A. INTRODUCTION

This chapter examines the potential for air quality impacts from the action. Air quality impacts can be either direct or indirect. Direct impacts stem from emissions generated by stationary sources from a new development, such as emissions from fuel burned on site for heating, ventilation, and air conditioning (HVAC) systems. Air quality impacts associated with construction activities may include fugitive dust, exhaust and emissions from construction equipment, and increased traffic on local roadways. Indirect impacts are defined as nearby existing stationary sources and the potential for emissions due to mobile sources/vehicles generated by an action. As the action does not involve the construction of any new developments requiring HVAC systems, stationary source and construction air quality analyses are not warranted and are not included in this chapter.

Diverted vehicular trips associated with the action have the potential to affect microscale CO concentrations at affected nearby intersections. According to the *CEQR Technical Manual* the following screening criteria are applicable to this action for identifying intersections that may warrant further analysis:

- Actions resulting in 100 or more trips through an intersection
- Actions resulting in a substantial number of local or regional diesel vehicle trips

As discussed in detail below, the action has resulted in traffic volumes at multiple intersections that have exceeded the 100-vehicle threshold. Therefore, this air quality analysis addresses the potential for diverted vehicles to significantly impact air quality in the area.

B. SCOPE OF WORK

The City Environmental Quality Review (CEQR) process requires review of the potential environmental impacts of the action. This chapter evaluates the potential for air quality impacts. The scope of work focuses on vehicular concentrations of carbon monoxide and PM10/2.5 at the intersections with the highest diverted (project-generated volumes) resulting from the security measures. Both No-Action and With-Action will be addressed for an analysis year of 2006. The air quality analysis was previously presented in the DEIS for One Police Plaza. This version of the report was prepared for the FEIS. It differs from the DEIS version due to:

- revised standards for fine particulates,
- discussion of bus diversion volumes due to closing of Park Row,
- slight changes in traffic due to the reversal of traffic on Baxter Street, and
- updated information on modeled pollutant concentrations.

C. AIR QUALITY STANDARDS AND CRITERIA

New York and National Ambient Air Quality Standards

Ambient air is defined by the United States Environmental Protection Agency (USEPA) as that portion of the atmosphere, external from buildings, to which the general public has access. National Ambient Air Quality Standards (NAAQS) were promulgated by USEPA for the protection of public health and welfare, allowing for an adequate margin of safety. The USEPA has set NAAQS for the following six criteria pollutants: sulfur dioxide, carbon monoxide, ozone, nitrogen dioxide, inhalable particulates, and lead. They consist of primary standards, established to protect public health with an adequate safety margin, and secondary standards, established to protect "plants and animals and to prevent economic damage." The six major pollutants, deemed criteria pollutants, because threshold criteria can be established for determining adverse effects on human health, are described below:

- Carbon Monoxide (CO). CO is a colorless, odorless gas produced from the incomplete combustion of gasoline and other fossil fuels. The primary source of CO in urban areas is from motor vehicles. Because this gas disperses quickly, CO concentrations can vary greatly over relatively short distances.

- Inhalable Particulates, also known as Respirable Particulates. Particulate matter is a generic term for a broad range of discrete liquid droplets or solid particles of various sizes. The standard now covers only those particles with diameters of 10 micrometers or less, which are the ones most likely to reach the lungs, and PM2.5 for particles with diameters of 2.5 micrometers or less. PM 2.5 is considered to be a regional pollutant.

- Lead (Pb). Lead is a heavy metal. Emissions 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 a result, ambient concentrations of lead have declined significantly.

- Nitrogen dioxide (NO_2). Nitrogen dioxide is a highly oxidizing, extremely corrosive toxic gas. It is formed by chemical conversion from nitric oxide (NO), which is emitted primarily by industrial furnaces, power plants, and motor vehicles.

- Ozone (O_3). Ozone, a principal component of smog, is not emitted directly into the air, but is formed through a series of chemical reactions between hydrocarbons and nitrogen oxides in the presence of sunlight.
- Sulfur dioxides (SO_2). Sulfur dioxides are heavy gases primarily associated with the combustion of sulfur-containing fuels such as coal and oil. No significant quantities are emitted from mobile sources.

New York State Ambient Air Quality Standards further regulate concentrations of the criteria pollutants discussed above. The New York State Department of Environmental Conservation (NYSDEC), Air Resources Division, is responsible for air quality monitoring in the state. Monitoring is performed for each of the criteria pollutants to assess compliance. Table 9-1 shows the National and New York State Ambient Air Quality Standards.

Table 9-1
National and New York State Ambient Air Quality Standards

Pollutant	Type of Standard	Averaging Period	Standard
Sulfur Dioxide	Primary Primary Secondary	Annual arithmetic mean 24-hour average[c] 3-hour average[c]	80 ug/m^3 (.03 ppm) 365 ug/m^3 (.14 ppm) 1300 ug/m^3 (.5 ppm)
Inhalable Particulates (PM10)	Revoked[a] Primary & Secondary	Annual arithmetic mean 24-hour average[b]	50 ug/m^3 150 ug/m^3
Inhalable Particulates (PM2.5)	Primary & Secondary Primary & Secondary	Annual arithmetic mean[d] 24-hour average[e]	15 ug/m^3 35 ug/m^3
Carbon Monoxide	Primary Primary	8-hour average[c] 1-hour average[c]	9 ppm (10 mg/m^3) 35 ppm (40 mg/m^3)
Ozone	Primary & Secondary Primary & Secondary	1-hour average[f] 8-hour average[g]	0.12 ppm (235 ug/m^3) 0.08 ppm (157 ug/m^3)
Nitrogen Dioxide	Primary & Secondary	Annual arithmetic mean	0.053 ppm (100 ug/m^3)
Lead	Primary & Secondary	Quarterly mean	1.5 ug/m^3

Notes: ug/m^3 = micrograms per cubic meter, ppm= parts per million

[a] *Due to a lack of evidence linking health problems to long-term exposure to coarse particle pollution, the agency revoked the annual PM_{10} standard in 2006 (effective December 17, 2006).*

[b] *Not to be exceeded more than once per year on average over 3 years.*

[C] *Not to be exceeded more than once a year.*

[d] *To attain this standard, the 3-year average of the weighted annual mean PM2.5 concentrations from single or multiple commmunity-oriented monitors must not exceed 15.0 ug/m^3.*

[e] *To attain this standard, the 3-year average of the 98th percentile of 24-hor concentrations at each population-oriented monitor within an area must not exceed 35 ug/m^3 (effective December 17, 2006).*

[f] *The NYC Metropolitan area is no longer subject to the 1-hour ozone standard.*

[g] *To attain this standard, the 3-year average of the fourth-highest daily maximum 8-hour average ozone concentrations measured at each monitor within an area over each year must not exceed 0.08 ppm.*

Source: US Environmental Protection Agency

New York City De Minimis Criteria

For carbon monoxide from mobile sources, the City's de minimis criteria are used to determine the significance of the incremental increases in CO concentrations that would result from a proposed action. These set the minimum change in an 8-hour average carbon monoxide concentration that would constitute a significant environmental impact. According to these criteria, significant impacts are defined as follows:

- An increase of 0.5 parts per million (ppm) or more in the maximum 8-hour average carbon monoxide concentration at a location where the predicted No-Action 8-hour concentration is equal to or above 8 ppm.

- 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 ppm.

For PM2.5 analyses of intersections at the microscale level, the City's de minimis criterion for determining significance is:

2 ug/m^3 for the 24-hour period, and

0.3 ug/m^3 for the annual period.

For the neighborhood scale of analysis, only the annual period is of concern, and the City's de minimis criterion for determining significance is:

0.1 ug/m^3 for the annual period.

For mobile and stationary sources combined, the average PM2.5 concentration within a 1 km-square grid centered on the worst-case receptor has a de minimis value of:

0.1 ug/m^3 for the annual period.

No de minimis values have been assigned to PM10.

D. EXISTING CONDITIONS

State Implementation Plan

The Clean Air Act requires states to submit to the U.S. Environmental Protection Agency (EPA) a State Implementation Plan (SIP) for attainment of the NAAQS. The 1977 and 1990 amendments require comprehensive plan revisions for areas where one or more of the standards have yet to be attained. New York County is located in the New York Metropolitan Air Quality Control Region and is part of NYSDEC Region 2. New York County meets the NAAQS for all pollutants except ozone, PM10 and PM2.5. Its nonattainment status for ozone is designated as Severe-17 for the 1-hour gone standard and Moderate for the 8-hour standard. It is designated as Moderate nonattainment for PM10. Prior to 5/20/02, the county also was part of a nonattainment area for CO. It is now designated as a CO maintenance area and is subject to the same requirements as a CO nonattainment area. A CO maintenance area must maintain the NAAQS for 20 years by following two sequential 10-year plans.

E. MOBILE SOURCE METHODS OF ANALYSIS

CO Screening Analysis

Diverted vehicular trips associated with the action have the potential to affect microscale CO concentrations at affected nearby intersections. To assess carbon monoxide due to vehicular traffic, a preliminary evaluation of intersections was carried out to identify those with the potential to violate the NAAQS or the NYC de minimis criteria for CO. If the results for the selected intersection(s) show compliance with the NAAQS and NYC de minimis standards under With-

Action conditions, then the remaining intersections are also presumed to be in compliance. Where multiple intersections warrant further analysis, a subset of worst-case intersections is typically selected for modeling. Based on the NYC *CEQR Technical Manual* and subsequent revisions to its procedures, the following screening criteria are applicable to this action for identifying intersections that may warrant further analysis:

- Actions resulting in 100 or more trips through an intersection
- Actions resulting in a substantial number of local or regional diesel vehicle trips

Table 9-2, which is based on the traffic diagrams in Chapter 7 (Traffic and Parking), shows that diverted traffic volumes at multiple intersections will exceed the 100-vehicle threshold under With-Action conditions. Project-generated increments are zero for many intersections, and they range from a negative traffic increment of -236 to an increase of 546 vehicles. The weekday AM period has the highest project-generated increments compared to the other peak traffic periods.

The highest increase in traffic due to the action occurs at the intersection of Mulberry Street and Worth Street, which has a project increment of 546 vehicles during the peak AM period. This is not a signalized intersection, and unsignalized intersections typically are not modeled. This is because the LOS on the primary link, which has the highest traffic volume, is allows traffic to flow freely.

For signalized intersections, the highest project increment, which occurs during the peak AM period, is at the intersection of St. James Place and Madison Street. Here, the peak AM volume would increase by 312 vehicles, from 761 vehicles under No-Action conditions to 1,073 under With-Action conditions. Rerouted buses travel along the primary links for this intersection under With-Action conditions. This intersection is recommended for modeling.

The second modeled intersection during the peak AM period is Foley Square at Worth St./Center Street. It would have a relatively high project increment of 271 vehicles coupled with a low LOS. In addition, the roadway links along this intersection would encompass the unsignalized intersections of Baxter Street at Worth Street and Mulberry Street at Worth Street, both of which showed high project-generated traffic. These links would experience additional bus traffic under With-Action conditions. As mentioned previously, these two unsignalized intersections have the highest project increments.

The third modeled intersection is Park Row at St. James Place/Chatham Square/Worth Street/Mott Street because it has a high increase in volume under With-Action conditions coupled with a low

LOS of E. It is The LOS of E under With-Action conditions shows a greater degree of congestion than the other two intersections selected for modeling.

If modeling with CAL3QHC shows no exceedances of the NAAQS of the NYC de minimis values for CO at these three intersections, then no exceedances would be expected at intersections with lower volumes and lower project increments. The remaining intersections and peak periods with project increments of 100 or more are largely characterized by lower project increments coupled with lower intersection volumes. Those intersections with comparatively higher intersection volumes have substantially lower project increments compared to the three recommended for modeling.

Mobile Source CO Modeling

The air quality mobile source analysis for the action utilized MOBILE6.2 for emission factors. CAL3QHC was the dispersion model used to evaluate 2006 No-Action and With-Action conditions.

Vehicular Data

Traffic volumes were obtained from the traffic analysis, which includes volumes, by approach, for key links and intersections within the study area. Vehicular speeds, also obtained from the traffic study, were based on field observations. Vehicular mix represents the proportions of vehicles falling into the twenty-eight MOBILE6.2 categories. The vehicular mix used for the analysis was based on field classification counts obtained from the traffic analysis for six vehicular types. These were expanded to the 28 MOBILE6.2 categories based on guidance from NYCDEP. The mixture of vehicular types, which may vary by time of day and type of roadway, is used to obtain composite emission factors from MOBILE6.2.

Table 9-2
2006 Intersection Volumes for No-Action and With-Action Conditions

		No-Action		Project	With-Action	
ID	AM Period	LOS	Volume	Volume	LOS	Volume
1	Park Row @ St. James Pl. @ Chatham Sq @ Worth @ Mott	D	1211	241	E	1452
2	Chatham Sq @ E. Broadway	B	1192	0	B	1192
3	Chatham Sq @ Catherine @ Division @ Bowery @ Doyer	C	1212	0	C	1212
4	St. James Pl. @ James		424	347		771
5	St. James Pl. @ Madison	C	761	312	C	1073
6	St. James Pl. @ P earl	B	1008	2	B	1010
7	Pearl @ Ave of the Finest @ RF Wagner Pl.	C	1915	181	D	2096
8	Pearl @ Frankfort @ Dover		1963	310		2273
9	Gold @ Frankfort @ Rose		521	110		631
10	Park Row @ Pearl		894	-894		0
11	Foley Sq @ Pearl @ Centre @ Reade @ Lafayette		904	297		1201
12	Centre @ Chambers	C	1773	297	C	2070
13	Broadway @ Duane	B	981	0	C	981
14	Broadway @ Thomas	C	910	0	B	910
15	Broadway @ Worth	C	1469	56	C	1525
16	Lafayette @ Worth	C	1132	153	C	1285
17	Foley Square @ Worth @ Centre	F	1227	271	D	1498
18	Baxter @ Hogan Pl.		27	0		27
19	Baxter @ Worth @ Worth		352	444		796
20	Mulberry @ Worth		352	546		898
21	Barclay @ Broadway	D	1984	-13	D	1971
22	Barclay @ Church	B	1394	190	B	1584
23	Beekman @ Park Row	B	1301	-136	B	1165
24	Broome @ Bowery	C	2187	0	C	2187
25	Canal @ Bowery	D	4866	0	D	4866
26	Canal @ Broadway	C	3415	0	C	3415
27	Canal @ Centre	C	2660	0	C	2660
28	Canal @ Lafayette	C	2665	0	C	2665
29	Canal @ Mulberry	C	2252	0	C	2252
30	Chambers @ Broadway	D	2011	0	D	2011
31	Chambers @ Church	D	2171	120	D	2291
32	Division @ Pike	B	1521	0	B	1521
33	Ea Broadway @ Forsyth	B	807	0	B	807
34	Frankfort @ Gold	C	521	110	C	631
35	Frankfort @ Pearl	D	1963	310	C	2273
36	Fulton @ Broadway	B	1219	80	B	1299
37	Fulton @ Church	B	1200	70	C	1270
38	Fulton @ Pearl	C	1105	69	C	1174
39	Bowery @ Grand	C	2291	0	C	2291
40	Bowery @ Kenmare	D	3297	0	D	3297
41	Spruce @ Park Row	C	1369	-236	A	1133
42	Tryon Row @ Centre	B	706	97	B	803
43	Vesey @ Broadway	C	1764	-133	C	1631
44	Vesey @ Church	B	1217	70	B	1287
45	Worth @ Church	C	1791	116	C	1907

ID	MID Period	LOS	Volume	Project Increment	LOS	Volume
1	Park Row @ St. James Pl. @ Chatham Sq @ Worth @ Mott	D	1,278	**115**	E	1,393
2	Chatham Sq @ Ea Broadway	C	1329	17	C	1346
3	Chatham Sq @ Catherine @ Division @ Bowery @ Doyer	C	1348	0	C	1348
4	St. James Pl. @ James		401	**191**		592
5	St. James Pl. @ Madison	B	686	**191**	C	877
6	St. James Pl. @ Pearl	A	719	100	A	819
7	Pearl @ Ave of the Fine @ RF Wagner Pl.	C	1390	**110**	C	1500
8	Pearl @ Frankfort @ Dover		1535	84		1619
9	Gold @ Frankfort @ Rose		647	34		681
10	Park Row @ Pearl		635	-635		0
11	Foley Sq @ Pearl @ Centre @ Reade @ Lafayette		802	**176**		978
12	Centre @ Chambers	C	1545	**176**	C	1721
13	Broadway @ Duane	B	968	0	B	968
14	Broadway @ Thomas	B	859	0	B	859
15	Broadway @ Worth	B	1437	**148**	B	1585
16	Lafayette @ Worth	C	1064	**182**	C	1246
17	Foley Square @ Worth @ Centre	D	1065	**233**	C	1298
18	Baxter @ Hogan Pl.		43	0		43
19	Baxter @ Worth		441	**327**		768
20	Mulberry @ Worth		541	**334**		875
21	Barclay @ Broadway	D	1744	-99	C	1645
22	Barclay @ Church	B	1264	-59	B	1205
23	Beekman @ Park Row	B	1342	-99	B	1243
24	Broome @ Bowery	B	1561	0	B	1561
25	Canal @ Bowery	C	3495	0	C	3495
26	Canal @ Broadway	C	2583	0	C	2583
27	Canal @ Centre	D	2068	0	D	2068
28	Canal @ Lafayette	B	2015	0	B	2015
29	Canal @ Mulberry	B	1990	0	B	1990
30	Chambers @ Broadway	C	1791	0	C	1791
31	Chambers @ Church	C	1894	0	C	1894
32	Division @ Pike	B	1425	0	B	1425
33	Ea Broadway @ Forsyth	B	845	0	B	845
34	Frankfort @ Gold	C	647	34	C	681
35	Frankfort @ Pearl	C	1535	84	C	1,619
36	Fulton @ Broadway	A	1,043	-75	A	1,027
37	Fulton @ Church	B	1102	-75	B	1027
38	Fulton @ Pearl	C	1247	-84	C	1163
39	Bowery @ Grand	C	1685	0	C	1685
40	Bowery @ Kenmare	D	2815	0	D	2815
41	Spruce @ Park Row	A	1194	-99	A	1095
42	Tryon Row @ Centre	A	650	34	A	684
43	Vesey @ Broadway	C	1534	-115	C	1419
44	Vesey @ Church	A	1102	-75	A	1027
45	Worth @ Church	B	1687	**148**	B	1835

ID	PM Period	LOS	Volume	Project Increment	LOS	Volume
1	Park Row @ St. James Pl. @ Chatham Sq @ @ Mott	D	1375	**113**	E	1488
2	Chatham Sq @ Ea Broadway	B	1411	0	B	1411
3	Chatham Sq @ Catherine @ Division @ Bowery @ Doyer	D	1729	0	D	1729
4	St. James Pl. @ James		396	**236**		632
5	St. James Pl. @ Madison	B	708	**193**	B	901
6	St. James Pl. @ Pearl	A	829	4	A	833
7	Pearl @ Ave of the Fine @ RF Wagner Pl.	D	1689	-80	D	1609
8	Pearl @ Frankfort @ Dover		2050	20		2070
9	Gold @ Frankfort @ Rose		528	125		310
10	Park Row @ Pearl		830	-830		0
11	Foley Sq @ Pearl @ Centre @ Reade @ Lafayette		1058	**184**		1242
12	Centre @ Chambers	C	2067	**184**	C	2251
13	Broadway @ Duane	B	868	0	B	868
14	Broadway @ Thomas	B	753	0	B	753
15	Broadway @ Worth	B	1443	32	B	1465
16	Lafayette @ Worth	B	1273	99	C	1372
17	Foley Square @ Worth @ Centre	E	1261	**178**	C	1439
18	Baxter @ Hogan Pl.		67	0		67
19	Baxter @ Worth		520	**331**		851
20	Mulberry @ Worth		548	**443**		991
21	Barclay @ Broadway	C	1675	-102	C	1573
22	Barclay @ Church	B	947	51	B	998
23	Beekman @ Park Row	B	1320	-110	B	1210
24	Broome @ Bowery	C	1883	0	C	1883
25	Canal @ Bowery	D	4025	0	D	4025
26	Canal @ Broadway	C	2547	0	C	2547
27	Canal @ Centre	C	2363	0	C	2363
28	Canal @ Lafayette	C	2180	0	C	2180
29	Canal @ Mulberry	C	2139	0	C	2139
30	Chambers @ Broadway	D	1,824	14	D	1838
31	Chambers @ Church	C	2161	0	C	2161
32	Division @ Pike	B	1819	0	B	1819
33	Ea Broadway @ Forsyth	B	893	0	B	893
34	Frankfort @ Gold	C	528	**125**	D	653
35	Frankfort @ Pearl	C	2,050	20	D	2070
36	Fulton @ Broadway	B	908	7	B	915
37	Fulton @ Church	B	791	40	B	831
38	Fulton @ Pearl	C	1475	0	C	1475
39	Bowery @ Grand	B	1962	0	B	1962
40	Bowery @ Kenmare	D	3200	0	D	3200
41	Spruce @ Park Row	A	1314	-120	A	1194
42	Tryon Row @ Centre	C	983	20	C	1003
43	Vesey @ Broadway	C	1457	-103	C	1354
44	Vesey @ Church	B	781	50	B	831
45	Worth @ Church	C	1756	32	B	1788

*Notes: * Numbers in bold type exceed the 100-vehicle screen*

*** Intersections without LOS are unsignalized*

Source: Philip Habib & Associates, Inc.,

Emission Factors

Carbon monoxide emission factors for 2006 were obtained from EPA's MOBILE6.2 model. For New York City, taxis and sport utility vehicles are treated as special categories of vehicles. Sport utility vehicles (SUVs) are included with light duty gasoline trucks in the LDGT1 category. Taxis are counted as a category separate from autos, and a separate MOBILE6.2 run with taxi-specific registration data was carried out.

The ambient temperature used in the model was 50º F, as currently recommended for Manhattan locations. Inputs pertaining to inspection/maintenance, anti-tampering programs, hot/cold starts, volatility, etc., were obtained from NYCDEP. A separate MOBILE6.2 run was set up for taxis, because their mileage and registration data is different from that of other vehicles. The resulting MOBILE6.2 emission factors were combined with the appropriate average vehicular mixes assigned to each of the roadways to calculate the composite emission factors, by speed, for use in the CAL3QHC model. The emission factors for project-generated vehicles also reflect the average relative proportions of 97% autos and 3% SUVs that were observed in the field.

CO Receptors

Sensitive receptors are homes, parks, schools, or other land uses where people congregate and which would be sensitive to air quality impacts. For the purposes of air quality analysis, any point to which the public has continuous access can be deemed a sensitive receptor site. Numerous receptor points are typically modeled at each intersection to identify the points of maximum potential CO concentration. To analyze CO levels, receptor points were modeled on the corners of the affected intersections, and additional points were modeled at 20-foot intervals for a distance of 100 feet along both sides of each intersection leg. Receptors were placed at mid-sidewalk and outside the air quality mixing zone.

Modeling

The CAL3QHC model was used to determine CO concentrations. CAL3QHC is a Gaussian dispersion model which determines pollutant concentrations at specified receptor points. It accounts for CO from both free-flowing vehicles and vehicles idling at signalized intersections. Inputs to the model included Cartesian coordinates for receptors, free flow approach and departure links, and the approach links for queued vehicles at intersections. Peak hour traffic volumes, signal cycle information, composite vehicular emission factors, and adjusted saturation flow rate are also input to the model. Information on roadway parameters was obtained from the traffic study. A surface roughness of 321 cm, representing land uses in a central business district (CBD), was used.

Free-flowing traffic links are set up separately from intersection queue links. Free flow links were modeled for a distance of 1,000 feet from the intersection in each direction. The mixing zone for free flow links was equal to the width of the traveled way plus an additional 10 feet (3 meters) on each side of the roadway. For queue links, the mixing zone was limited to the width of the traveled way.

Typical worst case meteorological conditions were also incorporated into the CAL3QHC inputs. These included a mixing layer height of 1,000 meters, a wind speed of 1 meter per second, and an atmospheric stability class of D (neutral stability). Settling and deposition velocities were assumed to be 0. Each computer run covered wind angles from 0 to 360 degrees and identified the worst case wind angle for each receptor point.

Background Concentrations

Mobile source modeling of CO concentrations at receptor locations accounts solely for emissions from vehicles on the nearby streets, but not for overall pollutant levels. Therefore, *background pollutant concentrations* must be added to modeled results to obtain total pollutant concentrations at a given receptor site. The 8-hour averaging period is of primary concern, and is the only one reported in this chapter. The recommended background CO level for the 8-hour averaging period in Manhattan is 2.0 ppm for 2006.

Calculation of Total CO Concentrations

To obtain total 8-hour CO concentrations, the 1-hour modeled CO values were multiplied by a persistence factor of 0.79, then added to the 8-hour background values. The same worst case wind angle would therefore apply to both the 1-hour and 8-hour averaging periods. Only the 8-hour CO and background values are presented in the report. If no violation of the 8-hour standard occurs, no violation of the 1-hour CO standard is likely.

PM 10/2.5 Screening

NYCDEP has developed a screening analysis for potential PM2.5 impacts based on the 2002 emissions for 21 diesel-powered vehicles. If the proposed action would add 21 diesel vehicles to an intersection during a peak period, then a more detailed analysis is required to determine whether the emissions would exceed 21 diesel vehicles using 2002 emission factors. In addition, if a proposed project would induce many vehicles of other classes, and the total PM10/2.5 emissions from all of the induced vehicles are equivalent to twenty-one 2002 diesel trucks, the screen is exceeded. NYCDEP has not determined a specific number of light duty gasoline vehicles (LDGV) that would be equivalent to heavy duty diesel vehicles (HDDV), as this ratio would vary with the future year of analysis. Therefore, the ratio must be determined for each project.

The MOBILE6.2 emissions model was run for 2002 and 2006 to determine the number of background vehicles that would have PM2.5 emissions equivalent to 21 diesel vehicles[1]. The emission factors included exhaust, brake, tire, and fugitive dust emissions. Based on the vehicular mix for No-Action conditions along Worth Street and St James Place, the 2006 composite exhaust emission factor for PM2.5 would be 0.3906 grams/hour. In 2002, the a worst-case heavy duty diesel truck would generate 5.23 grams per hour of PM2.5. Therefore, 21 diesel vehicles would generate 109.8 grams of PM2.5 (21 x 2.23=109.8) during a peak hour. With the lower composite emission factor of 0.3906 grams/hour, the volume of diverted vehicles needed to generate 109.8 grams/hour would be about 333 (109.8/0.3906=333).

As stated above, approximately 333 diverted vehicles in 2006 would generate hourly PM2.5 emissions equivalent to 21 heavy duty diesel trucks in 2002. The intersections that exceed this threshold are St. James Place at St. James Street, Baxter Street at Worth Street, and Mulberry Street at Worth Street. The majority of the project-generated volume is on St. James Place and Worth Street, not the cross streets. Since these intersections are not signalized, the arterial links were included in the modeling of the three nearby signalized intersections that were modeled for CO. Therefore, PM10 and PM2.5 were modeled for 1)Park Row @ St. James Place/Chatham Square/Worth Street/Mott Street, 2)Foley Square at Worth St./Center Street, and 3) St. James Place and Madison Street. these intersections.

F. NO-ACTION CONDITION

Under the No-Action condition, the security zone installed by NYPD after 9/11 would not be in place and traffic flow patterns, including all bus routes, would be maintained. These traffic volumes reflect physical and land use changes that have occurred independent of the action. Generally, when compared to the baseline conditions, traffic in much of the network has declined due to lower demand and/or shifted demand due to street configuration changes (e.g. the construction of a unified Foley Square plaza), the absence of portions of Vesey Street, the security plans for 26 Federal Plaza and for the NYSE, and other roadway changes. There have also been traffic demand changes due to loss of office space, and conversion of office to residential space. Under 2006 No-Action conditions, however, all bus routes would be maintained on Park Row as in the baseline condition, except for the M9 which is assumed to remain on its present "diverted" route to/from Battery Park City. The background traffic and speeds associated with No-Action conditions were used to determine CO concentrations for 2006.

[1] The selected speed is not important as PM10 and PM 2.5 emissions are independent of speed.

The intersection at Foley Square and Worth Street contains the highest traffic volumes of the three intersections analyzed for No-Action. The worst case receptor point is R42, which is 60 feet south of the southeastern midpoint of the current signalized intersection. The one-hour modeled value of 2.6 ppm is equivalent to an 8-hour average of 2.1 ppm, and the total 8-hour concentration of 4.1 ppm is within the NAAQS. The worst-case wind angle of 1° shows that the highest CO concentrations would occur when the wind is blowing at an angle that captures the CO emissions from northbound queues on Foley Square.

The worst case receptor for the Park Row/Chatham Square intersection is R30, which is 40 feet north of the northeast corner. The 1-hour modeled value of 2.2 ppm is equivalent to an 8-hour value of 1.7 ppm after the 0.79 persistence factor has been applied. The total 8-hour CO level, which includes the background concentration of 2.0 ppm, is 3.7 ppm. This is within the NAAQS of 9 ppm for the 8-hour period. The wind angle of 99° indicates that the primary sources of CO for Receptor 30 are the southwest bound queues on Chatham Square.

As shown in Table 8-3, the worst-case receptor point at the intersection of St. James Place and Madison Street under No-Action Conditions is R41, which is 40 feet south of the southeast corner. The 8-hour modeled value of 0.9 ppm, with the 2.0 ppm background value, translates into an 8-hour average of 2.9 ppm, which is below the NAAQS. The wind angle of 274° for R41 carries CO emissions primarily from the northbound queue.

Table 9-3
Eight-Hour Carbon Monoxide Concentrations (ppm)

No-Action Conditions		With-Action Conditions		Difference
Foley Square/Worth Street		**Foley Square/Worth Street**		**(With-Action -No-Action)**
Receptor	42	Receptor	42	
Wind Angle	1	Wind Angles	357	
Modeled CO	2.1	Modeled CO	2.0	
Background CO	2.0	Background CO	2.0	
Total CO	4.1	Total CO	4.0	0.1
Chatham Square/Worth Street		**Chatham Square/Worth Street**		**Difference (With-Action -No-Action)**
Receptor	30	Receptor	54	
Wind Angle	99	Wind Angle	218	
Modeled CO	1.7	Modeled CO	2.5	
Background CO	2.0	Background CO	2.0	
Total CO	3.7	Total CO	4.5	0.8
St. James Place/Madison Street		**St. James Place/Madison Street**		**Difference (No-Action - With-Action)**
Receptor	41	Receptor	40	
Wind Angle	274	Wind Angle	227	
Modeled CO	0.9	Modeled CO	1.5	
Background CO	2.0	Background CO	2.0	
Total CO	2.9	Total CO	3.5	0.6

Source: Sandstone Environmental Associates, Inc.

Mobile Source PM10

Background Concentrations

The nearest PM10 monitor for the project site is the JHS 126 in Brooklyn. The annual average PM10 concentration for 2004, the most recent year for which data are available, is an annual arithmetic mean of 17 ug/m^3. In 2004, the maximum 24-hour concentration at this monitor was 47 ug/m^3. Both of these values are within the NAAQS.

PM10 Modeling Inputs

Vehicular emission factors for PM10 were obtained from EPA's MOBILE6.2 model. Inputs for running MOBILE6.2 were obtained from NYCDEP. In contrast to CO emissions, ambient temperature and the thermal states of vehicular engines do not affect the emissions of fine particulates. The MOBILE6.2 emission factors include PM10 from vehicle exhaust, sulfates, and fugitive dust. The fugitive dust component of the emission factors was calculated using formulas in EPA's AP-42 document. The MOBILE6.2 model calculates idle emissions and emissions for moving vehicles. It is not sensitive to vehicular speed or the thermal state of the engine. All speeds have the same emission factor for a given vehicular category.

The vehicular mixes used to obtain composite emission factors from MOBILE6.2 for the CO analysis also were used for the PM10 analysis. However, they were refined to account for different periods of the day. The proportion of trucks and buses from 10 pm to 6 am was reduced to account for the lower volumes of these vehicle types during the nighttime period. The composite emission factors are used in conjunction with link volumes in the CAL3QHCR model to determine pollutant concentrations.

The next step was to run the input data with the CAL3QHCR model, which is used with five years of meteorological data. Data from JFK Airport for 1991 through 1995, which was the most recent data available, was used in the model. CAL3QHCR requires traffic volumes and emission factors for each hour of the day. CAL3QHCR provides two tiers of analysis. In a Tier 1 analysis, the same traffic volumes (typically a peak hour) are used for all 24 hours throughout the day.

For this project, the more refined Tier 2 analysis was run. Traffic volumes for No-Action conditions were calculated for all relevant roadway links for each hour of the 24-hour day. This was a Pattern 1 type of analysis, which assumes that all days of the week have the same traffic pattern.

Calculation of Total PM10 Concentrations

PM10 standards are for annual and 24-hour periods. CAL3QHCR calculates 24-hour and annual concentrations for each year of meteorological data. The modeled results from CAL3QHCR were added to the background concentrations. Table 9-4 shows the projected 24-hour and annual concentrations for PM10 resulting from the CAL3QHCR Tier 2 analysis for the receptors with the highest PM10 concentrations. Since the traffic for each peak period is incorporated into the 24-hour input data, the model does not have to be run separately for individual peak periods. Results are well within the NAAQS of 150 ug/m^3 for the 24-hour period for all receptors at all three intersections.

PM 2.5 Intersection Analysis

PM 2.5 was modeled to determine whether the project would be in compliance with both the NAAQS and the NYC de minimis values. Since PM2.5 concentrations are a portion of the PM10 values, the rationale for selecting the intersections is the same as explained under the discussion for PM10.

PM2.5 Background Concentrations

The nearest PM2.5 monitor for the project site is at Canal Street in Manhattan. The average PM2.5 concentration for 2003-2005 is an annual arithmetic mean of 15.1 ug/m^3. In 2005, the maximum 24-hour concentration at this monitor was 55.9 ug/m^3. The 24-hour concentration exceeds the new NAAQS of 35 ug/m^3, and the 3-year annual average slightly exceeds the NAAQS of 15 ug/m^3. However, the impact criteria for PM2.5 is based on project-generated increments, so the background values are not used in the analysis of impacts

PM2.5 Modeling Inputs

Emission factors for PM2.5 were obtained from the MOBILE6.2 model as described under the discussion of PM10 modeling inputs. The component for fugitive dust was calculated from the formulas in AP-42 and included in the PM2.5 emission factors used for the analysis.

Table 9-4
No-Action and With-Action PM10 Concentrations (ug/m^3)

Intersection	24-Hour PM 10 (ug/m^3)			Annual PM 10 (ug/m^3)		
	No-Action	With-Action	Difference	No-Action	With-Action	Difference
Foley Square/Worth Street						
Receptor	R17	R17		R17	R28	
Modeled Value	8.47	9.25		2.75	3.35	
Background	47.0	47.0		17.0	17.0	
Total	55.47	56.25	0.78	19.75	20.35	0.6
Chatham Square/Worth Street						
Receptor	R28	R28		R50	R50	
Modeled Value	6.09	7.57		2.26	2.84	
Background	47.0	47.0		17.0	17.0	
Total	53.09	54.57	1.48	19.26	19.84	0.58
St. James Place/Madison Street						
Receptor	R18	R39		R39	R39	
Modeled Value	3.82	5.88		1.50	2.33	
Background	47.0	47.0		17.0	17.0	
Total	50.82	52.88	2.06	18.50	19.33	0.83

Source: Sandstone Environmental Associates, Inc.

PM 2.5 No-Action Conditions

The projected 24-hour concentrations for PM 2.5 at the microscale level are shown in Table 9-5. Modeling incorporated the same receptor points and CAL3QHCR Tier 2 analysis described under the CO and PM10 discussions. The highest values for No-Action conditions occurred with the 1991 meteorological data. They include a modeled concentration of 1.35 ug/m^3 for the Foley Square/Worth Street Intersection, 0.89 ug/m^3 for the Chatham Square/Worth Street intersection, and 0.56 ug/m^3 for St James Place/Madison Street

The projected annual intersection concentrations are shown on Table 9-6. The highest modeled value of 0.43 ug/m^3 occurred for the 1995 data at Receptor 40 on Foley Square/Worth Street.

PM2.5 Neighborhood Analysis

The neighborhood scale of analysis models PM2.5 concentrations at receptor points that are 15 meters from the source. Only the annual average is analyzed for the neighborhood scale analysis. Table 9-7 shows the No-Action concentrations modeled for the neighborhood analysis. Under No-Action conditions, the highest modeled value of 0.19 ug/m^3 occurs at Receptor 8 with the 1991and 1995 meteorological data.

G. WITH-ACTION CONDITION

Mobile Source CO

CO concentrations under With-Action conditions would be in compliance with both the NAAQS and the NYC de minimis standards. Table 9-3 also shows the worst-case receptors for With-Action conditions. The intersection at Foley Square and Worth Street still has the highest overall traffic volume. Under With-Action conditions, some approaches would experience a net increase while others would experience a net decrease. Despite the overall increase in traffic volume, the worse-case receiver (R42) and total 8-hour CO concentration (4.0 ppm) are the same as for No-Action conditions. The wind angle has changed slightly from 1° to 357°.

Table 9-5
24-Hour No-Action and With-Action PM2.5 Intersection Concentrations (ug/m^3)

Intersection	24-Hour PM 2.5 (ug/m^3)		
	No-Action	**With-Action**	**Difference**
Foley Square/Worth Street			
Receptor (highest No-Action and With-Action, 1991)	R17	R17	
Modeled Value	1.35	1.50	0.15
Receptor (highest increment, 1995)	R31	R31	
Modeled Value	0.17	0.36	0.19
Chatham Square/Worth Street			
Receptor (highest No-Action, 1991)	R31	R31	
Modeled Value	0.89	1.11	0.22
Receptor (highest With-Action, highest increment 1991)	R51	R51	
Modeled Value	0.56	1.19	0.63
St. James Place/Madison Street			
Receptor (highest No-Action, 1991)	R28	R28	
Modeled Value	0.56	0.69	0.13
Receptor (highest With-Action, highest increment, 1995)	R40	R40	
Modeled Value	0.40	0.93	0.53

Source: Sandstone Environmental Associates, Inc.

Table 9-6
Annual No-Action and With-Action PM2.5 Intersection Concentrations (ug/m^3)

Intersection	Annual PM 2.5 (ug/m^3)		
	No-Action	**With-Action**	**Difference**
Foley Square/Worth Street			
Receptor (highest No-Action, 1995)	R40	R40	
Modeled Value	0.43	0.43	0.00
Receptor (highest With-Action, 1991)	R28	R28	
Modeled Value	0.35	0.51	0.16
Receptor (highest increment, 1991)	R30	R30	
Modeled Value	0.20	0.39	0.19
Chatham Square/Worth Street			
Receptor (highest No-Action and With-Action, 1995)	R50	R50	
Modeled Value	0.28	0.42	0.14
Receptor (highest increment 1991)	R52	R52	
Modeled Value	0.21	0.42	0.21
St. James Place/Madison Street			
Receptor (highest No-Action and With-Action, 1995)	R39	R39	
Modeled Value	0.20	0.35	0.15
Receptor (highest increment, 1995)	R41	R41	
Modeled Value	0.19	0.35	0.16

Source: Sandstone Environmental Associates, Inc.

Table 9-7
Annual No-Action and With-Action PM2.5 Neighborhood Concentrations (ug/m^3)

Intersection	Annual PM 2.5 (ug/m^3)		
	No-Action	With-Action	Difference
Foley Square/Worth Street			
Receptor (highest No-Action and With-Action, 1991)	R 8	R 8	
Modeled Value	0.19	0.23	0.04
Receptor (highest increment, 1991)	R14	R14	
Modeled Value	0.14	0.23	0.09
Chatham Square/Worth Street			
Receptor (highest No-Action and With-Action, 1995)	R18	R18	
Modeled Value	0.13	0.20	0.07
Receptor (highest increment 1991)	R04	R04	
Modeled Value	0.04	0.12	0.08
St. James Place/Madison Street			
Receptor (highest No-Action and With-Action and highest increment , 1995)	R16	R16	
Modeled Value	0.08	0.15	0.07

Source: Sandstone Environmental Associates, Inc.

The intersection at Park Row and Chatham Square has a worse-case receptor at R54, located 80 feet southeast of the western midpoint next to St. James Place. The 8-hour CO level is 2.7 ppm. When added with the background concentration, the overall 8-hour value of 4.5 is 0.8 more than its counterpart for No-Action conditions. The worst-case wind angle shifts from 99° under the No-Action to 218° under With-Action due to a change in the major CO contributor – the westbound queues on St. James Place.

The St. James Place/Madison Street intersection has the highest increase in traffic (312 vehicles) of the three intersections modeled. The worst-case receptor changes from R41 to R40, which is 80 feet southeast of the eastern corner of the intersection. The maximum modeled 8-hour value is 1.5, resulting in a total 8-hour with background CO concentration of 3.5 ppm. The worst-case wind of 227° indicates the influence of project-generated traffic on the St. James Place southbound queue.

PM10 Analysis

Table 9-4 shows the PM10 results for With-Action conditions. Under With-Action conditions, the maximum modeled value for the 24-hour period would be 9.25 ug/m³ which would occur for Receptor 17 at Foley Square/Worth Street. After adding in the background value of 47.0 ug/m³, the maximum total concentration of 56.25 ug/m³ would be within the NAAQS of 150 ug/m³. For the annual period, the maximum value of 3.35 ug/m³ would occur at Receptor 28 at the Foley Square/Worth Street intersection. The total concentration, with the background value, would be 20.35 ug/m³. This is within the NAAQS of 50.0 ug/m³. Thus there are no significant adverse impacts.

PM2.5 Intersection Analysis

Table 9-5 shows the results for the intersection analysis of PM2.5 for the 24-hour period. The highest modeled value of 1.50 ug/m³ would occur at Receptor 17 at Foley Square/Worth Street with the 1991 meteorological data. The greatest increase in PM2.5 would occur at Receptor 51 at the Chatham Square/Worth Street intersection with the 1991 meteorological data. The maximum increment of 0.63 ug/m³ is below the de minimis criterion of 2 ug/m³.

Table 9-6 shows the annual concentrations of PM2.5 for With-Action conditions. Among the three intersections, the highest modeled value would be 0.51 ug/m³, which would occur at Receptor 28 at the Foley Square/Worth Street intersection with the 1991 meteorological data. However, the highest relative increment of 0.21 ug/m³ would occur at Receptor 52 at the Chatham Square/Worth Street intersection with the 1991 data. This is below the de minimis criterion of 0.3 ug/m³.

PM2.5 Neighborhood Analysis

Annual average concentrations also were reviewed for all receptor points for all five years of meteorological data for No-Action and With-Action conditions. As shown in Table 9-7, the highest modeled concentration was 0.23 ug/m³, and the highest increment was 0.09 ug/m³, which occurred at Receptor 14 with the 1991 meteorological data at the Foley Square/Worth Street intersection. This does not exceed the NYC de minimis criterion of 0.1 ug/m³ for the annual average.

H. CONCLUSION

The results of the analyses presented in this chapter demonstrate that the CO, PM10, and PM2.5 concentrations due to the action have not resulted in any violations of NAAQS and the de minimis criterion for the modeled pollutants.