrounding area. The exhaust stream from the fume hoods would be handled via a dedicated system (separate from the building ventilation). The fume hood exhaust stream from the south side of the laboratory building would be vented via a stack at least 10 feet above the adjacent ~~to the~~ Hospital building ~~at a height of 181 feet from datum~~. The fume hood exhaust stream from the north side of the laboratory building would be vented via a stack at least 10 feet above the adjacent ~~to the~~ Flexner Hall Extension ~~at a height of 145 feet from datum. (Both stack heights would be at least 10 feet above the respective buildings.)~~ (Figure 5-10 in Chapter 5, "Historic and Cultural Resources shows the stack locations). The system would be designed to maintain a minimum operating exhaust velocity of 3,000 feet per minute, with the exhaust flow rate of 33,333 and 37,500 cubic feet per minute for the south and north exhaust systems, respectively (based on current design parameters).

Between the DEIS and FEIS, the institutional control to ensure requirements with respect to air quality was changed from a Restrictive Declaration to an (E) designation, administered by the Office of Environmental Remediation (OER), consistent with City practice. An (E) designation would be assigned to ensure that no significant adverse impacts related to air quality would

result from the proposed project. The (E) designation requirements related to air quality would apply to the Block 1480, Lot 10 (Laboratory Building Site).

~~Commitments regarding the exhaust parameters would be included in the Restrictive Declaration and may be developed further between the Draft and Final Environmental Impact Statement (EIS)~~.

- The text for the (E) designation related to air quality would be as follows:

> ***The proposed Laboratory Building will contain separate Laboratory Exhaust and Fume Exhaust systems. Each separate system will be divided into two sub-components.***
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> ***Two Fume Exhaust systems will be established for the proposed Laboratory Building — the first Fume Exhaust system would be located at the northern section of the Laboratory Building Site, adjacent to the existing Flexner Hall Extension Building at a stack height of 154 feet. The second Fume Exhaust system would be located at the southern section of the Laboratory Building Site, adjacent to the existing Hospital Building at a stack height of 178 feet. (Figure 5-10 in Chapter 5, "Historic and Cultural Resources" shows the stack locations).***
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> ***Both Fume Exhaust systems would be required to discharge at a height of 10 feet above their respective roofs. The two exhaust fans associated with the two fume hood exhaust systems must have a minimum velocity of 3,000 feet per minute, and an exhaust flow rate of 37,500 (for the northern exhaust system) and 33,333 cubic feet per minute (for the south exhaust systems).***

A detailed analysis was also prepared to assess the potential effect of constructing a deck structure over the FDR Drive on the dispersion of pollutants from the roadway in nearby publicly accessible areas. In addition, a screening analysis was undertaken to assess the potential effect of existing nearby large pollutant sources on air quality within the proposed project.

The analysis concludes that no significant adverse impact on air quality would occur as a result of the operation of the proposed project.

B. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of carbon monoxide (CO) are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and some other sources utilizing high-sulfur 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, 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 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. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas which does not persist in the atmosphere, CO concentrations can diminish greatly over relatively short distances; elevated concentrations are usually limited to locations near crowded intersections, heavily traveled and congested roadways, parking lots, and garages. Consequently, CO concentrations must be predicted on a local, or microscale, basis.

The proposed project would alter the dispersion of roadway emissions. Therefore, a mobile source analysis was conducted to evaluate future CO concentrations with and without the proposed project.

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 result in changes in the overall quantity of on-road emissions.

In addition to being a precursor to the formation of ozone, NO_2 (one component of NO_x) is also a regulated pollutant. Since NO_2 is mostly formed from the transformation of NO in the atmosphere, it has mostly been of concern further downwind from large stationary point sources, and not a local concern from mobile sources. (NO_x emissions from fuel combustion consist of approximately 90 percent NO and 10 percent NO_2 at the source.) However, with the promulgation of the 2010 1-hour average standard for NO_2, local sources such as vehicular emissions may become of greater concern for this pollutant, and are therefore discussed in this chapter. In addition, a screening analysis of potential local impacts on NO_2 concentrations from on-site fuel combustion was prepared.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Lead in gasoline has been banned under the CAA, and therefore, lead is not a pollutant of concern for the proposed project.

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

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of naturally occurring VOC; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and from forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the

combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic and some likely carcinogenic compounds.

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

The proposed project would alter the dispersion of roadway emissions. Therefore, a mobile source analysis was conducted to evaluate future PM concentrations with and without the proposed project. PM concentrations associated with on-site fuel combustion are addressed as well.

SULFUR DIOXIDE

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

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the CAA, primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table 8-1**.

The NAAQS for CO, annual NO_2, and 3-hour SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended particulate matter, settleable particles, non-methane hydrocarbons, 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the non-criteria pollutants beryllium, fluoride, and hydrogen sulfide.

Table 8-1
National Ambient Air Quality Standards (NAAQS)

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

Notes:
ppm – parts per million (unit of measure for gases only)
µg/m^3 – micrograms per cubic meter (unit of measure for gases and particles, including lead)
NA – not applicable
All annual periods refer to calendar year.
Standards are defined in ppm. Approximately equivalent concentrations in µg/m^3 are presented.

(1) Not to be exceeded more than once a year.
(2) EPA has lowered the NAAQS down from 1.5 µg/m^3, effective January 12, 2009.
(3) 3-year average of the annual 98th percentile daily maximum 1-hr average concentration. Effective April 12, 2010.
(4) 3-year average of the annual fourth highest daily maximum 8-hr average concentration.
(5) EPA has proposed lowering the primary standard further to within the range 0.060-0.070 ppm, and adding a secondary standard measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on this standard has been postponed but is expected to occur in 2013.
(6) EPA has lowered the primary standard from 15 µg/m^3, effective March 2013
(7) Not to be exceeded by the annual 98th percentile when averaged over 3 years.
(8) EPA revoked the 24-hour and annual primary standards, replacing them with a 1-hour average standard. Effective August 23, 2010.
(9) 3-year average of the annual 99th percentile daily maximum 1-hr average concentration.

Source: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards.

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 µg/m^3 to 35 µg/m^3 and retaining the level of the annual standard at 15 µg/m^3. The PM_{10} 24-hour average standard was retained and

the annual average PM_{10} standard was revoked. EPA recently announced a final decision to lower the primary annual-average standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060 to 0.070 ppm. EPA is also proposing a secondary ozone standard, measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on this standard has been postponed and is currently in review.

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

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

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

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

In 2002, EPA re-designated New York City as in attainment for CO. Under the resulting maintenance plan, New York City is committed to implementing site-specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period.

Manhattan has been designated as a moderate NAA for PM_{10}. On January 30, 2013, New York State requested that EPA approve its withdrawal of the 1995 SIP and redesignation request for the 1987 PM_{10} NAAQS, and that EPA make a clean data finding instead, based on data monitored from 2009-2011 indicating PM_{10} concentrations well below the 1987 NAAQS. Although not yet a redesignation to attainment status, if approved, this determination would remove further requirements for related SIP submissions.

On December 17, 2004, EPA took final action designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ non-attainment area under the Clean Air Act due to exceedance of the annual average standard. Based on recent monitoring data (2006-2009), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. EPA has determined that the area has attained the 1997 annual $PM_{2.5}$ NAAQS, effective December 15, 2010. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions. New York State submitted a redesignation request and maintenance plan to EPA in February

2013. As stated earlier EPA, has recently lowered the annual average primary standard to 12 $\mu g/m^3$. EPA will make initial attainment designations by 2014.

As described above, EPA has revised the 24-hour average $PM_{2.5}$ standard. In November 2009 EPA designated the New York City Metropolitan Area as nonattainment with the 2006 24-hour $PM_{2.5}$ NAAQS. The nonattainment area includes the same 10-county area originally designated as nonattainment with the 1997 annual $PM_{2.5}$ NAAQS. Based on recent monitoring data (2007-2011), EPA determined that the area has attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements for related SIP submissions. New York State submitted a redesignation request and maintenance plan to EPA in February 2013.

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties (the New York–New Jersey–Long Island NAA, New York portion) had been designated as a severe non-attainment area for ozone (1-hour average standard, 0.12 ppm). In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. The 1-hour standard was revoked in 2004 when it was replaced by the 8-hour ozone standard, but certain further requirements remained ('anti-backsliding'). On December 7, 2009, EPA determined that the Poughkeepsie nonattainment area (Dutchess, Orange, Ulster, and Putnam counties) has attained the 1-hour standard. On June 18, 2012, EPA determined that the New York–New Jersey–Long Island NAA has also attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements under the 1-hour standard.

Effective June 15, 2004, EPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard (LOCMA was moved to the Poughkeepsie moderate non-attainment area for 8-hour ozone). On February 8, 2008, the New York State Department of Environmental Conservation (NYSDEC) submitted final SIP revisions to EPA to address the 1997 8-hour ozone standard. Based on recent monitoring data (2007-2011), EPA determined that the Poughkeepsie and the NY-NJ-CT nonattainment areas have attained the 1997 8-hour ozone NAAQS (0.08 ppm). Although not yet a redesignation to attainment status, this determination removes further requirements under the 8-hour standard.

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

New York City is currently in attainment of the annual-average NO_2 standard. EPA has designated the entire state of New York as "unclassifiable/attainment" of the new 1-hour NO_2 standard effective February 29, 2012. Since additional monitoring is required for the 1-hour standard, areas will be reclassified once three years of monitoring data are available (2016 or 2017).

EPA has established a 1-hour SO_2 standard, replacing the former 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. Draft attainment designations were published by EPA in February 2013, indicating that EPA is deferring action to

designate areas in New York State and expects to proceed with designations once additional data are gathered.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The 2012 City Environmental Quality Review (*CEQR*) *Technical Manual* states that the significance of a predicted consequence of a project (i.e., whether it is material, substantial, large, or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected.[1] In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see **Table 8-1**) would be deemed to have a potential significant adverse impact.

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

DE MINIMIS CO CRITERIA

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

DE MINIMIS $PM_{2.5}$ CRITERIA

The monitored background levels of $PM_{2.5}$ have come down appreciably in recent years. As of June 5, 2013, New York City uses the following *de minimis* criteria for evaluating the potential $PM_{2.5}$ impacts for projects subject to CEQR. The *de minimis* criteria supersede the interim guidance criteria that were previously in effect.

- Predicted increase of more than half the difference between the background concentration and the 24-hour standard; or
- Predicted annual average $PM_{2.5}$ concentration increments greater than 0.1 $\mu g/m^3$ at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or
- Predicted annual average $PM_{2.5}$ concentration increments greater than 0.3 $\mu g/m^3$ at a discrete or ground level receptor location.

[1] *CEQR Technical Manual*, Chapter 1, section 222, June 2012.

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

The above criteria have been used to evaluate the significance of predicted impacts of the proposed project on $PM_{2.5}$ concentrations.

D. METHODOLOGY

CHEMICAL SPILL ANALYSIS

All proposed laboratories that would use hazardous chemicals would be equipped with fume hoods. Fume hoods are enclosures maintained under negative pressure and continuously vented to the outside. Their function is to protect laboratory staff from potentially harmful fumes. By providing a continuous exhaust from laboratory rooms, they also prevent any fumes released within the laboratory from escaping into other areas of the building, or through windows to the outside.

A quantitative analysis employing mathematical modeling was performed to assess the potential effects of an accidental chemical spill in any one of the proposed laboratory fume hoods. The chemical spill analysis followed the procedures and methodologies contained in the *CEQR Technical Manual* and examined the potential impacts on nearby buildings and places of public access, as well as potential impacts due to recirculation into air intake systems or windows of the proposed building. Maximum predicted concentrations were compared to the short-term exposure levels (STELs) or ceiling levels recommended by the U.S. Occupational Safety and Health Administration (OSHA) for the chemicals examined.

Detailed design information for the proposed laboratory ventilation systems was used to develop assumptions for the analysis of the potential for impacts from a chemical spill in one of the proposed laboratories.

~~It is expected that there would be two fume hood exhaust systems—one exhaust system would be located to the north adjacent to the Flexner Hall and the second would be located to the south adjacent to the Hospital building—with both discharging at a height of 10 feet above the respective roofs. The two exhaust fans would have a minimum velocity of 3,000 feet per minute, and are currently estimated to have exhaust flowrates of 37,500 and 33,333 cubic feet per minute for the north and south exhaust systems, respectively. Commitments regarding the exhaust parameters would be included in the Restrictive Declaration and may be developed further between the Draft and Final Environmental Impact Statement (EIS).~~

It is expected that the proposed Laboratory Building will contain separate laboratory exhaust and fume exhaust systems. Each separate system will be divided into two subcomponents. Two fume exhaust systems will be established for the proposed Laboratory building—one would be located at the northern section of the Laboratory Building, adjacent to the existing Flexner Hall Building, and the second would be located at the southern section of Laboratory Building adjacent to the existing Hospital Building (stack locations are shown in Figure 5-10 in Chapter 5, "Historic and Cultural Resources"). Both fume hood exhaust systems would be required to discharge at a height of 10 feet above their respective roofs. The exhaust fans associated with the two fume hoods shall be required to have a minimum exhaust velocity of 3,000 feet per minute, and an exhaust flow rate of 37,500 (for the northern exhaust system), and 33,333 cubic feet per minute (for the southern exhaust system).

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CHEMICALS FOR ANALYSIS

An inventory of the types and quantities of chemicals that are likely to be used in the proposed laboratories was developed by Rockefeller University. Common buffers, salts, enzymes, nucleotides, peptides, and other biochemicals were not considered in the analysis since they are not typically categorized as air pollutants. Chemicals were identified for further examination based on their toxicity and vapor pressure. Vapor pressure is a measure of the material's volatility—its tendency to evaporate, or to form vapors, which is a critical parameter in determining potential impacts from chemical spills. Nonvolatile chemicals, defined as chemicals with a vapor pressure of less than 10 mm mercury (Hg), were excluded. Exposure standards are safety- and health-based standards indicative of the chemical's toxicity—substances with higher toxicity have lower exposure standards. These include OSHA permissible exposure limit (PEL), National Institute for Occupational Safety and Health (NIOSH), immediately dangerous to life or health (IDLH), and OSHA and/or NIOSH STEL and ceiling values.

The worst-case chemical spill analysis was performed for the chemicals with the greatest potential hazard, presented in **Table 8-2**, which were selected from the full chemical inventory based on relative exposure thresholds and vapor pressures. Chemicals with high vapor pressures are most likely to have high evaporation rates. Since the chemicals selected for detailed analysis are most likely to have the highest emissions rates and the lowest exposure standards, if the analysis of these chemicals results in no significant impacts, it would indicate that the other chemicals in the inventory would also not present a potential for significant impacts.

ESTIMATES OF WORST-CASE EMISSION RATES

The dispersion of chemicals from a spill within the proposed laboratories was analyzed to assess the potential for exposure of the general public and of staff within the proposed laboratory building to hazardous fumes in the event of an accidental release. Evaporation rates for volatile chemicals expected to be used in the proposed laboratories were estimated using the model developed by the Shell Development Company.[1]

The Shell model, which was developed specifically to assess air quality impacts from chemical spills, calculates evaporation rates based on physical properties of the chemical, temperature, and rate of air flow over the spill surface. Room temperature conditions (20° C) and an air-flow rate of 0.5 meters/second were assumed for calculating evaporation rates.

The analysis conservatively assumes that a chemical spill in a fume hood would extend to an area of 12 square feet (approximately 1.11 square meters). The emission rates were determined using the evaporation rates and assuming this maximum spill area. For modeling purposes, the emission rates shown in **Table 8-3** are calculated for a 15-minute time period. The vapor from the spill would be drawn into the fume hood exhaust system and released into the atmosphere via the exhaust stacks. The large volume of air drawn through this system provides a high degree of dilution for hazardous fumes before they are released to the atmosphere.

Table 8-2
Chemicals Analyzed

Chemical	**Vapor Pressure** (mm Hg)	**STEL** (ppm)	**Ceiling** (ppm)
methylene chloride*	350	NA	NA
Isoflurane	238	NA	2
carbon disulfide	297	10	NA
Chloroform	160	2	50
carbon tetrachloride	91	2	25
Benzene	75	1	NA
1,2-dichloroethane	64	2	NA
nitric acid	48	4	NA
boron tribromide solution	40	NA	1
Formaldehyde	26	NA	0.1

Notes:
* No STEL or Ceiling values available. A Permissible Exposure Limit of 25 ppm is applied (time weighted average for up to a 10-hour workday during a 40-hour workweek.)
STEL: Short-Term Exposure Limit is a 15-minute TWA exposure that should not be exceeded at any time during a workday.
Ceiling: Level set by NIOSH or OSHA not to be exceeded in any work place based on 15 minutes exposure.
PPM: parts per million.
NA: No recommended corresponding guideline value available.

[1] Fleischer, M.T. *An Evaporation/Air Dispersion Model for Chemical Spills on Land*, Shell Development Company, December 1980.

Table 8-3
Estimated Emissions from a Spill in a Fume Hood

Chemical	Quantity (liters)	Evaporation Rate (gram/meter^2/sec)	Emission Rate* (gram/sec)
methylene chloride	2.0	2.20	2.45
isoflurane	0.25	2.76	3.07
carbon disulfide	0.1	1.55	1.73
chloroform	1.0	1.33	1.48
carbon tetrachloride	0.5	0.82	0.91
benzene	2.0	0.36	0.41
1,2-dichloroethane	0.1	0.40	0.44
nitric acid	2.0	0.27	0.30
boron tribromide solution	0.1	0.44	0.49
formaldehyde	1.0	0.08	0.08
Note: * Average emission rate			

DISPERSION MODELING

Recirculation in Laboratory Building Intakes

The potential for recirculation of the fume hood emissions back into the proposed laboratory building air intakes was assessed using the Wilson method.[1] This empirical procedure, which has been verified by both wind-tunnel and full-scale testing, is a refinement of the 1981 ASHRAE Handbook procedure, and takes into account such factors as plume momentum, stack-tip downwash, and cavity recirculation effects. The procedure determines the worst-case, absolute minimum dilution between exhaust vent and air intake. Three separate effects determine the eventual dilution: internal system dilution, obtained by combining exhaust streams (i.e., mixing in plenum chambers of multiple exhaust streams, and introducing fresh air supplied from roof intakes); wind dilution, dependent on the distance from vent to intake and the exit velocity; and dilution from the stack, caused by stack height and plume rise from vertical exhaust velocity. The critical wind speed for worst-case dilution is dependent on the exit velocity, the distance from vent to intake, and the cross-sectional area of the exhaust stack.

Dispersion in Surrounding Area

Maximum concentrations at elevated receptors downwind of the fume exhausts were estimated using the EPA/AMS AERMOD dispersion model[2]. AERMOD is a steady-state plume model that incorporates current concepts about flow and dispersion in complex terrain, including updated treatments of the boundary layer theory, understanding of turbulence and dispersion, and includes handling of terrain interactions. The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability to calculate pollutant concentrations at locations where the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. Hourly meteorological data collected at the LaGuardia Airport station from 2007 through 2011 were used in this analysis. The analysis of potential impacts from a chemical

[1] D.J. Wilson. *A Design Procedure for Estimating Air Intake Contamination from Nearby Exhaust Vents*, ASHRAE TRAS 89, Part 2A, pp. 136-152, 1983.

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

spill was conducted assuming stack tip downwash, urban dispersion and surface roughness length, with and without building downwash, and with elimination of calms.

Discrete receptors (i.e., locations at which concentrations are calculated) were placed on nearby buildings. The model receptor network consisted of locations along the facades and roof of the buildings, at operable windows, intake vents, and otherwise accessible locations. Rows of receptors were placed in the model at spaced intervals on the buildings at multiple elevations. 7-Minute digital elevation model (DEM) files were obtained for the receptor area. A terrain pre-processor program was used to determine the representative elevations for each receptor. All receptors were referenced to Universal Transverse Mercator (UTM) coordinates.

The power law relationship was used to convert the calculated 1-hour average maximum concentrations to short-term 15-minute averages. The 15-minute average concentrations were then compared to the STELs or to the ceiling levels for the chemicals examined.

STRUCTURE OVER THE FDR DRIVE

Since the proposed project is projected to generate fewer than 50 vehicle trips, potential increases in pollutant concentrations associated with proposed project trips would be negligible, and do not require further analysis according to the *CEQR Technical Manual*. However, the proposed project includes the construction of a platform structure over the portion of the FDR Drive adjacent to the Rockefeller University campus. The construction would result in an approximately 930-foot long section of the FDR Drive being enclosed on the west side and from above, potentially restricting pollutant dispersion in that section. The proposed platform structure would be connected to two existing covered sections of the FDR Drive—a 770-foot long section to the north and 100-foot long section to the south. Pollutant concentration increments associated with these physical alterations have been analyzed. The proposed and existing structures over the FDR Drive are shown in **Figure 8-1**.

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

The analysis of mobile sources for the proposed project employs models approved by EPA that have been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State, and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels, resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the proposed project. The approach has been modified to adjust for the physical alterations to the FDR Drive, as described below.

3.20.14

NOTE: FOR ILLUSTRATIVE PURPOSES ONLY

Between the DEIS and FEIS the esplanade design was modified through discussions with DCP and DPR.
The air quality analysis and conclusions are not affected by the design modifications.

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Proposed Structure, View from East
Figure 8-1

VEHICLE EMISSIONS

Engine Emissions

Vehicular CO and PM engine emission factors were computed using the EPA mobile source emissions model, MOBILE6.2[1]. This emissions model is capable of calculating engine emission factors for various vehicle types, based on the fuel type (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOBILE6.2 incorporate ~~the most current~~ guidance available from NYSDEC and the New York City Department of Environmental Protection (DEP).[2]

Heavy duty vehicles are not allowed on the FDR Drive. The light duty vehicles were further categorized into subcategories based on their relative breakdown within the fleet.[3] Appropriate credits were used to accurately reflect the inspection and maintenance program. The inspection and maintenance programs require inspections of automobiles and light trucks to determine if pollutant emissions from each vehicle exhaust system are lower than emission standards. Vehicles failing the emissions test must undergo maintenance and pass a repeat test to be registered in New York State. All taxis were assumed to be in hot stabilized mode (i.e., excluding any start emissions). An ambient temperature of 50.0° Fahrenheit was used as per the *CEQR Technical Manual* guidance.

Road Dust

The contribution of re-entrained road dust to PM_{10} concentrations, as presented in the PM_{10} SIP, is considered to be significant; therefore, the PM_{10} estimates include both exhaust and road dust. In accordance with the $PM_{2.5}$ interim guidance criteria methodology, $PM_{2.5}$ 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 annual neighborhood scale $PM_{2.5}$ microscale analyses, since 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[4] and the *CEQR Technical Manual*.

TRAFFIC DATA

Traffic volumes for the air quality analysis were derived from existing traffic counts collected between October 13, 2012 and October 21, 2012. Volumes were projected to grow by 0.25 percent per year, according to the 2012 *CEQR Technical Manual*, when the vehicle count was undertaken, to 2019, the year completion of the proposed project is anticipated. It was determined that peak hourly volumes would occur at the analyzed roadway on Saturday; therefore, the CO and PM short-term analyses were based on the observed Saturday hourly

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

[2] At the time the analysis was scoped and conducted, MOBILE6.2 rather than MOVES was the standard model for projects undergoing CEQR review.

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

[4] 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.

volume distribution. For the PM annual analysis, a weekly average hourly volume distribution was used. This distribution was calculated based on observed weekday, Saturday, and Sunday volume distributions. Conservative assumptions were utilized for vehicle speeds along the analyzed roadway. The traffic counts, projected volumes, and assumed speeds are presented in **Table 8-4**.

DISPERSION MODEL SELECTION

Maximum concentrations adjacent to the analysis sites resulting from vehicular emissions were predicted using the CAL3QHCR model.[1] The CAL3QHCR model employs a Gaussian (normal distribution) dispersion assumption. CAL3QHCR predicts emissions and dispersion from idling and moving vehicles. The CAL3QHCR model allows for the incorporation of hourly traffic and meteorology data, and is therefore more appropriate for calculating the 24-hour and annual average concentrations required to address the timescales of the PM NAAQS. This model also allows for certain adjustments that were necessary for this analysis, as described in greater detail below.

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 analysis was 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 2007-2011. All hours were modeled, and the highest resulting concentration for each averaging period is presented.

ANALYSIS YEAR

The microscale analyses were performed for 2019, the year completion of the proposed project is anticipated. The future analysis was performed for the future both without (No Build condition) and with the proposed project (Build 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 only for vehicular emissions on the streets within 1,000 feet and in the line of sight of the analysis site. Background concentrations must be added to modeling results to obtain total pollutant concentrations at an analysis site.

[1] EPA, User's Guide to CAL3QHC, A Modeling Methodology for Predicted Pollutant Concentrations Near Roadway Intersections, Office of Air Quality, Planning Standards, Research Triangle Park, North Carolina, EPA-454/R-92-006 (Revised), 1995; and

EPA, Addendum to the User's Guide to CAL3QHC Version 2.0 (CAL3QHCR User's Guide), 1995.

Table 8-4
Vehicle Volumes and Speeds

	Saturday						Annual Average			
	Vehicle Count* (2012)		Projected Volume** (2019)		Assumed Speed (mph)		Vehicle Count*** (2012)		Projected Volume** (2019)	
Hour	NB	SB	NB	SB	NB	SB	NB	SB	NB	SB
0	3337	3418	3396	3478	40	40	2818	2647	2868	2694
1	2596	2139	2641	2176	40	40	1894	1559	1928	1586
2	2010	1611	2045	1639	40	40	1320	1081	1344	1100
3	1642	1307	1671	1330	40	40	1047	910	1065	926
4	1644	1244	1672	1266	40	40	1200	1047	1221	1065
5	1662	1491	1691	1517	40	40	1752	1922	1783	1956
6	2022	2455	2058	2498	30	30	2808	3608	2858	3672
7	2833	3343	2883	3401	30	10	3697	4540	3762	4620
8	3469	3810	3530	3877	30	10	3530	4673	3592	4755
9	3706	4095	3771	4167	30	10	3440	4564	3501	4644
10	3799	4157	3865	4230	30	30	3508	4592	3570	4673
11	3964	4276	4034	4351	30	30	3565	4373	3627	4450
12	3826	4490	3893	4569	30	30	3505	4361	3566	4438
13	3642	4544	3706	4624	30	30	3677	4359	3742	4435
14	4073	4860	4145	4946	30	30	4034	4567	4105	4648
15	4386	4903	4463	4989	10	30	4112	4712	4184	4795
16	4490	5044	4569	5133	10	30	4245	4694	4320	4776
17	4279	5035	4354	5124	10	30	4043	4586	4115	4667
18	4024	5064	4095	5153	10	30	3937	4653	4007	4735
19	3739	5151	3805	5242	30	30	3808	4661	3875	4743
20	3563	5022	3626	5110	30	30	3866	4486	3934	4565
21	3529	4596	3591	4677	30	30	3815	4051	3883	4123
22	3582	4496	3645	4575	30	30	3459	3691	3520	3756
23	3651	4455	3715	4533	40	40	3213	3455	3269	3516

Notes:
* The vehicle counts represent the average of 2 Saturdays.
** The projected volumes assume 0.25 percent increase in volume per year.
*** Annual averages represent the weekly weighted average volumes calculated based on counts taken on 2 weekends and 5 weekdays.

The background concentrations used in the mobile source analysis were based on the existing concentrations recorded at the monitoring stations nearest to the proposed project site from 2007 to 2011. The background concentrations represent the highest measured 3-year average $PM_{2.5}$ concentration, the 98th percentile 24-hour average $PM_{2.5}$ concentration, and the second highest 24-hour PM_{10} and 8-hour and 1-hour CO concentrations, consistent with the form of the NAAQS. A full description of the concentrations can be found in Section F, "Existing Conditions," and in **Table 8-6**.

SOURCE PLACEMENT

Emission sources were defined in the model according to the general CAL3QHCR model guidance and the *CEQR Technical Manual's* guidance regarding mobile source analysis. This includes roadway links out to a distance of 1,000 feet in each direction from the area of interest. Normally the area of interest is the center of an intersection; in this case, since there is no intersection in the model, a 2,000-foot section of the FDR Drive was modeled centered on the deck-covered areas. This included areas covered in the existing condition as well as the proposed project area (see "Modeling Approach", below, for more information on the approach to modeling dispersion from deck-covered areas.) This provides a reasonable worst-case analysis, since other locations would have similar emissions, but lower dispersion effects associated with

the deck. Since there are no intersections in the model, all links represent cruise emissions (including congestion), with no signal queuing.

RECEPTOR PLACEMENT

Multiple receptors (i.e., precise locations at which concentrations are predicted) were modeled at intervals along the FDR Drive to the east on the East River Esplanade. Receptors for predicting annual average neighborhood-scale $PM_{2.5}$ concentrations were placed at a distance of 15 meters from the nearest moving lane, based on the *CEQR Technical Manual* procedure for neighborhood-scale corridor $PM_{2.5}$ modeling.

MODELING APPROACH

The general approach for modeling the proposed project's impact on pollutant dispersion near the FDR Drive was to model both the No Build and the Build conditions with CAL3QHCR, while making some adjustments to account for specific physical constraints on the dispersion of emissions from the covered sections of the FDR Drive (both existing and proposed). As a conservative approach, since the adjustments increase projected concentrations, No Build conditions were modeled without any adjustments, even in areas where deck cover exists, while adjustments were applied in the Build condition for both the proposed project and existing deck areas. This results in conservatively low concentrations projected for the No Build, and conservatively high increments attributed to the proposed project, since some of the effect attributed to the increment would actually exist in the No Build condition.

There are two effects which require specific adjustments:

- The restriction of vertical dispersion due to the deck over the roadway; and
- The restriction of horizontal dispersion due to the full enclosure to the west of the roadway.

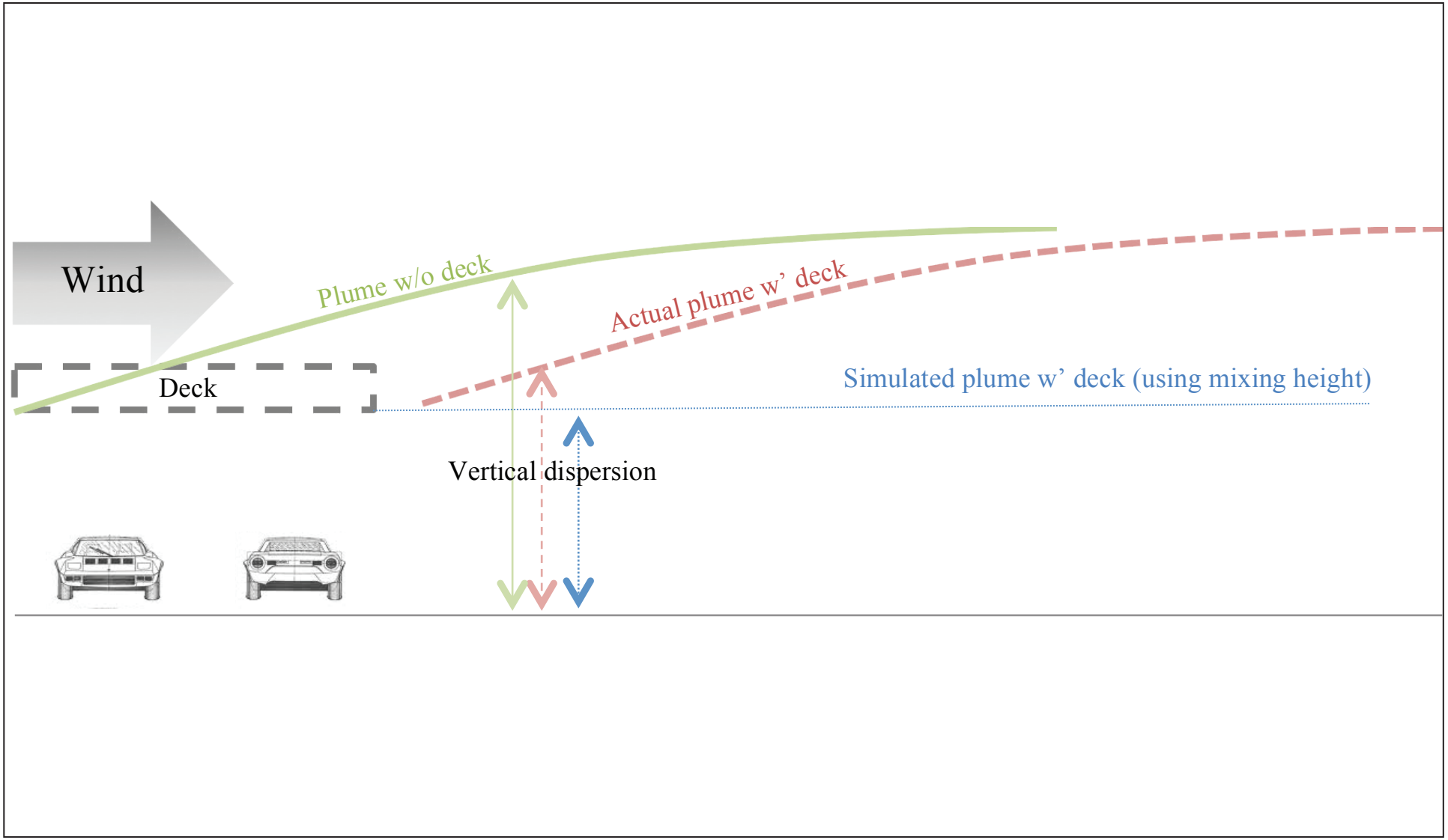
The following sections describe in detail how the model was adjusted to account for these effects. The potential addition of a low barrier between the covered roadway and the esplanade would not substantially effect either of these dispersion effects other than to increase dispersion of pollutants emitted (see more on this in **Appendix G**).

Vertical Dispersion Restriction

Vertical dispersion would be limited due to the deck over the roadway. This effect would be most pronounced immediately next to the roadway, on the East River Esplanade. A schematic drawing depicting this effect is presented in **Figure 8-2**.

To simulate this condition, the meteorological mixing height was artificially set to the height of the deck's underside in the Build condition model. In the No Build condition there are two existing covered sections, but most of the area of focus is near an open section of the FDR Drive. Since this mixing height setting would affect all sources in the model, the adjustment cannot be made without affecting all sections, and therefore, the No Build model includes the actual mixing height data (i.e., it is not adjusted). This assumption produces conservatively high incremental impacts (the increase in concentration from Build to No Build conditions) since the modeled No Build concentrations are slightly lower near the existing covered sections. Note that this effect is not expected to be substantial because the esplanade receptors are very close to the emission source and very little vertical dispersion would occur over such a short distance, even without the restriction.

7.16.13



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Vertical Dispersion With and Without Deck Cover
Figure 8-2

Horizontal Dispersion Restriction

Horizontal dispersion would be restricted due to the full enclosure to the west of the roadway, preventing flow of air and pollutants over the wall to the west. Since pollutants cannot disperse to the west, concentrations along the East River Esplanade would be expected to increase.

To account for this, "plume reflection" from the west wall of the decked-over the FDR Drive was simulated. Plume reflection is a modeling concept commonly used for simulating the effect of the ground on the vertical dispersion of elevated plumes, whereby the concentration which would otherwise be predicted below ground level if the ground were not present is added to the concentration at the same distance above ground, under the assumption that the plume is 'reflected' off the surface. In the case of the proposed project, the plume reflection concept was applied to the horizontal dispersion reflecting off the western wall along the FDR Drive, as shown schematically in **Figure 8-3**. This was achieved by post processing the dispersion results. Virtual or "reflected" receptors were placed west of the wall, such that the distance between the wall and the receptors was equal to the distance between the wall and the parallel esplanade receptors. As depicted in **Figure 8-3**, the total projected concentration on the esplanade at R_1 would be the sum of the model-simulated concentrations at R_1 added to the model-simulated concentrations at R_1'. This effect would apply when the wind direction is generally along the roadway axis (north-northeasterly or south-southwesterly winds).

In the CO and $PM_{2.5}$ 24-hour analysis model, the worst-case primary and reflected concentrations were summed, conservatively, regardless of wind direction or receptor location (i.e., the highest concentration at the reflected receptors was added to the highest concentration at primary receptors).

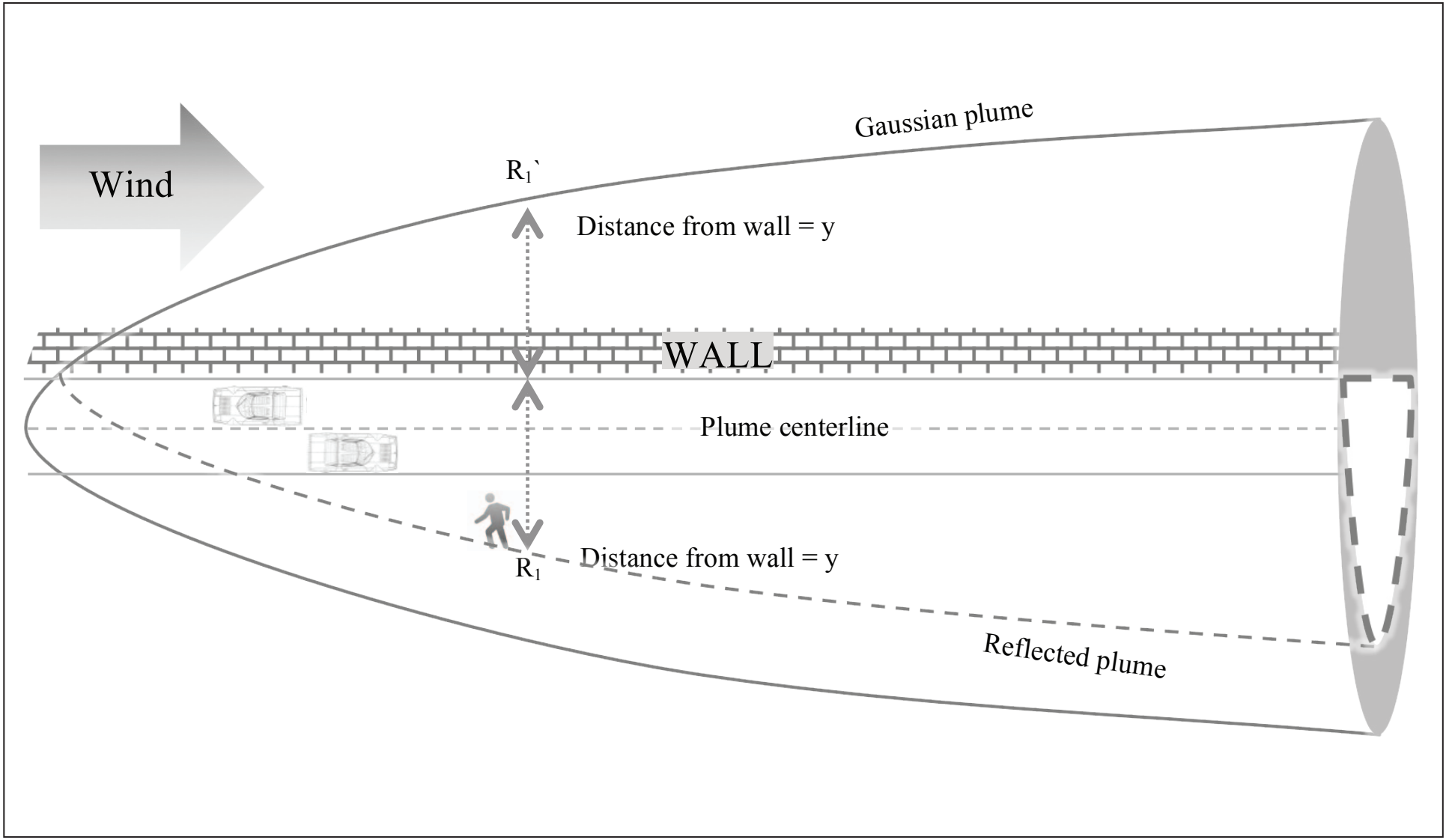
The results of the annual $PM_{2.5}$ analysis were processed so as to apply the reflected component in applicable wind conditions (depicted schematically in **Figure 8-4**) within the year and averaged over the full annual period with no reflected increment during hours when the wind would conditions are not applicable. Worst-case annual average primary and reflected concentrations were summed, conservatively, receptor location (i.e., the highest concentration at the reflected receptors was added to the highest concentration at primary receptors).

ADDITIONAL SOURCES

The *CEQR Technical Manual* also requires an assessment of any actions that could result in the location of sensitive uses near existing or planned future emissions stacks that may affect the use. Although not specified in the manual, the City has interpreted this requirement further to include "large" emission sources (examples of large emission sources provided in the *CEQR Technical Manual* include solid and medical waste incinerators, cogeneration plants, asphalt and concrete plants, or power plants) within 1,000 of the proposed new uses. To assess the potential effects of these existing sources on the proposed project, a review of existing permitted facilities was conducted within 1,000 feet of the new uses. Sources permitted under NYSDEC's Title V program and State Facility permit program were considered.

One large source was identified for analysis: the New York Presbyterian Hospital-Weill Cornell Medical College (NYPH-Weill Medical College) steam plant on East 70th Street. Although this source would clearly not affect the proposed project, given the height of the stack and the low lying project, a screening analysis was performed, as described below.

7.16.13



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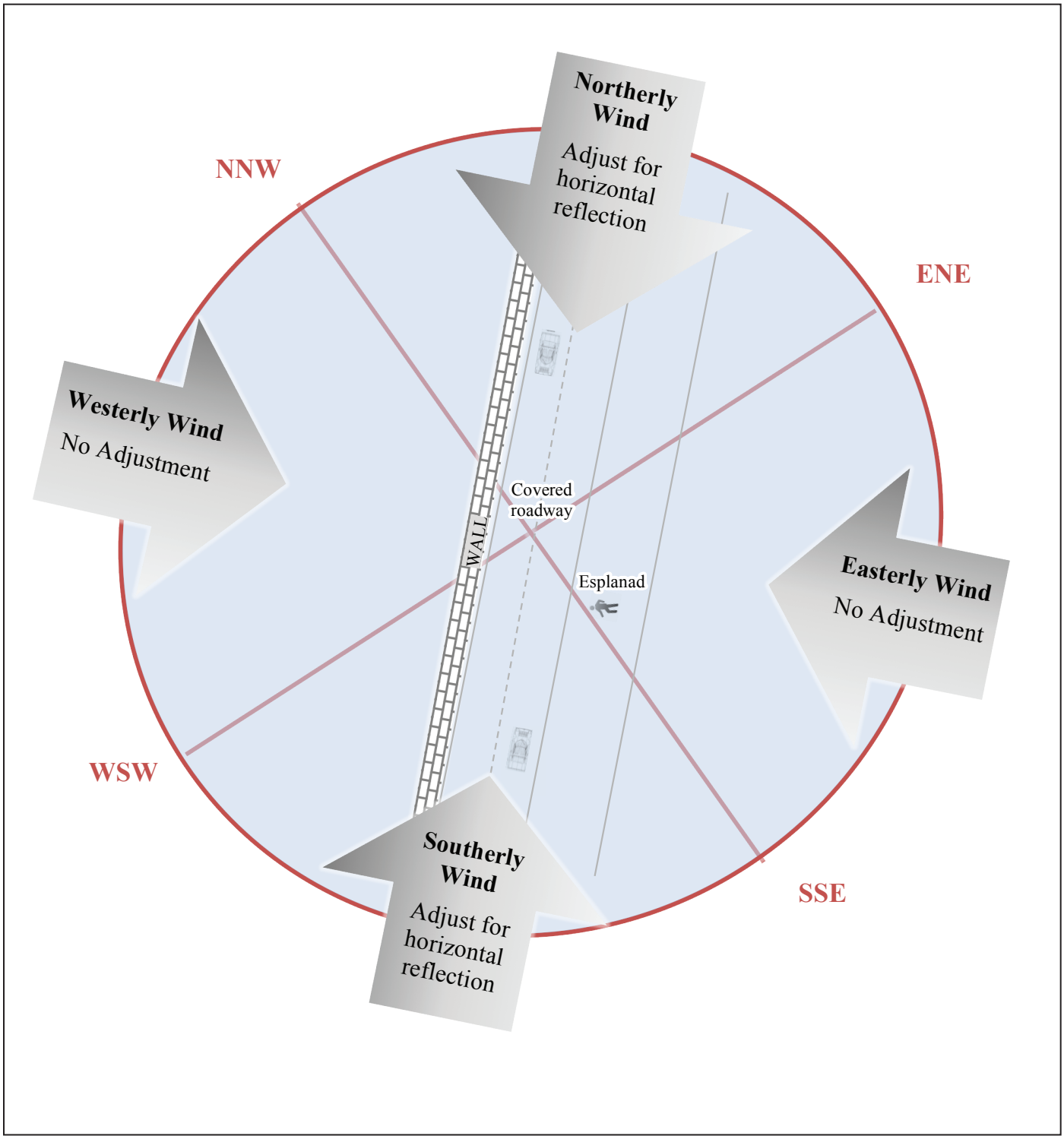
Horizontal Dispersion With and Without Deck Cover
Figure 8-3

10.22.13



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Post-Processing Adjustments by Wind Sector

Figure 8-4

DISPERSION MODEL

Potential 1-hour NO_2, 24-hour $PM_{2.5}$ and annual average $PM_{2.5}$ impacts from the NYPH-Weill Medical College system were evaluated using the EPA-approved AERSCREEN model (version 11076). AERSCREEN predicts worst-case 1-hour impacts downwind from a point, area, or volume source. AERSCREEN generates application-specific worst-case meteorology using representative minimum and maximum ambient air temperatures, and site-specific surface characteristics such as albedo, Bowen ratio, and surface roughness. The model incorporates the PRIME downwash algorithms that are part of the AERMOD refined model and utilizes BPIP-Prime to provide a detailed analysis of downwash influences on a direction-specific basis. AERSCREEN also incorporates AERMOD's complex terrain algorithms and utilizes the AERMAP terrain processor to account for the actual terrain in the vicinity of the source on a direction-specific basis. The model was run both with and without the influence of building downwash and with urban diffusion coefficients based on a review of land-use maps of the area. Other model options were selected based upon EPA guidance.

If the worst-case concentrations predicted by AERSCREEN are above significant impact levels, further analysis with AERMOD would be required to determine the potential for air quality impacts from a proposed project. However, if the worst-case concentrations predicted by the AERSCREEN model are below significant impact levels, there is no potential for impact and no further analysis is required.

EMISSION RATES AND STACK PARAMETERS

The screening was prepared using a generic 1 g/s emission rate, and then post processing the results for each pollutant and averaging-time combination by multiplying the result by the appropriate emission rate for each pollutant and averaging-time combination and by the default AERSCREEN persistence factor for each averaging-time. (Since no chemistry calculations were involved, the resulting concentrations are linearly related to the emission factor.) The models were run both with and without downwash and included the receptors nearest to the source.

The emission rates and stack exhaust parameters used in the AERSCREEN analysis are presented in **Table 8-5**.

Table 8-5
Emission Rates and Stack Parameters

Parameter	NYPH-Weill Medical College
Stack Height (ft) (1)	403
Stack Diameter (ft) (1)	8
Exhaust Velocity (ft/s)	44.1 (2)
Exhaust Temperature (F)	450 (2)
$PM_{2.5}$ Emission Rate (g/s) (3)	0.48
PM_{10} Emission Rate (g/s) (3)	0.59
NO_x Emission Rate (g/s) (3)	7.77
CO Emission Rate (g/s) (3)	3.75
SO_2 Emission Rate (g/s) (3)	16.6

Sources:
(1) Title V permit for the source.
(2) Based on 2008 Stack test report for NYPH-Weill Medical College sources.
(3) Emission rates are based on EPA, *AP-42 Compilation of Air Pollutant Emission Factors*, Chapter 1.3 and 3.1, 2010; and on the estimated maximum daily heat input averaged over 24 hours.

NO_2 concentrations were estimated using NO_2 to NO_x ratios of 0.8 for the maximum 1-hour concentration and 0.75 for the annual concentration, per EPA guidance.[1]

METEOROLOGICAL DATA

The meteorological data used by the AERSCREEN model is generated by the MAKEMET program which uses application-specific worst-case meteorology, using representative minimum and maximum ambient air temperatures, and site-specific surface characteristics such as albedo, Bowen ratio, and surface roughness to determine worst-case hourly impacts. The default minimum and maximum air temperatures of 250 K and 310 K, a minimum wind speed of 0.5 m/s, and an anemometer height of 10 m were used in the model. Surface characteristics from the LaGuardia meteorological station were also used.

RECEPTOR LOCATIONS

The a distance between the NYPH-Weill Medical College stack and the sensitive uses within the proposed project ranged from approximately 656 feet to 1,607 feet. Concentrations were modeled at locations throughout that range (receptors) and were modeled up to a height of up to 22.3 feet above grade.

BACKGROUND CONCENTRATIONS

Background concentrations were added to the projected source increments, as described above for the HVAC analysis.

E. EXISTING CONDITIONS

The most recent concentrations of all criteria pollutants measured at NYSDEC air quality monitoring stations nearest to the proposed project site are presented in **Table 8-6**. All concentrations are presented in the statistical format as defined by the NAAQS for each applicable pollutant and averaging period. In cases where the available stations were not near the proposed project, the highest values were selected from available stations. As shown, other than ozone, the recently monitored concentrations did not exceed the NAAQS. The existing concentrations are based on measurements recorded during the years 2007-2011. Note that in most cases, since concentrations are diminishing over time, concentrations in 2011 were lower than the highest concentrations from the last five years.

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

Table 8-6
Representative Monitored Ambient Air Quality Data
(Maximum, 2007-2011 unless noted)

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	CCNY, Manhattan	ppm	8-hour	1.8 [1]	9
			1-hour	2.7 [1]	35
SO_2	Botanical Garden, Brooklyn	µg/m^3	3-hour	162	1,300
			1-hour	134 [2]	197
PM_{10}	P.S. 19, Manhattan	µg/m^3	24-hour	44 [4]	150
$PM_{2.5}$	PS 19, Manhattan	µg/m^3	Annual	13.6	15
			24-hour	27 [5]	35
NO_2	Botanical Garden, Brooklyn Queens College 2, Queens	µg/m^3	Annual	43	100
			1-hour	126 [3]	188
Lead	J.H.S. 126, Brooklyn	µg/m^3	3-month	0.02	0.15
Ozone	CCNY, Manhattan	ppm	8-hour	**0.076** +	0.075

Notes:
The form of all concentrations is the same as defined for the NAAQS of the corresponding pollutant and time average. Background values are from the *CEQR Technical Manual* where available.
+ Exceeds the NAAQS.
1. CCNY CO background data is based on the 4 years of available monitoring data (2008-2011). Sampling commenced at CCNY on 07/09/2008
2. 3-year average of the 99th percentile of daily maximum 1-hour average concentrations for 2009-2011. EPA replaced the 24-hr and the annual standards with the 1-hour standard in 2010, and these values are not available prior to that period.
3. 3-year average of the 98th percentile daily maximum 1-hour average concentrations for 2009-2011. EPA introduced this new standard in 2010, and these values are not available prior to that period.
4. Highest 2nd max values from the latest 3 years of available monitoring data from NYSDEC (2009-2011)
5. Average of the 98th percentile for the latest 3 years of available monitoring data from NYSDEC (2009-2011)

Source: NYSDEC, New York State Ambient Air Quality Data.

F. FUTURE NO ACTION SCENARIO

Relative to the existing condition, in the future without the proposed project there would be some background growth in traffic and potentially further reductions in background pollutant concentrations due to public and private efforts to achieve greater fuel efficiency and use cleaner fuels. The future without the proposed project was analyzed in the same manner as with the proposed project for all analyses, as described above. Since the conclusions of the analyses are largely dependent on comparison with the future without the proposed project, the results of both analyses are presented in the following section.

G. FUTURE WITH ACTION SCENARIO

CHEMICAL SPILL ANALYSIS

RECIRCULATION IN LABORATORY BUILDING INTAKES

The recirculation analysis indicates that the minimum potential dilution factor between the fan exhausts and the nearest air intake below the rooftop is over 4,304,205 (i.e., pollutant concentrations at the nearest intake to the exhaust fan would be 4,304,205 times less than the concentration at the fan exhaust). Thus, for example, a methylene chloride spill in a fume hood as described above would produce a maximum concentration at the nearest intake location of about 0.000009 ppm.

The results of the recirculation analysis are presented in **Table 8-7**. The results indicate that a spill in a fume hood as described above would produce a maximum concentration at the nearest intake location well below the corresponding STELs or ceiling values set by OSHA and/or

NIOSH for each of the chemicals analyzed. Consequently, it can be concluded that no significant impact would be expected due to recirculation of fume hood emissions back into the proposed laboratory building's air intakes in the event of a chemical spill.

Table 8-7
Fume Hood Recirculation Analysis
Maximum Predicted Concentrations (ppm)

Chemical	STEL/OSHA Ceiling	15-Minute Average
Methylene Chloride	25	9.27E-06
Isoflurane	2	5.35E-06
Carbon Disulfide	10	7.28E-06
Chloroform	2	3.98E-06
Carbon Tetrachloride	2	1.90E-06
Benzene	1	1.67E-06
1,2-Dichloroethane	2	1.44E-06
Nitric Acid	2	1.52E-06
Boron tribromide Solution	1	6.32E-07
Formaldehyde	0.10	8.95E-07
Note: * 15-Minute Average emission rate		

DISPERSION IN SURROUNDING AREA

The results of the analysis of potential emissions from the fume hood exhaust system are shown below in **Table 8-8**. The maximum concentrations at elevated receptors downwind of the fume hood exhausts were estimated using the methodology previously described, and were determined to be below the STEL levels. The results of the dispersion analysis demonstrate that no significant adverse impacts from the exhaust system of the proposed laboratories would be expected with the proposed project.

Table 8-8
Maximum Predicted Concentrations (ppm)

Chemical	STEL/OSHA Ceiling	15-Minute Average
Methylene Chloride	25	0.72
Isoflurane	2	0.41
Carbon Disulfide	10	0.56
Chloroform	2	0.31
Carbon Tetrachloride	2	0.15
Benzene	1	0.13
1,2-Dichloroethane	2	0.11
Nitric Acid	2	0.12
Boron tribromide Solution	1	0.05
Formaldehyde	0.10	0.07
Note: * 15-Minute Average emission rate		

STRUCTURE OVER THE FDR DRIVE

The maximum projected $PM_{2.5}$ concentration increments and total CO concentrations with the proposed project are presented in **Tables 8-9 and 8-10**, respectively. $PM_{2.5}$ concentration increments would not exceed the *de minimis* threshold values, and total CO concentrations would not exceed the NAAQS or the CEQR *de minimis* threshold. Therefore, no significant

adverse air quality impacts would result from the construction of the proposed laboratory building over the FDR Drive.

Table 8-9
Maximum Modeled PM2.5 Concentration Increments on Esplanade (µg/m^3)

Averaging Period	Maximum from FDR		Increment	De Minimis
	No Build	Build		
24-hour	3.66	5.78	2.19	4.0
Annual (neighborhood scale)	0.32	0.41	0.09	0.1

Table 8-10
Maximum Modeled CO Concentrations on Esplanade (ppm)

Averaging Period	Background	Maximum from FDR		Total Concentration		NAAQS / De Minimis
		No Build	Build	No Build	Build	
1-hour	2.7	2.9	4.6	5.6	7.3	*35*
8-hour	1.8	1.6	2.8	3.4	4.6	*9 / 6.2* (1)

Note:
(1) 8-hour CO CEQR *de minimis* criterion, > 6.2 ppm, represents an increment of half the difference between the standard (9.0 ppm) and the No Action concentrations (3.4 ppm).

It is important to note that while the reasonable worst case annual increment is lower than the *de minimis* level for neighborhood-scale impact, comparing this increment with that criterion is extremely conservative, because the neighborhood-scale criterion is defined so as to evaluate the potential for impacts on a large area, and is measured at a distance of 15 meters from the edge of the roadway with the assumption that this impact may be representative of an area along the entire corridor. That is not the case in this instance: the effect of the deck structure on pollutant concentrations would be limited to the area adjacent to the structure, since the proposed project is not adding any vehicular traffic to the FDR Drive.

ADDITIONAL SOURCES

The maximum modeled pollutant concentrations from the NYPH-Weill Medical College steam plant, along with the relevant background concentrations, the total potential concentrations and the applicable NAAQS, are presented in **Table 8-11**. The projected contribution of the NYPH-Weill Medical College plant to $PM_{2.5}$ concentration at the proposed project locations would be lower than the City's *de minimis* criteria thresholds, and all total pollutant concentrations (when added to the applicable background) would be well below the NAAQS.

Overall, no significant adverse air quality impact on the proposed project would occur as a result of the operation of nearby large emission sources.

Table 8-11
Maximum Modeled Pollutant Concentrations from NYPH-Weill Medical College on the Proposed Project ($\mu g/m^3$)

Pollutant	Averaging Period	Modeled Concentration	Background Concentration	Total Concentration	NAAQS
NO_2[(1)]	1-hour	11.0	126	137.0	188
	Annual	1.0	64	65.0	100
SO_2	1-hour	29.2	133.5	162.7	196
	3-hour	29.2	162.3	191.5	1,300
PM_{10}	24-hour	0.6	53	53.6	150
CO	1-hour	6.6	3092.0	3098.6	40,000
	8-hour	6.0	2061.3	2067.3	10,000
$PM_{2.5}$	24-hour	0.51	Not relevant	Not relevant	4.0 (*de minimis*)
	Annual	0.08	Not relevant	Not relevant	0.3 (*de minimis*)

Note:
(1) NO_2 concentrations were estimated using NO_2 /NO_x ratio of 0.8 for NO_2 1-hour and 0.75 for NO_2 annual as per EPA guidance.

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