APPENDIX F
Air Quality
and
Greenhouse Gas Emissions

Air Quality

Appendix F:

A. EFFECTS OF TRAFFIC MITIGATION MEASURES ON AIR QUALITY

Chapter 19 showed the maximum predicted carbon monoxide (CO) and particulate matter (PM_{10} and $PM_{2.5}$) concentrations for the proposed project, and concluded that the proposed project would not result in any significant adverse air quality impacts. Therefore, no air quality mitigation is required. This section considers the effects on air quality of the proposed project with implementation of the traffic mitigation measures discussed in Chapter 23, "Mitigation."

The tables presented below illustrate the effect that proposed traffic mitigation measures, developed as part of the traffic analysis for the proposed project (see Chapter 17, "Traffic and Parking"), would have on maximum predicted pollutant concentrations with the proposed project. Tables F-1 and F-2 summarize the maximum CO and PM_{10} Build and Build With Mitigation concentrations, respectively. Tables F-3 and F-4 summarize the maximum 24-hour and annual average $PM_{2.5}$ concentration increment with the mitigation measures in place, respectively.

The values shown are the highest predicted concentrations for the analyzed receptor locations. The results show that with the proposed traffic mitigation measures, future concentrations of pollutants with the proposed project would be below the National Ambient Air Quality Standards (NAAQS) for CO and PM_{10} and would not result in any significant adverse air quality impacts using the *de minimis* criteria for CO impacts or the updated interim guidance criteria for $PM_{2.5}$ impacts.

Table F-1
Future Maximum Predicted 8-Hour Average Carbon Monoxide Build and Build With Mitigation Concentrations (parts per million)

Receptor Site	Location	Time Period	8-Hour Concentration (ppm)[1]	
			Build	Build With Mitigation
1	Kent Avenue & South 3rd Street	PM	2.7	2.8
2	Kent Avenue & South 4th Street	PM	2.6	2.8
3	Wythe Avenue & South 3rd Street	PM	2.6	2.5
4	Wythe Avenue & South 4th Street	PM	2.6	2.5

Note: [1] 8-hour standard is 9 ppm.

Table F-2
Future Maximum Predicted 24-Hour Average PM_{10} Build and Build With Mitigation Concentrations ($\mu g/m^3$)

Receptor Site	Location	24-Hour Concentration[1]	
		Build	Build With Mitigation
2	Kent Avenue & South 4th Street	65.03	65.71

Note: [1] 24-hour standard is 150 $\mu g/m^3$.

Table F-3
Future Maximum Predicted 24-Hour Average $PM_{2.5}$ Concentrations Increments with Mitigation ($\mu g/m^3$)

Receptor Site	Location	24-Hour Concentration Increments[1]	
		Build	Build With Mitigation
2	Kent Avenue & South 4th Street	0.12	0.58
Note: [1]$PM_{2.5}$ interim guidance criteria—24-hour average, 2 $\mu g/m^3$ (5 $\mu g/m^3$ not-to-exceed value).			

Table F-4
Future Maximum Predicted Annual Average $PM_{2.5}$ Concentrations Increments with Mitigation ($\mu g/m^3$)

Receptor Site	Location	Annual Concentration Increments[1]	
		Build	Build With Mitigation
2	Kent Avenue & South 4th Street	0.02	0.05
Note: [1]$PM_{2.5}$ interim guidance criteria—annual (neighborhood scale), 0.1 $\mu g/m^3$.			

B. METHODOLOGY FOR WIND TUNNEL MODELING

INTRODUCTION

Based on the initial results of the AERMOD modeling analysis, a wind tunnel study was conducted to assess the potential $PM_{2.5}$ impacts from the New York Power Authority (NYPA) North 1st Street facility on the proposed project.

WIND TUNNEL TEST PROCEDURE

$PM_{2.5}$ concentrations emitted from the NYPA facility were estimated through wind tunnel tests on a scale model of the proposed project, the NYPA facility, and their surroundings. The wind tunnel data were analyzed in combination with historical hour-by-hour wind conditions and pollutant background levels.

Rowan Williams Davies & Irwin (RWDI), Inc. constructed a scale model of the proposed project and its surroundings, for the purpose of analysis in a boundary layer wind tunnel. A 1:400 scale model of the proposed project (and all surrounding buildings and structures within a 1,600-foot radius) was constructed on a circular disk. The atmospheric turbulence was simulated in the long working section of a wind tunnel by means of spires at the upwind end and roughness blocks on the tunnel floor. For each wind direction, the spires and roughness were selected to produce wind velocity profiles similar to what would be expected at the site, based on the terrain upwind of the site.

The wind tunnel tests were conducted by emitting a tracer gas at a known concentration and scaled flow rate from the NYPA facility exhaust stack using established scaling procedures. Mean concentrations of tracer gas (carbon monoxide) were measured at receptor locations by drawing samples through flush-mounted tubes leading to a bank of infrared gas analyzers. RWDI measured concentrations in the wind tunnel for 30 seconds for each speed/wind angle combination. Measurements were conducted at a wind angle increment of every 15°. The mean tracer gas concentration measured at each receptor was recorded in the form of a dilution ratio, i.e., the ratio of the known gas concentration and the measured gas concentration at receptors.

STACK PARAMETERS

The stack exhaust gas temperature and velocity, and the stack height and exit diameter, are presented in Table 19a-5 of Chapter 19, "Air Quality." The $PM_{2.5}$ emission rate used in the wind tunnel study was derived from stack tests performed at facilities operating the same gas turbine used at the NYPA facility. (PM emission data is not available from the North 1st facility, or from any of the other identical gas turbine facilities operated by NYPA, because the New York State Department of Environmental Conservation (NYSDEC) Title V permits for those facilities do not require periodic testing of PM, including $PM_{2.5}$.)

The $PM_{2.5}$ emission rate is based on the statistical average of the emission test data, consistent with the procedure outlined in the *EPA Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources* for deriving the emission factor for combustion turbines. Applying this procedure and based on the stack test data, the $PM_{2.5}$ emission rate is estimated to be 1.48 lb/hr, which is equivalent to an emission factor of 0.00355 lb/MMBtu. This emission factor includes both the filterable and condensable fractions. The filterable and condensable fractions were both assumed to be 100 percent $PM_{2.5}$.

REASONABLE WORST CASE OPERATING SCENARIO

A reasonable worst case operating scenario was developed in consultation with the New York City Department of City Planning (DCP) and the New York City Department of Environmental Protection (DEP) to estimate maximum 24-hour and annual $PM_{2.5}$ concentrations from the existing NYPA facility. Over the five-year NYPA operating period studied (2002-2006), the NYPA facility operated at an annual average capacity of approximately 20 to 30 percent. However, to estimate the maximum potential concentrations of $PM_{2.5}$, a reasonable worst case operating scenario was developed. Hourly data obtained from the EPA Clean Air Markets Division website[1] was reviewed. The data showed that the NYPA facility operates more often in the summer months and less often at other times of the year. With the exception of one occasion over the study period, the NYPA facility did not run the entire day, and on most days it did not operate at all. To approximate a reasonable worst case scenario, the daily number of hours the NYPA facility operated was compared to the daily maximum ambient temperature. Then, the maximum number of hours the NYPA facility ran within each 10°F temperature range (e.g., 50°F to 59°F) was determined. This daily maximum number of hours was then assumed for all days where the maximum temperature was within the temperature range, even if the NYPA facility ran fewer hours or not at all. Overall, the reasonable worst case operating scenario assumes the NYPA facility operates at approximately 72 percent on an annual basis, which is more than three times the average annual operation during the study period. Indeed, operations at the NYPA facility over the course of the last year have declined significantly, to less than 10 percent of full capacity. Therefore, the reasonable worst case operating scenario is considered very conservative.

HOURGAS ANALYSIS

The wind tunnel analysis employed a post-processing step using RWDI's HOURGAS software program. The HOURGAS analysis accounts for the time variation in wind conditions to predict the 24-hour and annual average $PM_{2.5}$ concentrations over the five years of meteorological data

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[1] http://camddataandmaps.epa.gov/gdm/index.cfm?fuseaction=emissions.wizard

considered. This was achieved by calculating the appropriate dilution factor for each hour, based on the wind speed and direction during that hour from the LaGuardia Airport meteorological station over a period of five years (2002 to 2006). The actual dilution factor for a specific wind speed and direction was calculated by interpolating the data for the nearest wind speed and direction.

RECEPTORS

Receptors were placed to represent the general impacts over a broad area of the proposed project's building façades. On Site A, the highest residential floors would be at an elevation of approximately 110 feet, and floors above this height would be for commercial or community facility use with inoperable windows and no air intakes. A number of receptors were also placed at ground-level, near the base of proposed buildings, and in Grand Ferry Park.

C. ANALYSIS OF TEMPORARY BOILERS STACKS ON REFINERY

For the air quality analysis of the Refinery, the build condition assumed that there would be no boiler stacks on the roof of this building, and the boiler installation serving the Refinery would be vented to Site C to avoid potential significant impacts with the completion of the proposed project. However, as a contingency, if the construction of the Refinery were to occur before Site C is completed, there would be a temporary boiler exhaust on the roof of the Refinery, until the completion of Site B. Therefore, a stationary source analysis was conducted to evaluate potential impacts from the proposed project with the temporary Refinery boilers.

METHODOLOGY FOR PREDICTING POLLUTANT CONCENTRATIONS

Any boilers installed to serve the Refinery would utilize natural gas exclusively. Stack exhaust parameters and emission estimates for the proposed boiler installation were conservatively estimated. The boiler fuel usage and capacity was obtained from conceptual design information. The proposed boiler stack was assumed to exhaust to a single location on the tallest portion of the Refinery. Emissions rates were calculated based on emissions factors obtained from the EPA *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*. PM_{10} and $PM_{2.5}$ emissions include both the filterable and condensable fractions. Table F-5 presents the stack parameters and emission rates used in the analysis for the temporary Refinery. Stack parameters and emission rates for Sites C, D, and E are also included. Parameters for Sites A and B were not included since this analysis was performed to analyze the temporary condition when the Refinery would be constructed, but these buildings would not be constructed yet.

Table F-5
Boiler Stack Parameters and Emission Rates

Parameter		Development			
		Site C[3]	Site D	Site E	Refinery
Building Size (gsf)		587,668	330,592	354,437	394,800
Building Height (ft)		399	297	148	195
Stack Exhaust Temp. (°F)		300	300	300	300
Stack Exhaust Height (ft)		400	330.7	157	220
Stack Exhaust Flow (ACFM)[1] [2]		12,723	6,185	6,185	7,377
Stack Exhaust Velocity (ft/s) [2]		30	21	21	30
Lb/hr[2]	NOx	0.537	0.302	0.324	0.361
	CO	2.351	1.322	1.418	1.176
	$PM_{2.5}$	0.213	0.120	0.128	0.106
	PM_{10}	0.213	0.120	0.128	0.106

Notes:
(1) ACFM = actual cubic feet per minute.
(2) Emission rates and stack parameters are based on 100 percent load operation (per unit). Emissions at other loads were estimated by scaling the emission rates and exhaust flow proportionate to the load.
(3) Site C only has emissions from it's HVAC systems and does not include the Refinery in this analysis.
Reference:
Emission factors are based on AP-42, while stack parameters are based on conceptual design data.

Since the boilers would operate primarily during colder periods, the annual impact analysis used historical monthly weather data for New York City to adjust the boiler load for each month of the year to approximate the average monthly boiler demand.

Multiple scenarios were modeled to estimate emissions and predict impacts. The boilers would be capable of operating at various loads depending on the heating and hot water demands of the proposed development program's buildings. Therefore, boiler operations were modeled at loads of 25, 50, 75, and 100 percent to calculate impacts over a full range of operating conditions. The highest modeled scenario was reported for each pollutant.

The same methodology used for the analysis of the proposed project was used for the temporary refinery HVAC modeling analysis, including use of the same dispersion model, meteorological data, receptor network, and background concentrations (see Chapter).

THE FUTURE WITH THE PROPOSED PROJECT

Table F-6 shows maximum predicted concentrations for NO_2, CO, and PM_{10} from the proposed project with the temporary refinery HVAC system. As shown in the table, the maximum concentrations from stack emissions, when added to ambient background levels, are well below the NAAQS.

Table F-6
Future Maximum Modeled Pollutant Concentrations from the Proposed Project ($\mu g/m^3$)

Pollutant	Averaging Period	Concentration Due to Stack Emission	Maximum Background Concentration	Modeled Load Condition	Total Concentration	Standard
NO_2[1]	Annual	0.89	71.5	25%	72.4	100
CO	1-Hour	514.9	4,851	50%	5,366	40,000
	8-Hour	88.1	2,863	100%	2,951	10,000
PM_{10} [2]	24-hour	3.0	60	100%	63.0	150

Notes:
[1] NO_2 impacts were estimated using a NO_2/NO_x ratio of 0.55.
[2] EPA revoked the annual NAAQS for PM_{10}, effective December 18, 2006.

The air quality modeling analysis also determined the highest predicted increase in 24-hour and annual average $PM_{2.5}$ concentrations from the proposed project HVAC systems with the temporary boiler stacks located at the Refinery. As shown in Table F-7, the maximum 24-hour incremental impacts at any discrete receptor location would be less than the applicable interim guidance criterion of 2 μg/m^3. On an annual basis, the projected $PM_{2.5}$ impacts would be less than the applicable interim guidance criterion of 0.3 μg/m^3 for local impacts, and the DEP interim guidance criterion of 0.1 μg/m^3 for neighborhood scale impacts. Therefore, no potential significant stationary source air quality impacts related to $PM_{2.5}$ are expected to occur with the proposed project's temporary refinery HVAC system.

Table F-7
Future Maximum Predicted $PM_{2.5}$ Concentrations

Pollutant	Averaging Period	Maximum Concentration	Modeled Load Condition	Threshold Concentration (μg/m^3)
$PM_{2.5}$	24-hour	1.98	100%	5/2
	Annual (discrete)	0.12	25%	0.3
	Annual (neighborhood scale)	0.01	25%	0.1

As discussed in Chapter 19, to preclude the potential for significant adverse air quality impacts from the proposed project with the temporary Refinery, the Restrictive Declaration would have the following requirements for the proposed development at the Refinery in the event that the construction of the Refinery were to occur before the completion of Site C:

Block 2414, Lot 1 (Refinery). Heating, ventilating, and air conditioning stack(s) must utilize natural gas, to avoid any potential significant air quality impacts. Boiler exhaust stacks on this property must have a minimum exhaust height of 220 feet above Brooklyn Datum and be located at least 743 feet from the lot line facing South 5th Street to avoid any potential significant air quality impacts. Upon completion of Site B, no boiler exhausts stacks are permitted on this property.

With these restrictions, emissions from the boiler exhaust stacks would not result in any significant adverse air quality impacts. ✷

Greenhouse Gas Emissions

ENERGY CONSUMPTION SUMMARY By Cosentini Associates

		Electrical Cons. (kWh)	Gas Cons. (kBtu)	Water Cons. (1000 gallons)	% of Total Building Energy	Total Building Energy (kBtu/yr)	Total Source Energy (kBtu/yr)
Base:							
Primary heating							
	Primary heating	1,391,109	69,944,264	0	34.6 %	74,692,118	87,870,528
	Other Htg Accessories	770,470	0	0	1.2 %	2,629,614	7,889,630
	Heating Subtotal	**2,161,579**	**69,944,264**	**0**	**35.9 %**	**77,321,731**	**95,760,152**
Primary cooling							
	Cooling Compressor	8,075,812	0	0	12.8 %	27,562,745	82,696,504
	Tower/Cond Fans	1,107,296	0	844	1.8 %	3,779,202	11,338,738
	Condenser Pump	0	0	0	0.0 %	0	0
	Other Clg Accessories	1,796	0	0	0.0 %	6,129	18,388
	Cooling Subtotal....	**9,184,904**	**0**	**844**	**14.5 %**	**31,348,077**	**94,053,632**
Auxiliary							
	Supply Fans	7,908,478	0	0	12.5 %	26,991,635	80,983,000
	Pumps	0	0	0	0.0 %	0	0
	Stand-alone Base Utilities	0	0	0	0.0 %	0	0
	Aux Subtotal....	**7,908,478**	**0**	**0**	**12.5 %**	**26,991,635**	**80,983,000**
Lighting							
	Lighting	**23,426,548**	**0**	**0**	**37.1 %**	**79,954,807**	**239,888,398**
Totals:		42,681,508	69,944,264	844	100.0 %	215,616,251	510,685,184