A. INTRODUCTION

The North River Wastewater Treatment Plant (the Plant) is owned and operated by the New York City Department of Environmental Protection (DEP) and serves approximately 550,000 people on the west side of Manhattan. The Plant is a secondary treatment plant with a design dry weather flow of 170 million gallons per day (MGD), and a peak wet weather flow of 340 MGD, located in the Borough of Manhattan, at 725 West 135th Street, New York, NY. It has a combination of wastewater and stormwater collected along the west side of Manhattan treated through a series of wet-stream treatment and solid-stream processing systems that require significant heat and power. One by-product of the solid-stream processing is methane gas, which can be used to generate heat, power, or both.

The plant facilities include wastewater unit processes and sludge storage and handling. The unit processes at the plant consist of screening, primary settling, grit removal, activated sludge treatment by step aeration, final settling, and disinfection by chlorination. The sludge handling at the facility includes gravity thickening, anaerobic digestion, and sludge dewatering.

The Plant currently implements cogeneration of heat and power through direct drive engine driven pumps and aeration blowers that are necessary for providing treatment. The existing tri-fuel pump and blower engines (ten total) are nearing the end of their useful life and are due for a major overhaul or replacement. The proposed project is the replacement of the old existing engines with electrification of the Plant and the installation of cogeneration facilities to improve operations and reliability, reduce greenhouse gas emissions (GHG), and provide cost effective solutions over the existing engine driven pump and blower systems.

The existing facility currently has five (5) 1,700 brake horsepower (bhp) Enterprise model DGSR-46 compression ignition reciprocating engines used to provide power to operate the main sewage pumps and five (5) 940 bhp Mirrlees Blackstone KP5 Major compression ignition reciprocating engines used to provide power to operate the air blowers for the aeration tanks. All five of the pump engines are operational; however, only three of the five blower engines are operational. The existing engines operate on digester gas with #2 fuel oil as the pilot fuel, natural gas with #2 fuel oil as the pilot fuel, or on 100% #2 fuel oil.

The proposed cogeneration plant will replace all ten (10) of the existing tri-fuel pump and blower engines with five (5) new 3.37 megawatt (MW) spark ignited reciprocating engine generators that will be interconnected with the Con Edison electrical supply. Four of the five engines would operate (13.5 MW maximum), with the fifth as a standby unit. The engines would operate on both digester gas and natural gas. Fuel oil will no longer be used and is not required for pilot fuel. Prior to being supplied to the engines, the digester gas will be treated to remove particulates, moisture, sulfuric acid and siloxanes. The waste gas from the pretreatment system will be sent to a thermal oxidizer and would exhaust out one of the existing blower engine stacks. Oxidation catalysts will be installed to treat the engine exhaust to meet plant specific

requirements for non-criteria pollutant emissions, including formaldehyde. Waste Heat recovery equipment and associated piping sized for the new facility will be installed to improve overall system efficiency. With the installation of the cogeneration plant, the facility's two existing emergency turbine generators will be removed. The engines would be housed in the existing engine room and would exhaust through the existing pump engine stacks, with physical stack parameters such as location, height and diameter remaining unchanged.

In addition to the new cogeneration plant, the facility may install four (4) 2 MW diesel emergency generators during the construction period to provide back-up power to the Plant during emergencies. Once the cogeneration plant is installed and operating, these four emergency generators would be removed.

This chapter describes the methodology and assumptions that were utilized to determine the air quality impacts from the proposed project and compares the impacts to applicable regulatory requirements. Maximum predicted concentrations from the criteria pollutants: nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO), and particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), were compared to the National Ambient Air Quality Standards (NAAQS). Maximum predicted incremental concentrations from particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) were compared to the DEC and DEP Interim guidance thresholds. Maximum predicted concentrations of non-criteria pollutants (VOCs and HAP) emissions, including formaldehyde, from the proposed project were compared to the DEC's Air Guide-1 Short-term and Annual Guideline Concentrations (SGCs and AGCs).

The proposed project is not expected to significantly alter traffic conditions. Therefore, a quantified assessment of on-street mobile source emissions is not warranted.

A modified Title V permit application will be submitted to the NYSDEC for the proposed project which will show compliance with all federal and state regulations such as Non-attainment New Source Review (NANSR), Prevention of Significant Deterioration (PSD), New Source Performance Standards (NSPS), Reasonably Available Control Technology (RACT) for NOx emissions, and Best Available Control Technology (BACT) for the control of non-criteria pollutants and compliance with Air Guide-1.

The modeling procedures follow the Air Quality Modeling Protocol submitted to DEP on July 17, 2012 and the New York State Department of Environmental Conservation (NYSDEC) approved Air Guide-1 protocol for the existing facility[1].

CONCLUSIONS

As discussed below, the maximum predicted pollutant concentrations and $PM_{2.5}$ increments in the future with the proposed project would be below the corresponding ambient air quality standards and guidance thresholds. Therefore, the proposed project would not have significant adverse impacts from the cogeneration facility.

[1] April 19, 2010 approval letter from Sam Lieblich, P.E., Regional Air Pollution Control Engineer, NYSDEC to Vincent Sapienza, P.E., Deputy Commissioner, Bureau of Wastewater Treatment, NYCDEP.

B. POLLUTANTS FOR ANALYSIS

Ambient air quality is affected by air pollutants produced by both motor vehicles and stationary sources. Emissions from motor vehicles are referred to as mobile source emissions, while emissions from fixed facilities are referred to as stationary source emissions. Ambient concentrations of carbon monoxide (CO) are predominantly influenced by mobile source emissions. Particulate matter (PM), volatile organic compounds (VOCs), and nitrogen oxides (nitric oxide, NO, and nitrogen dioxide, NO_2, collectively referred to as NO_x) are emitted from both mobile and stationary sources. Fine PM is also formed when emissions of NO_x, sulfur oxides (SO_x), ammonia, organic compounds, and other gases react or condense in the atmosphere. Emissions of sulfur dioxide (SO_2) are associated mainly with stationary sources, and sources utilizing non-road diesel such as diesel trains, marine engines, and non-road vehicles (e.g., construction engines). On-road diesel vehicles currently contribute very little to SO_2 emissions since the sulfur content of on-road diesel fuel, which is federally regulated, is extremely low. Ozone is formed in the atmosphere by complex photochemical processes that include NO_x and VOCs. These pollutants are regulated by the U.S. Environmental Protection Agency (EPA) under the Clean Air Act, and are referred to as 'criteria pollutants'.

CARBON MONOXIDE

CO, a colorless and odorless gas, is produced in the urban environment primarily by the incomplete combustion of gasoline and other fossil fuels. In urban areas, approximately 80 to 90 percent of CO emissions are from motor vehicles. Since CO is a reactive gas which does not persist in the atmosphere, CO concentrations can 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.

CO emissions were evaluated from the plant's combustion sources in the future with the proposed project.

NITROGEN OXIDES, VOCS, AND OZONE

NO_x are of principal concern because of their role, together with VOCs, as precursors in the formation of ozone. Ozone is formed through a series of reactions that take place in the atmosphere in the presence of sunlight. Because the reactions are slow, and occur as the pollutants are advected downwind, elevated ozone levels are often found many miles from sources of the precursor pollutants. The effects of NO_x and VOC emissions from all sources are therefore generally examined on a regional basis. The contribution of any action or project to regional emissions of these pollutants would include any added stationary or mobile source emissions.

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

Potential NO_2 concentrations were analyzed from the plant's combustion sources in the future with the proposed project.

LEAD

Airborne lead emissions are currently associated principally with industrial sources. Effective January 1, 1996, the Clean Air Act (CAA) banned the sale of the small amount of leaded fuel that was still available in some parts of the country for use in on-road vehicles, concluding a 25-year effort to phase out lead in gasoline. Even at locations in the New York City area where traffic volumes are very high, atmospheric lead concentrations are far below the 3-month average national standard of 0.15 micrograms per cubic meter ($\mu g/m^3$).

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

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

PM is a broad class of air pollutants that includes discrete particles of a wide range of sizes and chemical compositions, as either liquid droplets (aerosols) or solids suspended in the atmosphere. The constituents of PM are both numerous and varied, and they are emitted from a wide variety of sources (both natural and anthropogenic). Natural sources include the condensed and reacted forms of naturally occurring VOC; salt particles resulting from the evaporation of sea spray; wind-borne pollen, fungi, molds, algae, yeasts, rusts, bacteria, and material from live and decaying plant and animal life; particles eroded from beaches, soil, and rock; and particles emitted from volcanic and geothermal eruptions and from forest fires. Naturally occurring PM is generally greater than 2.5 micrometers in diameter. Major anthropogenic sources include the combustion of fossil fuels (e.g., vehicular exhaust, power generation, boilers, engines, and home heating), chemical and manufacturing processes, all types of construction, agricultural activities, as well as wood-burning stoves and fireplaces. PM also acts as a substrate for the adsorption (accumulation of gases, liquids, or solutes on the surface of a solid or liquid) of other pollutants, often toxic and some likely carcinogenic compounds.

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

Potential PM_{10} and incremental $PM_{2.5}$ concentrations from the future with the proposed project were evaluated.

SULFUR DIOXIDE

SO_2 emissions are primarily associated with the combustion of sulfur-containing fuels (oil and coal). Monitored SO_2 concentrations in New York City are lower than the current national standards. Due to the federal restrictions on the sulfur content in diesel fuel for on-road vehicles, no significant quantities are emitted from vehicular sources.

Digester and natural gas will be combusted in the new cogeneration engines and in the existing boilers in the future with the proposed project. Fuel oil will no longer be utilized, except for ultra low sulfur diesel (ULSD) fuel oil in the emergency turbines and engines. However, an analysis was performed to determine potential SO_2 concentrations in the future with the proposed project.

NONCRITERIA POLLUTANTS

In addition to criteria pollutants, New York State also seeks to control the ambient levels of air toxics through the use of recommended guideline concentrations in the New York Code, Rules and Regulations (6 NYCRR Part 212). These "non-criteria air pollutants" include carcinogens, as well as non-carcinogenic compounds and irritants. NYSDEC provides 1-hour and annual average guideline concentrations called Short-Term Guideline Concentrations (SGCs) and Annual Guideline Concentrations (AGCs) for these compounds and describes the methodology for assessing the impact due to air toxic emissions in *Air Guide-1: Guidelines for the Control of Toxic Air Contaminants* (DAR-1, NYSDEC, 1997).

As discussed in NYSDEC's Air Guide-1, the "predicted ambient impacts are compared with guideline values to assess the acceptability of a proposed new source." The word guideline is stressed in NYSDEC's Air Guide-1 because these values were developed to aid in the regulatory decision-making process. Annual guideline concentrations in particular, are developed to protect the public health from the effects associated with long-term continuous, exposure to a contaminant. Although these guidelines are based on the best professional assessments of currently available toxicological data, they have not undergone the rigorous regulatory scrutiny that would be afforded a proposed Federal or State standard. New York State has not proposed adoption of these "guideline values" as standards for several very practical reasons. As noted in Air Guide-1:

- If adopted as standards, they would be difficult to modify as new toxicological data become available;
- There would be no flexibility in the application of standards to allow for the most current toxicological information;
- A significant portion of the AGCs and SGCs are interim guidelines based on occupational values and do not reflect the extensive toxicological review necessary to establish a standard; and
- For many contaminants, new standards might have to be adopted before any permitting decisions could be made.

Therefore, the use of guideline values in place of adoption "standards" allows the State to make essential regulatory decisions protecting public health and the environment in a timely, effective manner while considering the most current toxicological information.

Under an environmental review, if there are predicted exceedances of SGCs or AGCs on the surrounding community from the exhaust emissions of a facility, including the background concentrations where such data are available, an assessment of the potential control measures and/or modifications that would be required to eliminate the predicted exceedances resulting from the incremental impact of the project would have to be addressed. New York State regulations require that a Best Available Control Technology (BACT) analysis be performed when the AGC based on a one-in-million risk level for toxic non-criteria pollutants is exceeded by a factor less than 10 due to emissions from a stationary source. The AGC cannot be exceeded by a factor greater than 10.

This includes an assessment on a case-by-case basis of:

- Process, fuels, and raw materials available to be used;
- Engineering aspects of the application of various types of control technology, which have been adequately demonstrated;
- Process and fuel changes;
- Respective cost of the application of all such control technologies, process changes, alternative fuels, etc.; and
- Applicable State and Federal emission standards.

The SGC and AGC values from *Air Guide-1* tables (*DAR-1 AGC/SGC Tables)* and additional NYSDEC guidance (October, 2010) were used in the analysis. The total non-criteria pollutant concentrations were compared to the SGC and AGCs.

C. AIR QUALITY REGULATIONS, STANDARDS, AND BENCHMARKS

NATIONAL AND STATE AIR QUALITY STANDARDS

As required by the Clean Air Act (CAA), primary and secondary National Ambient Air Quality Standards (NAAQS) have been established for six major air pollutants: CO, NO_2, ozone, respirable PM (both $PM_{2.5}$ and PM_{10}), SO_2, and lead. The primary standards represent levels that are requisite to protect the public health, allowing an adequate margin of safety. The secondary standards are intended to protect the nation's welfare, and account for air pollutant effects on soil, water, visibility, materials, vegetation, and other aspects of the environment. The primary and secondary standards are the same for NO_2 (annual), ozone, lead, and PM, and there is no secondary standard for CO and the 1-hour NO_2 standard. The NAAQS are presented in **Table D-1**. The NAAQS for CO, annual NO_2, and 3-hour SO_2 have also been adopted as the ambient air quality standards for New York State, but are defined on a running 12-month basis rather than for calendar years only. New York State also has standards for total suspended particulate matter (TSP), settleable particles, non-methane hydrocarbons (NMHC), 24-hour and annual SO_2, and ozone which correspond to federal standards that have since been revoked or replaced, and for the non-criteria pollutants beryllium, fluoride, and hydrogen sulfide (H_2S).

EPA has revised the NAAQS for PM, effective December 18, 2006. The revision included lowering the level of the 24-hour $PM_{2.5}$ standard from 65 $\mu g/m^3$ to 35 $\mu g/m^3$ and retaining the level of the annual standard at 15 $\mu g/m^3$. The PM_{10} 24-hour average standard was retained and the annual average PM_{10} standard was revoked. EPA recently announced a final decision to lower the primary annual-average standard from 15 $\mu g/m^3$ to 12 $\mu g/m^3$, effective March 2013.

EPA has also revised the 8-hour ozone standard, lowering it from 0.08 to 0.075 parts per million (ppm), effective as of May 2008. On January 6, 2010, EPA proposed a change in the 2008 ozone NAAQS, lowering the primary NAAQS from the current 0.075 ppm level to within the range of 0.060 to 0.070 ppm. EPA is also proposing a secondary ozone standard, measured as a cumulative concentration within the range of 7 to 15 ppm-hours aimed mainly at protecting sensitive vegetation. A final decision on this standard has been postponed but is expected to occur in 2013.

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

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

Pollutant	Primary		Secondary	
	ppm	µg/m^3	Ppm	µg/m^3
Carbon Monoxide (CO)				
8-Hour Average [1]	9	10,000	None	
1-Hour Average [1]	35	40,000		
Lead				
Rolling 3-Month Average [2]	NA	0.15	NA	0.15
Nitrogen Dioxide (NO_2)				
1-Hour Average [3]	0.100	189	None	
Annual Average	0.053	100	0.053	100
Ozone (O_3)				
8-Hour Average [4,5]	0.075	150	0.075	150
Respirable Particulate Matter (PM_{10})				
24-Hour Average [1]	NA	150	NA	150
Fine Respirable Particulate Matter ($PM_{2.5}$)				
Annual Mean [6]	NA	12	NA	15
24-Hour Average [7]	NA	35	NA	35
Sulfur Dioxide (SO_2) [8]				
1-Hour Average[9]	0.075	196	NA	NA
Maximum 3-Hour Average [1]	NA	NA	0.50	1,300

Notes:

ppm – parts per million
µg/m^3 – micrograms per cubic meter
NA – not applicable

All annual periods refer to calendar year.

PM concentrations (including lead) are in µg/m^3 since ppm is a measure for gas concentrations. Concentrations of all gaseous pollutants are defined in ppm and approximately equivalent concentrations in µg/m^3 are presented.

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

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

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

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

NAAQS ATTAINMENT STATUS AND STATE IMPLEMENTATION PLANS

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

In 2002, EPA re-designated New York City as in attainment for CO. The Clean Air Act requires that a maintenance plan ensure continued compliance with the CO NAAQS for former non-attainment areas. New York City is also committed to implementing site-specific control measures throughout the city to reduce CO levels, should unanticipated localized growth result in elevated CO levels during the maintenance period.

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

On December 17, 2004, EPA took final action designating the five New York City counties and Nassau, Suffolk, Rockland, Westchester, and Orange Counties as a $PM_{2.5}$ non-attainment area under the Clean Air Act due to exceedance of the annual average standard. Based on recent monitoring data (2006-2011), annual average concentrations of $PM_{2.5}$ in New York City no longer exceed the annual standard. EPA has determined that the area has attained the 1997 annual $PM_{2.5}$ NAAQS, effective December 15, 2010. Although not yet a redesignation to attainment status, this determination removed further requirements for related SIP submissions. New York State submitted a redesignation request and maintenance plan to EPA in February 2013. As stated earlier, EPA has recently lowered the annual average primary standard to 12 $\mu g/m^3$. EPA will make initial attainment designations by December 2014. Based on analysis of 2009-2011 monitoring data, it is likely that the region will be in attainment for the new standard.

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

Nassau, Rockland, Suffolk, Westchester, Lower Orange County Metropolitan Area (LOCMA), and the five New York City counties had been designated as a severe non-attainment area for

ozone (1-hour average standard). In November 1998, New York State submitted its *Phase II Alternative Attainment Demonstration for Ozone*, which was finalized and approved by EPA effective March 6, 2002, addressing attainment of the 1-hour ozone NAAQS by 2007. The 1-hour standard was revoked in 2004 when it was replaced by the 8-hour ozone standard, but certain further requirements remained ('anti-backsliding'). On December 7, 2009, EPA determined that the Poughkeepsie nonattainment area (Dutchess, Orange, Ulster, and Putnam counties) has attained the 1-hour standard. On June 18, 2012, EPA determined that the New York Metropolitan Area (NYMA) has also attained the standard. Although not yet a redesignation to attainment status, this determination removes further requirements under the 1-hour standard.

Effective June 15, 2004, EPA designated these same counties as moderate non-attainment for the 1997 8-hour average ozone standard. On February 8, 2008, NYSDEC submitted final revisions to the SIP to EPA to address the 1997 8-hour ozone standard. On June 18, 2012, EPA determined that the Poughkeepsie and the NY-NJ-CT areas has attained the 1997 8-hour ozone NAAQS (0.08 ppm). Although not yet a redesignation to attainment status, this determination removes further requirements under the 1997 8-hour standard.

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

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

EPA has established a 1-hour SO_2 standard, replacing the former 24-hour and annual standards, effective August 23, 2010. Based on the available monitoring data, all New York State counties currently meet the 1-hour standard. Additional monitoring will be required. EPA plans to make final attainment designations in 2013. SIPs for nonattainment areas will be due by June 2015.

DETERMINING THE SIGNIFICANCE OF AIR QUALITY IMPACTS

The significance of a predicted consequence of a project (i.e., whether it is material, substantial, large, or important) should be assessed in connection with its setting (e.g., urban or rural), its probability of occurrence, its duration, its irreversibility, its geographic scope, its magnitude, and the number of people affected. In terms of the magnitude of air quality impacts, any action predicted to increase the concentration of a criteria air pollutant to a level that would exceed the concentrations defined by the NAAQS (see Table D-1) would be deemed to have a potential significant adverse impact. In addition, in order to maintain concentrations lower than the NAAQS in attainment areas, or to ensure that concentrations will not be significantly increased in non-attainment areas, threshold levels have been defined for certain pollutants; any action predicted to increase the concentrations of these pollutants above the thresholds would be deemed to have a potential significant adverse impact, even in cases where violations of the NAAQS are not predicted.

$PM_{2.5}$ INTERIM GUIDANCE CRITERIA

NYSDEC has published a policy to provide interim direction for evaluating $PM_{2.5}$ impacts[1]. This policy applies only to facilities applying for permits or major permit modifications under SEQRA that emit 15 tons of PM_{10} or more annually. The policy states that such a project will be deemed to have a potentially significant adverse impact if the project's maximum impacts are predicted to increase $PM_{2.5}$ concentrations by more than 0.3 µg/m^3 averaged annually or more than 5 µg/m^3 on a 24-hour basis. Projects that exceed either the annual or 24-hour threshold will be required to prepare an Environmental Impact Statement (EIS) to assess the severity of the impacts, to evaluate alternatives, and to employ reasonable and necessary mitigation measures to minimize the $PM_{2.5}$ impacts of the source to the maximum extent practicable.

In addition, New York City uses interim guidance criteria for evaluating the potential $PM_{2.5}$ impacts for projects subject to CEQR. The interim guidance criteria currently employed for determination of potential significant adverse $PM_{2.5}$ impacts under CEQR are as follows:

- 24-hour average $PM_{2.5}$ concentration increments that are predicted to be greater than 5 µg/m^3 at a discrete receptor location would be considered a significant adverse impact on air quality under operational conditions (i.e., a permanent condition predicted to exist for many years regardless of the frequency of occurrence);
- 24-hour average $PM_{2.5}$ concentration increments that are predicted to be greater than 2 µg/m^3 but no greater than 5 µg/m^3 would be considered a significant adverse impact on air quality based on the magnitude, frequency, duration, location, and size of the area of the predicted concentrations;
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.1 µg/m^3 at ground level on a neighborhood scale (i.e., the annual increase in concentration representing the average over an area of approximately 1 square kilometer, centered on the location where the maximum ground-level impact is predicted for stationary sources; or at a distance from a roadway corridor similar to the minimum distance defined for locating neighborhood scale monitoring stations); or
- Annual average $PM_{2.5}$ concentration increments that are predicted to be greater than 0.3 µg/m^3 at a discrete receptor location (elevated or ground level).

Actions under CEQR predicted to increase $PM_{2.5}$ concentrations by more than the above interim guidance criteria will be considered to have a potential significant adverse impact. The *CEQR Technical Manual* recommends that actions subject to CEQR that fail the interim guidance criteria prepare an EIS and examine potential measures to reduce or eliminate such potential significant adverse impacts.

The proposed project's annual emissions of PM_{10} are estimated to be below the 15-ton-per-year threshold under NYSDEC's $PM_{2.5}$ policy guidance. However, the NYCDEP's interim guidance criteria has been used to evaluate the significance of predicted incremental concentrations of the proposed project on $PM_{2.5}$ concentrations and determine the need to minimize particulate matter emissions from the proposed project.

[1] CP33/Assessing and Mitigating Impacts of Fine Particulate Emissions, NYSDEC 12/29/2003.

D. METHODOLOGY

The Plant would provide electric generating cogeneration facilities to improve operations and reliability, reduce greenhouse gas emissions, and provide cost effective solutions over the existing tri-fuel engine driven pump and blower systems.

EMISSION SOURCES AND STACK PARAMETERS

COGENERATION FACILITY

The modeling analysis is based on the largest engine configuration under consideration by the design team: five 3.37 MW MWM TCG 2032 V16 (MWM) spark ignited reciprocating engine generators for a total installed capacity of 16.85 MW.

Under normal operating conditions, the facility is only expected to operate between 7.5 MW and 8.5 MW, with supplemental electricity (approximately 1.5 MW) provided by Con-Edison for a total operating capacity between 9 MW and 10 MW to power the Plant. The facility's operating capacity under normal operating conditions can be achieved with three out of the five MWM engines operating at less than 100 % load. In addition, to decrease maintenance on the engines and increase the engine's useful life, the facility is expected to operate the engines at a load factor between 75% and 90% capacity (7.6 MW to 9.1 MW). Three 3.37 MW engines at 100% load is 10.1 MW; more than sufficient for normal operating conditions.

During wet-weather events that usually occur approximately 20 or 30 days out of the year, the facility may need up to an additional 2 MW (11 MW to 12 MW total capacity) in order to start-up the fourth main sewage pump. In order to achieve the additional 2MW, four of the five MWM engines would need to operate, for a maximum total of 13.5 MW. This situation is considered an emergency condition since supplemental power from Con Ed would also need to be down. However, for the purposes of the short-term modeling analysis, it is assumed that four out of the five installed engines would operate at 100% load (13.5 MW maximum), with the fifth engine as a standby unit.

Due to the nature of electricity generation, the proposed facility may be operated on a non-continuous basis, and at varying loads. Engine operating loads at 100 percent load, 75 percent load, and 50 percent load were considered in the air quality analysis in order to determine the maximum potential impacts.

The engines would operate on both digester gas and natural gas. Fuel oil will no longer be used and is not required for pilot fuel.

For the annual modeling analysis, a reasonable worst-case operating scenario was assumed, based on a conservative total of 735,380 mmBtu/yr annual heat input capacity from both digester gas and natural gas consumption (approximately 10.4 MW annually). This future annual total is based on estimates summarized in the Feasibility Study[1] and verified by the design team. Maximum annual digester gas consumption is estimated as 358,240 mmBtu/yr (based on 60% VSS destruction), with the balance from natural gas consumption (to support the remaining power gap).

The proposed project will also include pretreatment of the digester gas prior to being sent to the engines. The waste gas, about 0.6 million standard cubic feet per day (mmscfd), would be sent to a thermal oxidizer and exhausted out one of the plant's existing blower engine stacks.

[1] Draft February 2012 Investment Grade Feasibility Study for Cogeneration at the North River WWTP.

Source Parameters

The cogeneration facility engines would be housed in the existing engine room and would exhaust through the existing pump engine stacks, with physical stack parameters such as location, height and diameter remaining unchanged. Stack exhaust data such as exit velocity and temperature were obtained from the vendor and modeled to determine the maximum potential pollutant concentrations for the future with the proposed project. The analysis was performed for the whole system. Consistent with the modeling performed for the existing facility, the analysis assumed one collocated stack for both the short-term and annual modeling analyses.

Table D-2 provides a summary of the stack exhaust parameters for the proposed cogeneration facility.

Table D-2
Stack Exhaust Parameters for the Proposed Cogeneration Facility

Parameter	Cogeneration Engines	Thermal Oxidizer
Number of Units	4 operating at 100% load and 1 standby for the short-term analyses 5 operating at a reasonable worst-case load for the annual average analyses	1
Size	3.37 MW	8.85 mmBtu/hr
Stack Height (above grade) (feet)(1)	161	161
Stack Diameter (inches)	23.5	23.5
Stack Exhaust Temperature (F)(2)	356	1600
Stack Exhaust Velocity (feet per second)(3)	71.85	8.85

Notes:

(1) Cogeneration engines exhausting through the existing pump engine stacks. Thermal oxidizer exhausting through an existing blower engine stack. Grade elevation is 5 feet. The height of the rooftop park is 54 feet above grade and the height of the stacks above the park is 107 feet.

(2) Stack exhaust temperature for the cogeneration engines was provided by the vendor, which is the minimum exhaust temperature after heat recovery. Stack exhaust temperature and flow for the thermal oxidizer were also an estimate of 1600 acfm at 1600 F based on vendor information.

(3) Stack exhaust velocity for the cogeneration engines was based on a stack flow rate of 12,985 acfm at 356 F provided by the vendor.

Table D-3 provides a summary of the short-term and annual pollutant emission rates for the cogeneration facility. Emission rates for NOx, CO, VOC, SO_2, PM_{10}, $PM_{2.5}$, and formaldehyde (HCOH) meet federal regulatory thresholds, such as the New Source Performance Standards (NSPS), New Source Review (NSR) and Prevention of Significant Deterioration (PSD) threshold levels. The engines would include the installation of an oxidation catalyst to control CO, VOC, and HCOH emissions from combustion of both digester gas and natural gas. Emission factors used will be provided in the specification for the engine vendors. The cogeneration plant will be permitted under a NYSDEC Title V air permit modification and will file for DEP air permits. Total annual NOx, VOC, PM_{10}, and $PM_{2.5}$ emissions will meet NSR thresholds. Total annual CO and SO_2 emissions will meet PSD thresholds. Non-criteria pollutant emission rates, which were based on uncontrolled emission factors in AP-42, are provided in **Appendix D-1**. It should be noted that these emissions will be controlled by the oxidation catalyst; therefore a conservative 80% control efficiency was included in the modeling analysis to account for this control.

Table D-3
Emission Rates for the Proposed Cogeneration Facility

Parameter	Cogeneration Engines Emission Rate [4] (g/s)	Thermal Oxidizer Emission Rate (g/s)
NO_x (1-hour) [1]	4.871	0.0231
NO_x (Annual) [2]	3.761	0.0231
CO (1-hour and 8-hour) [1]	8.034	0.0069
PM_{10} (24-hour) [1]	0.854	0.0069
$PM_{2.5}$ (24-hour) [1]	0.251	0.0239
$PM_{2.5}$ (Annual) [2]	0.194	0.0239
SO_2 (1-hour and 3-hour) [1]	0.805	0.0047
Formaldehyde (1-hour) [3,1]	0.100	0.000236
Formaldehyde (Annual) [3,2]	0.078	0.000236

Notes:

[1] Short-term emissions for the cogeneration engines are the maximum of either digester gas or natural gas combustion. CO emissions included in the table are the maximum emissions before tripping PSD regulatory thresholds and are expected to be much lower due to the oxidation catalyst. No credit was taken to account for the catalyst in the modeling analysis for CO. Formaldehyde emissions reflect control due to the oxidation catalyst.

[2] Annual emissions for the cogeneration engines are the total emissions from both digester gas and natural gas combustion.

[3] Formaldehyde is readily photo-oxidized in the atmosphere, so a half-life of 1-hour[1] was used in the analysis. For the thermal oxidizer, formaldehyde emissions in the tail gas are expected to be removed by at least 90%; emission rates provided are conservative and are expected to be lower.

[4] Emission rates for the cogeneration engines are the total emissions from all engines exhausting through a collocated stack (4 engines operating in the short-term condition; 5 engines operating in the annual condition).

NEW INTERIM EMERGENCY GENERATORS

Construction of the cogeneration facility would be performed in stages with existing engines removed and new engines installed in pairs until all five engines are installed in order for there to be enough backup power for the Plant to operate in an emergency situation. One alternative under consideration is to utilize the two existing emergency turbine generators and the existing 2 MW emergency engine as back-up power during the construction period (same operating scenario as the existing condition). A second alternative is the installation of four (4), 2 MW diesel emergency generators installed at the beginning of the construction period and removed once the cogeneration facility is operational. These four new emergency engines would exhaust out the existing turbine generator stacks and would only be used for emergency back-up power. Routine maintenance and testing of the emergency engines includes operation for one hour, every two weeks, for a total of 26 hours per year per engine. An analysis of the interim emergency generators used during the construction of the cogeneration facility is included in Attachment G, "*Construction*".

[1] http://ces.iisc.ernet.in/energy/HC270799/HDL/ENV/enven/vol340.htm

EXISTING PLANT SOURCES

The modeling analysis also included other sources that would continue to operate at the Plant in the future with the proposed project to determine total concentrations for comparison to the NAAQS and Air Guide-1 thresholds. The existing modeled sources are listed below.

Combustion Sources

- Boilers (3-32.3MMBtulhr, 1-8.6MMBtulhr; all dual fuel) - 3 individual stacks
- Emergency generator (1-2,000 KW) - 1 stack
- Blackstart generator (1-200 KW) - 1 stack within superstructure
- Enclosed Flare (1) - 1 stack

The existing enclosed flare would remain for emergency flaring of unused digester gas. Based on the assumptions in the Feasibility Report, in the future with the proposed project, all the digester gas would be combusted in the new cogeneration facility with the excess diverted to the Plant's existing boilers. The flare is not expected to combust any excess digester gas. If it does, this operation would only be for intermittent periods of time and therefore, would not have a significant contribution to total predicted concentrations. Therefore, the modeling analysis assumed maximum fuel combusted in the cogeneration facility and boilers, with no excess fuel sent to the flare.

Process Sources

- North Odor Control System (NOCS) – 2 stacks
- South Odor Control System (SOCS) – 1 stack
- West Odor Control System (WOCS) – exhaust sent to the NOCS plenum and exhausted out the NCOS stacks
- Final Settling Tanks (uncontrolled surface areas)

SOURCE PARAMETERS

Combustion Sources

The stacks for the existing boilers are clustered at the north end of the park in the vicinity of the cogeneration facility stacks. The 2000 KW emergency generator exhausts horizontally out of one of the arches along the western perimeter of the plant. These stacks were modeled as individual point sources. The blackstart generator stack exhausts within the superstructure. This source was modeled as a volume source with dimensions based upon the size of the arches.

The emission rates for the existing combustion sources were based on the results of the most recent stack tests[1] and on the planned operation of each piece of equipment.[2]

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[1] Compliance emission test report for NYCDEP North River WPCP for emission sources including Odor Control systems (NOCS, SOCS), Boiler#3 and Flare tested on October 18, Oct 19 and Oct 17, 2007 respectively; North River Water Pollution Control Plant WP-164 Pump Engines 1 and 2 and Blower Engines 1 and 5, Test period July 16th -20th, 2007.

[2] The exempt activities (i.e., the blackstart 200 kW generator and the 8.6 MMBTUIhr boiler) were not included in the source testing program; emission rates from these sources were based on AP-42 emission factors.

The analysis assumes that all the existing combustion sources to remain at the plant would be operating simultaneously with the cogeneration facility in the future with the proposed project.

The three 31.4 mmBtu/hr existing boilers are capable of burning digester gas, natural gas, and #2 fuel oil, however, per the Plant's NOx RACT Compliance Plan[1] DEP proposed an enforceable fuel limitation requiring combustion of only natural gas or digester gas in the boilers during normal operation. Results of the most recent stack tests indicated that NOx emissions from the boilers are in compliance with NOx RACT while firing gaseous fuels. Therefore, in the future with the proposed project, the analysis assumed the existing boilers would burn only digester or natural gas.

In addition, consistent with normal operation of the boilers and the Plant's Title V permit, a reasonable worst-case scenario was modeled assuming two large boilers and one small boiler operating during the heating season (November through April) and two large boilers operating during the warm weather months (May through October). Maximum expected annual digester and natural gas fuel usage in the boilers in the future with the proposed project derived from the Feasibility Study is expected to be similar or less than the fuel usage under existing conditions; therefore the analysis of the boilers in the future with the proposed project was unchanged from existing conditions, for a worst-case, conservative analysis.

The emergency engine generators are expected to operate one hour, every two weeks during the hours from 7AM to 3PM, for a total of 26 hours per year, per generator. Hourly emissions were prorated in the model for the short-term and averaging periods.

Table D-4 provides a summary of the stack parameters and emission rates for the existing combustion sources to remain on-site in the future with the proposed project.

Non-criteria pollutant emission rates from the existing combustion sources are provided in **Appendix D-1**.

[1] DEP Air Title V Wastewater Treatment Plants, Subpart 227-2.3(a)(1) Reasonably Available Control Technology (RACT) for Oxides of Nitrogen (NOx) Analysis, December 30, 2011.

Table D-4
Stack Parameters and Emission Rates for the Existing Combustion Sources

Parameter	Emission Rate (g/s)			
	Boilers[4]	2000KW Emergency Generator[3,9]	200KW Emergency Blackstart Generator[3,8]	Flare
Stack Height (above grade) (feet)	161 [7]	15	--	87
Stack Diameter (inches)	48	16	--	72
Stack Exhaust Temperature (F)	264	830	--	1187
Stack Exhaust Velocity (feet per second)	10.9	179.9	--	67.6
NO_x (1-hour) [1]	0.0610 / 0.0773	(5)	(5)	(10)
NO_x (Annual) [2]	0.0069 / 0.0087	0.0204	0.0026	(10)
CO (1-hour and 8-hour) [1]	0.0008 / .0875	0.0166 / 0.0021 [6]	0.2358 / 0.0295 [6]	(10)
PM_{10} (24-hour) [1]	0.0529 / 0.0670	0.0079	0.0020	(10)
$PM_{2.5}$ (24-hour) [1]	0.0529 / 0.0670	0.0079	0.0019	(10)
$PM_{2.5}$ (Annual) [2]	0.006 / 0.0076	0.0002	0.00005	(10)
SO_2 (1-hour and 3 hour) [1]	0.0895 / 0.1134	0.0006 [5]	0.0047 [5]	(10)
Formaldehyde (1-hour) [1]	0.0012 / 0.0015	2.19E-04	2.19E-05	(10)
Formaldehyde (Annual)[2]	0.0001 / 0.00013	6.5E-07	6.5E-08	(10)

Notes:

[1] Short-term emissions are the maximum of either digester gas or natural gas combustion.

[2] Annual emissions are the total emissions from both digester gas and natural gas combustion.

[3] Short-term emissions are pro-rated with each engine running for one hour during the day and assuming they would be tested between 7AM-3PM.

[4] First value is emissions from 1 large boiler and 2nd value is emissions from 1 large + 1 small boiler

[5] These operate for a limited number of hours and considered intermittent sources, therefore, concentrations were not analyzed for 1-hour NO_2 and 1-hour SO_2.

[6] 1st value is for CO 1-hour and 2nd value is pro-rated for CO 8-hour.

[7] Grade elevation is 5 feet. The height of the rooftop park is 54 feet above grade and the height of the stack above the park is 107 feet.

[8] The emissions exhaust within the superstructure, and was therefore modeled as a surface based volume source.

[9] Trailer mounted generator exhausting horizontally out of one of the arches, and therefore modeled as a horizontal point source following regulatory guidance.

[10] Operation of the flare was not analyzed in the future with the proposed project.

Process Sources

The wastewater processes at the plant are also sources of non-criteria pollutants due to volatilization of contaminants in the wastewater influent as it travels through the plant. All sources of process emissions at the plant, with the exception of the final sedimentation tanks (FTSs), are covered, and their odorous emissions are collected and sent to one of the three large, odor control systems: North Odor Control System (NOCS), South Odor Control System (SOCS), or West Odor Control System (WOCS). Emissions from the SOCS exhaust through a single stack, while emissions from the WOCS

are sent to the NOCS plenum, and the combined emissions exhaust through the two identical NOCS stacks. All three stacks were modeled as individual point sources.

The FSTs are at the end of the entire treatment process and emissions are anticipated to be extremely low; however, air toxic emissions from the tanks were included in the modeling analysis. The FSTs are open area sources within the plant superstructure and emissions from the tanks contact ambient air at the open arches along the outer walls of the plant. Therefore, emissions from the FSTs were modeled as volume sources with dimensions based upon the size of the arches.

Emissions of non-criteria pollutants from the combustion sources and the NOCS and SOCS stacks were based on the most recent stack test data. Stack exhaust parameters were based on the stack test conditions and/or permit conditions for each source.

Emissions of non-criteria pollutants from the FSTs were obtained from the 2003 DEP Environmental Assessment[1] and were based on the USEPA-approved air emission estimation model, TOXCHEM+. TOXCHEM+ is a general fate model that performs a mass balance around each unit operation, as well as the entire plant. To predict emissions, the model considers the fate of the wastewater HAPs and VOCs due to volatilization, biodegradation, and adsorption onto solids, which are subsequently separated and removed for disposal. The model predicts the mass of each organic compound lost and/or emitted through volatilization, biodegradation, and adsorption from each unit operation analyzed.

No significant changes in the plant processes or operations in the future with the proposed project are anticipated.

Appendix D-1 provides the pollutant emission rates for the existing process sources.

MODEL SELECTION

The air quality modeling analysis was performed using the USEPA-approved AERMOD dispersion model. The AERMOD model calculates pollutant concentrations from one or more points (e.g., exhaust stacks) based on hourly meteorological data, and has the capability of calculating pollutant concentrations at locations when the plume from the exhaust stack is affected by the aerodynamic wakes and eddies (downwash) produced by nearby structures. Computations with the AERMOD model to determine impacts from the facility were made assuming urban dispersion coefficients, regulatory default options (stack tip downwash, elevated terrain, calm winds processing, etc.), inclusion of building wake, and the use of flagpole receptors.

METHODOLOGY FOR ESTIMATING 1-HOUR NO_2 CONCENTRATIONS

1-Hour average NO_2 concentration increments from the future with the proposed project was estimated using AERMOD model's Plume Volume Molar Ratio Method (PVMRM) module to analyze chemical transformation within the model. The PVMRM module incorporates hourly background ozone concentrations to estimate NO_x transformation within the source plume. Ozone concentrations were taken from the DEC City College of New York (CCNY) monitoring station that is the nearest and most representative ozone monitoring station for the years 2008-

[1] NYCDEP environmental assessment (Process Optimization and Odor Minimization; Contracts 35G, H and E Air Quality Report, Malcolm Pirnie, 2003)

2011 and I.S 52 monitoring station in Bronx for 2007. An initial NO_2 to NO_x ratio of 20 percent[1] at the source exhaust stack was used for the proposed cogeneration engines, and 10 percent for the boilers which is considered representative for these source types. For all the other sources, the default ratio of 50 percent was used.

Total 1-hour NO_2 concentrations were determined following methodologies that are accepted by the EPA as appropriate and conservative. The methodology used to determine the compliance of total 1-hour NO_2 concentrations from the future facility sources with the 1-hour NO_2 NAAQS[2] was based on adding the monitored background to modeled concentrations, as follows: hourly modeled concentrations from the future facility sources were first added to the seasonal hourly background monitored concentrations; then the highest combined daily 1-hour NO_2 concentration was determined at each receptor location and the 98th percentile daily 1-hour maximum concentration for each modeled year was calculated within the AERMOD model; finally the 98th percentile concentrations were averaged over the latest five years. This refined approach is recognized as being conservative by EPA and the City.

METEOROLOGY

The modeling analysis was performed using the latest five-year meteorological data set from the nearest representative National Weather Service (NWS) station, consisting of surface data from LaGuardia Airport, NY and concurrent upper air data from Brookhaven National Laboratory in Upton, NY (2007 to 2011). Land-use characteristics were developed using the USEPA AERSURFACE program (USEPA, 2008).

RECEPTOR NETWORK

Three uniform ground level Cartesian receptor grids were used in the modeling analysis. The first is a coarse Cartesian receptor grid with receptor spacing of 500 meters extending from 3 km to 10 km in all directions from the facility; the second is a medium Cartesian receptor grid with 200 meter receptor spacing, extending from 1.5 km to 3 km in all directions from the facility. The third is a fine Cartesian receptor grid with 75 meter spacing, extending from the center of the facility out to 1.5 km. Discrete sensitive and flagpole receptors were also placed within the rooftop park at places of public access, at elevated floor levels representing the windows, balconies, and rooftops on the nearby adjacent apartment buildings, and at the riverside park along Riverside Drive.[3] National Elevation Dataset (NED) files were utilized to obtain terrain elevations for the receptor area. AERMAP, a terrain pre-processor program was used to determine the representative elevations for each receptor.

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[1] MACTEC for Alaska Department of Environmental Conservation, Evaluation of Bias in AERMOD-PVMRM, June 2005 http://www.epa.gov/scram001/7thconf/aermod/pvmrm_bias_eval.pdf;

San Joaquin Valley, Recommended In-stack NO_2/NOx Ratios,

http://www.valleyair.org/busind/pto/Tox_Resources/AirQualityMonitoring.htm#modeling_guidance

[2] http://www.epa.gov/ttn/scram/guidance/clarification/Additional_Clarifications_AppendixW_Hourly-NO2-NAAQS_FINAL_03-01-2011.pdf

[3] Note that this modeling analysis required to satisfy CEQR requirements is more conservative than modeling that would be required for NYSDEC. Consistent with the *CEQR Technical Manual*, the windows of the buildings were included as sensitive receptor locations and ground level receptors were evaluated at 1.8 meters (breathing height of the average person), rather than a height of 0.0 meters.

BACKGROUND CONCENTRATIONS

To estimate the maximum expected total pollutant concentrations, the modeled concentrations from the emission sources must be added to a background value that accounts for existing pollutant concentrations from other sources (see **Table D-5**). To develop background levels, concentrations measured at the most representative NYSDEC ambient monitoring station over the latest available 5-year period (2007-2011) were used for annual average NO_2 and 3-hour average SO_2 background, while the latest available 3-year period was used for the 24-hour PM_{10} background concentration. Note that the background concentrations for the 1-hour and 24-hour standards are consistent with the form of the NAAQS.

Table D-5
Maximum Background Pollutant Concentrations

Pollutant	Average Period	Location	Concentration (µg/m3)	NAAQS (µg/m3)
NO2	1-hour	Queens College 2	(1)	188
NO2	Annual(2)	Queens College 2	43.2	100
SO2	1-Hour(3)	I.S. 52, Bronx	133	196
SO2	3-Hour(4)	I.S. 52, Bronx	141	1,300
CO	1-Hour (4)	CCNY, New York	3090.4	40,000
CO	8-Hour	CCNY, New York	2060.2	10,000
PM10	24-hour (5)	I.S. 52, Bronx	43	150
PM2.5	24-hour (6)	P.S. 154, New York	27	35
PM2.5	Annual(6)	P.S. 154, New York	10.9	15

Notes:
(1) The 1-Hour NO_2 background concentration is not presented in the table since the AERMOD model determines the total 98th percentile 1-Hour NO_2 concentration at each receptor.
(2) Annual average NO_2 background concentration is based on the 5-year highest value from 2007–2011.
(3) The 1-Hour SO_2 background concentration is the annual 99th percentile of daily maximum 1-hour average concentration, averaged over the recent 3-years (2009-2011).
(4) The 3-hour SO_2 background concentration is based on the 5-year highest second-highest measured value from 2006–2010.
(5) PM_{10} is based on the 3-year highest second-highest value from 2009–2011.
(6) The $PM_{2.5}$ 24-hour concentration is the average of the annual 98th percentile from 2009- 2011. The $PM_{2.5}$ annual concentration is also measured from the same years.
Source: New York State Air Quality Report Ambient Air Monitoring System, DEC, 2007-2011.

MODELING ANALYSIS

CRITERIA POLLUTANTS

The AERMOD modeling analysis was performed for the criteria pollutants for comparison to the NAAQS for CO, SO_2, NO_2, and PM_{10}. In addition, the analysis included a comparison of incremental $PM_{2.5}$ concentrations to the NYSDEC interim guidance thresholds. Maximum concentrations from the future with the proposed project were modeled and compared with the maximum concentrations from the existing Plant.

Methodology for Estimating PM2.5 Concentrations

Incremental concentrations were analyzed and compared to the interim guidance thresholds (i.e., predicted concentrations from the future with the proposed project minus the predicted concentrations from the existing Plant were compared to the interim guidance thresholds).

Existing Facility Sources

The existing facility modeled sources are the same as the existing sources in the future with the proposed project, with the inclusion of the existing pump and blower engines and the operation of the waste gas flare.

There are currently five 1,700 brake horsepower (BHP) pump engines with one used as a standby unit and five 940 BHP blower engines with one also used as a standby unit. Excess digester gas not being utilized in the pump and blower engines or the boilers are sent to the flare. Concurrently with this EA, an analysis of the existing facility is being performed for compliance with the Plant's Title V permit. The same methodology for the modeling of the existing facility, following the NYSDEC approved protocol was used for the $PM_{2.5}$ incremental analysis.

Stack parameters and emission rates for the boilers, emergency turbines, and emergency generators are the same as the future with the proposed project **(see Table D-4). Table D-6** provides the stack parameters and $PM_{2.5}$ emission rates from the existing pump and blower engines and the flare.

Table D-6
Stack Parameters and Emission Rates for the Existing Engines and the Flare

Parameter	Emission Rate (g/s)		
	Pump Engines	Blower Engines	Flare
Stack Height (above grade) (feet)	161	161	87
Stack Diameter (inches)	23.5(1)	23.5(1)	72
Stack Exhaust Temperature (F)	868	759	1187
Stack Exhaust Velocity (feet per second)	94.8(2)	55(2)	67.6
PM2.5 (24-hour)	0.2032(2)	0.1527(2)	0.0475
PM2.5 (Annual)	0.0225(2)	0.0357(2)	0.0022

Notes:

[1] Each engine has its own dedicated stack, however, the pump engines were modeled as one co-located equivalent exhaust stack (with 37.2 inches equivalent diameter) and the blower engines modeled as one co-located equivalent exhaust stack (with 37.2 inches equivalent diameter).

[2] For the pump and blower engines, hourly emission rates and stack exhaust velocities for each fuel type were estimated using an hour-by-hour fuel profile of actual loads from a representative year (October 2009-October 2010). Based on the hourly fuel profile, approximately 2 pump engines and 3 blower engines operate on an annual average basis, however in 2011, an electrically driven blower engine was installed to take the load off of one of the blower engines, thereby displacing the emissions from the fuel-driven engine. This analysis is conservative since the existing facility concentrations from the pump and blower engines are based on a more refined actual hourly load profile as compared to the future cogeneration facility reasonable worst case assumptions.

NON-CRITERIA POLLUTANTS

Screening Analysis

The AERMOD modeling analysis was also performed for the non-criteria pollutants, including formaldehyde for comparison to the Air Guide-l guideline concentrations. Given the total number of contaminants of concern (139 in all) a conservative screening analysis was first employed. Using this approach, the sources were modeled in AERMOD with a unitized emission rate (1 gram/sec) over the five years of meteorological data. The maximum 1-hour and annual impacts (based on the unitary emission input) from each source of non-criteria pollutant emissions at the plant at various receptor locations from the five years of modeling were then tabulated and the maximums for each source were added. Since the location of the maximum impacts of the individual sources would be at different locations throughout the plant, combining the maximum impacts is very conservative. Compounds with maximum impacts below either the

SGC or AGC using this approach would meet these criteria. For compounds that indicated to have the potential for an exceedance of an SGC or an AGC from this conservative analysis (such as formaldehyde and chloroform), refined modeling was conducted to determine more accurate impact predictions (see discussion below).

Refined Analysis

In the refined pollutant-specific modeling analysis, each source was modeled at its pollutant-specific emission rate (maximum hourly and/or annual average) and the maximum 1-hour and annual average impacts were compared with the SGC and AGC, respectively.

E. EXISTING CONDITIONS

Representative criteria pollutant concentrations measured in recent years at NYSDEC air quality monitoring stations nearest to the proposed project site are presented in **Table D-5**, above. The values presented are consistent with the NAAQS format. For example, the 8-hour ozone concentration shown is the 3-year average of the fourth highest daily maximum 8-hour average concentrations. The concentrations were obtained from the 2011 New York State Ambient Air Quality Report, the most recent report available. As shown in **Table D-7**, the recently monitored levels did not exceed the NAAQS.

Table D-7
Representative Monitored Ambient Air Quality Data

Pollutant	Location	Units	Averaging Period	Concentration	NAAQS
CO	CCNY, Manhattan	ppm	8-hour	1.7	9
			1-hour	2.7	35
SO_2	Botanical Garden, Bronx[1]	µg/m^3	3-hour	102.6	1,300
			1-hour	133.5	196
PM_{10}	Morrisania, Bronx	µg/m^3	24-hour	37	150
$PM_{2.5}$	P.S. 154, New York	µg/m^3	Annual	10.9	15
			24-hour	27	35
NO_2	Queens College 2, Queens[2]	µg/m^3	Annual	40.7	100
			1-hour	126.9	188
Lead	Morrisania, Bronx	µg/m^3	3-month	0.008	0.15
Ozone	CCNY, Manhattan	ppm	8-hour	0.072	0.075

Notes:
(1) The 1-hour value is based on a three-year average (2009-2011) of the 99th percentile of daily maximum 1-hour average concentrations. EPA replaced the 24-hr and the annual standards with the 1-hour standard.
(2) The 1-hour value is based on a three-year average (2009-2011) of the 98th percentile of daily maximum 1-hour average concentrations.
Source: NYSDEC, New York State Ambient Air Quality Report (2009-2011).

F. THE FUTURE WITHOUT THE PROPOSED PROJECT

In the future without the proposed action, air quality in the region is anticipated to be similar to that described for existing conditions. Land uses are expected to remain generally the same in this neighborhood and since air quality regulations mandated by the CAA are anticipated to maintain or improve air quality in the region, it can be expected that air quality conditions in the future without the proposed project would be no worse than those that presently exist.

G. PROBABLE IMPACTS OF THE PROPOSED PROJECT

Criteria Pollutants

Using the procedures described above, the AERMOD model was used to estimate the maximum pollutant concentrations for comparison to the NAAQS.

Table D-8 presents the maximum criteria pollutant impacts in the future with the proposed project.

Table D-8
Maximum Predicted Total Concentrations (in μg/m^3)[1]

Pollutant	Averaging Period	Background Conc. (μg/m)	Predicted Impact (μg/m)	Total Max Predicted Conc. (μg/m)	NAAQS (μg/m^3)
NO_2	1-hour	--	--	185 [(2)]	188
	Annual	43.2	15.6	58.8	100
SO_2	1-hour	133	56.9	189.9	196
	3-hour	141	39.4	180.4	1,300
PM_{10}	24-hour	43	22.4	65.4	150
CO	1-hour	3090.4	4461	7551.4	40,000
	8-hour	2060.2	256.1	2316.3	10,000

Note:
1 Concentrations presented are based on engines operating at 100% load, which was considered the worst-case load based on a screening analysis.
2 The 1-Hour NO_2 concentration presented here is the maximum of the total 98th percentile 1-Hour NO_2 concentration predicted at any receptor using seasonal-hourly background concentrations.

The results of the modeling analysis indicated that the proposed project would not result in any impacts of the NAAQS. Therefore, no significant adverse air quality impacts are predicted from NO_2, SO_2, PM_{10} and CO emissions.

$PM_{2.5}$

$PM_{2.5}$ concentrations were determined on an incremental basis and compared to the interim guidance criteria to evaluate whether such predicted incremental concentrations would be considered potential significant adverse impacts. **Table D-9** presents the maximum predicted $PM_{2.5}$ increments from the future with the proposed project.

Table D-9
Maximum Predicted $PM_{2.5}$ Concentrations (in μg/m^3)

Pollutant	Averaging Period	Maximum Increment	Incremental Threshold
$PM_{2.5}$	24-hour	1.85	2 / 5
	Annual	0.14	0.3

The results show that the predicted annual and daily (24-hour) $PM_{2.5}$ increments are below the interim guidance criteria, and therefore no significant adverse air quality impacts are predicted from $PM_{2.5}$ emissions.

Non-Criteria Pollutants

The AERMOD model was used to estimate the maximum non-criteria pollutant concentrations for comparison to the NYSDEC's Air Guide-1 SGCs and AGCs.

Table D-10 presents the maximum non-criteria pollutant impacts in the future with the proposed project. All short-term impacts are below the SGCs.

Chloroform has a predicted exceedance of 3.3 times its AGC at 0.14 $\mu g/m^3$. Predicted concentrations of chloroform are from existing Plant sources and represent BACT from the north odor control stack and FSTs. No changes are being made to the existing process sources with the new cogeneration facility. Therefore, there are no significant adverse impacts predicted from chloroform emissions from the proposed project.

With the cogeneration facility, predicted concentrations of formaldehyde from the future with the proposed project are five times the AGC, lower than formaldehyde concentrations predicted under existing conditions. Since the cogeneration facility would include an oxidation catalyst as part of the design, this is considered BACT for reducing formaldehyde emissions and within the guidelines acceptable to NYSDEC. Therefore, there are no significant adverse impacts predicted from formaldehyde emissions from the proposed project.

CONCLUSIONS

Based on the analyses conducted above, the cogeneration facility would not result in any predicted potential significant adverse air quality impacts associated with criteria air pollutants: NO_2, SO_2, $PM_{2.5}$, PM_{10}, and CO and non-criteria pollutants.

GREENHOUSE GAS EMISSIONS

As discussed in the *City Environmental Quality Review (CEQR) Technical Manual* (January 2012), increased concentrations of greenhouse gases (GHGs) in the atmosphere are changing the global climate, resulting in wide-ranging effects on the environment, including rising sea levels, increases in temperature, and changes in precipitation levels. Although this is occurring on a global scale, the environmental effects of climate change are also likely to be felt at the local level. Through PlaNYC, the City has established sustainability initiatives and goals for greatly reducing GHG emissions and adapting to climate change in the City. The goal to reduce citywide GHG emissions to 30 percent below 2005 levels by 2030 was codified by Local Law 22 of 2008, known as the New York City Climate Protection Act (the "GHG reduction goal").[1] The City is also engaged in several initiatives to assess potential local effects of global climate change and develop strategies to make existing and proposed infrastructure and development citywide more resilient to the effects of climate change.

[1] Administrative Code of the City of New York, §24-803.

Table D-10
Maximum Short-Term and Annual Predicted Concentrations of Non-Criteria Pollutants (in µg/m^3)(1)

Compound	Short-term Impact (µg/m^3)	SGC (µg/m^3)	Percent of SGC (%)	Annual Impact (µg/m^3)	AGC (µg/m^3)	Percent of AGC (%)
Formaldehyde	3.44	30	11.5%	0.30	0.06	492.8%
1,1,1-Trichloroethane	0.18	9,000	0.0%	0.003	5,000	0.0%
1,1,2,2-Tetrachloroethane	0.21	---	---	0.004	16.0	0.0%
1,1,2-Trichloroethane	0.17	---	---	0.003	1.40	0.2%
1,1-Dichloroethane	0.12	---	---	0.003	0.63	0.4%
1,1-Dichloroethene	0.12	---	---	0.002	70	0.0%
1,2,4-Trichlorobenzene	0.87	3,700	0.0%	0.02	---	---
1,2,4-Trimethylbenzene	0.17	---	---	0.004	6	0.1%
1,2-Dibromoethane (EDB)	0.01	---	---	3.76E-04	1.70E-03	22.1%
1,2-Dichlorobenzene	0.18	30,000	0.0%	0.003	200	0.0%
1,2-Dichloroethane	0.12	---	---	0.003	3.80E-02	6.7%
1,2-Dichloropropane	0.14	---	---	0.003	4.00	0.1%
1,3,5-Trimethylbenzene	0.15	---	---	0.003	290	0.0%
1,3-Butadiene	0.13	---	---	0.00	3.30E-02	11.6%
1,3-Dichlorobenzene	0.18	---	---	0.003	10.0	0.0%
1,4-Dichlorobenzene	1.34	---	---	0.04	9.00E-02	44.1%
1,4-Dioxane	0.43	3,000	0.0%	0.01	0.13	6.4%
2,2,4-Trimethylpentane	0.18	---	---	0.00	3,300	0.0%
2-Butanone (MEK)	0.61	13,000	0.0%	0.01	5,000	0.0%
2-Hexanone	0.49	4,000	0.0%	0.01	30.0	0.0%
2-Methylnaphthalene	0.01	---	---	0.000	7.1	0.0%
2-Propanol	0.48	98,000	0.0%	0.01	7,000	0.0%
3-Chloropropene	0.37	600	0.1%	0.01	1.00	0.7%
3-Methylchloranthrene	0.00	---	---	4.52E-08	---	---
4-Ethyltoluene	0.15	NA	---	0.003	NA	---
4-Methyl-2-pentanone	0.12	31,000	0.0%	0.002	3,000	0.0%
7,12-Dimethylbenz(a)anthracene	0.00	---	---	4.02E-07	---	---
Acenaphthene	0.05	---	---	1.61E-05	---	---
Acenaphthylene	0.11	---	---	5.61E-05	---	---
Acetaldehyde	1.68	4,500	0.0%	0.07	0.45	14.8%
Acetone	6.14	180,000	0.0%	0.14	30,000	0.0%
Acrolein	0.94	2.5	37.8%	0.04	0.35	11.7%
alpha-Chlorotoulene	0.15	240	0.1%	0.003	2.00E-02	15.0%
Aluminium	0.00	---	---	0.00E+00	2.40	0.0%
Ammonia	239.97	2,400	10.0%	0.04	100	0.0%
Anthracene	0.01	---	---	1.64E-06	2.00E-02	0.0%
Antimony	0.00	---	---	0.00E+00	1.20	0.0%
Arsenic	0.00	---	---	5.02E-06	2.30E-04	2.2%
Barium	0.01	---	---	1.11E-04	0.50	0.0%
Benzene	9.79	1,300	0.8%	0.01	0.13	7.0%

Table D-10 (cont'd)
Maximum Short-Term and Annual Predicted Concentrations of Non-Criteria Pollutants (in μg/m^3)(1)

Compound	Short-term Impact (μg/m^3)	SGC (μg/m^3)	Percent of SGC (%)	Annual Impact (μg/m^3)	AGC (μg/m^3)	Percent of AGC (%)
Benz(a)anthracene	0.01	---	---	8.46E-07	2.00E-02	0.0%
Benzo(a)pyrene	0.00	---	---	3.68E-06	9.10E-04	0.4%
Benzo(b)fluoranthene	0.01	---	---	2.80E-06	---	---
Benzo(k)fluoranthene	0.00	---	---	3.26E-07	---	---
Benzo(b,k)fluoranthene	0.00	NA	---	0.00E+00	NA	---
Benzo(g,h,l)perylene	0.01	---	---	4.05E-06	---	---
Beryllium	0.00	---	---	3.01E-07	4.20E-04	0.1%
Bis(2-ethylhexyl)phthalate (dioctyl phthalate)	1.30	---	---	0.07	0.42	16.3%
Boron	0.00	NA	---	0.00E+00	NA	---
Bromine	0.00	130	0.0%	0.00E+00	1.60	0.0%
Bromodichloromethane	0.81	---	---	0.02	70	0.0%
Bromoform	0.31	---	---	0.01	0.91	0.7%
Bromomethane	0.12	3,900	0.0%	0.002	5.0	0.0%
Butane	4.72	---	---	0.06	57,000	0.0%
Butylbenzylphthalate	0.02	---	---	0.001	0.42	0.1%
Cadmium	0.00	---	---	2.76E-05	2.40E-04	11.5%
Calcium	0.00	NA	---	0.00E+00	NA	---
Carbon Disulfide	0.18	6,200	0.0%	0.004	700.0	0.0%
Carbon Tetrachloride	0.19	1,900	0.0%	0.00	0.17	2.3%
Chlorobenzene	0.17	---	---	0.003	110	0.0%
Chloroethane	0.08	---	---	0.002	10,000	0.0%
Chloroform	10.67	150	7.1%	0.14	0.04	325.2%
Chloromethane	0.25	22,000	0.0%	0.005	90	0.0%
Chromium	0.00	---	---	3.52E-05	45	0.0%
Chrysene	0.02	---	---	7.55E-06	2.00E-02	0.0%
cis-1,2-Dichloroethene	0.29	---	---	0.01	63	0.0%
cis-1,3-Dichloropopene	0.14	NA	---	0.003	NA	---
Cobalt	0.00	---	---	2.11E-06	1.00E-03	0.2%
Copper	0.00	100	0.0%	2.14E-05	2.00E-02	0.1%
Cumene (Isopropylbenzene)	0.15	---	---	0.003	400	0.0%
Cyclohexane	0.10	---	---	0.002	6,000	0.0%
Dibenz(a,h)anthracene	0.00	---	---	4.76E-07	2.00E-02	0.0%
Dibromochloromethane	0.25	NA	---	0.005	NA	---
Dibutyl phthalate	0.00	---	---	1.36E-04	12	0.0%
Dichlorobenzene	0.00	---	---	3.01E-05	---	---
Diethyl phthalate	0.01	---	---	2.21E-04	12	0.0%
Endosulfan-1	0.00	---	---	1.25E-05	2.30	0.0%
Endrin	0.00	---	---	2.26E-05	1.00	0.0%
Ethane	24.03	---	---	0.92	2,900	0.0%
Ethanol	0.56	---	---	0.01	45,000	0.0%

Table D-10 (cont'd)
Maximum Short-Term and Annual Predicted Concentrations of Non-Criteria Pollutants (in μg/m^3)(1)

Compound	Short-term Impact (μg/m^3)	SGC (μg/m^3)	Percent of SGC (%)	Annual Impact (μg/m^3)	AGC (μg/m^3)	Percent of AGC (%)
EthylBenzene	0.18	54,000	0.0%	0.00	1,000	0.0%
Fluoranthene	0.05	---	---	1.41E-05	---	---
Fluorene	0.15	---	---	6.18E-05	---	---
Freon 11	0.17	9,000	0.0%	0.003	5,000	0.0%
Freon 113	0.23	960,000	0.0%	0.004	180,000	0.0%
Freon 114	0.21	---	---	0.004	17,000	0.0%
Freon 12	0.15	---	---	0.003	12,000	0.0%
Heptachlor	0.00	---	---	2.33E-05	7.70E-04	3.0%
Heptane	0.15	210,000	0.0%	0.003	3,900	0.0%
Hexachlorobutadiene	1.27	---	---	0.02	4.50E-02	54.9%
alpha-Bhc (alpha-Hexachlorocyclohexane) (apha-Linden)	0.00	---	---	5.32E-05	5.60E-04	9.5%
beta-Bhc (beta-Hexachlorocyclohexane) (beta-Linden)	0.00	---	---	4.74E-06	1.90E-03	0.2%
delta-Bhc (delta-Hexachlorocyclohexane) (delta-Linden)	0.00	NA	---	7.77E-06	NA	---
gamma-Hexachlorocyclohexane (Lindane)	0.00	---	---	1.79E-05	1.20	0.0%
Hexane	4.26	---	---	0.06	700	0.0%
Indeno(1,2,3-cd)pyrene	0.00	---	---	5.78E-07	---	---
Iron	0.00	NA	---	0.00E+00	NA	---
Lead	0.00	---	---	1.26E-05	3.80E-02	0.0%
Manganese	0.00	---	---	9.55E-06	5.00E-02	0.0%
Mercury	0.00	---	---	6.53E-06	0.60	0.0%
Methane	91.44	---	---	0.01	1,600	0.0%
Methyl tert-butyl ether	0.79	---	---	0.02	3,000	0.0%
Methylene Chloride	7.87	14,000	0.1%	0.17	2.10	8.0%
Molybdenum	0.00	---	---	2.76E-05	1.20	0.0%
Naphthalene	1.51	7,900	0.0%	0.001	3.00	0.0%
Nickel	0.00	6	0.1%	5.28E-05	4.20E-03	1.3%
OCDD (Octachlorodibenzodioxin)	0.00	NA	---	0.00E+00	NA	---
Pentane	6.16	---	---	0.09	4,200	0.0%
Phenanthrene	0.47	---	---	1.36E-04	2.00E-02	0.7%
Phenol	0.01	5,800	0.0%	0.000	20.0	0.0%
Phosphorus (Yellow or white)	0.00	---	---	0.00E+00	7.00E-02	0.0%
Polycyclic Organic Matter (POM)	0.00	NA	---	0.0	NA	---
Potassium	0.00	NA	---	0.00E+00	NA	---
Propane	10.39	---	---	0.37	43,000	0.0%
Propylbenzene	0.15	54,000	0.0%	0.003	1,000	0.0%

Table D-10 (cont'd)
Maximum Short-Term and Annual Predicted Concentrations of Non-Criteria Pollutants (in μg/m^3)[(1)]

Compound	Short-term Impact (μg/m^3)	SGC (μg/m^3)	Percent of SGC (%)	Annual Impact (μg/m^3)	AGC (μg/m^3)	Percent of AGC (%)
Propylene	32.18	---	---	0.004	3,000	0.0%
Pyrene	0.04	---	---	1.58E-05	2.00E-02	0.1%
Selenium	0.00	---	---	6.03E-07	20	0.0%
Silicon	0.00	NA	---	0.00E+00	NA	---
Sodium	0.00	NA	---	0.00E+00	NA	---
Styrene	0.14	17,000	0.0%	0.003	1,000	0.0%
Tetrachloroethene (Tetrachloroethylene)	9.87	1,000	1.0%	0.21	1.00	20.8%
Tetrahydrofuran	0.34	30,000	0.0%	0.01	350.0	0.0%
Tin	0.00	20	0.0%	0.00E+00	0.24	0.0%
Toluene	8.39	37,000	0.0%	0.08	5,000	0.0%
Total non-methane organic compound (TNMOC)	923	NA	---	0.10	NA	---
Total Organic Compounds (TOC)	1,038	NA	---	0.39	NA	---
Total PAH (Polycyclic aromatic hydrocarbons)	2.45	---	---	0.000	2.00E-02	2.4%
Trans-1,2-Dichloroethene	0.12	---	---	0.002	63	0.0%
trans-1,3-Dichloropropene	0.14	NA	---	0.003	NA	---
Trichloroethene	0.84	14,000	0.0%	0.02	0.50	3.8%
Vanadium	0.01	---	---	5.78E-05	0.20	0.0%
Vinyl Chloride (Chloroethene)	0.08	180,000	0.0%	0.002	0.11	1.5%
m,p-Xylene (Xylene)	2.53	4,300	0.1%	0.01	100	0.0%
m-Xylene (1,3-xylene)	0.14	4,300	0.0%	0.002	100	0.0%
o-Xylene (1,2-xylene)	0.16	4,300	0.0%	0.003	100	0.0%
p-Xylene (1,4-xylene)	0.04	4,300	0.0%	0.001	100	0.0%
Zinc	0.06	---	---	7.29E-04	45	0.0%

Notes:
[(1)] VOC impacts, with the exception of formaldehyde, reflect a minimum of 80% control efficiency from the cogeneration facility due to the presence of the oxidation catalyst. Formaldehyde impacts reflect a 95% control efficiency, as guaranteed by the vendor.

GHG emissions from the cogeneration facility are linked to the amount of fuel oil used (most impact), natural gas used (lower impact) and/or digester gas used (CO_2 emissions do not contribute). If digester gas production can be increased, it can offset the emissions generated from fuel oil and/or natural gas.

The proposed spark ignited natural gas generators maximize the use of digester gas generated to maximize the potential GHG benefit. The GHG reduction potential has a direct relationship with the ability to generate and utilize digester gas.

The proposed project would generate most of the power required to operate the pumps and blowers as well as electricity for the plant, with a small portion being purchased from Con Edison. The proposed cogeneration system would increase reliability of electrical service and

potentially decrease its cost, utilizing most of the digester gas produced at the Plant, eliminating the use of no. 2 fuel oil, maximizing the use of digester gas, and reducing the amount of fossil fuel required for steam generation from the existing facility's boilers. Cogeneration systems are also an important component of energy and environmental design objectives.

With cogeneration, the thermal byproduct of electricity generation, which is typically not used, is captured and used to supply heat and hot water on-site. The efficiency and benefit of cogeneration is two-fold: First, on-site power reduces the electric load that is typically supplied by existing power plants, helping to manage the peak electricity usage most notably during the summer months. This is an important consideration in that existing regional fossil fuel power plants serving New York City are 30 years old on average, and use 30 to 60 percent more fuel than newer plants to generate the same amount of electricity.[1] These older plants generally operate when electric loads are high, while renewable or non-fossil fuel facilities are used to meet energy demand during non-peak periods. Second, transmission and distribution of electricity over long distances results in measurable losses. The GHG inventory for New York City approximates the losses to be more than 5 percent.[2] The transmission losses are reduced when power is produced on-site. As a result of the energy savings achieved, cogeneration systems can lower operating costs and reduce both regional criteria pollutant and greenhouse gas (GHG) emissions.

The baseline annual GHG emissions are 38,656 metric tons CO_2e per year from existing facility operations and the use of purchased electricity from the local utility.[3] The use of purchased electricity does not result in any on-site emissions. However, consumed electricity is associated with GHG emissions from power plants running on fossil fuels. Total future GHG emissions are estimated as approximately 19,541 – 28,199 metric tons CO_2e from the future cogeneration plant[4] supplemented with a small portion of purchased electricity. Under all future operating scenarios, the proposed cogeneration system will have a significant reduction in GHG emissions from the baseline levels, reducing existing GHG emissions by approximately 10,457 – 19,115 metric tons per year (27% - 49% GHG reduction). This reduction is consistent with the various New York City and New York State policies and goals of improving energy efficiency and reducing GHG emissions. ✷

[1] The City of New York, PlaNYC: A Greener, Greater New York, 2007.

[2] The City of New York, Inventory of New York City Greenhouse Gas Emissions, September 17, 2008.

[3] Investment Grade Feasibility Study for Cogeneration at the North River Wastewater Treatment Plant, February 2012.

[4] The total future GHG emissions range depending on implementation of improved digester gas production associated with digester process improvements and/or codigestion of supplemental organics.