

## **14.1 INTRODUCTION**

### **14.1.1 CONTEXT**

The analysis of potential impacts of the Proposed Action on air quality is described in this chapter. The attacks on the World Trade Center (WTC) on September 11, 2001, and the consequent collapse of the Twin Towers and the ensuing fires, created a large plume of particulate matter, smoke, and combustion byproducts which blanketed Downtown Manhattan and was carried downwind to other areas of the city. Over a period of weeks, as the fires were extinguished and as the air cleared, outdoor air quality improved, with levels of all monitored pollutants in nearby neighborhoods returning to normal by February 2002. The destruction of buildings and transportation infrastructure resulted in some significant reductions in traffic volumes and changes in traffic patterns in Downtown Manhattan, as described in Chapter 13A, "Traffic and Parking." The World Trade Center Memorial and Redevelopment Plan (Proposed Action), once completed, would revitalize the area, generating new and restored activity; the ensuing traffic volumes would be somewhat different than those that would have been present had September 11 not occurred. The Proposed Action would introduce new local streets and would also include extensive below-grade transportation infrastructure to accommodate vehicle and bus parking, and truck delivery docks. All of these elements are potential sources of air pollution that are analyzed in this chapter.

Additional information regarding the emissions and dispersion modeling procedures, methodology, and detailed results are included in Appendix G. Analysis of the predicted impacts of construction of the Proposed Action on air quality is presented in Chapter 21, "Construction Impacts."

### **14.1.2 CONCLUSIONS**

The predicted impact of the Proposed Action on air quality during the operational phase, summarized below, was analyzed based on both the Current Conditions Scenario and the Pre-September 11 Scenario. Operation of the Proposed Action is not predicted to cause any significant adverse air quality impacts in either 2009 or 2015, or to cause any exceedance of National Ambient Air Quality Standard (NAAQS) in either of those years.

#### ***PRE-SEPTEMBER 11 SCENARIO***

No significant adverse impacts were predicted during the operational phase of the Proposed Action. Three locations were analyzed for potential air quality impacts (Liberty Street/Albany Street and Route 9A; Vesey Street and Route 9A; and the proposed bus loading area at Greenwich Street from Vesey to Liberty Streets). Using a conservative screening approach, maximum predicted future 8-hour average carbon monoxide (CO) increments from the Proposed Action ranged from no change to 1.4 parts per million (ppm), with the highest predicted total

concentration, including background, of 7.1 ppm. Predicted changes in concentrations of fine respirable particulate matter (PM<sub>2.5</sub>) smaller than 2.5 micrometers (µm) ranged from a slight decrease to an increase of 0.39 micrograms per cubic meter (µg/m<sup>3</sup>) on a 24-hour average basis, and from 0.01 µg/m<sup>3</sup> to 0.08 µg/m<sup>3</sup> on an annual average neighborhood scale. Predicted change in concentrations of respirable particulate matter (PM<sub>10</sub>) smaller than 10 µm ranged from a slight decrease, to a maximum 24-hour average of 3.0 µg/m<sup>3</sup> and an annual average 0.9 µg/m<sup>3</sup>.

The modeling for this scenario was conducted assuming at-grade construction of Route 9A; it is expected that the results with the short bypass alternative for Route 9A reconstruction would be higher but would likely not be significant and, as with the at-grade alternative, would not result in exceedances of the NAAQS.

### ***CURRENT CONDITIONS SCENARIO***

Under this scenario, maximum predicted future 8-hour average CO increments ranged from no change to 1.5 ppm, with the highest predicted total concentration of 7.1 ppm; these values were predicted using the same conservative screening approach. Predicted changes in PM<sub>2.5</sub> concentrations ranged from a slight decrease to 0.42 µg/m<sup>3</sup> on a 24-hour average, and from 0.04 µg/m<sup>3</sup> to 0.07 µg/m<sup>3</sup> on an annual average neighborhood scale with the Route 9A at-grade alternative, and (using a highly conservative analysis) from 0.10 to 0.14 µg/m<sup>3</sup> with the short bypass alternative. Predicted change in concentrations of PM<sub>10</sub> ranged from a slight decrease to a maximum 24-hour average of 4.9 µg/m<sup>3</sup> and an annual average 1.6 µg/m<sup>3</sup>.

## **14.2 AIR QUALITY IN THE CONTEXT OF SEPTEMBER 11**

In response to comments raised by the public on the Draft Scope for the GEIS, this section includes a summary, from other sources, of the impact of September 11 on air quality in Lower Manhattan. This is not intended as a comprehensive analysis, but is focused on issues pertinent to understanding what occurred, and that may be relevant to the study of the Proposed Action. Data and information presented here are based on: analysis by AKRF of New York State Department of Environmental Conservation's (NYSDEC) monitored data; the U.S. Environmental Protection Agency (EPA) study of WTC exposure<sup>1</sup> and oral comments on the EPA report received by the external peer review committee on July 14 15, 2003; the Evaluation Report by the Office of Inspector General of the EPA (OIG) on the EPA response<sup>2</sup>; the Natural Resources Defense Council's (NRDC) assessment<sup>3</sup>; and the results of a health survey in Lower Manhattan from December, 2001, performed by New York City Department of Health (NYCDOH) in collaboration with the Centers for Disease Control and Prevention (CDC)<sup>4</sup>, as well as anecdotal information, questions and concerns raised by members of the general public in various forums and media.

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<sup>1</sup> EPA, *External Review Draft—Exposure and Human Health Evaluation of Airborne Pollution from the World Trade Center Disaster*, NCEA, October 2002.

<sup>2</sup> EPA, *EPA's Response to the World Trade Center Collapse: Challenges, Successes, and Areas for Improvement*, Report No. 2003-P-00012, Office of Inspector General, August 21, 2003.

<sup>3</sup> NRDC, *The Environmental Impacts Of World Trade Center Attacks—A Preliminary Assessment*, February 2002.

<sup>4</sup> NYCDOH, *A Community Needs Assessment of Lower Manhattan Following the World Trade Center Attack*, Community HealthWorks, December 2001.

### 14.2.1 POLLUTANTS RELEASED ON SEPTEMBER 11

The destruction of the Twin Towers and the environmental aftermath in a heavily populated urban setting were unprecedented. A complex mixture of smoke and dust blanketed Lower Manhattan, penetrated many surrounding buildings, and was carried downwind.

The massive plume of pulverized material consisted mainly of cement, glass fibers, and cellulose, but also included high concentrations of silica, calcium, sulfate, metals such as lead and zinc, and numerous other compounds. The dust also included significant amounts of polycyclic aromatic hydrocarbons (PAHs), products of incomplete combustion, which had adsorbed to particles. Roughly 1.5 percent of the material was respirable, that is  $PM_{10}$ , including approximately 0.5 percent in the  $PM_{2.5}$  size range. Some of the concerns regarding the WTC dust are unique to the events of September 11 and are not addressed by standards such as the National Ambient Air Quality Standards (NAAQS). For example, the alkalinity of WTC dust is a possible health concern for exposed individuals, not only because of the basic nature of some constituent particles but also because of other unusual features, such as slender microscopic glass fibers with toxic materials attached to them or very fine particles composed of unusual combinations of silica coalesced with lead or other toxic materials. The particulate matter standards, normally used for comparison with concentrations of particulate matter in outdoor air, were not based on particulate matter including such combinations of contaminants, since they are not normally found in ambient air.

The initial explosion and the below-grade fires that continued to burn long after September 11 released smoke containing combustion and partial combustion products, including, among others, PCBs, acetone, benzene, 1,3-butadiene, chloromethane, ethylbenzene, and toluene.

### 14.2.2 MONITORED CONCENTRATIONS

Comparison of measured concentrations to benchmarks in this section refers to screening levels below which it has been determined that no significant health impact is expected; these include both existing benchmarks where available, and benchmarks that were developed specifically for comparison with the monitoring that followed September 11.

Monitoring of pollutant concentrations in the near vicinity of the WTC and on-site began on September 14 and 23, depending on the pollutant. During the weeks that followed September 11, concentrations of monitored air pollutants exceeded screening benchmarks, and elevated levels of contaminants were recorded within and near the WTC Site. Population exposure to these exceedances was reduced by the fact that after the event, most of the affected areas were within restricted access zones, that is, zones where access was limited to emergency management and rescue personnel and to other credentialed people.

By mid to late October, particulate matter, chromium, PCBs, and lead concentrations across Lower Manhattan had largely returned to levels typical of New York City and other U.S. urban areas, with only a few WTC or nearby sites occasionally approaching or exceeding the  $PM_{2.5}$  Air Quality Index level of concern. In late September, monitored concentrations of airborne lead higher than normal background levels were measured at perimeter sites; however, concentrations did not exceed the NAAQS.

Although extremely elevated dioxin concentrations were measured in some instances to a distance of a few blocks around WTC, returning to normal by December, the dioxin exposure due to September 11 was not expected to significantly increase the lifetime total exposure of individuals, and was not expected to increase the risk of related health problems.

The large majority of outdoor air measurements of asbestos were below established benchmarks and within the range of typical background levels. Few exceedances of asbestos occurred near September 11 in time and in close proximity to the WTC. There is some evidence of incursion of asbestos into indoor environments. A few very high levels of asbestos were found in settled dust indoors and in the WTC material.

Of the 11 volatile organic compounds (VOCs) evaluated, short term exceedances of screening benchmarks were seen for acetone, benzene, 1,3-butadiene, chloromethane, ethylbenzene, and toluene. Except for benzene, exceedances for these chemicals occurred in restricted zones where public access was prohibited. The benzene exceedances were more frequent and were measured farther from the WTC Site. Very high concentrations of benzene may have been sustained for a month or more after September 11.

In general, based on monitoring data, outdoor levels of all air pollutants decreased to background concentrations characteristic of pre-September 11 in the New York metropolitan area by January to February 2002. During the days following September 11 before air quality monitoring began (September 14 and 23 depending on the pollutant), it is reasonable to conclude that concentrations were significantly higher.

### **14.2.3 HUMAN EXPOSURE AND HEALTH IMPACTS**

The penetration of substantial quantities of the dust into indoor office or residential spaces likely increased the potential for indoor exposures to higher levels of constituent elements and compounds via ingestion or inhalation of re-entrained particles. EPA concluded that people exposed to the extremely high levels of ambient particulate matter and its components during the collapse of the Twin Towers and for several hours afterward were at risk of immediate acute and possibly chronic symptoms. Following that period and for several days thereafter—a period for which limited data are available—exposure and health impacts could not be evaluated with certainty.

EPA has concluded, in its October 2002 draft study, that except for the first few days, people in the surrounding community were unlikely to suffer short or long term adverse health effects caused by exposure to elevations in outdoor air concentrations of the contaminants evaluated. However, people who remained in restricted zones and rescue workers who were not using adequate respiratory protection were likely to be exposed to benchmark exceedances and associated health risks. Additionally, people who spent extensive periods in indoor spaces that were not properly cleaned may have been exposed to re-entrained particulate contaminants.

Various indoor cleanup operations were undertaken, including instructions for residents to clean their own apartments, and various testing and cleaning programs. The impact of indoor air quality on the health of returning residents remains uncertain. Some questions have been raised by members of the public and by members of the peer review committee regarding the current state of indoor contamination. Although the current cleanup program has been completed, EPA has recently committed to take further samples to resolve the issue of indoor cleanup in order to reduce future exposure.

A wide range of complaints related to air quality in the aftermath of September 11 were reported. The NYCDOH survey of residents in a few neighborhoods in Lower Manhattan, conducted in the end of October, 2001, concluded that 50 percent of those surveyed were experiencing health symptoms such as shortness of breath, and nose, throat and eye irritation. The survey included only residents who had reoccupied their residences at that time. One private

organization—NRDC, has estimated by extrapolating from the NYCDOH survey that as of December, 2001, as many as 6,000 residents in the three neighborhoods surveyed, and up to 4,000 additional people who had been there during the event or participated in rescue and clean-up operations, were experiencing short-term respiratory health symptoms. Preliminary results from an ongoing research project at the NYU School of Medicine, as one of many related projects coordinated by the National Institute of Environmental Health Sciences (NIEHS), previously healthy persons living near the WTC Site had a greater increase in prevalence of respiratory symptoms after September 11 than persons living at a distance from the site. Some medical experts have expressed concern that people who had extensive exposure may experience permanent respiratory symptoms. In summary, there is a great deal of uncertainty regarding the long term health impacts of September 11. There is an ongoing effort by New York City Department of Health and Mental Hygiene (DOHMH) to prepare a comprehensive health registry of those most directly exposed to the events of September 11, which will follow up with participants in the future as well. It is hoped that this and other efforts will give a clearer picture of the health impacts of September 11, but some impacts and exposure levels may never be entirely known.

#### **14.2.4 RELEVANCE TO THE FUTURE**

##### *LMDC COMMITMENTS*

With the above uncertainty in mind, and in order to minimize impacts from the massive simultaneous reconstruction efforts in Lower Manhattan, LMDC, in coordination with all agencies involved in the reconstruction, has taken upon itself a higher standard for environmental performance in an effort to reduce to the extent practical environmental impacts during both the construction and the operational phases of the Proposed Action, with special attention given to air quality. The policy for significantly reducing diesel emissions during construction, for instance, will result in a large fleet of clean-technology construction equipment in service long after the project is constructed; the associated long term benefit to air pollution will be on both local and regional scales.

##### *AMBIENT AIR QUALITY*

The primary NAAQS, defining acceptable levels of criteria pollutants in outdoor air, were designed to protect public health, including the health of “sensitive” populations, such as asthmatics, children, and the elderly. These standards, in addition to other relevant benchmarks described in section 14.3.2, are used in this study for the assessment of predicted impacts related to the Proposed Action.

Regarding pollutants that are discussed in this study, particulate matter monitoring around the WTC Site began on September 26, 2001. Nearly all particulate matter associated with the September 11 dust cloud was larger than 30 micrometers in diameter. PM<sub>2.5</sub> measurements from newly established ground-based sampling sites around the WTC perimeter varied widely, depending on wind direction. During some days in late September and early October, 24-hr average PM<sub>2.5</sub> concentrations exceeded 200 µg/m<sup>3</sup> at locations along the WTC perimeter. However, PM<sub>2.5</sub> concentrations decreased rapidly with distance from the WTC, with few elevated PM<sub>2.5</sub> values (exceeding 40 µg/m<sup>3</sup>) at monitoring locations ranging from three to ten blocks away from the WTC. During the entire period following September 11, PM<sub>2.5</sub> values recorded at Lower Manhattan monitoring sites away from the WTC perimeter were not markedly different than during periods before or since. Although PM<sub>2.5</sub> high values were monitored at some sites, no exceedance of the PM<sub>2.5</sub> or PM<sub>10</sub> NAAQS were monitored. A

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summary of the particulate matter data monitored at WTC monitoring sites through July 2003 is presented in Table 14-1.

**Table 14-1  
Particulate Matter Concentrations Monitored at WTC Specific Monitors, 2001-2003**

	<b>Albany Street</b>	<b>Battery Park</b>	<b>Chambers Street</b>	<b>Pace Plaza</b>	<b>Wall Street</b>
<b>PM<sub>10</sub></b>					
Sept. 24 to Dec. 31, 2001, 24-hour average (range)	11.9 -- 79.5	NA	NA	NA	11.0 – 49.1
2002 annual average	26.8	NA	NA	20.5	27.4
July 2002 to July 2003 annual average	19.1	NA	NA	20.4	NA
2002 2nd high 24-hour average	65.4	NA	NA	45.0	54.0
July 2002 to July 2003 2nd high 24-hour average	52.9	NA	NA	73.1	NA
<b>PM<sub>2.5</sub></b>					
Sept. 24 to Dec. 31, 2001, 24-hour average (range)	5.9 - 37.6	4.8 - 32.9	4.8 - 39.3	5.2 - 42.4	5.6 - 25.1
2002 annual average	15.1	NA	14.7	14.8	15.0
July 2002-July 2003 annual average	16.9	NA	NA	13.2	NA
2002 98th percentile 24-hour average	41.7	NA	32.0	42.3	31.9
July 2002-July 2003 98th percentile 24-hour average	30.4	NA	NA	33.9	NA
<b>Notes:</b>	Data that was impacted by the Quebec forest fire in July 2002 were eliminated from this summary.				
<b>Source:</b>	AKRF analysis of hourly data provided by NYSDEC.				

The particulate matter concentrations monitored at the source-oriented stations, starting in 2002 (Table 14-1), are comparable to normal concentrations in Manhattan, as presented in Table 14-3 in section 14.3.3 below. The PM10 concentrations are somewhat higher in 2002, possibly due to recovery and cleanup operations. The highest PM<sub>2.5</sub> concentrations in Lower Manhattan at these monitors in 2002 were actually slightly lower than the highest concentrations monitored elsewhere in Manhattan.

**SOURCES OF AIR POLLUTANTS FROM THE PROPOSED ACTION**

It should be noted that the Proposed Action would not introduce sources of most of the non-criteria pollutants or high-alkalinity PM or glass fibers that affected Lower Manhattan following September 11. Any excavation and tunneling planned would not include hazardous material from September 11, which has largely been removed from the WTC Site during recovery and cleanup operations. Any remaining contaminants would be managed or isolated to protect public health and the environment, in the manner set forth in Chapter 11, "Hazardous Materials." It is also expected that any remaining contamination on the Southern Site would be removed or addressed in the appropriate manner by the respective owners of the properties, in accordance with applicable law and regulations.

Under the Proposed Action, the most substantive new emission of pollutants other than criteria pollutants would be in the context of diesel emissions from construction equipment and later from buses and trucks. Diesel exhaust includes gaseous components, such as aldehydes benzene, 1,3-butadiene, and PAHs and nitro-PAHs, as well as some toxics adsorbed to the surfaces of

particles, such as PAHs and their derivatives—comprising less than 1 percent of the particulate diesel exhaust mass. Environmental performance commitments made by LMDC and the Port Authority for the Proposed Action require reduction and control of diesel emissions, both during construction and operation through emissions reduction technologies and other measures aimed at minimizing diesel exhaust emissions to be set forth in the *Sustainable Design Guidelines* (the current draft of which is attached as Appendix A). For example, the diesel fuel to be used on-site for backup and emergency power would have ultra low sulfur content. Potential impacts from diesel-powered engines are addressed below and analyzed in depth in Chapter 21, “Construction Impacts.”

### 14.3 METHODOLOGY

This section includes a discussion of the selection of pollutants for analysis, benchmarks and regulations for assessing future potential impacts and determining their significance, background concentrations, and the methodologies used for the analyses. Three types of analyses are discussed: regional emissions, and local mobile and stationary sources. The regional (mesoscale) analysis includes an examination of the total predicted emissions from all project-related sources. The mobile source and stationary source analyses examine the potential impacts of the Proposed Actions on local air quality. Mobile sources include all roadway and intersection emissions; stationary sources include exhaust from stationary fuel combustion sources and exhaust from enclosed vehicle facilities. In cases where multiple sources may affect air quality in the same location, the potential cumulative impact was assessed. The mobile source section includes a discussion of emission rates for each source, the dispersion models selected for analysis, the meteorological data applied to the models and the locations analyzed.

#### 14.3.1 POLLUTANTS FOR ANALYSIS

In the New York metropolitan area, ambient concentrations of CO are predominantly influenced by mobile source emissions. Emissions of particulate matter (PM) and nitrogen oxides (NO<sub>x</sub>—nitrogen oxide, NO, together with nitrogen dioxide, NO<sub>2</sub>) come from both mobile and stationary sources; emissions of sulfur dioxide (SO<sub>2</sub>) are associated mainly with stationary sources. Ozone, one of the region’s most problematic air pollutants, is not emitted directly in any significant quantity, but is formed in the atmosphere by a series of complex chemical reactions involving volatile organic compounds (VOCs) and NO<sub>x</sub>.

##### *CARBON MONOXIDE*

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. CO concentrations can 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 Action would result in changes in traffic patterns and an increase in traffic volume in the study area; therefore, an analysis was performed of the impact from traffic increases on CO levels at critical intersections in the study area and near air vents of enclosed vehicular facilities.

*NITROGEN OXIDES, VOCs, AND OZONE*

Nitrogen oxides are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. While there is a standard for average annual NO<sub>2</sub> concentrations, it is normally examined only for fossil fuel energy sources. 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 diffusing downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO<sub>x</sub> and VOC emissions from mobile sources are therefore generally examined on a regional basis, together with the emissions of these pollutants from stationary sources. The change in regional mobile source emissions of these pollutants is related to the total number of vehicle trips and vehicle miles of travel throughout the New York metropolitan area, which is designated as a “Severe Non-Attainment area” for ozone by EPA. The Proposed Action would potentially result in changes to the regional vehicular travel patterns in the study areas. Therefore, the change in regional NO<sub>x</sub> and VOC emissions was analyzed.

*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 levels. 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 Action, and, therefore, an analysis was not warranted.

*RESPIRABLE PARTICULATE MATTER—PM<sub>10</sub> AND PM<sub>2.5</sub>*

Particulate matter is a broad class of air pollutants that include discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets or solids suspended in the atmosphere (aerosols). 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 natural organic vapors: 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. 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.

Fine particulate matter, or PM<sub>2.5</sub>, are “fine particles” with an aerodynamic diameter of less than or equal to 2.5 micrometers. This smaller fraction of the particle size range 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<sub>2.5</sub> 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 particulate matter. Diesel-powered vehicles, especially heavy trucks and buses, are a significant source of respirable PM; PM concentrations may, consequently, be locally elevated near roadways with high volumes of heavy diesel-powered vehicles. An analysis of PM<sub>2.5</sub> and PM<sub>10</sub> (particles with an aerodynamic diameter of less than or equal to 10 micrometers) has been conducted for the Proposed Action.

#### *SULFUR DIOXIDE*

SO<sub>2</sub> 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 and therefore an analysis was not warranted.

### **14.3.2 AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS**

#### *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, NO<sub>2</sub>, ozone, respirable PM, SO<sub>2</sub>, and lead. EPA recently promulgated additional respirable PM standards. In addition to retaining the PM<sub>10</sub> standards, EPA adopted 24 hour and annual standards for PM<sub>2.5</sub>, which became effective September 16, 1997. The standards for these pollutants are presented in Table 14-2. These standards have also been adopted as the ambient air quality standards for New York State. The primary standards protect the 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 NO<sub>2</sub>, ozone, lead and PM, the primary and secondary standards are the same.

#### *STATE IMPLEMENTATION PLAN*

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. Manhattan has been designated as Moderate Non-Attainment for PM<sub>10</sub>, and all counties in New York City as well as Suffolk and Nassau counties have been designated Severe Non-Attainment for ozone.

EPA has recently re-designated New York City as in attainment for CO. The CAA requires that a maintenance plan ensure continued compliance of 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.

**Table 14-2  
Ambient Air Quality Standards**

Pollutant	Primary		Secondary	
	ppm	µg/m <sup>3</sup>	ppm	µg/m <sup>3</sup>
<b>Carbon Monoxide (CO)</b>				
Maximum 8-Hour Concentration <sup>1</sup>	9	10,000	None	
Maximum 1-Hour Concentration <sup>1</sup>	35	40,000		
<b>Lead</b>				
Maximum Arithmetic Mean Averaged Over 3 Consecutive Months	NA	1.5	None	
<b>Nitrogen Dioxide (NO<sub>2</sub>)</b>				
Annual Arithmetic Average	0.053	100	0.053	100
<b>Ozone (O<sub>3</sub>)</b>				
1-Hour Average <sup>2</sup>	0.12	235	0.12	235
8-Hour Average <sup>3</sup>	0.08	157	0.08	157
<b>Total Suspended Particles (TSP)</b>				
Annual Mean	NA	45	None	
Rural Open Space		55		
Rural Residential		65		
Urban Residential		75		
Urban Industrial				
Maximum 24-Hour Concentration	NA	250		
<b>Respirable Particulate Matter (PM<sub>10</sub>)</b>				
Average of 3 Annual Arithmetic Means	NA	50	NA	50
24-Hour Concentration <sup>1</sup>	NA	150	NA	150
<b>Fine Respirable Particulate Matter (PM<sub>2.5</sub>)</b>				
Average of 3 Annual Arithmetic Means	NA	15	NA	15
24-Hour Concentration <sup>4</sup>	NA	65	NA	65
<b>Sulfur Dioxide (SO<sub>2</sub>)</b>				
Annual Arithmetic Mean	0.03	80	NA	NA
Maximum 24-Hour Concentration <sup>1</sup>	0.14	365	NA	NA
Maximum 3-Hour Concentration <sup>1</sup>	NA	NA	0.50	1,300
<p><b>Notes:</b> ppm – parts per million  µg/m<sup>3</sup> – micrograms per cubic meter  NA – not applicable</p> <p>Particulate matter concentrations are in µg/m<sup>3</sup>. Concentrations of all gaseous pollutants are defined in ppm -- approximately equivalent concentrations in µg/m<sup>3</sup> 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><sup>1</sup> Not to be exceeded more than once a year.  <sup>2</sup> Applies only to areas designated as Non Attainment.  <sup>3</sup> Three-year average of the annual fourth highest daily maximum 8-hr average concentration.  <sup>4</sup> Not to be exceeded by the 98th percentile averaged over 3 years.</p> <p><b>Sources:</b> 40 CFR Part 50: National Primary and Secondary Ambient Air Quality Standards;  6 NYCRR Part 257: Air Quality Standards.</p>				

A State Implementation Plan (SIP) is a state's plan on how it will meet the NAAQS under the deadlines established by the CAA. In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which addressed attainment of the NAAQS by 2007, and has recently submitted revisions to the SIP for the attainment of the one-hour ozone NAAQS. These SIP revisions included additional emission reductions that EPA requested to demonstrate attainment of the standard and to update the SIP estimates using a new EPA model to predict mobile source emissions (MOBILE6.2).

#### *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 (above) 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 these thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

#### *De Minimis Criteria Regarding CO Impacts*

New York City has developed 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 (known as de minimis 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 concentrations and the 8-hour standard, when No Action concentrations are below 8.0 ppm.

#### *Interim Guidance Criteria Regarding PM<sub>2.5</sub> Impacts*

The above-mentioned 24-hour and annual average NAAQS for PM<sub>2.5</sub>, aimed at protecting public health and welfare, came into effect September 16, 1997. These standards have also been adopted by New York State.

NYSDEC is currently reviewing and evaluating the PM<sub>2.5</sub> ambient air quality monitoring data that have been collected within New York City. At this time, EPA has not yet formally determined if the measured PM<sub>2.5</sub> levels in New York City indicate whether the city (or counties within the city) will be designated as either attainment (i.e., meeting the standards) or non-attainment (i.e., not meeting the standards) with respect to the PM<sub>2.5</sub> ambient air quality standards.

NYSDEC has published a proposed draft policy to provide interim direction for evaluating PM<sub>2.5</sub> impacts. This draft policy would apply only to facilities applying for permits or major permit modification under the State Environmental Quality Review Act (SEQRA) that emit 15 tons of PM<sub>10</sub> or more annually. The interim draft policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum predicted impacts are predicted to increase PM<sub>2.5</sub> concentrations by more than 0.3 µg/m<sup>3</sup> averaged annually or more than 5 µg/m<sup>3</sup> on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an EIS to assess the severity of the impacts, to evaluate alternatives, and to

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employ reasonable and necessary mitigation measures to minimize the PM<sub>2.5</sub> impacts of the source to the maximum extent practicable.

NYCDEP is currently recommending interim guidance criteria for evaluating the potential PM<sub>2.5</sub> impacts from NYCDEP projects subject to City Environmental Quality Review (CEQR). The interim guidance criteria currently employed by NYCDEP<sup>1</sup> for determination of potential significant adverse impacts from PM<sub>2.5</sub> are as follows:

- Predicted 24-hour (daily) average increase in PM<sub>2.5</sub> concentrations greater than 5 µg/m<sup>3</sup> at a discrete location of public access, either at ground or elevated levels (microscale analysis);
- Predicted annual average increase in ground-level PM<sub>2.5</sub> concentrations greater than 0.1 µg/m<sup>3</sup> 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 impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating background monitoring stations);

Actions under CEQR that would increase PM<sub>2.5</sub> concentrations more than the interim guidance criteria above will be considered to have potential significant adverse impacts. NYCDEP recommends that its actions subject to CEQR that fail the interim guidance criteria prepare an Environmental Impact Statement (EIS) and examine potential measures to reduce or eliminate such potential significant adverse impacts.

In order to put these levels in context, the average bias (difference) between 24-hour average PM<sub>2.5</sub> concentrations measured at collocated monitors (two identical monitors at the same location) in four monitoring stations in New York City from January to December 2000 ranged from 0.41 to 0.83 µg/m<sup>3</sup>. Monitored changes in concentration that would be lower than these levels could not conclusively indicate any change in concentration.

The above NYCDEP draft interim guidance criteria have been used for the purpose of evaluating the significance of predicted impacts of the Proposed Action on PM<sub>2.5</sub> concentrations from mobile sources, and determine the need to minimize particulate matter emissions from the Proposed Action.

### **GENERAL CONFORMITY**

The conformity requirements of the Clean Air Act and regulations promulgated thereunder (conformity requirements) limit the ability of federal agencies to assist, fund, permit, and approve projects that do not conform to the applicable SIP. When subject to this regulation, the lead agency is responsible for demonstrating conformity for its proposed action. At a federal level, conformity determinations must be made according to the requirements of 40 CFR Parts 51 and 93 (federal general conformity regulations).

The general conformity requirements in 40 CFR Part 93, Subpart B, apply to those federal actions in non-attainment or maintenance areas where the action's direct and indirect emissions have the potential to emit one or more of the six criteria pollutants at rates equal to or exceeding the prescribed rates or representing 10 percent or more of a non-attainment or maintenance area's total emissions inventory for that pollutant. In the case of New York City, the prescribed

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<sup>1</sup> NYCDEP, *Croton Water Filtration Plant EIS*, January 2004.

annual rates are 25 tons of VOCs or NO<sub>x</sub> (severe ozone non-attainment area) and, in Manhattan only, 100 tons of PM<sub>10</sub> (moderate PM<sub>10</sub> non-attainment area).

The general conformity requirements do not apply to federal actions that:

- do not satisfy either one of the above conditions;
- occur in an attainment area;
- are related to transportation plans, programs, and projects developed, funded, or approved under the Federal Transit Act (49 U.S.C. 1601); or
- qualify for exemptions established at § 51.853.

The regulation assumes that a proposed federal action whose criteria pollutant emissions have already been included in the local SIP's attainment or maintenance demonstrations conforms to the SIP.

Independently from this Draft GEIS, LMDC will determine whether the Proposed Action is subject to the general conformity procedure. As part of this procedure, LMDC will determine whether the emissions from the Proposed Action exceed the general conformity applicability thresholds found at 40 CFR § 93.153(b). If so, LMDC will conduct a general conformity analysis pursuant to 40 CFR Part 93, Subpart B. The quantification of emissions from the Proposed Action will include the direct and indirect emissions from construction vehicles, on-site construction equipment, and emissions from vehicle trips associated with the Proposed Action over the years 2005 through 2015.

Should FTA funding be applied to transportation related construction, such as a below grade bus garage, further analysis will be undertaken in the context of Transportation Conformity.

### **14.3.3 BACKGROUND CONDITIONS**

The local modeling analyses directly account for only those pollutants emitted by sources that are included in the models. For mobile source analysis, vehicular-generated emissions on the streets within 1,000 feet and which are within the line of sight of receptor locations are included. In modeling stationary sources, such as generators, cogeneration, or exhaust vents, those individual sources are modeled explicitly; other background sources that are in the immediate vicinity are included where applicable. The calculated difference between the Build condition and the No Action condition is the predicted increment. Background concentrations must be added to the concentrations predicted from all of these sources (which are modeled explicitly) to obtain the total predicted ambient concentrations at any given location. (In the case of PM<sub>2.5</sub>, official annual background levels, representing the average of three years, is not available; annual PM<sub>2.5</sub> is evaluated by comparing the predicted increment to the interim guidance threshold levels, although highest recorded background levels as shown on NYSDEC monitors is also provided in the analysis below.)

Worst-case background concentrations are represented by the highest concentrations monitored during past years at the nearest NYSDEC background monitoring stations. Stations used for background would generally be stations that are designed to monitor general population exposure and are located so as not to monitor specific local sources (i.e., stations that are not source-oriented, such as mobile source stations) but rather the impact of distant background sources. The concentrations monitored at such stations do nonetheless include a component of

impacts from local sources, such as traffic, and therefore this approach results in a conservatively high estimate of total predicted concentrations.

The case of Lower Manhattan is somewhat unique in this respect, because prior to September 11, 2001, there were not many monitoring stations in the immediate vicinity. In response to the events of September 11 and the ensuing impact on air quality, New York State and federal agencies initiated numerous air monitoring activities to better understand the ongoing impact of the disaster on air quality. The impacts of September 11 are described in detail in section 14.2 above.

The data presented here relate the conditions prior to September 11, as well as data monitored long after September 11 which were not influenced by the events themselves, and represent existing conditions at a time when general activity in Lower Manhattan is still reduced, but possibly include components of ongoing reconstruction activity. Conditions during both of these periods can be used as background concentrations for current and future conditions, as described above, to obtain the complete picture in respect to predicted outdoor air quality and the impact of the Proposed Action on air quality in general. This procedure results in conservatively high concentrations, because background concentrations of pollutants are decreasing over the years.

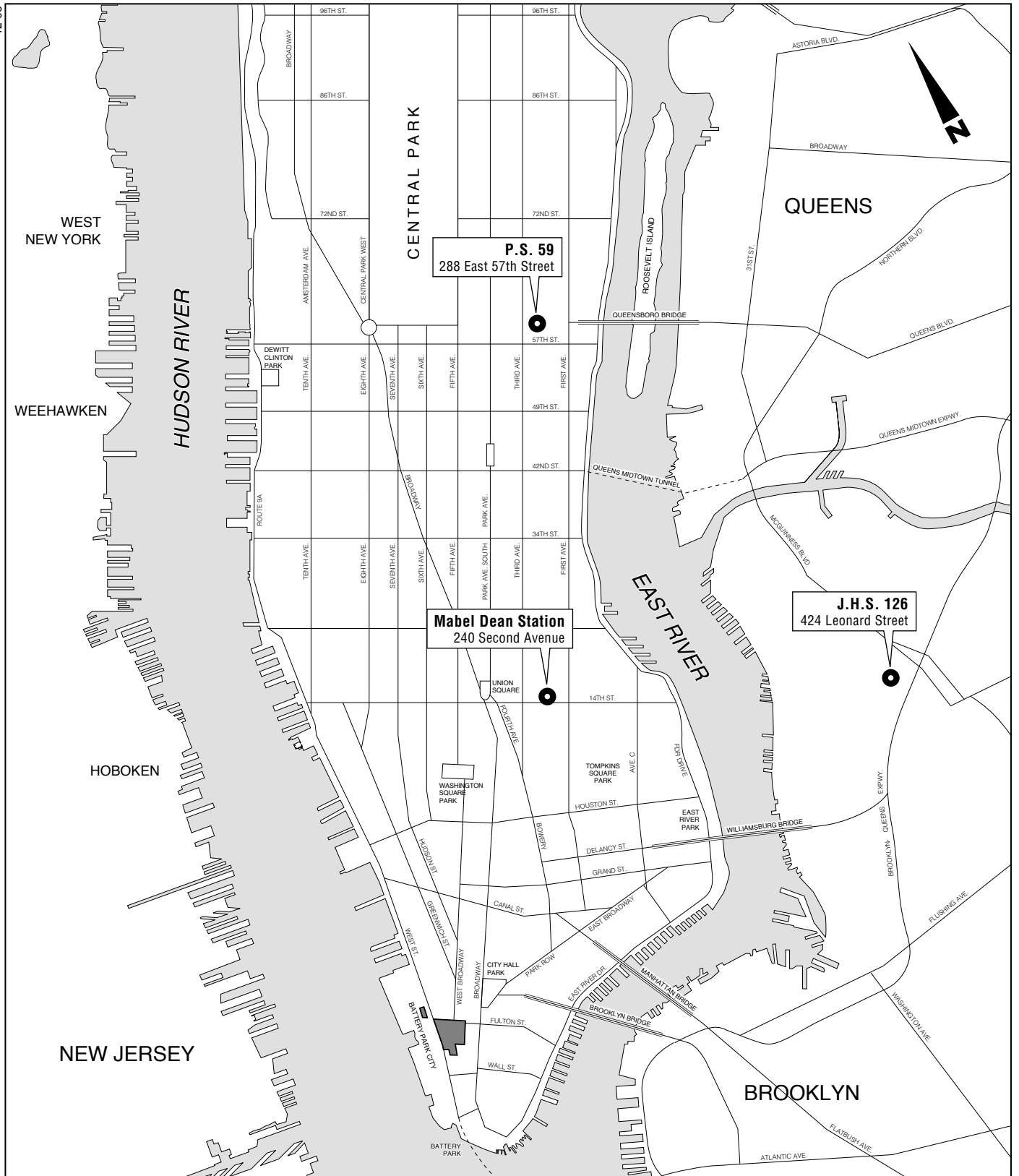
Monitored concentrations from 2000 through 2002 at the nearest stations (shown in Figure 14-1) are presented in Table 14-3. Although monitored  $PM_{2.5}$  values are presented, they are used only as a conservatively high estimate of background due to the fact that NYSDEC has not yet officially determined the procedure for determining  $PM_{2.5}$  backgrounds. The maximum concentrations presented for each pollutant and averaging period are the levels that were used as background in this study.


The higher levels of  $PM_{10}$  monitored in Lower Manhattan at source-oriented stations during 2002 are not included here, since they represent the impact of recovery and cleanup efforts that will not be present in the years analyzed. During the construction period, the impact of the proposed construction activity is explicitly modeled and added to background values (see Chapter 21, “Construction Impacts,” for details).


#### **14.3.4 REGIONAL EMISSIONS ANALYSIS**

A mesoscale (i.e., regional) analysis of air pollutants is typically performed by computing total pollutant levels (“burdens”) within a project’s overall study area. Pollutant burdens represent total expected quantities of pollutant emissions for a region throughout a defined time period. The increment in pollutant emissions was computed for the annual quantities of VOCs,  $NO_x$ , and  $PM_{10}$  that would be emitted due to project-related changes in vehicular activity within the entire study area. Traffic generation and the associated vehicle miles were estimated for both the Pre-September 11 scenario and the Proposed Action, with the difference between these two conditions representing the increase in VMT attributable to the proposed project. Stationary sources are not expected to significantly increase emissions and were not analyzed.

Vehicular pollutant burdens were computed based on the EPA vehicle emission estimating procedures, using MOBILE6.2 (for PM, VOCs, and  $NO_x$ ), and on the changes in vehicle miles traveled (VMT) for the final build year—2015. The choice and use of MOBILE6.2 is described in more detail in section 14.3.5, and in Appendix G.



 Project Site

 Location of Background Air Quality Monitoring Station

0 2000 4000 FEET  
SCALE

**Table 14-3  
Monitored Concentrations from the Nearest Air Quality Stations**

Pollutant	Station	Period	Units	2000	2001	2002	Max
CO	PS 59, 288 E. 57th Street, Manhattan	1-hour	ppm	4.1	3.7	3.2	<b>4.1</b>
		8-hour	ppm	2.8	2.3	2.2	<b>2.8</b>
NO <sub>2</sub>	Mabel Dean Station, 240 2nd Ave.	Annual	ppm	0.036	0.038	NA	<b>0.038</b>
	PS 59, 288 E. 57th Street, Manhattan	Annual	ppm	0.038	0.038	0.038	
SO <sub>2</sub>	Mabel Dean station, 240 2nd Ave.	3-hour	ppm	0.081	0.064	NA	<b>0.081</b>
	PS 59, 288 E. 57th Street, Manhattan	3-hour	ppm	0.073	0.065	0.057	
	Mabel Dean station, 240 2nd Ave.	24-hour	ppm	0.045	0.045	NA	<b>0.046</b>
	PS 59, 288 E. 57th Street, Manhattan	24-hour	ppm	0.046	0.038	0.036	
	Mabel Dean station, 240 2nd Ave.	Annual	ppm	0.013	0.014	NA	<b>0.014</b>
	PS 59, 288 E. 57th Street, Manhattan	Annual	ppm	0.013	0.012	0.012	
PM <sub>10</sub>	Mabel Dean station, 240 2nd Ave.	24-hour	µg/m <sup>3</sup>	49	30	NA	<b>50</b>
	JHS 126 424 Leonard St, Brooklyn	24-hour	µg/m <sup>3</sup>	NA	50	42	
	Mabel Dean station, 240 2nd Ave.	Annual	µg/m <sup>3</sup>	22	19	NA	<b>22</b>
	JHS 126 424 Leonard St, Brooklyn	Annual	µg/m <sup>3</sup>	NA	20	21	
PM <sub>2.5</sub>	Mabel Dean station, 240 2nd Ave.	24-hour	µg/m <sup>3</sup>	43	44	NA	<b>44</b>
	JHS 126 424 Leonard St, Brooklyn	24-hour	µg/m <sup>3</sup>	NA	35	34	
	Mabel Dean station, 240 2nd Ave.	Annual	µg/m <sup>3</sup>	16.8	17.1	NA	<b>17.1</b>
	JHS 126 424 Leonard St, Brooklyn	Annual	µg/m <sup>3</sup>	NA	15.3	14.0	
<b>Notes:</b>	NA—Full data not available All averages other than annual are second-highest of the year, except PM <sub>2.5</sub> 24-hour averages, which are the 98th percentile value. Mabel Dean station was located at the former Mabel Dean High School Annex.						
<b>Sources:</b>	NYCDEP, EPA						

The annual number of vehicle trips was estimated based on travel demand factors presented in Chapter 13A, "Traffic and Parking." Based on the characteristics of the different program components, separate estimates were made for Weekday, Saturday and Sunday travel in order to estimate annual traffic trips. Trip estimates for each land use were translated into vehicle miles based on an average travel distance of 9.2 miles for work related trips as reported by NYMTC. Adjustments were also made to account for the substitution affect of trips that would be relocating to the Project Site from within the region, and are therefore not new to the region.

NYSDEC has submitted detailed draft MOBILE6 regional emissions modeling results to EPA for 2007 as an update to the ozone SIP, including a breakdown of miles traveled on all roadway types and speeds by all vehicle classes. The average emission rates per mile from that analysis were scaled to the target years using the original NYSDEC model for those years, and were used as a basis for all mobile source emissions in this analysis. Meteorological conditions for the VOCs and NO<sub>x</sub> were taken from the SIP determination, reflecting the summer ozone season.

Additional details of this analysis are provided in Appendix G.

### 14.3.5 ANALYSIS OF MOBILE SOURCES

Maximum concentrations of CO, PM<sub>10</sub>, and PM<sub>2.5</sub> were predicted for the analysis years 2009 and 2015. The concentrations were calculated for the averaging periods corresponding to those



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defined for each pollutant in the NAAQS: 24-hour and annual for PM and 8-hour for CO. Since no violations of the 1 hour CO standard have been measured in New York City within the last 10 years, 1-hour averages were not summarized in this report (although all 1-hour predicted CO concentrations would be well within the applicable standard).

The analysis uses a modeling approach approved by EPA that has been widely employed for evaluating CO and PM<sub>10</sub> impacts of projects in New York City, New York State, and throughout the country, with some additional, newer procedures for modeling PM<sub>2.5</sub> that have been developed in coordination with NYCDEP. This approach is coupled with a series of worst-case assumptions relating to meteorology, traffic, and background concentrations, resulting in a conservatively high estimate of expected concentrations and ensuing air quality impacts caused by the Proposed Action.

Additional details of the data used are provided in Appendix G.

### *VEHICLE EMISSIONS DATA*

Vehicular exhaust emission factors were computed using the EPA Mobile Source Emissions Model, MOBILE6.2. This is the latest, recently released, emissions model, capable of calculating engine emission factors for various vehicle types, based on the fuel (gas, diesel, or alternative technologies), meteorological conditions, vehicle speeds, roadway types, number of starts per day and engine soak time, and various other factors that influence emissions, such as inspection maintenance programs.

Vehicle classification data were based on field studies and data obtained from other traffic studies as discussed in Chapter 13A, "Traffic and Parking." Emission estimates were based on guidance from NYCDEP and NYSDEC on the appropriate credits to be used in the MOBILE6.2 model 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.

Based on the latest guidance from NYSDEC and NYCDEP, sport utility vehicles (SUVs) were classified as light-duty gasoline powered trucks, with operating conditions (starts per day and soak time) and registration characteristics (age of vehicles and mileage accumulation) set to be the same as for light-duty vehicles (LDV), in order to properly model their emissions. Taxis are assumed to all 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<sup>1</sup>.

An ambient temperature of 52.5° Fahrenheit was used for the sites in New York City. This temperature, calculated based on the latest guidance from EPA, NYSDEC, and NYCDEP, represents the average temperature measured at the Central Park meteorological station during the 10 highest 8-hour CO events measured at the East 34th Street NYSDEC monitoring station in 2000 through 2002.

EPA has recently proposed revisions to the transportation conformity rules to incorporate procedures for assessing the effects of PM<sub>2.5</sub> for future projects that may be subject to

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<sup>1</sup> The MOBILE6 emissions model utilizes 29 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).

transportation conformity in PM<sub>2.5</sub> non-attainment areas.<sup>1</sup> Under these proposed revisions, fugitive road dust would be included in regional emissions and in local hotspot analyses only if it is identified as a significant contributor to PM<sub>2.5</sub> regional air quality. Although EPA has not yet made a determination as to whether any specific areas have a regional PM<sub>2.5</sub> issue with respect to road dust, it is unlikely that such a determination would be made for locations within the New York City metropolitan area. First, predicted impacts based on modeling emission inventories are significantly higher than actual measured concentrations of PM attributed to road dust. This is the case in New York City, where the primary component of measured PM<sub>10</sub> concentrations in the designated Non-Attainment area (Manhattan) was found to be due to diesel engine exhausts, rather than road dust. Second, while EPA has determined that areas that are not in attainment with the PM<sub>10</sub> standard have significant emissions of fugitive road dust, there is less evidence that this road dust is a contributor to PM<sub>2.5</sub> concentrations.

Furthermore, in the event that EPA would require quantified analysis of PM<sub>2.5</sub> at “hot-spot” (i.e., microscale receptor) locations, EPA would only require an assessment of the contribution from fugitive dust if those emissions were identified as regionally significant. This would first require preparation of a PM<sub>2.5</sub> SIP by NYSDEC, an identification of specific hot-spot locations requiring quantified analysis for transportation conformity decisions, and a determination that inclusion of re-entrained road dust in the hot-spot analysis is warranted; designation of New York in regard to attainment of the PM<sub>2.5</sub> NAAQS is expected in 2004. Since none of these criteria have been met, and since fugitive road dust is unlikely to be characterized as a regionally or locally significant contributor to PM<sub>2.5</sub> concentrations, inclusion of fugitive road dust was not considered to be necessary for assessing PM<sub>2.5</sub> impacts from the Proposed Action.

Since the contribution of re-entrained road dust to PM<sub>10</sub> concentrations, as presented in the PM<sub>10</sub> SIP, is considered to be significant, the PM<sub>10</sub> estimates include both exhaust and road dust. Road dust emission factors were calculated according to the latest procedure delineated by EPA<sup>2</sup>.

#### *DISPERSION MODELS*

##### *Carbon Monoxide*

At all sites selected for CO analysis, initial screening of worst-case predicted maximum 1- and 8-hour average CO concentrations were determined using EPA’s CAL3QHC model<sup>3</sup>, Version 2.0. The CAL3QHC model is a Gaussian dispersion model, which assumes that the dispersion of pollutants downwind of a pollution source follows a Gaussian (or normal) distribution, and is designed specifically for predicting CO concentrations along roadway segments.

##### *Particulate Matter*

Ambient concentrations of PM were computed at the selected receptor sites using the more refined version, CAL3QHCR. This version of the model can utilize hourly traffic and meteorology data, and is therefore more appropriate for calculating 24-hour and annual average concentrations. Tier II analysis, which includes the modeling of hour-by-hour concentrations

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<sup>1</sup> 68 Fed. Reg. 62690-62729, November 5, 2003.

<sup>2</sup> EPA, “Compilation of Air Pollutant Emission Factors AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources”, Draft Ch. 13.2.1, NC, <http://www.epa.gov/ttn/chief/ap42/>, August 2003.

<sup>3</sup> EPA, User’s guide to CAL3QHC, “A Modeling Methodology for Predicting Pollutant Concentrations Near Roadway Intersections”, Office of Air Quality Planning and Standards, Research Triangle Park, North Carolina, September 1995.

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based on hourly traffic data and hourly meteorological data over a 5-year monitoring period, was performed to predict maximum 24-hour and annual average PM levels.

In addition to the standard intersection models, two special features were modeled:

*Tunnel Emissions:* The dispersion of pollutants from the proposed short bypass tunnel alternative for Route 9A was modeled within the same traffic modeling framework, with a special procedure applied to the tunnel emissions. The tunnel would consist of two separate tubes, one for each traffic direction. Vehicle engine emissions within the tunnel would be mixed within the tunnel air and emitted via the exit portals. Air flow in the tunnel would be induced by a longitudinal, portal to portal jet fan ventilation system assisted by the traffic induced piston air flow. To emulate these emissions, an additional link was added from each exit portal in the out bound direction for a distance of 60 meters (roughly 197 feet). The mass emission rate of pollutants from these links consisted of the total emissions within each tube throughout the length of the tunnel.

*Bus Idling:* A model was designed to simulate the emission from buses that would be loading and unloading passengers along Greenwich Street south of Fulton Street. The main focus of this analysis is diesel bus idle emissions, and therefore PM is the pollutant of concern. Since these streets are new sections introduced by the Proposed Action, there is no model for that area for the Future Without the Proposed Action Scenario, and incremental impact criteria are not relevant. The intersection of Fulton and Greenwich Streets was modeled according to the standard procedure described in this section for intersections; the bus idle emissions were emulated by introducing a narrow line source which included the total predicted idle emissions along the west side of Greenwich Street for each hour, with the length of the source varying hourly by the number of buses predicted to be present.

More information on the determination of these procedures is presented in Appendix G.

### *METEOROLOGICAL CONDITIONS*

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, which accounts for the effects of dispersion or mixing in the atmosphere.

The CAL3QHC CO computations were performed using a wind speed of 1 meter/second, and stability class D, representative of neutral conditions in New York City. At each receptor location, the wind angle that maximized, the pollutant concentrations was used in the analysis regardless of frequency of occurrence.

The CAL3QHCR Tier II PM analyses utilized monitored hourly meteorological data from LaGuardia Airport station in the years 1998–2002. All hours are modeled, and the highest resulting concentration for any averaging time is presented.

### *RECEPTOR LOCATIONS*

At each location analyzed, receptors (locations defined in the model at which concentrations are calculated) were located at the nearest sensitive land uses, such as public spaces that would be continuously accessible for the duration of the averaging time, windows of residential buildings, and building fresh air intake vents. Receptors in the annual PM<sub>2.5</sub> neighborhood scale models were placed at a minimum distance of 15 meters from the nearest moving lane, based on the NYCDEP procedure for neighborhood scale corridor PM<sub>2.5</sub> modeling.

The locations that were analyzed, shown in Figure 14-2, were the intersections of Route 9A and Vesey Street, Route 9A and Liberty Street and Route 9A and Albany Street (both intersections included in one model), and Greenwich Street from Vesey Street to Liberty Street—the area where tour buses would load and unload visitors to the Memorial. These intersections include the locations that would experience the highest volumes of traffic from all access routes converging near the WTC Site, as well as intersections used by vehicles accessing and returning from the below-grade vehicular facilities.

### **14.3.6 ANALYSIS OF STATIONARY SOURCES**

Stationary sources located within the Project Site would include: emergency generators for life-saving operations and generators used for client-operated backup power in case of power outage, which would be tested up to 1 hour per month; and ventilation system outlets that would exhaust air from the enclosed below-grade vehicular facilities, including bus and car parking, delivery truck docks, security vehicle inspection facility, and connecting ramps. HVAC systems would be electric and/or steam distributed by Con Edison with no additional generation facilities associated with them. Wind turbines would also be placed on Freedom Tower which would generate electricity to that tower, reducing the power demand from conventional sources. The project alternatives include two options for on-site power cogeneration in addition to the above-mentioned sources, which are analyzed in Chapter 23, “Alternatives.”

The backup and life saving emergency generators would be fueled by ultra low sulfur diesel fuel (ULSD). The generators would be used in the event of the sudden loss of power from the electrical grid. Occasionally, the generators would be tested for a short period of time to ensure availability and reliability in the event of an actual emergency. Emergency generators are exempt from NYSDEC air permitting requirements if they meet the applicable requirements of 6 NYCRR 201. The emergency generators would be installed and operated in accordance with applicable requirements. Potential air quality impacts are considered insignificant since the emergency generators would be used only for testing purposes outside of an actual emergency, and the frequency and duration of such tests would be minimal.

Operational specifications would be as follows:

1. All building air intakes, below-grade vehicular ventilation exhaust, and generator exhaust would be located at a minimum elevation of 40 feet; and
2. All generators would be using ULSD.

In the pre-September 11 condition, sources on the site included backup and emergency generators of a similar capacity. In addition, there were some generators operating regularly onsite supplementing power for some activities. Below grade parking was available as well. Precise details of these sources are not available at this time since records and the people involved in much of the on-site operations did not survive the tragic events of September 11.

## **14.4 PREDICTED IMPACTS OF THE PROPOSED ACTION**

### **14.4.1 PREDICTED REGION WIDE EMISSIONS**

Predicted future emissions due to the Proposed Action were calculated; estimates were prepared of the project’s affect on vehicle miles traveled (VMT) in the region. The estimates were prepared on an annual basis and focus on the predicted increase in VMT within the downstate New York and the Northern New Jersey non-attainment regions. Similar estimates were

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prepared for the future without the Proposed Action. Based on these estimates, the increase in emissions due to the Proposed Action relative to the future without the Proposed Action was calculated.

Because the 2009 interim program does not yet replace most of the office space that existed at the Project Site, there would still be a net reduction in vehicle travel generated by the Proposed Action in 2009 when compared to the Pre-September 11 Scenario. By 2015, full development at the Project Site is estimated to result in an increase of approximately 1.9 million vehicle miles. To estimate increased travel within the two regions, vehicle trips were sorted by origin/destination information reported in the U.S. Census and a portion of the travel was assigned to New Jersey. As a conservative estimate, a smaller portion related to trips to/from other areas (e.g., Connecticut) was also assigned to the New York region. Based on this distribution the incremental annual mileage in the New York region is estimated to be 1.541 million miles and the increase in the New Jersey region is estimated to be 325 thousand miles.

The predicted annual increase in VMT by region and associated increase in emissions in 2015 is presented in Table 14-4. The emission rates were based on the average NY County emission rates for 2007 calculated based on the regional VMT and total emissions as modeled by NYSDEC for the 2003 SIP update (using MOBILE6), and on the ratio of the 2007 emission factors to the 2015 emission factors using that same method.

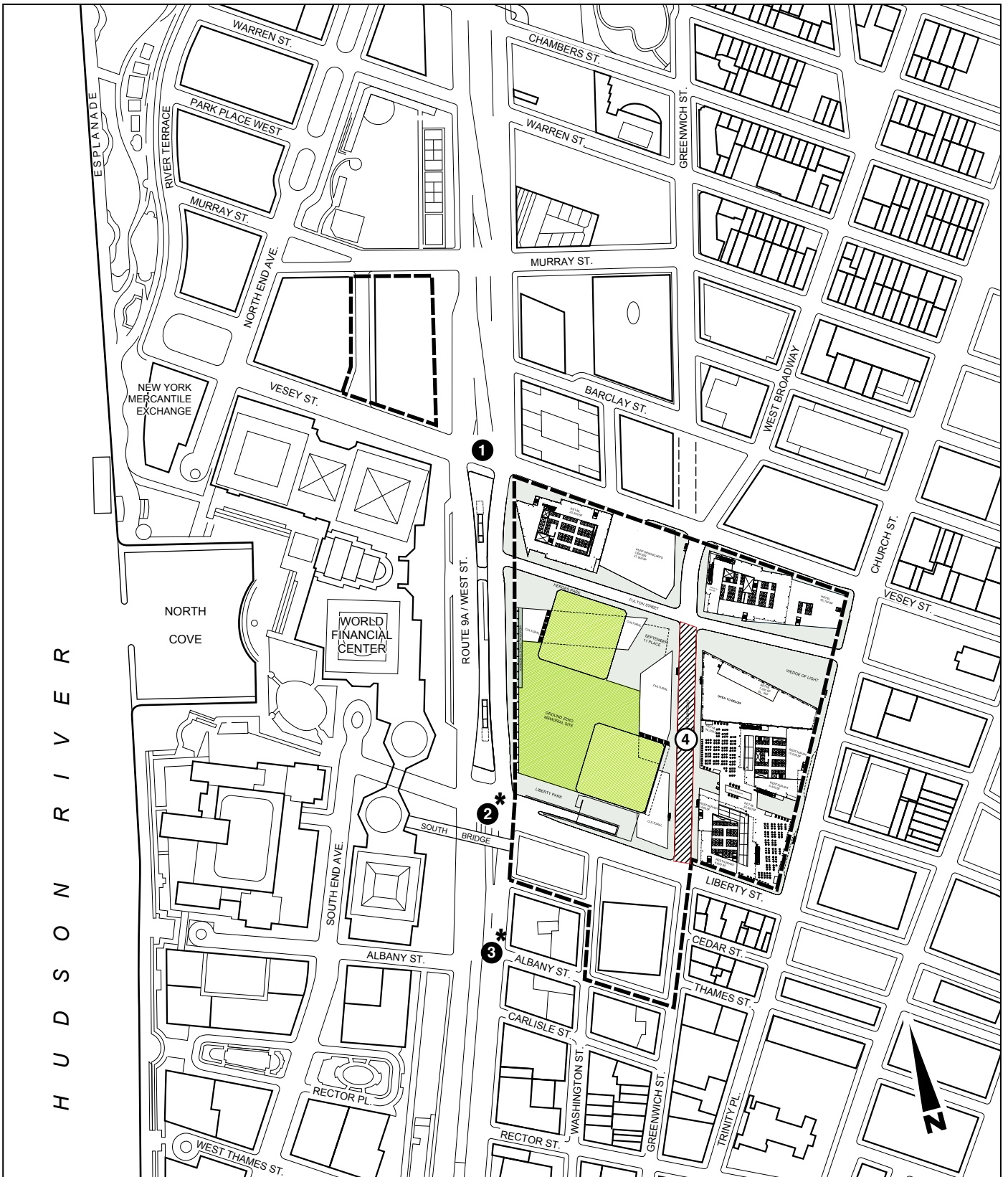
**Table 14-4  
Total Estimated Increase in Regional Emissions—2015**




Region	VMT Increase	Pollutant	Average Emission Factor (g/VMT)	tons/year
New York	1,541,000	VOC	0.39	0.66
		NO <sub>x</sub>	0.41	0.70
		PM <sub>10</sub>	1.0324*	1.75
New Jersey	324,700	VOC	0.39	0.14
		NO <sub>x</sub>	0.41	0.15
		PM <sub>10</sub>	1.0324*	0.37
<b>Notes:</b> * This factor includes an estimated 1.0 µg/m <sup>3</sup> of road dust. If road dust was determined to be regionally insignificant and not included in the SIP, the emission would be significantly lower.				

**14.4.2 PREDICTED IMPACTS OF STATIONARY SOURCES**

No significant adverse impacts are predicted due to the operation of backup and emergency generators.

Ventilation of the below grade parking facilities will be designed in a manner that would conform to any applicable laws and regulations, and that would not result in any significant adverse impacts on air quality.



-  Project Site
-  1/2/3 Intersections
-  4 Visitor Bus Loading and Unloading Zone
- \* Sites 2 and 3 were included in a single dispersion model

0 200 400 FEET  
SCALE

### 14.4.3 PREDICTED IMPACTS OF MOBILE SOURCES

#### PREDICTED IMPACTS OF MOBILE SOURCES—CURRENT CONDITIONS SCENARIO

##### Current Conditions Scenario—2009

Concentrations of all analyzed pollutants in 2009 under the Current Conditions Scenario presented in Table 14-5 and 14-6 represent the predicted concentrations with Route 9A at grade and short bypass, respectively. No exceedance of any benchmarks levels were predicted for the proposed Route 9A at grade alternative. Some reductions in concentrations were predicted for the at grade alternative in the Liberty Street area; this is probably due to the change in direction of traffic and geometry of the street. The PM<sub>2.5</sub> annual neighborhood scale concentrations under the proposed Route 9A short bypass alternative are higher than 0.1 µg/m<sup>3</sup>. This is largely due to the contribution of tunnel emissions, and the fact that the neighborhood scale receptors were placed conservatively close to the roadway.

**Table 14-5**  
**Total Predicted Pollutant Concentrations**  
**Current Conditions At Grade Scenario, 2009**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	5.6	7.1	1.5
		Annual*	24-hour	47.2	47.6
	PM <sub>10</sub>		24-hour	17.73	17.80
		Annual	65.9	69.4	3.5
Liberty-Albany St./Route 9A	CO	24-hour	27.62	28.93	1.31
		Annual	4.8	4.9	0.1
	PM <sub>2.5</sub>	24-hour	47.1	47.2	0.1
		Annual*	17.69	17.73	0.04
PM <sub>10</sub>	24-hour	61.5	61.4	-0.1	
	Annual	26.16	26.10	-0.06	

**Notes:** All PM concentrations are in µg/m<sup>3</sup>; CO concentrations are in ppm.  
All CO results are screening CAL3QHC analyses.  
\* PM<sub>2.5</sub> annual concentrations are neighborhood scale.

Along Greenwich Street, in the area where buses will be loading and unloading visitors to the WTC Site, the predicted contribution from all local mobile sources, PM<sub>2.5</sub> concentrations are predicted to be a maximum of 1.14 µg/m<sup>3</sup> and 0.14 µg/m<sup>3</sup> on a 24-hour and annual average basis, respectively. Total predicted PM<sub>10</sub> concentrations, including background, were 62.1 and 25.8 µg/m<sup>3</sup> on a 24-hour and annual average basis, respectively. No exceedance of the PM<sub>10</sub> or of PM<sub>2.5</sub> 24-hour NAAQS is predicted. Since this is in a location where there was no roadway previously, the comparison to PM<sub>2.5</sub> interim guidance threshold values normally used for increased traffic on existing roadways is inappropriate. For comparative purposes, the total contribution from all mobile sources along Route 9A is on the order of 0.6 µg/m<sup>3</sup> annually, and 3.1 µg/m<sup>3</sup> on a 24-hour basis—three to four times higher than those computed near the new section along Greenwich Street.

**Table 14-6  
Total Predicted Pollutant Concentrations  
Current Conditions Short Bypass Scenario, 2009**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	6.4	6.5	0.1
		PM <sub>2.5</sub>	24-hour	48.0	48.8
	Annual*		17.67	17.81	0.14
	PM <sub>10</sub>	24-hour	59.5	68.3	8.8
		Annual	25.22	28.21	2.99
Liberty-Albany St./Route 9A	CO	8-hour	3.3	5.2	1.9
		PM <sub>2.5</sub>	24-hour	47.5	48.0
	Annual*		17.60	17.70	0.10
	PM <sub>10</sub>	24-hour	63.4	65.3	1.9
		Annual	26.12	26.79	0.67
<b>Notes:</b> All PM concentrations are in $\mu\text{g}/\text{m}^3$ ; CO concentrations are in ppm. All CO results are screening CAL3QHC analyses. * PM <sub>2.5</sub> annual concentrations are neighborhood scale.					

**Current Conditions Scenario—2015**

Concentrations of all analyzed pollutants in 2015 under the Current Conditions Scenario presented in Table 14-7 and 14-8 represent the predicted concentrations with Route 9A at grade and short bypass, respectively. Some reductions were predicted for the at grade scenario in the Liberty Street area; this is probably due to the change in direction of traffic and geometry of the street. The PM<sub>2.5</sub> annual neighborhood scale concentrations under the short bypass scenario are higher than 0.1  $\mu\text{g}/\text{m}^3$ . This is largely due to the contribution of tunnel emissions, and the fact that the neighborhood scale receptors were placed conservatively close to the roadway; the increment would be lower for the Pre-September 11 Scenario due to the higher traffic volumes predicted without the Proposed Action in that scenario.

The Greenwich Street bus area was analyzed only for 2009, since the highest visitor rate and ensuing bus volumes were predicted for that year and since vehicular emissions were predicted to be higher in 2009 than in subsequent years (see “Current Conditions Scenario—2009” above).

**PREDICTED IMPACTS OF MOBILE SOURCES—PRE-SEPTEMBER 11 SCENARIO**

**Pre-September 11 Scenario—2009**

Concentrations of all analyzed pollutants in 2009 under the Pre-September 11 Scenario presented in Table 14-9 represent the predicted concentrations with Proposed Route 9A at grade alternative. Some reductions were predicted in the Liberty Street area; this is probably due to the change in direction of traffic and geometry of the street. As shown in this table, the Proposed Action is not predicted to cause any significant adverse air quality impacts or to cause any exceedance of the NAAQS under the Route 9A at grade alternative.



**Table 14-7**  
**Total Predicted Pollutant Concentrations**  
**Current Conditions At Grade Scenario, 2015**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	4.7	5.9	1.2
	PM <sub>2.5</sub>	24-hour	46.4	46.7	0.2
		Annual*	17.57	17.63	0.05
	PM <sub>10</sub>	24-hour	67.9	72.8	4.9
Annual		28.36	29.98	1.62	
Liberty-Albany St./Route 9A	CO	8-hour	4.1	4.7	0.6
	PM <sub>2.5</sub>	24-hour	46.2	46.3	0.1
		Annual*	17.50	17.56	0.06
	PM <sub>10</sub>	24-hour	62.5	63.2	0.6
Annual		26.36	26.93	0.57	
<b>Notes:</b> All PM concentrations are in $\mu\text{g}/\text{m}^3$ ; CO concentrations are in ppm. All CO results are screening CAL3QHC analyses. * PM <sub>2.5</sub> annual concentrations are neighborhood scale.					

**Table 14-8**  
**Total Predicted Pollutant Concentrations**  
**Current Conditions Short Bypass Scenario, 2015**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	4.4	5.7	1.3
	PM <sub>2.5</sub>	24-hour	46.4	47.4	1.0
		Annual*	17.49	17.62	0.13
	PM <sub>10</sub>	24-hour	58.9	71.0	12.1
Annual		24.64	29.22	4.58	
Liberty-Albany St./Route 9A	CO	8-hour	3.8	3.8	0
	PM <sub>2.5</sub>	24-hour	46.6	46.8	0.2
		Annual*	17.48	17.53	0.05
	PM <sub>10</sub>	24-hour	64.2	70.9	6.7
Annual		26.12	29.03	2.91	
<b>Notes:</b> All PM concentrations are in $\mu\text{g}/\text{m}^3$ ; CO concentrations are in ppm. All CO results are screening CAL3QHC analyses. * PM <sub>2.5</sub> annual concentrations are neighborhood scale.					

It is expected that the results with the short bypass alternative for Route 9A reconstruction would be higher than those predicted at Table 14-9, but would likely not be significant and, as with the at grade alternative, would not result in exceedances of the NAAQS.

Since Greenwich Street is a new street, the analysis for Pre-September 11 and Current Conditions Scenarios would be the same (see “Current Conditions Scenario—2009” above).

**Table 14-9  
Total Predicted Pollutant Concentrations  
Pre-September 11 At Grade Scenario, 2009**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	5.7	7.1	1.4
	PM <sub>2.5</sub>	24-hour	47.4	47.6	0.2
		Annual*	17.78	17.80	0.03
	PM <sub>10</sub>	24-hour	67.8	69.4	1.6
Annual		28.56	28.93	0.37	
Liberty-Albany St./Route 9A	CO	8-hour	4.9	4.9	0
	PM <sub>2.5</sub>	24-hour	47.3	47.2	-0.1
		Annual*	17.72	17.73	0.01
	PM <sub>10</sub>	24-hour	62.2	61.4	-0.8
Annual		26.30	26.10	-0.20	
<b>Notes:</b> All PM concentrations are in $\mu\text{g}/\text{m}^3$ ; CO concentrations are in ppm. All CO results are screening CAL3QHC analyses. * PM <sub>2.5</sub> annual concentrations are neighborhood scale.					

***Pre-September 11 Scenario—2015***

Concentrations of all analyzed pollutants in 2015 under the Pre-September 11 Scenario presented in Table 14-10 represent the predicted concentrations with the proposed Route 9A at grade alternative. Some reductions were predicted in the Liberty Street area; this is probably due to the change in direction of traffic and geometry of the street. As shown in the table, the Proposed Action is not predicted to cause any significant adverse air quality impacts or to cause any exceedance of the NAAQS under the Route 9A at grade alternative.

It is expected that the results with the short bypass alternative for Route 9A reconstruction would be higher than that predicted at Table 14-10, but would likely not be significant and, as with the at grade alternative, would not result in exceedances of the NAAQS.

Since Greenwich Street is a new street, the analysis for Pre-September 11 and Current Conditions Scenarios would be the same (see “Current Conditions Scenario—2009” above).

**Table 14-10**  
**Total Predicted Pollutant Concentrations**  
**Pre-September 11 At Grade Scenario, 2015**

Site	Pollutant	Period	Future Without the Proposed Action	Future With the Proposed Action	Increment
Vesey St./Route 9A	CO	8-hour	4.8	5.9	1.1
	PM <sub>2.5</sub>	24-hour	46.3	46.7	0.4
		Annual*	17.55	17.63	0.08
	PM <sub>10</sub>	24-hour	69.8	72.8	3.0
		Annual	29.10	29.98	0.88
Liberty-Albany St./Route 9A	CO	8-hour	4.3	4.7	0.4
	PM <sub>2.5</sub>	24-hour	46.2	46.3	0.1
		Annual*	17.53	17.56	0.03
	PM <sub>10</sub>	24-hour	63.4	63.2	-0.2
		Annual	26.53	26.93	0.40
<b>Notes:</b> All PM concentrations are in $\mu\text{g}/\text{m}^3$ ; CO concentrations are in ppm. All CO results are screening CAL3QHC analyses. * PM <sub>2.5</sub> annual concentrations are neighborhood scale.					

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