

A. INTRODUCTION

This chapter examines the potential for air quality impacts from the proposed project. Air quality impacts can be either direct or indirect. Direct impacts stem from emissions generated by stationary sources at a projected or potential development site, such as emissions from fuel burned on site for heating, ventilation, and air conditioning (HVAC) systems. Indirect impacts are caused by potential emissions from nearby existing stationary sources and the potential for emissions due to mobile sources/vehicles generated by the projected and potential developments.

This section also describes the expected use of potentially hazardous materials and the procedures and systems that would be employed in the proposed school facility to ensure the safety of staff, students and the surrounding community in the event of a chemical spill in one of the proposed laboratories. In addition, potential effects of stationary source emissions from existing nearby industrial facilities on the proposed school facility are assessed.

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. Typically, ambient concentrations of carbon monoxide (CO) are predominantly influenced by mobile source emissions. Volatile organic compounds (VOCs) and nitrogen oxides (NO and NO₂, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Emissions of sulfur dioxide (SO₂) are associated mainly with stationary sources, and sources utilizing non-road diesel such as diesel trains, marine engines and non-road vehicles such as construction engines, but diesel-powered vehicles, primarily heavy duty trucks and buses, also currently contribute somewhat to these emissions; diesel fuel regulations, which will begin to take affect in 2006 will reduce SO₂ emissions from mobile sources to extremely low levels. Particulate matter (PM) is emitted from both stationary and mobile sources. Fine particulate matter is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs, emitted mainly from industrial processes and mobile sources.

CARBON MONOXIDE

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

The proposed project would result in changes in traffic patterns and an increase in traffic volume in the study area and could potentially result in local increases in CO concentrations. Therefore, a mobile source analysis was conducted at critical intersections in the study area 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 change in regional mobile source emissions of these pollutants would be related to the total vehicle miles added or subtracted on various roadway types throughout the New York and New Jersey metropolitan area, which is designated as a severe non-attainment area for ozone by EPA.

The proposed project would not have a significant effect on the overall volume of vehicular travel in the metropolitan area; therefore, no measurable impact on regional NO_x emissions or on ozone levels is predicted. An analysis of project-related emissions of these pollutants from mobile sources was therefore not warranted. In addition, there is a standard for average annual NO₂ concentrations, which is normally examined only for fossil fuel energy sources.

Potential impacts from the fuel to be burned for the proposed project's HVAC systems were evaluated.

LEAD

Lead emissions in air are principally associated with industrial sources and motor vehicles that use gasoline containing lead additives. Most U.S. vehicles produced since 1975, and all produced after 1980, are designed to use unleaded fuel. As these newer vehicles have replaced the older ones, motor vehicle related lead emissions have decreased. As a result, ambient concentrations of lead have declined significantly. Nationally, the average measured atmospheric lead level in 1985 was only about one-quarter the level in 1975.

In 1985, EPA announced new rules drastically reducing the amount of lead permitted in leaded gasoline. The maximum allowable lead level in leaded gasoline was reduced from the previous limit of 1.1 to 0.5 grams per gallon effective July 1, 1985, and to 0.1 grams per gallon effective January 1, 1986. Monitoring results indicate that this action has been effective in significantly reducing atmospheric lead concentrations. Effective January 1, 1996, the Clean Air Act banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, concluding the 25-year effort to phase out lead in gasoline. Even at locations in the New York City area where traffic volumes are very high, atmospheric lead concentrations are far below the national standard of 1.5 micrograms per cubic meter (3-month average).

No significant sources of lead are associated with the proposed project, and, therefore, an analysis was not warranted.

RESPIRABLE PARTICULATE MATTER—PM₁₀ AND PM_{2.5}

Particulate Matter (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 volatile organic compounds, 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. Particulate matter also acts as a substrate for the adsorption 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, or PM_{2.5}, and particles with an aerodynamic diameter of less than or equal to 10 micrometers, or PM₁₀, 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 adsorbed 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 particulate matter (often soon after the release from an exhaust pipe or stack) or from precursor gases reacting in the atmosphere to form secondary PM.

Diesel-powered vehicles, especially heavy duty trucks and buses, are a significant source of respirable PM, most of which is PM_{2.5}. PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. The proposed project would not result in any significant increases in heavy-duty diesel traffic near the project site or in the region, and therefore, an analysis of potential impacts from respirable particulate matter is not warranted.

SULFUR DIOXIDE

SO₂ emissions are primarily associated with the combustion of sulfur-containing fuels: oil and coal.

Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources. Monitored SO₂ concentrations in New York City are below the national standards. Vehicular sources of SO₂ are not significant and therefore, an analysis of this pollutant from mobile sources is not warranted.

AIR TOXICS

In addition to the criteria pollutants discussed above, air toxics are of concern. Air toxics are emitted by a wide range of man-made and naturally occurring sources. Emissions of air toxics from industries are regulated by the EPA. Federal ambient air quality standards do not exist for non-criteria air toxics; however, the New York State Department of Environmental Conservation (NYSDEC) has issued standards for certain non-criteria compounds, including beryllium, gaseous fluorides, and hydrogen sulfide. NYSDEC has also developed guideline concentrations for numerous air toxic compounds. The NYSDEC guidance document DAR-1 (December 2003) contains a compilation of annual and short term (1-hour) guideline concentrations for these compounds. The NYSDEC guidance thresholds represent ambient levels that are considered safe for public exposure.

C. AIR QUALITY STANDARDS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the Clean Air Act, primary and secondary NAAQS have been established for six major air pollutants: CO, NO₂, ozone, respirable PM (both PM_{2.5} and PM₁₀), SO₂, and lead. The primary standards protect public health and represent levels at which there are no known significant effects on human health. 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. For NO₂, ozone, lead and PM, the primary and secondary standards are the same; there is no secondary standard for CO. EPA promulgated additional NAAQS, which became effective September 16, 1997: a new 8-hour standard for ozone, which will replace the existing 1-hour standard, and in addition to retaining the PM₁₀ standards, EPA adopted 24-hour and annual standards for PM_{2.5}. The standards for these pollutants are presented in Table 8-1. These standards have also been adopted as the ambient air quality standards for New York State.

STATE IMPLEMENTATION PLAN (SIP)

The Clean Air Act, as amended in 1990 (CAA) 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 is a state's plan on how it will meet the NAAQS under the deadlines established by the CAA.

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

Manhattan has been designated as a moderate NAA for PM₁₀. On December 17, 2004, EPA took final action designating the five boroughs of New York City, as well as Nassau, Suffolk, Rockland, Westchester and Orange counties, as PM_{2.5} non-attainment areas under the CAA. State and local governments are required to develop implementation plans designed to meet the standards by early 2008.

Nassau, Rockland, Suffolk, Westchester, and the five counties of New York City have been designated as severe non-attainment for the ozone 1-hour standard. 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 one-hour ozone NAAQS by 2007. New York State has recently submitted revisions to the SIP. These SIP revisions include additional emission reductions that EPA requested to demonstrate attainment of the standard and an update of the SIP estimates using two new EPA models—the mobile source emissions model MOBILE6, and the non-road emissions model NONROAD. (The models have been updated to reflect current knowledge of engine emissions, and the latest mobile and non-road engine emissions regulations.) On April 15, 2004, EPA designated these same counties as moderate non-attainment for the new 8-hour ozone standard, which became effective as of June 15, 2004 (the entire Orange County was moved to the Poughkeepsie moderate non-attainment area for 8-hour ozone). EPA revoked the 1-hour standard in June,

Table 8-1
Ambient Air Quality Standards

Pollutant	Primary		Secondary	
	ppm	$\mu\text{g}/\text{m}^3$	ppm	$\mu\text{g}/\text{m}^3$
Carbon Monoxide (CO)				
Maximum 8–Hour Concentration ¹	9	10,000	None	
Maximum 1–Hour Concentration ¹	35	40,000		
Lead				
Maximum Arithmetic Mean Averaged Over 3 Consecutive Months	NA	1.5	NA	1.5
Nitrogen Dioxide (NO₂)				
Annual Arithmetic Average	0.053	100	0.053	100
Ozone (O₃)				
1–Hour Average ²	0.12	235	0.12	235
8–Hour Average ³	0.08	157	0.08	157
Total Suspended Particles (TSP)				
Annual Mean	NA	45	None	
Rural Open Space		55		
Rural Residential		65		
Urban Residential		75		
Urban Industrial				
Maximum 24–Hour Concentration	NA	250		
Respirable Particulate Matter (PM₁₀)				
Average of 3 Annual Arithmetic Means	NA	50	NA	50
24–Hour Concentration ¹	NA	150	NA	150
Fine Respirable Particulate Matter (PM_{2.5})				
Average of 3 Annual Arithmetic Means	NA	15	NA	15
24–Hour Concentration ⁴	NA	65	NA	65
Sulfur Dioxide (SO₂)				
Annual Arithmetic Mean	0.03	80	NA	NA
Maximum 24–Hour Concentration ¹	0.14	365	NA	NA
Maximum 3–Hour Concentration ¹	NA	NA	0.50	1,300
<p>Notes: ppm – parts per million $\mu\text{g}/\text{m}^3$ – micrograms per cubic meter NA – not applicable</p> <p>Particulate matter concentrations are in $\mu\text{g}/\text{m}^3$. Concentrations of all gaseous pollutants are defined in ppm — approximately equivalent concentrations in $\mu\text{g}/\text{m}^3$ are presented.</p> <p>TSP levels are regulated by a New York State Standard only. All other standards are National Ambient Air Quality Standards (NAAQS).</p> <p>¹ Not to be exceeded more than once a year. ² Applies only to areas designated as Non Attainment. ³ Three–year average of the annual fourth highest daily maximum 8–hr average concentration. ⁴ Not to be exceeded by the 98th percentile averaged over 3 years.</p> <p>Sources: 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards; 6 NYCRR Part 257: Air Quality Standards.</p>				

2005; however, the specific control measures for the 1-hour standard included in the SIP will be required to stay in place until the 8-hour standard is attained. The discretionary emissions reductions in the SIP would also remain but could be revised or dropped based on modeling. A new SIP for ozone will be adopted by the state no later than June 15, 2007, with a target attainment deadline of June 15, 2010.

DETERMINING THE SIGNIFICANCE 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.

New York City has developed *de minimis* criteria to assess the significance of the incremental increase in CO concentrations that would result from proposed projects or actions, as set forth in the *City Environmental Quality Review (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.

D. METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

MOBILE SOURCES

To compare estimated CO concentrations with the national and state ambient air quality standards for CO (which are based on 1- and 8-hour averages of CO concentrations), estimates of maximum concentrations for these same periods must be prepared.

INTRODUCTION

The prediction of vehicle-generated concentrations in an urban environment incorporates meteorological phenomena, traffic conditions, and physical configurations. Air pollutant dispersion models mathematically simulate how traffic, meteorology, and geometry 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 it is necessary to predict the reasonable worst case condition, most of these dispersion models predict conservatively high concentrations of pollutants, particularly under adverse meteorological conditions.

The CO analyses for the proposed project employ a model approved by EPA that has been widely used for evaluating air quality impacts of projects in New York City, other parts of New York State,

and throughout the country. The modeling approach includes a series of conservative assumptions relating to meteorology, traffic, and background concentration levels, resulting in a conservatively high estimate of expected pollutant concentrations that could ensue from the proposed project.

DISPERSION MODEL FOR MICROSCALE ANALYSES

Maximum CO concentrations adjacent to streets near the project site, resulting from vehicle emissions, were predicted using the CAL3QHC model Version 2.0.¹ The CAL3QHC model employs a Gaussian (normal distribution) dispersion assumption and includes an algorithm for estimating vehicular queue lengths at signalized intersections. CAL3QHC predicts emissions and dispersion of CO from idling and moving vehicles. The queuing algorithm includes site-specific traffic parameters, such as signal timing and delay calculations (from the 2000 *Highway Capacity Manual* traffic forecasting model), saturation flow rate, vehicle arrival type, and signal actuation (i.e., pre-timed or actuated signal) characteristics to accurately predict the number of idling vehicles. The CAL3QHC model has been updated with an extended module, CAL3QHCR, which allows for the incorporation of hourly meteorological data into the modeling, instead of worst-case assumptions regarding meteorological parameters. This refined version of the model, CAL3QHCR, is employed if maximum predicted future CO concentrations are greater than the applicable ambient air quality standards or when *de minimis* thresholds are exceeded using the first-level CAL3QHC modeling.

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 accumulation of pollutants at a particular prediction location (receptor), and atmospheric stability accounts for the effects of vertical mixing in the atmosphere.

CO calculations were performed using the CAL3QHC model. In applying the CAL3QHC model, the wind angle was varied to determine the wind direction resulting in the maximum concentrations at each receptor.

Following the EPA guidelines,² CO computations were performed using a wind speed of 1 meter per second, and the neutral stability class D. The 8-hour average CO concentrations were estimated by multiplying the predicted 1-hour average CO concentrations by a factor of 0.70 to account for persistence of meteorological conditions and fluctuations in traffic volumes. A surface roughness of 3.21 meters was chosen. At each receptor location, the wind angle that maximized the pollutant concentrations was used in the analysis regardless of frequency of occurrence. These assumptions ensured that worst-case meteorology was used to estimate impacts.

¹ *User's Guide to CAL3QHC, A Modeling Methodology for Predicted Pollutant Concentrations Near Roadway Intersections*, Office of Air Quality, Planning Standards, EPA, Research Triangle Park, North Carolina, Publication EPA-454/R-92-006.

² *Guidelines for Modeling Carbon Monoxide from Roadway Intersections*, EPA Office of Air Quality Planning and Standards, Publication EPA-454/R-92-005.

ANALYSIS YEAR

The CO microscale analyses were performed for existing conditions and 2010, the year by which the proposed project is likely to be completed. The future analysis was performed both without the proposed action (the No Build condition) and with the proposed action (the Build condition).

VEHICLE EMISSIONS DATA

Vehicular CO emission factors were computed using the EPA mobile source emissions model, MOBILE6.2¹. This is the most current, recently released emissions model capable of calculating engine emission factors for various vehicle types, based on the fuel (gasoline, diesel, or natural gas), meteorological conditions, vehicle speeds, vehicle age, roadway types, number of starts per day, and engine soak time, and various other factors that influence emissions, such as inspection maintenance programs. The inputs and use of MOBILE6.2 incorporates the most current guidance available from the NYSDEC and NYCDEP.

Vehicle classification data were based on field studies. 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 the vehicles' exhaust systems are below 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 (excluding any start emissions). The general categories of vehicle types for specific roadways were further categorized into subcategories based on their relative fleet-wide breakdown.²

An ambient temperature of 43° Fahrenheit was assumed for the emission computations.

TRAFFIC DATA

Traffic data for the air quality analysis were derived from existing traffic counts, projected future growth in traffic, and other information developed as part of the traffic analysis for the proposed project (see Chapter 7, "Traffic and Parking"). Traffic data for the future without and with the proposed project were employed in the respective air quality modeling scenarios. The weekday AM (7:30 to 8:30 AM) and PM (3:00 to 4:00 PM) peak periods were subjected to microscale analysis. These time periods were selected for the mobile source analysis because they produce the maximum anticipated project-generated traffic and therefore have the greatest potential for significant air quality impacts.

BACKGROUND CONCENTRATIONS

Background concentrations are those pollutant concentrations not directly accounted for through the modeling analysis, which directly accounts for vehicle-generated emissions on the streets within 1,000 feet and line-of-sight of the receptor location. Background concentrations must be added to modeling results to obtain total pollutant concentrations at a study site.

¹ EPA, User's Guide to MOBILE6.1 and MOBILE6.2: Mobile Source Emission Factor Model, EPA420-R-02-028, October 2002.

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

The 8-hour average background concentration used in this analysis was 2.0 ppm for the 2005 and 2010 predictions. This value, obtained from NYCDEP, is based on CO concentrations measured at NYSDEC monitoring stations and is adjusted to reflect the reduced vehicular emissions expected in the analysis year. For purposes of this adjustment, based on EPA guidance, it was assumed that 20 percent of the background value is caused by stationary source emissions that have remained relatively unchanged with time and that 80 percent of the background value is caused by mobile sources that decrease with time. This decrease reflects the increasing numbers of federally mandated lower-emission vehicles that are projected to enter the vehicle fleet as older, higher-polluting vehicles are retired (i.e., vehicle turnover), and the continuing benefits of the New York State inspection and maintenance program.

MOBILE SOURCE ANALYSIS SITES

To analyze the effects on air quality from localized increases in traffic, a microscale analysis was conducted for the proposed project. The analysis location selected for study was the intersection of the Grand Concourse and East 153rd Street. This intersection was selected based on two criteria. First, this intersection currently experiences high levels of traffic volumes and congestion (Level of Service D). In addition, this location, along with Concourse Village West and East 153rd Street, would experience the largest increase in project-generated traffic. The intersection of Grand Concourse and East 153rd Street was selected over Concourse Village West and East 153rd Street for the air quality analysis due to an overall poorer level of service at the Grand Concourse and East 153rd Street in the build with mitigation condition (the intersection at Concourse Village West and East 153rd Street would be signalized under the proposed mitigation measures). Therefore, the Grand Concourse and East 153rd Street intersection would be expected to result in the greatest project-related impacts due to the proposed school facility.

RECEPTOR LOCATIONS

Multiple receptors (i.e. precise locations at which concentrations are predicted) were modeled at the selected site; receptors were placed along the approach and departure links at spaced intervals. The receptors were placed at sidewalk or roadside locations with continuous public access at the selected intersection.

STATIONARY SOURCES

HVAC SOURCE SCREENING ANALYSIS

A screening analysis was performed to assess air quality impacts associated with emissions from the HVAC systems of the proposed project. The methodology described in the *CEQR Technical Manual* was used for the analysis, which determines the threshold of development size below which the action would not have a significant adverse impact. The screening procedures utilize information regarding the type of fuel to be burned, the maximum development size, and the HVAC exhaust stack height to evaluate whether a significant adverse impact is likely. 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*, there is the potential for significant adverse air quality impacts, and a refined dispersion modeling analysis would be required. Otherwise, the source passes the screening analysis, and no further analysis is required.

Mott Haven School Facility

Since the proposed project would consist of four individual school buildings, each potentially having its own HVAC system, a screening analysis was performed to assess air quality impacts associated with emissions from the HVAC system of each school building on other school buildings (i.e., project-on-project impacts). In addition, a cumulative screening analysis was performed to assess air quality impacts associated with emissions from the HVAC systems of the entire proposed school facility on existing buildings in the study area.

INDUSTRIAL SOURCE SCREENING ANALYSIS

To assess air quality impacts on the proposed development associated with emissions from nearby industrial sources, an investigation of industrial sources was conducted. Initially, land use and Sanborn maps were reviewed to identify potential sources of emissions from manufacturing/industrial operations. Next, a field survey was conducted to identify buildings within 400 feet of the project site that have the potential for emitting air pollutants. The survey was conducted on March 4, 2005. To completely cover the study area, all of the blocks bounded by the Grand Concourse to the west, Courtlandt Avenue to the east, East 151st Street to the south, and East 158th Street to the north were surveyed to observe uses and to identify visible emissions. As discussed below, it was determined from the site visit that a number of businesses in the area had the potential to be an air quality concern.

A list of the identified businesses was then submitted to the New York City Department of Environmental Protection's (NYCDEP) Bureau of Environmental Compliance (BEC) to obtain all the available certificates of operation for these locations and to determine whether manufacturing or industrial emissions occur. In addition, a search of Federal and State-permitted facilities within the study area was conducted using the EPA's Envirofacts database.¹ An air quality dispersion model screening database, ISC3, was used to estimate maximum potential impacts from different sources at various distances from the site. Impact distances selected for each source were the minimum distances between the boundary of the project site and the source site. Predicted worst-case impacts on the proposed development were compared with the short-term guideline concentrations (SGCs) and annual guideline concentrations (AGCs) recommended in the New York State Department of Environmental Conservation (NYSDEC)'s *DAR-1 AGC/SGC Tables*.² These guideline concentrations present the airborne concentrations, which are applied as a screening threshold to determine whether future occupants of the proposed project could be significantly impacted from nearby sources of air pollution.

CHEMICAL SPILL ANALYSIS

Introduction

Emissions from the proposed school facility's fume hood exhaust system, in the event of an accidental chemical spill in one of the laboratories, were evaluated. Impacts were evaluated using information, procedures, and methodologies contained in the *CEQR Technical Manual*. Maximum concentrations were compared to the short-term exposure levels (STELs) or to the ceiling levels recommended by the U.S. Occupational Safety and Health Administration (OSHA) for the chemicals examined. It is assumed that the types and quantities of materials that

¹ http://oaspub.epa.gov/enviro/ef_home2.air

² NYSDEC Division of Air Resources, Bureau of Stationary Sources, December, 2003.

are to be used in the proposed school facility are those typically used in high school science laboratories at New York City Department of Education schools.

The following section details the expected usage of potentially hazardous materials, as well as the systems that would be employed at the proposed school to ensure the safety of the students and staff and the surrounding community in the event of an accidental laboratory chemical spill in the science laboratories. A quantitative analysis employing mathematical modeling was performed to determine potential impacts on nearby places of public access and potential impacts due to recirculation into air intake systems.

Laboratory Fume Hood Exhausts

All laboratories in which hazardous chemicals are used would be equipped with fume hoods. Fume hoods are enclosures that are maintained under negative pressure and continuously vented to the outside. Their function is to protect teachers, staff, and students 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.

Since design information is not available on the fume hood exhaust system for the proposed school facility, a set of conservative assumptions was used. The fume hood exhausts would likely be combined and vented to the building roof through a single stack; however, the worst-case analysis assumed a single fume hood vented separately to the roof. The fume hood exhaust stack height was initially assumed to be 10 feet above the building roof. An exhaust fan sufficient to maintain a minimum exit velocity of 1,500 feet per minute through a 12 inch diameter stack discharge was also assumed.

Planned Operations

An inventory of chemicals that may be present in a typical laboratory in the proposed high school facility was examined. From the chemical inventory, 10 chemicals were selected for further examination, based on their toxicity and potential for air quality impacts. Common buffers, salts, enzymes, nucleotides, peptides, and other bio-chemicals were not considered in the analysis since they are not typically categorized as air pollutants. Nonvolatile chemicals (a vapor pressure of less than 10 mm Hg) were excluded as well. Table 8-2 shows the hazardous chemicals selected. The vapor pressure shown for each chemical is a measure of the material's volatility—its tendency to evaporate, or to form fumes or vapors, which is a critical parameter in determining potential impacts from chemical spills. The exposure standards (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 short-term exposure level [STEL] and ceiling values) are measures of the material's toxicity—more toxic substances have lower exposure standards.

Estimates of Worst-Case Emission Rates

The dispersion of hazardous chemicals from a spill within one of the proposed laboratories was analyzed to assess the potential for exposure of the general public and of students and staff within the school to hazardous fumes in the event of an accident. Evaporation rates for volatile hazardous chemicals expected to be used in the proposed laboratories were estimated using the model developed by the Shell Development Company¹. The Shell model, which was developed specifically to assess air

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

Mott Haven School Facility

quality impacts from chemical spills, calculates evaporation rates based on physical properties of the material, 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.

Based on relative STELs and the vapor pressures of the chemicals listed in Table 8-2, the most potentially hazardous chemical, shown in Table 8-3, was selected for the “worst-case” spill analysis. Besides the relative toxicities, other factors such as molecular weight, container size, and frequency of use were also considered. Chemicals with high vapor pressures evaporate most rapidly. The chemical selected also has the lowest STEL. Since the chemical selected for detailed analysis is most likely to have the highest emissions rate and the lowest exposure standards, if the analysis of this chemical resulted in no significant impacts, it would indicate that the other chemicals listed in Table 8-2 would also not present any significant potential impacts.

Table 8-2
Expected Hazardous Materials in the Proposed Laboratories

Chemical	Vapor Pressure (mmHG)	PEL (ppm)	STEL (ppm)	IDLH (ppm)	Ceiling (ppm)
Acetic Acid [64-19-7]	11	10	-	50	10
Acetone [67-64-1]	180	1,000	-	2,500	250
Cyclohexene [110-83-8]	67	300	-	2000	300
Ether [60-29-7]	442	400	-	1,900	-
Ethyl Alcohol [64-17-5]	44	1,000	-	3,300	1,000
Hydrofluoric Acid [7664-39-3]	14	3	-	30	3
Methyl Alcohol [67-56-1]	96	200	-	6,000	200
Nitric Acid [7697-37-2]	48	2	4	25	2
Petroleum distillates (Naphtha) [80002-05-9]	40	400	-	1,100	1,800
Toluene [108-88-3]	21	100	150	500	100

Notes:

PEL—Permissible Exposure Limit; Time Weighted Average (TWA) 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.
 IDLH—Immediately Dangerous to Life or Health.
 Ceiling—Level set by NIOSH or OSHA not to be exceeded in any working exposure.
 ppm = parts per million.
 Where a hyphen (-) appears there is no recommended corresponding guideline value.

Table 8-3
Chemicals Selected for Worst-Case Spill Analysis

Chemical	Quantity (liters)	Evaporation Rate (gram/meter ² /sec)	Emission Rate* (gram/sec)
Nitric Acid	—	0.266	0.296
Note: * Average emission rate			

The analysis conservatively assumes that a full container of the chemical would be spilled in a fume hood. For a spill area of approximately 1.1 square meters, the emission rates were determined using the evaporation rates. For modeling purposes, the emission rate shown in Table 8-3 is 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 roof exhaust fans.

The high volume of air drawn through this system provides a high degree of dilution for hazardous fumes before they are released above the roof.

Modeling

The potential for recirculation of the fume hood emissions back into the building air intakes was assessed using the Wilson method¹. 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, introduction of 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.

The recirculation analysis indicates that the minimum potential dilution factor between the fan exhausts and the nearest air intake below the rooftop is over 1,000 (i.e., pollutant concentrations at the nearest intake to the exhaust fan would be 1/1,000th the concentration at the fan). Thus, a nitric acid spill in a fume hood as described above would produce a maximum concentration at the nearest intake location of about 0.02 parts per million (ppm).

Therefore, a spill in a fume hood as described above would produce a maximum concentration at the nearest intake location well below the corresponding STELs set by OSHA and/or NIOSH for any of the chemicals in Table 8-2.

The study performed also considered the impact of an accidental spill on nearby receptors, such as open windows on nearby buildings. As mentioned above, the fume hood ventilation design was found to achieve a minimum dilution ratio criterion of 1,000:1.

Maximum concentrations at elevated receptors downwind of the fume exhausts were estimated using the EPA INPUFF model, version 2.0². This is the only EPA model designed to estimate impacts from short-term releases and was used to develop the EPA guidelines³. INPUFF assumes a Gaussian dispersion of a pollutant “puff” (a brief release, as opposed to a continuous one) as it is transported downwind of a release point. Stable atmospheric conditions and a 1-meter/second wind speed were assumed.

Receptors (locations at which concentrations are calculated) were modeled at multiple heights at the closest possible locations to an exhaust fan. Since the emissions resulting from chemical spills are short-term releases, a worst-case assumption of the wind blowing the exhaust directly to the window or air intake receptors was made for modeling purposes.

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 Peterson, W.B., *A Multiple Source Gaussian Puff Dispersion Algorithm—Users Guide*, EPA, 600/8-86-024, August 1986.

³ EPA, *Chemical Emergency Preparedness Program, Interim Guidance*, November 1985.

E. EXISTING CONDITIONS

EXISTING MONITORED AIR QUALITY CONDITIONS

Monitored concentrations of CO, SO₂, particulates, NO₂, lead, and ozone ambient air quality data for the area are shown in Table 8-4. These values are the most recent monitored data available that have been published by NYSDEC for these locations. There were no monitored violations of the NAAQS for the pollutants at these sites in 2003.

**Table 8-4
Representative Monitored Ambient Air Quality Data**

Pollutants	Location	Units	Period	Concentrations			Number of Exceedances of Federal Standard	
				Mean	Highest	Second Highest	Primary	Secondary
CO	Botanical Gardens	ppm	8-hour	-	2.2	2.2	0	-
			1-hour	-	4.1	3.4	0	-
SO ₂	IS52	ppm	Annual	0.011	-	-	0	-
			24-hour	-	0.052	0.051	0	-
			3-hour	-	0.089	0.080	-	0
Respirable Particulates (PM ₁₀)	IS52	µg/m ³	Annual	21	-	-	0	0
			24-hour	-	60	46	0	0
Respirable Particulates (PM _{2.5})	IS52	µg/m ³	Annual	14.8	-	-	-	-
			24-hour	-	52.0	51.1	-	-
NO ₂	IS52	ppm	Annual	0.030	-	-	0	0
Lead	Susan Wagner	µg/m ³	3-month	-	0.01	0.01	0	0
O ₃	IS52	ppm	1-hour	-	0.109	0.107	0	0

Source: 2003 Annual New York State Air Quality Report, NYSDEC.

PREDICTED POLLUTANT CONCENTRATIONS IN THE STUDY AREA

As noted previously, receptors were placed at multiple sidewalk locations next to the intersection under analysis. The receptor with the highest predicted CO concentrations was used to represent this intersection site for the existing condition. CO concentrations were calculated for each receptor location, at the intersection, for each peak period specified above.

Table 8-5 shows the maximum predicted existing (2005) CO 8-hour average concentrations at the intersection of the Grand Concourse and East 153rd Street. (No 1-hour values are shown since predicted values are much lower than the standard.) At all receptor sites, the maximum predicted 8-hour average concentrations are within the national standard of 9 ppm.

**Table 8-5
Maximum Predicted Existing 8-Hour Average Carbon Monoxide Concentration for 2005 (ppm)**

Intersection	Location	Time Period	8-Hour Concentration
1	Grand Concourse & 153rd Street	AM	3.3

Note: 8-Hour NAAQS for CO is 9 ppm.

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

MOBILE SOURCE ANALYSIS

CO concentrations without the proposed project were determined for the 2010 analysis year using the modeling methodology previously described. Table 8-6 shows future maximum predicted 8-hour average CO concentrations without the proposed actions (i.e., 2010 No Build values) at the analysis intersection in the project study area. The value shown is the highest predicted concentration at the intersection for any of the time periods analyzed.

Table 8-6
Future (2010) Maximum Predicted 8-Hour Average
Carbon Monoxide No Build Concentration (ppm)

Intersection	Location	Time Period	8-Hour Concentration
1	Grand Concourse and 153rd Street	AM	3.1
National Ambient Air Quality Standards—8-hour: 9 ppm.			

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

MOBILE SOURCE ANALYSIS

CO concentrations with the proposed project were determined for the 2010 analysis year using the methodology previously described. Table 8-7 shows the maximum predicted future 8-hour average CO concentrations with the proposed project at the intersection studied. (No 1-hour values are shown since no exceedances of the standard would occur and the de minimis criteria are only applicable to 8-hour concentrations. Therefore, the 8-hour values are the most critical for impact assessment.) The values shown are the highest predicted concentrations for the receptor location for the time periods analyzed. The results indicate that the proposed project would not result in any violations of the CO standard or any significant impacts at the receptor locations.

Table 8-7
Future (2010) Maximum Predicted 8-Hour Average
Carbon Monoxide Build Concentration (ppm)

Intersection	Location	Time Period	8-Hour Concentration	
			No Build	Build
1	Grand Concourse & 153rd Street	AM	3.1	3.2
Note: 8-Hour NAAQS for CO is 9 ppm.				

HVAC EQUIPMENT IMPACTS

The primary stationary source of air pollutants associated with the proposed school facility would be emissions from the combustion of natural gas by HVAC equipment. The primary pollutant of concern when burning natural gas is NO_x. The screening methodology in the *CEQR Technical Manual* was used for the analysis, with the total size of the proposed school facility in gross square feet (i.e., 275,000 gsf) and the use of natural gas as fuel. At the distance to the nearest receptors of a similar or greater height (approximately 63 feet), the proposed project is

below the maximum permitted levels specified in Figure 3Q-9 of the *CEQR Technical Manual*. Therefore, the proposed project would not result in any potential adverse air quality impacts from HVAC emission sources.

INDUSTRIAL SOURCE IMPACTS

As discussed above, a review of land use, Sanborn maps, and a field survey was conducted to identify manufacturing and industrial uses within 400 feet of the rezoning area. Addresses with potential industrial emissions were identified based on existing on-site businesses, as well as the presence of visible venting apparatus.

Of the eight addresses identified to have the potential for pollutant emissions, a total of two businesses are on file with BEC or NYSDEC and are determined to have potential air pollutant emissions. Table 8-8 shows the air contaminants, estimated emissions, calculated concentrations, and the respective, recommended short-term (a 1-hour period, unless otherwise noted) and annual guideline concentrations. The concentrations shown represent predicted impacts on the site nearest to each industrial source in order to determine worst-case impacts on the proposed project.

The conservative screening procedure used to estimate maximum potential impacts from these businesses showed that their operations would not result in any predicted violations of the NAAQS or any exceedances of the recommended SGC or AGC. Therefore, based on the data available on the surrounding industrial uses, the proposed project would not experience significant adverse air quality impacts.

CHEMICAL SPILL ANALYSIS

The chemical spill analysis determined that maximum concentrations at off-site receptors would be below the STEL for nitric acid. In order to ensure that impacts at receptor sites within the school facility do not exceed the STEL level, exhaust fans would be placed at a minimum distance of 150 feet from the nearest window or air intake, or the exhaust stack would be constructed at a minimum elevation of 80 feet above project site grade.

The results of the analysis of emissions from the proposed school facility's fume hood exhaust system are shown below in Table 8-9. The maximum concentration at elevated receptors downwind of the fume exhausts were estimated using the methodology previously described. The maximum concentration found at the proposed school facility would be below the STEL level.

Therefore, the results indicate that there would be no predicted significant health effects from the exhaust system of the laboratories in the proposed school buildings and the surrounding community.

Table 8-8
Maximum Predicted Impacts on Proposed Project from Industrial Sources
Cumulative Impacts

Potential Contaminants	CAS No.	Source ID	Hours of Operation		Estimated Emissions (g/s)	Estimated Short-term Impact (ug/m3)	SGC (ug/m3)	Estimated Long-term Impact (ug/m3)	AGC (ug/m3)	Notes
			hrs/day	days/yr						
Styrene	100-42-5	1)	24	200	1.26E-04	5.46	17,000	0.044	1,000	a
Total Styrene					1.26E-04	5.46	17,000	0.044	1,000	a
Ethyl Benzene	100-41-4	1)	24	200	1.26E-04	5.46	54,000	0.044	1,000	a
Total Ethyl Benzene					1.26E-04	5.46	54,000	0.044	1,000	a
Phenol	108-95-2	1)	24	200	1.26E-04	5.46	5,800	0.044	45	a
Total Phenol					1.26E-04	5.46	5,800	0.044	45	a
Toluene	108-88-3	1)	24	200	1.26E-04	5.46	37,000	0.044	400	a
		2)	2	100	1.13E-02	2.42	37,000	0.001	400	a
			2	100	1.13E-02	2.42	37,000	0.001	400	a
Total Toluene					2.28E-02	10.30	37,000	0.045	400	a
Dimethyl Ketone (Acetone)	67-64-1	2)	2	100	2.77E-02	5.91	180,000	0.002	28,000	a
			2	100	2.77E-02	5.91	180,000	0.002	28,000	a
Total Dimethyl Ketone (Acetone)					5.54E-02	11.81	180,000	0.005	28,000	a
Xylene, M,O&P Mixture	1330-20-7	2)	2	100	5.67E-03	1.21	4,300	0.000	100	a
			2	100	5.67E-03	1.21	4,300	0.000	100	a
Total Xylene, M, O&P Mixture					1.13E-02	2.42	4,300	0.001	100	a
Butyl Acetate	123-86-4	2)	2	100	8.19E-02	17.45	95,000	0.007	17,000	a
			2	100	8.19E-02	17.45	95,000	0.007	17,000	a
Total Butyl Acetate					1.64E-01	34.89	95,000	0.013	17,000	a
Particulates	NY075-00-0	2)	2	100	8.19E-02	17.45	380	0.007	50	a
			2	100	3.63E-03	0.78	380	0.0003	50	a
Total Particulates					8.56E-02	18.23	380	0.007	50	a

Notes:

a) NYSDEC DAR-1 AGC/SGC Tables

AGC - Annual Guideline Concentrations

SGC - Short-term Guideline Concentrations

Table 8-9
Maximum Predicted Concentrations (ppm)

Chemical	STEL	15-Minute Average
Nitric Acid	2	1.5

*