Air Quality Evaluation and Title V Operating Permit Modification Application

SOUTH PIER IMPROVEMENT PROJECT
29TH STREET AND 2ND AVENUE
BROOKLYN, NEW YORK

SUBMITTED TO	New York State Department of Environmental Conservation, Division of Environmental Permits, Region II 47-40 21st Street Long Island City, New York 11101
APPLICANT	Astoria Generating Company, L.P. a USPowerGen Company 505 Fifth Avenue, 21st Floor New York, New York 10017
PREPARED BY	ESS Group, Inc. 401 Wampanoag Trail, Suite 400 East Providence, Rhode Island 02915
	Project No. U160-001
	February 2009

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1.0 INTRODUCTION

Astoria Generating Company, L.P. (AGC), is proposing to modify the Gowanus Generating Station (GGS) located at 29th Street and 2nd Avenue, Brooklyn, New York. The proposed modification is part of a project, known as the South Pier Improvement Project (SPIP) and will consist of the installation of one General Electric LMS100™ combustion turbine/electric generator set (LMS100) rated at 100 megawatts (MW) incorporating state-of-the-art air pollution control equipment and facility wide emissions restrictions at the GGS. The primary objective for the SPIP is to improve the GGS by the addition of new, cleaner, state-of-the-art electric generation while reducing the actual net emissions in the Sunset Park community. The emissions being reduced are regulated pollutants including carbon monoxide (CO), volatile organic compounds (VOCs), particulate matter (PM) with an aerodynamic diameter of 10 microns or less (PM_{10}), PM with an aerodynamic diameter of 2.5 microns or less ($PM_{2.5}$), nitrogen oxides (NO_X) and sulfur dioxide (SO_2). NO_X and SO_2 are precursors to $PM_{2.5}$ formation and NO_X is also a precursor to ozone (O_3) formation. In addition, carbon dioxide (CO_2), which is not a regulated pollutant, will also be reduced.

In order to achieve the SPIP objectives, a two-part permitting and emission reduction strategy was developed. The first part of the strategy is the installation of the new, highly efficient LMS100 combustion turbine with add-on emission controls, and limiting its emissions through enforceable permit limits. The potential emissions from the LMS100 will be "netted" to be below New Source Review (NSR)/Prevention of Significant Deterioration (PSD) Net Emission Increase Threshold Levels (also known as NSR/PSD emission threshold levels). Netting is the implementation of emissions reductions to existing units and then subtracting these reductions from a new emission source for determining net project emissions. This strategy allows the LMS100 installation to be considered a minor modification not subject to NSR.

The second part of the strategy is to reduce actual emission levels from the existing nearby Narrows Generating Station (NGS) units also owned by AGC through voluntary action. This will be accomplished through a separate Title V Permit modification application to the DEC. This application package is intended to result in a modification of the Title V Operating Permit issued by the New York State Department of Environmental Conservation (NYSDEC) to the GGS and to authorize the construction and operation of the SPIP and existing combustion turbines under a facility wide emission cap. This permit will provide certainty to the community that AGC will implement the SPIP emissions reductions as proposed at GGS. The Title V Operating Permit will be structured to obligate AGC to reduce emissions at GGS if the LMS100 is built, such that future emissions (including the operation of the LMS100) from the GGS must be less than the historical baseline emissions of NO_X, CO, and SO_2 from the GGS facility.

This application requests that the Title V Operating Permit specifically contain enforceable conditions. The NYSDEC Title V Operating Permit application forms (Attachment A) contain the specific proposed wording for these conditions on the referenced pages:

- Timing and commitment to convert GGS liquid fuel to Ultra Low Sulfur Diesel (ULSD) (page 18)
- Timing of the effective date of the GGS Title V operating permit emission caps (page 19)

The following conditions will be included in the GGS Title V Operating Permit Modification and shall be enforceable on AGC and any future owners or successors. The primary conditions AGC proposes to be included in the GGS permit that will permanently cap total emissions at the GGS are as follows:

GGS Proposed Annual Facility Emissions Limits

Upon commercial operation of the LMS100, AGC will be required to comply with the requirements of this Title V Operating Permit modification for the GGS permit (DEC ID 2-6102-00116/00021). The modification will assure the local community that future events will not result in an emissions increase from the GGS. The absolute tons per year (TPY) of each of the criteria pollutants shall never be increased from the following levels: $PM_{2.5}$ = 29.25, PM_{10} = 29.25, SO_2 = 7.62, NO_X = 441.74, CO = 60.19, VOC = 10.85, and Lead (Pb) = 0.01. AGC and any future owners or successors waives the right to amend this permit with respect to total annual emissions or operate the facility in a manner that increases emissions from the permitted levels any of the criteria pollutants. Permit excursions that are the result of an emergency will be considered under the emergency defense provision of the permit; however, normal load growth of the system and the inability to install additional capacity to support normal load growth shall not be considered an emergency.

2.0 NEW COMBUSTION TURBINE AND ANCILLARY EQUIPMENT

The SPIP site is located at the GGS in Brooklyn, New York. Figure 1 shows the SPIP site on a United States Geological Survey (USGS) basemap and Figure 2 shows the preliminary site plan. The entrance to the GGS is located at 29th Street and 2nd Avenue. The SPIP will be built on approximately 2.75 acres on the south pier that is approximately 200 feet north of the GGS entrance and is bounded to the north, west, and south by Gowanus Bay. The pier is a previously developed site consisting of compacted fill secured by a steel sheet-piled bulkhead and rip-rap perimeter.

The GGS currently consists of 32 combustion turbines which are mounted on four barges which fire distillate fuel oil and natural gas. Each unit is rated at 299 Million British Thermal Units (MMBtu) per hour. Sixteen of the combustion turbine/electric generating sets fire fuel oil only and are identified as Emission Unit G-W0005 in the existing GGS Title V Operating Permit. Sixteen of the combustion turbine/electric generating sets fire natural gas and fuel oil and are identified as Emission Unit G-W0006 in the GGS Title V Operating Permit. Each of the 32 units has a starter diesel rated at 600 horsepower. The Title V Operating Permit Modification will combine the existing 32 combustion turbines and the LMS100 under the envelope of one emission unit. By combining all emission sources at the GGS under one emission unit, the facility will be able to maintain maximum operational flexibility while restricting facility-wide emissions below the caps identified in Section 1.0.

The principal components of the SPIP consist of one LMS100, a combustion air intercooler, a fin fan cooler, a natural gas compressor, a step up transformer, a trailer-mounted portable water de-mineralization system, a de-mineralized water storage tank, fire water storage tank, an aqueous ammonia storage tank, an exhaust stack, and utility interconnection. The electric generator is directly connected to the shaft of the LMS100. The LMS100 exhaust exits through a stack after passing through the emission control technologies (i.e., Selective Catalytic Reduction [SCR] and CO Catalyst). The LMS100 will have the following state-of-the-art emission control technologies to significantly limit potential emissions: water injection to reduce the formation of NO_X within the gas turbine, SCR to further reduce NO_X, and a CO oxidation catalyst to minimize CO and VOC emissions. Emissions of SO_2 and PM will be controlled through the primary use of natural gas and ULSD for back up. Natural gas will be utilized as the primary fuel with ULSD as a backup fuel. The LMS100 exhaust will pass through emission control devices before being vented to the atmosphere through a new stack, approximately 100 feet tall with an inside diameter of 13 feet 6 inches.

The LMS100 is the first modern production gas turbine in the power generation industry to employ off-engine intercooling technology with the use of an external heat exchanger. The LMS100 provides the highest simple-cycle efficiency available in the power industry today.[1]

The method of combustion for the LMS100 is also very efficient. Air is compressed through aerodynamically improved blades and flow channels until it reaches the combustion zone. The fuel and air are mixed through tangential inlet slots on the burner cone to form the lean-premix fuel. The fuel is burned in a controlled, efficient process, which results in a low-temperature, stable, single-flame halo. In

[1] G.E., 2004. GE Energy New High Efficiency Simple Cycle Gas Turbine – GE's LMS100™ GER-4222A (06/04) http://www.gepower.com/prod_serv/products/tech_docs/en/downloads/ger4222a.pdf Accessed April 29, 2008.

the secondary combustion zone, the remaining fuel is injected into each combustion chamber vortex to provide additional premixing. This combustion technology minimizes NO_X formation in the combustion process.

Natural gas will be provided via an existing supply line and metering station at the GGS facility. Gas is currently delivered to the GGS at a pressure of approximately 250 pounds (lbs) per square inch gauge. The gas will pass through the existing gas main running along 2nd Avenue and then through a new meter to be installed next to the existing gas meters. The pressure of the gas will be raised in a gas compressor and then supplied to the LMS100. If required by final plant design, other ancillary gas equipment such as a gas bypass/reducing station and moisture separators and filters may also be installed.

The current GGS facility utilizes liquid fuel that is delivered by transient barges and stored in permanently moored fuel storage barges attached to the existing GGS north pier. The SPIP will not change the current liquid fuel delivery or storage other than the fuel will be changed to ULSD, which will be delivered via barge to existing fuel storage barges at the GGS (as is currently being done today with No. 2 fuel oil). The existing GGS currently receives fuel oil deliveries based on the use of oil. The frequency of deliveries is minimal due to the low annual run hours of the facility. ULSD will be pumped to the LMS100 from existing fuel storage barges in the same manner as for the existing GGS turbines.

2.1 Operating Conditions

The LMS100 will operate as a simple-cycle, peaking power plant or peaker. The facility will generally run only when electrical demand is high (during peak periods) or when there are conditions that require the facility for grid support and reliability. The LMS100 is nominally rated to produce 100 MW of electric power under typical operating conditions.

3.0 REGULATORY REQUIREMENTS

The Clean Air Act provides the principal regulatory basis for permitting any new, major emission source or a modification to an existing major source. This section discusses each of the criteria air pollutants that may be emitted from the new equipment along with a discussion of how these emissions will be minimized. Stringent emission limits, the installation of state of the art emissions controls and the use of clean fuels will ensure that the SPIP will not adversely affect existing air quality.

3.1 Air Quality Regulatory Framework

The construction and operation of the SPIP will be subject to federal, state and city air regulations that will be implemented through permits to be applied for by AGC:

- NSR for New and Modified Facilities. 6 New York Codes, Rules and Regulations (NYCRR) 231.
- NYSDEC Title V Permit Modification. 6 NYCRR 201-6.
- Acid Rain Permit (Title IV). 6 NYCRR 201-6.
- NO_X Budget Program. 6 NYCRR 204.
- Reasonably Available Control Technology (RACT) For Oxides of Nitrogen (NO_X). 6 NYCRR 227-2.
- Acid Deposition Reduction (ADR) NO_X Budget Trading Program. 6 NYCRR 237.
- ADR SO_2 Budget Trading Program. 6 NYCRR 238.
- CO_2 Budget Trading Program. 6 NYCRR 242.
- Primary and Secondary National Ambient Air Quality Standards (NAAQS). 40 Code of Federal Regulations (CFR) 50.
- Air Quality Standards. 6 NYCRR 257.
- Standards of Performance for New Stationary Sources - Subpart KKKK – Standards of Performance for Stationary Combustion Turbines. 40 CFR 60.
- NYC DEP Stationary Combustion Installation Permit.

On July 11, 2008, the D.C. Circuit Court of Appeals issued a decision vacating the Clean Air Interstate Rule (CAIR) and remanded it to EPA to be re-promulgated. On December 23, 2008 the D.C. Circuit Court of Appeals temporarily reinstated the CAIR Rule until EPA can draft new regulations that will satisfy the requirements of the July 11th opinion. Three Clean Air Interstate Rules (CAIR) governing NO_X Ozone Season Trading (6 NYCRR 243), Annual NO_X Trading (6 NYCRR 244) and Annual SO_2 Trading (6 NYCRR 245) in New York are based on the EPA CAIR rule. Therefore it is uncertain at this time exactly what the resolution of the CAIR rules may be. The New York State components of the CAIR NO_X Ozone Season Trading Program and the CAIR NO_X and SO_2 Annual Trading Program, are designed to mitigate interstate transport of fine particulates and NO_X by limiting emissions of NO_X and

SO_2 from fossil fuel-fired electricity generating units. Although there is uncertainty in the future of the CAIR programs, based on discussions and guidance from DEC, AGS has provided the Clean Air Interstate Rule Permit Applications in Attachment F of Appendix B. The NYSDEC is currently developing guidance documents for the implementation of the CAIR Rule and it intends to sunset the existing Acid Deposition Reduction Program regulations identified above as the ADR NO_X Budget Trading Program (6 NYCRR 237) and the ADR SO_2 Budget Trading Program (6 NYCRR 238) with the implementation of the CAIR Rule.

3.2 6 NYCRR 201-6: Title V Operating Permit

The SPIP is subject to the requirements of 6 NYCRR Subpart 201-6: Title V Operating Permits which requires the proponent to submit an application to modify the existing Title V Operating Permit and receive NYSDEC approval prior to construction and operation. The SPIP constitutes a proposed modification to an existing major source, the GGS. The modification will propose emission caps on the facility for the purpose of remaining below NSR thresholds for both PSD and NonAttainment Review in accordance with the requirements of Section 201-7.2 of the NYSDEC regulations. Please see Attachment A for the Title V Operating Permit Application Forms.

3.3 6 NYCRR 201-6: Acid Rain Permit (Title IV)

The LMS100 will be a "New Unit" subject to the Federal Acid Rain Program as an "Affected Unit", in accordance with the definitions and requirements of 40 CFR 72. An "Affected Unit" is defined by the United States Environmental Protection Agency (U.S. EPA) as any "New Unit" that serves a generator to produce electricity for sale. The GGS will become an "Affected Source" under the Federal Acid Rain Program due to the SPIP and as such an Acid Rain Permit for the proposed new Affected Unit will need to be added to the applicable requirements of the GGS Title V Operating Permit. The purpose of this regulation is to "cap" or limit acid rain emissions from power plants in the United States.

The Acid Rain Program requires owners and operators of "Affected Units" to purchase allowances to offset their potential emissions of SO_2. "Affected Units" are also required to utilize a continuous emissions monitoring system, certified and operated in accordance with 40 CFR 75. This requirement includes the continuous measurement and recording of SO_2, NO_X, and CO_2 emissions and the reporting of emissions to U.S. EPA quarterly in an electronic on-line format. U.S. EPA requires the owner/operator to appoint a Designated Representative from the GGS for all submissions and allowance transactions related to the Acid Rain Program. The proposed project will meet all of the applicable requirements of the Acid Rain Program. The Phase II Title IV requirements are implemented in New York State through the Title V operating permit program. Please see Attachment C for the Title IV Acid Rain Permit Application.

3.4 6 NYCRR 204: Nitrogen Oxide Budget Program

6 NYCRR 204 is the NYSDEC NO_X Budget Program, which is designed to mitigate the interstate transport of O_3 and NO_X which is an O_3 precursor. The GGS is a NO_X Budget Source under this program which is a "Cap and Trade" system which requires sources to hold sufficient NO_X allowances to cover their emissions during the May to September "Ozone Season". GGS will retain the required

amount of NO_X allowances that will be equal to or greater than the facility's Ozone Season NO_X emissions. This program will be phased out when the CAIR Rule comes into full effect in New York at some time in 2009 (see Section 3.10). Please see Attachment F for the Clean Air Interstate Rule Permits.

3.5 6 NYCRR 227-2: Reasonably Available Control Technology for Nitrogen Oxides

NYSDEC requires the application of RACT to "existing" stationary NO_X sources pursuant to 6 NYCRR 227-2. This includes modifications to existing sources like the GGS. Since the LMS100 will meet NO_X limits of 2.5 parts per million (ppm) when firing natural gas and 3.5 ppm while firing ULSD fuel it will operate below the NYSDEC Combustion Turbine RACT emission limit. Therefore, no additional control or operational measures be required for the LMS100 to achieve compliance with NO_X RACT.

3.6 6 NYCRR 231: New Source Review for New and Modified Facilities

AGC is proposing to impose emission restrictions on the new LMS100 and on the existing GGS units in order to ensure that the net emissions increase from the new LMS100 will remain below NSR permitting thresholds. These limitations will be included in this application for a Title V Operating Permit in accordance with Subpart 201-6. This combination of emission restrictions on the new LMS100 and the existing GGS units will result in net emission increases at the GGS facility that will be below the permitting thresholds contained in Part 231 NSR for New and Modified Facilities of the NYSDEC Air Resources regulations. Net emission increases and decreases from the SPIP are described in the emissions discussion of the application and all permit conditions will be made enforceable in accordance with the requirements of Subpart 231-6 of the NYSDEC Air Resources regulations as part of this Subpart 201-6 Title V Operating Permit provided in Attachment A.

3.7 6 NYCRR 237: Acid Deposition Reduction Nitrogen Oxide Budget Trading Program

The ADR NO_X Budget Trading Program is designed to reduce acid deposition in New York State by limiting emissions of NO_X from fossil fuel-fired electricity generating units during the non-Ozone Season. Any unit that, any time on or after January 1, 1999, serves a generator with a nameplate capacity equal to or greater than 25 MW electric and sells any amount of electricity shall be a NO_X budget unit, and any source that includes one or more such units shall be a NO_X budget source, subject to the requirements of Part 237. To the extent this program is applicable and not superseded by 6 NYCRR 244-3, an application will be submitted 12 months before the unit commences operation. This program will be phased out when the CAIR Rule comes into full effect in New York at some time in 2009 (see Section 3.10). Please see Attachment F for the Clean Air Interstate Rule Permits.

3.8 6 NYCRR 238: Acid Deposition Reduction Sulfur Dioxide Budget Trading Program

The ADR SO_2 Budget Trading Program is designed to reduce acid deposition in New York State by limiting emissions of SO_2 from stationary sources defined as SO_2 budget units. As previously indicated in the Title IV Acid Rain Permit section, the LMS100 combustion turbine/generator will be a "New Unit" subject to the federal Acid Rain Program as an "Affected Unit", in accordance with the definitions and requirements of 40 CFR 72. This qualifies the LMS100 as an SO_2 Budget Unit under 6 NYCRR 238. To the extent this program is applicable and not superseded by 6 NYCRR 245-3, an application will be submitted 12 months before the unit commences operation. This program will be phased out when the CAIR Rule comes into full effect in New York at some time in 2009 (see Section 3.10). Please see Attachment F for the Clean Air Interstate Rule Permits.

3.9 6 NYCRR 242: Carbon Dioxide Budget Permit (New York State Component of the Regional Greenhouse Gas Initiative)

New York State has promulgated regulations to implement a ten-state, regional agreement, the Regional Greenhouse Gas Initiative that will reduce greenhouse gas emissions from power plants. The proposed regulations will create a regulatory structure for incentives and penalties designed to reduce carbon emissions statewide. The agreement establishes a market-based “cap-and-trade” auction system that requires power plants to obtain allowances to cover the amount of their carbon emissions. The LMS100 has an output rating of 25 MW or greater and will be applicable to the requirements of 6 NYCRR 242. AGC will be required to purchase sufficient CO_2 allowances at auction, which are at least equal to CO_2 emissions from the new unit.

3.10 40 CFR 50 National Primary and Secondary Ambient Air Quality Standards

40 CFR 50 establishes NAAQS. Primary NAAQS define levels of air quality which the Administrator judges are necessary, with an adequate margin of safety, to protect the public health. Secondary NAAQS define levels of air quality which the Administrator judges necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant. The NAAQS are subject to revision, and additional primary and secondary standards may be promulgated as the U.S. EPA Administrator deems necessary to protect the public health and welfare.

U.S. EPA has established NAAQS for six criteria pollutants; SO_2, nitrogen dioxide (NO_2), CO, O_3, Pb, and PM ($PM_{2.5}$ and PM_{10}). These standards have been developed to establish air quality limits which would protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. The SPIP must demonstrate that emissions from the LMS100 will not cause or contribute to a violation of any NAAQS. The Air Quality Dispersion Modeling section of this application demonstrates that emissions from the SPIP will not cause or contribute to a violation of the NAAQS.

3.11 New Source Performance Standards

The U.S. EPA has established New Source Performance Standards for a variety of combustion and industrial processes. The LMS100 is subject to the operating constraints and emissions limitations contained in New Source Performance Standards Subpart KKKK “Standards of Performance for Stationary Combustion Turbines.” This regulation sets emission limitations for NO_X and SO_2. NO_X emissions from an applicable unit are required to stay at or below 15 ppm while firing natural gas and 42 ppm, both concentrations corrected to 15% oxygen (O_2), while firing fuel oil. SO_2 emissions are limited to 0.060 lb SO_2/MMBtu from an applicable unit. The LMS100 will have a NO_X emission limit of 2.5 ppm when firing natural gas and 3.5 ppm while firing ULSD and a maximum SO_2 emission rate of 0.00237 lb/MMBtu which are far below the limits in Subpart KKKK and therefore meet the requirements of this regulation.

3.12 NYC DEP Stationary Combustion Installation Permit

The SPIP will be required to submit a NYC DEP Stationary Combustion Installation Permit. Please see Attachment G for the related NYC DEP application forms.

3.13 Air Emission Reduction Strategy

The first part of the strategy is the installation of a new, highly efficient LMS100 combustion turbine with add-on emission controls, and capping the future emissions at the GGS through enforceable permit limits. The potential emissions from the LMS100 will be “netted” to be below regulatory emission threshold levels by enforceable permit limits that reduce the actual emission levels from the existing GGS units. Therefore, the installation of the LMS100 is considered a minor modification of the existing facility.

As noted in Section 1.0, the second part of the strategy to voluntarily reduce actual emission levels from the existing NGS units will be addressed by a separate application to DEC. The air emission reduction strategy is based on the practice of “Emissions Netting”, which is the implementation of emissions reductions to existing units and then subtracting these reductions from a new emission source for determining “net” project emissions. For the SPIP, the reduced emissions from the existing GGS are subtracted from the proposed LMS100 emissions to determine the applicability of state and federal NSR and PSD regulations. As a result, the addition of the LMS100 is classified as a minor modification to the existing facility.

4.0 EMISSIONS AND CONTROL TECHNOLOGY

4.1 LMS100 Projected Emissions

Projected annual emissions of the LMS100 will be limited as summarized in Table 4.1.2-2 of Section 4.1. These emissions are based on the amount of time the LMS100 is expected to operate into the foreseeable future and relates to a capacity factor of approximately 35% (inclusive of using ULSD 7% of the time) or a capacity factor of approximately 36.5% if gas fuel is used exclusively or a capacity factor of 9.0% if ULSD is used exclusively. Emission calculations are based on a maximum of 240 cold starts per year. Projected annual emissions of the LMS100 were calculated using the General Electric (GE) guaranteed emission factors and GE modeled maximum emission rates.

The annual emissions include emissions resulting from startup and shutdown of the LMS100 in addition to those from normal operations. Start-up is defined as the 30 minute period of time from the point that the gas turbine begins firing fuel. A shutdown is defined as the period of time when the stop signal is initiated to when fuel is no longer being combusted in the engine or a subsequent start is initiated, not to exceed 30 minutes per occurrence.

The LMS100 is designed to limit emissions through a variety of technologies and controls. The following discussion outlines the LMS100 factory-installed technologies along with the add-on controls that further minimize and mitigate potential air emissions. The projected emission rates of the LMS100 with the add-on controls are presented in this section.

4.1.1 Emissions from Normal Operation

Combustion of natural gas and ULSD in the LMS100 combustion turbine will result in emissions which include NO_X, SO_2, PM_{10}, $PM_{2.5}$, CO, VOCs and Pb. NO_X and VOCs are precursors to the criteria pollutant O_3. Both primary natural gas fuel and the backup ULSD are considered clean fuels. Maximum emission rates for criteria pollutants were determined from the LMS100 on an hourly basis. Tables 4.1.1-1 and 4.1.1-2 provide a summary of criteria pollutant emission rates from the LMS100 during natural gas and ULSD firing. Each table provides emission rates under several different operating conditions which encompass the range of anticipated ambient conditions and operating loads. The hourly emission rates for each criteria pollutant and ammonia (NH_3) from the LMS100 while firing Natural Gas is shown in Table 4.1.1-1. The hourly emission rates for each criteria pollutant from the unit while firing ULSD is shown in Table 4.1.1-2.

Table 4.1.1-1 Natural Gas-Fired LMS100 Emissions by Load and Ambient Temperature in Pounds per Hour

Pollutant	100% Load		
	-5°F	59°F	105°F
NO_X	7.75	8.09 [a]	6.88
CO	11.32	11.82 [a]	10.05
$PM_{10}/PM_{2.5}$	7.78	8.43	8.46 [a]
SO_2	1.91	2.10 [a]	1.70
VOCs	3.94 [a]	3.59	3.02
Pb	0.00	0.00	0.00
H_2SO_4	0.05	0.05 [a]	0.05
NH_3	5.73	5.98 [a]	5.09
Pollutant	**75% Load**		
	-5°F	59°F	105°F
NO_X	6.16	6.34 [a]	5.49
CO	8.99	9.26 [a]	8.01
$PM_{10}/PM_{2.5}$	7.60	7.88	8.04 [a]
SO_2	1.51	1.64 [a]	1.35
VOCs	3.32 [a]	3.06	1.86
Pb	0.00	0.00	0.00
H_2SO_4	0.05	0.05 [a]	0.05
NH_3	4.55	4.68 [a]	4.05
Pollutant	**50% Load**		
	-5°F	59°F	105°F
NO_X	4.56	4.66 [a]	4.11
CO	6.65	6.81 [a]	6.00
$PM_{10}/PM_{2.5}$	7.48	7.69	7.81 [a]
SO_2	1.11	1.21 [a]	1.01
VOCs	2.56 [a]	1.90	1.14
Pb	0.00	0.00	0.00
H_2SO_4	0.05	0.05 [a]	0.05
NH_3	3.37	3.45 [a]	3.03

Notes:
H_2SO_4 = Sulfuric Acid
a = Highest emission rate at specified load

Table 4.1.1-2 ULSD LMS100 Emissions by Load and Ambient Temperature in Pounds per Hour

Pollutant	100% Load		
	-5°F	59°F	105°F
NO_X	11.28	11.42 [a]	9.55
CO	11.77	11.92 [a]	9.96
$PM_{10}/PM_{2.5}$	28.59	28.83 [a]	24.71
SO_2	1.28	1.29 [a]	1.08
VOCs	4.85 [a]	4.70	3.99
Pb	0.01	0.01 [a]	0.01
H_2SO_4	0.02	0.02 [a]	0.02
NH_3	11.91	12.06 [a]	10.08
Pollutant	**75% Load**		
	-5°F	**59°F**	**105°F**
NO_X	8.93	8.95 [a]	7.62
CO	9.32	9.34 [a]	7.95
$PM_{10}/PM_{2.5}$	22.73	22.62 [a]	19.79
SO_2	1.01	1.01 [a]	0.86
VOCs	4.09 [a]	4.01	3.39
Pb	0.01	0.01 [a]	0.01
H_2SO_4	0.02	0.02 [a]	0.02
NH_3	9.43	9.45 [a]	8.05
Pollutant	**50% Load**		
	-5°F	**59°F**	**105°F**
NO_X	6.58	6.60 [a]	5.70
CO	6.86	6.89 [a]	5.95
$PM_{10}/PM_{2.5}$	16.92	16.85 [a]	14.92
SO_2	0.74	0.75 [a]	0.64
VOCs	3.24 [a]	3.18	2.75
Pb	0.01	0.01 [a]	0.01
H_2SO_4	0.02	0.02 [a]	0.02
NH_3	6.94	6.97 [a]	6.02

Note:
a = Highest emission rate at specified load

4.1.2 Combustion Turbine Emissions during Start-up and Shutdown

Emissions of CO and NO_X from the combustion turbine will be higher during periods of startup and shutdown than during normal operation due to both the transient nature of these activities and lower combustion and exhaust gas temperatures. As a conservative assumption, the potential emissions from startup activities have been estimated based on natural gas firing and an anticipated maximum of 240 starts per year. The maximum expected short term CO and NO_X emission rates, along with the expected emissions per startup or shutdown event, and the resulting total potential emissions from these activities are shown in Table 4.1.2-1.

Table 4.1.2-1 LMS100 Potential Emissions for Start up/Shutdown

Pollutant		Lbs/Hour	TPY
Start up	NO_X	9.75	0.20
	CO	20.06	0.99
Shutdown	NO_X	10.71	0.31
	CO	23.06	1.35

The resultant potential emissions based on maximum hourly emission rates from the LMS100 during normal operation including start up/shutdown are shown in Table 4.1.2-2.

Table 4.1.2-2 LMS100 Potential Emissions

Pollutant	Tons Per 12-Month Rolling Period (including Startup/Shutdown) LMS100 Potential To Emit Tons per Year
NO_X	13.94
CO	21.23
$PM_{10}/PM_{2.5}$	19.26
SO_2	3.36
VOCs	6.32
Pb	0.005
H_2SO_4	0.07
NH_3	11.03

4.2 Criteria Pollutants and Emission Control Technology

4.2.1 Nitrogen Oxides

The LMS100 is designed to utilize water injection to limit NO_X emissions to 25 ppm when operating on natural gas and 42 ppm when firing ULSD prior to additional backend emission controls. Further NO_X emission control will be achieved by an SCR.

Water injection limits NO_X formation by injecting small amounts of water or steam into the immediate vicinity of the combustor burner flame. The presence of water or steam mixes in the flame with the combustion by-products, and reduces flame temperatures by dilution and cooling of combustion by-products. This process result is a lower flame temperature and consequently reduced formation of thermal NO_X.

The addition of an SCR at the backend removes NO_X from the combustion turbine exhaust gas stream by the injection of aqueous ammonia solution into the hot exhaust gas path where it passes through a catalyst grid. The catalyst causes a chemical reaction between the aqueous ammonia and the hot stack gases which reduces most of the NO_X to nitrogen (N_2) and water. The SCR will use a 19% aqueous ammonia solution (the most commonly used form for this application). Storage of aqueous ammonia requires safety precautions which are described in Section 3.11 of the Draft Environmental Impact Statement. NO_X emissions will be reduced by approximately 90% by the SCR system.

4.2.2 Sulfur Dioxide

AGC has committed to firing natural gas as the primary fuel and ULSD as a backup fuel for the LMS100. Natural gas has a negligible amount of sulfur content and ULSD contains 0.0015% sulfur resulting in extremely low SO_2 emissions during natural gas and oil fired operations without additional controls.

The use of natural gas fuel will limit the stack SO_2 emission rate to 2.1 lb/hour[2] and the maximum ULSD SO_2 emission rate will be 1.3 lb/hour.

4.2.3 Particulate Matter

The emissions of $PM_{2.5}$ from the LMS100 have been conservatively assumed to equal to the emissions of PM_{10}. $PM_{2.5/10}$ emission control will be achieved in the LMS100 by efficiently burning low ash and low sulfur fuels. The LMS100 will burn natural gas and ULSD only, combined with state-of-the-art combustion technology and operating controls, to provide the most stringent degree of particulate emissions control available for combustion turbines.

New York State is in the process of implementing the U.S. EPA's Final Rule for Implementation of the NSR Program for $PM_{2.5}$. Presently, both 6 NYCRR Part 231 and NYSDEC Policy CP-33, Assessing and Mitigating Impacts of Fine Particulate Matter Emissions (NYSDEC, 2003) offer guidance with respect to meeting future $PM_{2.5}$ standards in the absence of a revised State Implementation Plan. The NYSDEC Part 231 has a $PM_{2.5}$ threshold level of 10 TPY for determining NSR and PSD applicability. In contrast, CP-33 concludes that "if primary PM_{10} emissions from the project do not equal or exceed 15 TPY, then the $PM_{2.5}$ impacts from the project shall be deemed insignificant and no further assessment shall be required under this policy." The SPIP has been designed to comply with both 6 NYCRR Part 231 and the NYSDEC Policy CP-33.

[2] Based on 0.85 grains of sulfur/dry standard cubic foot of gas.

It is important to note that at the present time, there is no U.S. EPA formal reference method for measuring $PM_{2.5}$. According to the NYSDEC website (NYSDEC, 2004), additional studies are ongoing and procedures for measuring $PM_{2.5}$ are still being developed.

4.2.4 Carbon Monoxide

The combustor design and configuration of the LMS100 achieves one of the lowest CO emission rates of any type of generation unit. The clean burning nature of natural gas and ULSD fuels minimizes CO emissions due to unburned carbon. CO emissions will be further reduced by an oxidation catalyst (also known as a CO catalyst) located in the LMS100 exhaust duct. The LMS100 will typically operate in the upper regions of its operating load range at temperatures high enough to minimize CO formation in the combustion process.

4.2.5 Ozone

As stated above, NO_X and VOC emissions are precursors to O_3 formation. Control technologies used to minimize NO_X emissions have been previously described. Control technologies used to minimize LMS100 VOC emissions include the use of clean burning fuels, state-of-the-art combustion technology, add-on oxidation catalyst systems, and establishing minimum load restrictions. The LMS100 will use a combustor design and configuration that achieves among the lowest VOC emission rate of any similar type of unit. The clean burning nature of natural gas and ULSD fuels further minimizes VOC emissions due to unburned carbon. Additional reduction of VOC emissions will come from the oxidation catalyst that is also used to control CO emissions. The LMS100 will typically operate in the upper regions of its operating load range at combustion temperatures high enough to minimize VOCs formation in the combustion process.

4.2.6 Ammonia

The SCR emissions control systems will reduce the NO_X emissions from the turbines by injecting a 19% aqueous ammonia solution into the exhaust gas stream upstream of a catalyst. The NO_X and NH_3 react on the surface of the catalyst to form nitrogen and water. Some portion of the injected NH_3 will pass through the catalyst unreacted. These unreacted NH_3 emissions are referred to as ammonia slip.

4.3 LMS100 Emission Factors

Projected emissions for the LMS100 are based on GE guaranteed emission factors and modeled combustion analyses provided by GE. The GE provided data are “end of stack” values which include reductions with the installation of GE supplied CO catalyst and SCR emission control equipment. Tables 4.3-1 and 4.3-2 summarize the emission factors for the LMS100 on ULSD and natural gas firing, respectively.

Table 4.3-1 Maximum Natural Gas Firing LMS100 Emission Rates at 50 to 100% Load

Pollutant	lb/hr	lb/MMBtu (HHV)	ppmvd @ 15% O_2
NO_X	8.09	0.00913	2.5
CO	11.82	0.01334	6.0
$PM_{10}/PM_{2.5}$	8.50	0.01710	-
NH_3	5.98	0.00675	5.0
SO_2	2.10	0.00237	-
VOCs	3.94	0.00513	3.7
Pb	0.00	-	-
H_2SO_4	0.05	0.00011	-

Notes:
Data is based on LMS100 operations from 50 to 100% load
100% Load Heat Input = 885.8 MMBtu/hr
HHV = High Heating Value of Fuel
ppmvd = Parts Per Million, Volumetric Dry

Table 4.3-2 Maximum ULSD Fuel Oil Firing LMS100 Emission Rates at 50 to 100% Load

Pollutant	lb/hr	lb/MMBtu (HHV)	ppmvd @ 15% O_2
NO_X	11.42	0.01361	3.5
CO	11.92	0.01420	6.0
$PM_{10}/PM_{2.5}$	28.83	0.03507	-
NH_3	12.06	0.01437	10
SO_2	1.29	0.00154	-
VOCs	4.85	0.00660	5
Pb	0.01	0.00002	-
H_2SO_4	0.02	0.00005	-

Notes:
Data is based on LMS100 operations from 50 - 100% load
100% Load Heat Input = 839.2 MMBtu/hr

4.4 Non-Criteria Pollutants and Hazardous Air Pollutants

In addition to the established criteria pollutants, NYSDEC has established ambient air quality standards for some non-criteria pollutants, as noted in 6 NYCRR 257. Specifically, these pollutants are beryllium, fluorides, and hydrogen sulfide. The SPIP will not emit any of the other pollutants identified above.

4.5 Initial Determination of New Source Review/Prevention of Significant Deterioration Applicability

To determine if the installation of the LMS100 is above or below the NSR/PSD emission threshold levels a definition of the operational profile and quantification of the potential emissions must be made. Once emission estimates are made they can be compared to threshold levels. If NSR/PSD emission threshold levels are exceeded, Emissions Netting with the existing GGS equipment will be employed. AGC's primary objective is to maintain the potential emissions increases below NSR/PSD emission threshold levels such that the installation is a minor modification. Where the potential increases in emissions from the LMS100 exceed the NSR/PSD emission threshold levels, Emissions Netting is used to reduce the potential increases below NSR/PSD emission threshold levels. Where Emissions Netting is required, the GGS actual baseline emissions must also be determined to provide a reference point for quantifying creditable emission increases and decreases for the modification.

4.5.1 Comparison of Projected LMS100 Emissions with New Source Review/Prevention of Significant Deterioration Emission Threshold Levels

A comparison of the proposed LMS100 emission limits for each of the criteria pollutants to the NSR/PSD emission threshold levels are presented in Table 4.5.1-1.

Table 4.5.1-1 Projected LMS100 Emissions Compared to NSR/PSD Emission Threshold Levels

Pollutant	LMS100 Emissions (TPY)	NSR/PSD Emission Threshold Levels (TPY)	Positive Values Indicate NSR/PSD Emission Thresholds Levels Met (TPY)
NO_X	13.94	**25**	11.06
NO_2 (as NO_X)	13.94	**40**	26.06
CO	21.23	**100**	78.77
SO_2	3.36	**40**	36.64
PM	19.26	**25**	5.74
PM_{10}	19.26	**15**	-4.26
$PM_{2.5}$	19.26	**10**	-9.26
VOCs	6.32	**25**	18.68
Pb	0.005	**0.6**	0.595
Fluoride	-	**3**	-
H_2SO_4	0.07	**7**	6.9

As indicated in Table 4.4.1-1, the LMS100 would exceed the NSR/PSD emission threshold levels for PM_{10} and $PM_{2.5}$ if the LMS100 were added with out any reductions in existing GGS emissions. AGC will implement Emissions Netting within the proposed modified GGS to reduce net emissions below the NSR/PSD emission threshold levels.

4.5.2 Emissions Netting

The SPIP is a proposed modification to the GGS which is an existing major source of air pollution as defined in the NYSDEC air pollution regulations. Emissions Netting is the process of evaluating prospective emission changes at an existing major source to determine if a significant "net emissions increase" of any pollutant will result. If the calculated net increase is significant, then NSR (NSR or PSD) permitting rules would apply on a pollutant by pollutant basis. The SPIP will not result in a significant net emissions increase because it will propose enforceable emission reductions from existing units at the GGS facility and place an emission cap on the GGS facility which will allow the addition of the LMS100 at the GGS to remain below the significant "net emissions increase" thresholds in the regulations.

Where a proposed modification exceeds the significant project threshold(s) specified in 6 NYCRR § 231-13.3 Table 3 and §231-13.4 Table 4, the modification can apply enforceable reduction in emissions from the existing equipment such that the result will be emission levels below the "significant net emission" increase levels due to Emissions Netting as allowed in NYSDEC Subpart 231-6.2.

The "Baseline Period" for the proposed SPIP is first determined as a reference point for quantifying creditable emission increases and decreases for the modification. The SPIP baseline period may consist of the two consecutive year period immediately preceding the date of receipt by the department of a permit application for a proposed source project or some other two consecutive years which are shown, and which the department accepts as being, more representative of normal source operation based on actual operating hours, production rates and material input within the five years immediately preceding the date of receipt by the NYSDEC of a permit application for the modification. The SPIP baseline period will be the two year consecutive period from January 2004 to December 2005 based on historic operations. Emission reductions to be realized from GGS must be determined from "Baseline Actual Emissions" calculated for the two year "Baseline Period" of January 2004 through December 2005. Tables 4.5.2-1 and 4.5.2-2 contain the Baseline Actual Emissions calculations for the GGS facility. Distillate oil-fired emissions are detailed in Table 4.5.2-1. Natural gas-fired emissions and starter diesel distillate oil-fired emissions are detailed in Table 4.5.2-2. Please see Attachment E for the Baseline Period Demonstration. A summary of the GGS baseline actual emissions are listed in Table 4.5.2-3.

Table 4.5.2-1 GGS Baseline Determination – Part 1

Distillate Oil-Fired Emissions (Barges 1, 2, 3, 4)	
Fuel Heat Value (Btu/gal)	136,661
Barge 1 & 4 2004 (gal/yr)	4,215,100
Barge 1 & 4 2005 (gal/yr)	10,766,000
Barge 2 & 3 2004 (gal/yr)	401,700
Barge 2 & 3 2005 (gal/yr)	518,800
Sum Barge 1 & 4 (2004-2005) (gal/yr)	14,981,100
Sum Barge 2 & 3 (2004-2005) (gal/yr)	920,500
2004 liquid fuel consumed (gal)	4,616,800
2005 liquid fuel consumed (gal)	11,284,800
24 Month Consecutive Total Liquid Consumption Sum Barges 1, 2, 3, 4 (gal/yr)	15,901,600

Pollutant	Emission Factor (lb/MMBtu)	Emission Factor Source	Lbs per 24 Month period (2004-2005)	Baseline Lbs per Year	Baseline TPY
CO	0.0033	AP-42	7,171	3,586	1.8
NO_X					611.7
Barge 1 & 4	0.686	ST	1,490,766	745,383	372.7
Barge 2 & 3	0.44	ST	956,177	478,088	239.0
Pb	1.4E-05	AP-42	30	15	0.008
SO_2			375,957	187,979	94.0
2004	0.1515	AP-42	95,587	47,793	23.9
2005	0.1818	AP-42	280,371	140,185	70.1
VOCs					5.4
Barge 1 & 4	0.0004	AP-42	869	435	0.2
Barge 2 & 3	0.00959	ST	20,840	10,420	5.2
PM (Condensable)	7.20E-03	AP-42	15,647	7,823	3.9
PM (Filterable)	1.80E-02	ST	39,116	19,558	9.8
PM (Total)	2.50E-02	AP-42 & ST	54,328	27,164	13.6

Notes:
AP-42 = U.S. EPA's Compilation of Air Pollution Emission Factors, Section 3.1, Stationary Gas Turbines for Electricity Generation (April 2000)
ST = Emission factor derived from site specific stack testing

Table 4.5.2-2 GGS Baseline Determination – Part 2

Natural Gas-Fired Emissions (Barges 2, 3)					
Fuel Heat Value:		1,037	Btu/scf		
24 Month Consecutive Total Gas Consumption		3,530,800	MCFs		
Pollutant	**Emission Factor (lb/MMBtu)**	**Emission Factor Source**	**Lbs per 24 Month period (2004-2005)**	**Baseline Lbs per Year**	**Baseline TPY**
CO	0.082	AP-42	300,238	150,119	75.1
NO_X	0.261	ST	955,636	477,818	238.9
Pb	ND	AP-42	ND	ND	0.0
SO_2	0.0034	AP-42	12,449	6,224	3.1
VOCs	3.54E-03	ST	12,961	6,481	3.2
PM (Total)	6.60E-03	AP-42	24,166	12,083	6.0

Notes:
AP-42 = U.S. EPA's Compilation of Air Pollution Emission Factors, Section 3.1, Stationary Gas Turbines for Electricity Generation (April 2000).
ST = Emission factor derived from site specific stack testing.

Starter Diesels Distillate Oil-Fired Emissions (Barges 1, 2, 3, 4)					
Fuel Heat Value:		136,689	Btu/gal		
24 Month Total Liquid Consumption		32,900	gal/yr		
Pollutant	**Emission Factor (lb/MMBtu)**	**Emission Factor Source**	**Lbs per 24 Month period (2004-2005)**	**Baseline Lbs per Year**	**Baseline TPY**
CO	0.95	AP-42	4,272	2,136	1.1
NO_X	4.41	AP-42	19,832	9,916	5.0
Pb	ND	AP-42	ND	ND	0.0
SO_2	0.29	AP-42	1,304	652	0.3
VOCs	0.35	AP-42	1,574	787	0.4
PM (Total)	3.10E-01	AP-42	1,394	697	0.3

Note:
AP-42 = U.S. EPA's Compilation of Air Pollution Emission Factors, Section 3.3, Uncontrolled Gasoline and Diesel Industrial Engines, Supplement B (October 1996)

Table 4.5.2-3 GGS Baseline Actual Emissions (January 2004–December 2005)

Pollutant	TPY
CO	77.92
NO_X	855.60
Pb	0.008
SO_2	97.43
VOCs	9.06
PM (Total)	19.97

The following three steps were taken to determine the amount of “Baseline Actual Emissions” that would need to be reduced for the SPIP to stay below NSR thresholds.

1. Potential emissions from the new LMS100 unit were calculated using GE supplied emission factors and are shown in Table 4.5.2-4.

Table 4.5.2-4 LMS100 Potential Emissions

Pollutant	Tons Per 12-Month Rolling Period
	LMS100 Potential to Emit Tons per Year
NO_X	13.94
CO	21.23
$PM_{10}/PM_{2.5}$	19.26
SO_2	3.36
VOCs	6.32
Pb	0.005
H_2SO_4	0.07
NH_3	11.03

2. Emission reductions from Baseline Emissions required at GGS to remain below NSR for PSD and Nonattainment Review were calculated. $PM_{2.5}$ emissions from the LMS100 were the critical pollutant in this determination. To net out of NSR/PSD the existing GGS facility will be required to reduce $PM_{2.5/10}$ by a minimum 9.27 TPY to limit the increased emissions to a level below the NSR/PSD emission threshold levels. $PM_{2.5/10}$ emissions will be reduced by 9.99 TPY and will therefore allow the project to net out of NSR/PSD review. Net emission increases from the LMS100 were required to remain below 10 TPY. See Table 4.5.2-5.

Table 4.5.2-5 SPIP/GGS Determination of NSR Applicability for Addition of LMS100

Pollutant	Tons Per 12-Month Rolling Period					
	LMS100 Potential Emissions TPY	GGS - Net Emission Reductions Barges 1 – 4 TPY	GGS - Net Emissions Increase or Decrease[1] TPY	NSR Significant Increase Threshold TPY	NSR Program	Applicable
NO_X	13.94	-427.80	-413.86	25 40	NSR PSD	No No
CO	21.23	-38.96	-17.73	100	PSD	No
PM	19.26	-9.99	9.27	25	PSD	No
PM_{10}	19.26	-9.99	9.27	15	PSD	No
$PM_{2.5}$	19.26	-9.99	9.27	10	NSR	No
SO_2	3.36	-93.17	-89.81	40	PSD	No
VOCs	6.32	-4.53	1.79	25	NSR	No
Pb	0.005	-0.004	0.001	0.6	PSD	No
H_2SO_4	0.07	-	0.07	7	PSD	No
NH_3	11.03	-	11.03	NA	NA	NA

Note:
1 = Under column heading "GGS- Net Emissions Increase or Decrease," negative values indicate a net decrease in emissions and positive values indicate a net increase in emissions

3. Based on NSR thresholds and projected emissions for the LMS100, "Baseline Actual Emissions" from the GGS must be reduced by 50%. These reductions will be achieved by an enforceable emissions cap at the GGS. Emission reductions to be realized from GGS from "Baseline Actual Emissions" calculated for the 24 month "Baseline Period" from January 2004 through December 2005 will be substantial. The table below represents the facility wide potential emissions from the GGS after the SPIP which are proposed as enforceable permit limits that will cap the facility wide emissions and are shown in Table 4.5.2-6.

Table 4.5.2-6 SPIP - GGS Permit Limits

Pollutant	Tons Per 12-Month Rolling Period		
	LMS100 Emissions TPY	GGS Emissions Barges 1-4 TPY	Facility-Wide Potential Emissions TPY
NO_X	13.94	427.80	441.74
CO	21.23	38.95	60.19
PM	19.26	9.99	29.25
PM_{10}	19.26	9.99	29.25
$PM_{2.5}$	19.26	9.99	29.25
SO_2	3.36	4.26	7.62[3]
VOCs	6.32	4.53	10.85
Pb	0.005	0.004	0.01
H_2SO_4	0.07	-	0.07
NH_3	11.03	NA	11.03

4.5.3 Facility Wide Permit Limitation

AGC is proposing a facility wide emissions cap for the GGS facility at the levels set forth in Table 4.5.2-6 such that the SPIP net emissions from the new LMS100 installation will be below NSR and PSD thresholds contained in NYCRR 6 Subpart 231-6 Modifications to Existing Major Facilities in Nonattainment Areas and Attainment Areas of the State within the Ozone Transport Region. This ensures that the installation of the LMS100 does not result in a NSR major modification and that the net emission increase from the new installation is below all significant increase thresholds.

[3] Incorporates the change to ULSD fuel in the existing GGS units upon the effective date of the permit i.e. commercial operation of the LMS 100

5.0 AIR QUALITY ANALYSIS

5.1 Climate Characteristics

The SPIP site is located along the Upper New York Bay in the Borough of Brooklyn, New York. The region has warm summers and cold winters typical of a continental-type climate. Mean monthly temperatures range from a low of 20°F in January and February to a high of 75°F in July. Typical daytime high temperatures range from approximately 32°F during the winter, to about 83°F during the summer. The average annual temperature is a moderate 51°F.

Annual precipitation in the region is between 35 and 40 inches per year. Precipitation is somewhat evenly distributed during the year. However, there are more pronounced precipitation events during the spring and summer months. It is during this period, when thunderstorms associated with cold fronts and unstable air masses occur, that heavy rainfall can take place over short periods of time.

Local wind patterns are heavily influenced by the geography of the Hudson River Valley and the Atlantic Ocean. National Weather Service data for the La Guardia Airport office reflect predominant winds from the south and southeast, with a secondary maximum from the west and northwest directions. Although these wind directions prevail due to the passage of large scale weather systems, they are accentuated by the proximity of nearby bodies of water.

5.2 Topography

The SPIP site is located within Brooklyn, New York. Figure 1 depicts the SPIP site on a USGS digital raster grid (Jersey City and Brooklyn Quad). Topography in the vicinity of the SPIP is generally flat and ground level ranges from 0 to approximately 30 feet above mean sea level (MSL) from the waterfront to the Brooklyn-Queens Expressway (elevated above 3rd Avenue). Continuing west, topography gradually rises and crests at 220 feet MSL at "Battle Hill" which is located in the northeast corner of Green-Wood Cemetery. Battle Hill is listed as the highest point in all of Brooklyn.[4]

5.3 Existing Air Quality

The U.S. EPA has established NAAQS for six criteria pollutants; SO_2, NO_2, CO, O_3, Pb, $PM_{2.5}$ and PM_{10}. These standards have been developed to establish air quality limits which would protect public health, including the health of "sensitive" populations such as asthmatics, children, and the elderly. Areas which meet NAAQS are classified as being in "Attainment." Areas which do not meet NAAQS are classified as being in "Nonattainment." As indicated in Table 5.3-1 below, the ambient air quality in the vicinity of the SPIP is Nonattainment for $PM_{2.5}$ and O_3. The designated level of Nonattainment for O_3 is Moderate. The NAAQS do not distinguish levels of Nonattainment for $PM_{2.5}$. Details of the Attainment status for these and the other criteria pollutants are listed in Table 5.3-1.

[4] Sunset Park website, 2008. www.sunset-park.com Accessed February 8, 2008

Table 5.3-1 SPIP Vicinity Attainment Status per 40 CFR 81.333, as of August 18, , 2008

Pollutant	Designation Date	Classification Type
CO	5/20/02	Attainment
NO_2	-	Cannot be classified or better than national standards
$PM_{2.5}$	4/5/05	Nonattainment
PM_{10} [1]	-	-
SO_2	-	Cannot be Classified
O_3 (8-hour)[2]	6/15/04	Nonattainment (Moderate)
Pb	-	Not Designated

Notes:
1 = The PM_{10} Annual Standard was revoked 12/17/2006. The 24 hour standard is still in place. New York State attainment status for the 24 hour PM_{10} standard outside of New York County (Manhattan) is not listed at 40 CFR 81.333.
2 = The one-hour O_3 standard was revoked effective June 15, 2005, for all areas in New York State.
- = Data not listed/available.

The attainment status in the vicinity of the SPIP is based on detailed ambient air quality data, which were collected from ambient air monitors located in the vicinity of the SPIP. These data are representative of existing ambient air quality of the vicinity of the proposed project. Tables 5.3-2 and 5.3-3 list the pertinent data from nearby state operated ambient air monitors and the criteria for choosing those background concentrations.

Table 5.3-2 presents the existing background ambient air quality data for Brooklyn (Kings County). Since many of the criteria pollutants are not monitored in Brooklyn, Table 5.3-3 was prepared to present the existing background ambient air quality data for all of New York City, including Brooklyn.

During 2005—2007, the three most recent years upon which the background air quality is based, only one data gap occurred in New York City: PM_{10} monitoring was discontinued after 2005 in all of New York State except for Franklin County, which is far removed from the site. In order to fill this gap, New Jersey data were examined to determine data availability upwind of the site. Data were available for 2006 and 2007 from Jersey City; these are also listed in Table 5.3-3.

Table 5.3-4 presents an overall summary of the background concentrations and the NAAQS for each pollutant.

Table 5.3-2 Maximum Background Concentration Values (2005-2007) for Brooklyn, New York

Pollutant	Averaging Period	2005	2006	2007	Background	NAAQS
CO	1-hour	4.1 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	5.4 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	CO monitoring discontinued in Kings County.	5.4 ppm 6,289 µg/m^3	35 ppm 40,000 µg/m^3
	8-hour	2.2 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	2.5 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn		2.5 ppm 2,912 µg/m^3	9 ppm 10,000 µg/m^3
NO_2	Annual	NO_2 not monitored in Kings County.				0.053 ppm 100 µg/m^3
$PM_{2.5}$	24-hour	36 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	38 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	37 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	37.0 µg/m^3 *(average)*	35 µg/m^3
	Annual	15.3 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	12.8 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	14.1 µg/^{m3} JHS 126, 424 Leonard St, Brooklyn	14.1 µg/m^3 *(average)*	15.0 µg/m^3
PM_{10}	24-hour	20 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	PM_{10} monitoring discontinued in New York City		20 µg/m^3	150 µg/m^3
SO_2	3-hour	SO_2 not monitored in Kings County.				0.5 ppm 1,300 µg/m^3
	24-hour					0.14 ppm 365 µg/m^3
	Annual					0.030 ppm 80 µg/m^3
O_3	8-hour	O_3 not monitored in Kings County.				0.08 ppm 160 µg/m^3
Pb	Quarterly Average	0.03 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	0.02 µg/m^3 JHS 126, 424 Leonard St, Brooklyn	0.02 µg/^{m3} JHS 126, 424 Leonard St, Brooklyn	0.03 µg/m^3	1.5 µg/m^3

Notes:
1. MTA = Metropolitan Transit Authority; JHS = Junior High School
2. µg/m^3 = micrograms per cubic meter
3. The short-term CO, PM_{10}, and SO_2 background concentrations (1-hour, 3-hour, 8-hour, and 24-hour) are the highest of the second-high values.
4. The annual NO_2 and SO_2 background concentrations are the highest of the annual mean values.
5. The 24-hour $PM_{2.5}$ background concentration is the 3-year average of the 98th percentile values.
6. The annual $PM_{2.5}$ background concentration is the 3-year average of the annual mean values.
7. Background values selected were the highest values meeting the above criteria from among the monitors in Kings County, New York, over the most recent 3-year period (2005-2007).

Table 5.3-3 Maximum Background Concentration Values (2005-2007) for All of New York City, with Supplementary New Jersey Data

Pollutant	Averaging Period	2005	2006	2007	Background	NAAQS
CO	1-hour	4.1 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	5.4 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	3.1 ppm 14439 Gravett Rd, Queens	5.4 ppm 6,289 $\mu g/m^3$	35 ppm 40,000 $\mu g/m^3$
	8-hour	2.2 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	2.5 ppm MTA, 302 Gold St near Flatbush Ave, Brooklyn	2.4 ppm 14439 Gravett Rd, Queens	2.5 ppm 2,912 $\mu g/m^3$	9 ppm 10,000 $\mu g/m^3$
NO_2	Annual	0.037 ppm PS 59, 288 E 57th St, Manhattan	0.034 ppm PS 59, 288 E 57th St, Manhattan	0.034 ppm PS 59, 288 E 57th St, Manhattan	0.037 ppm 70.8 $\mu g/m^3$	0.053 ppm 100 $\mu g/m^3$
$PM_{2.5}$	24-hour	40 $\mu g/m^3$ PS 59, 288 E 57th St, Manhattan	41 $\mu g/m^3$ PS 59, 288 E 57th St, Manhattan	44 $\mu g/m^3$ PS 19, 185 1st Ave, Manhattan	41.7 $\mu g/m^3$ *(average)*	35 $\mu g/m^3$
	Annual	17.0 $\mu g/m^3$ PS 59, 288 E 57th St, Manhattan	14.4 $\mu g/m^3$ PS 59, 288 E 57th St, Manhattan	16.4 $\mu g/m^3$ PS 59, 288 E 57th St, Manhattan	15.9 $\mu g/m^3$ *(average)*	15.0 $\mu g/m^3$
PM_{10}	24-hour	29 $\mu g/m^3$ E 156th St, btw Dawson & Kelly, Bronx	PM_{10} monitoring discontinued in New York City. 52 $\mu g/m^3$ Consolidated Fire House, 355 Newark Ave, Jersey City, NJ	49 $\mu g/m^3$ Consolidated Fire House, 355 Newark Ave, Jersey City, NJ	29 $\mu g/m^3$ (NYC only) 52 $\mu g/m^3$ (NYC + NJ)	150 $\mu g/m^3$
SO_2	3-hour	0.067 ppm E 156th St, btw Dawson & Kelly, Bronx	0.064 ppm PS 59, 288 E 57th St, Manhattan	0.054 ppm E 156th St, btw Dawson & Kelly, Bronx	0.067 ppm 178 $\mu g/m^3$	0.5 ppm 1,300 $\mu g/m^3$
	24-hour	0.042 ppm E 156th St, btw Dawson & Kelly, Bronx	0.034 ppm E 156th St, btw Dawson & Kelly, Bronx	0.036 ppm E 156th St, btw Dawson & Kelly, Bronx	0.042 ppm 112 $\mu g/m^3$	0.14 ppm 365 $\mu g/m^3$
	Annual	0.011 ppm E 156th St, btw Dawson & Kelly, Bronx	0.010 ppm PS 59, 288 E 57th St, Manhattan	0.013 ppm 200th St & Southern Blvd, Bronx	0.013 ppm 35 $\mu g/m^3$	0.030 ppm 80 $\mu g/m^3$
O_3	8-hour	0.094 ppm Susan Wagner HS, Brielle Ave & Manor Rd, Staten Island	0.092 ppm Susan Wagner HS, Brielle Ave & Manor Rd, Staten Island	0.083 ppm Susan Wagner HS, Brielle Ave & Manor Rd, Staten Island	0.090 ppm 179 $\mu g/m^3$ *(average)*	0.08 ppm 160 $\mu g/m^3$
Pb	Quarterly Average	0.03 $\mu g/m^3$ JHS 126, 424 Leonard St, Brooklyn	0.02 $\mu g/m^3$ JHS 126, 424 Leonard St, Brooklyn	0.02 $\mu g/m^3$ JHS 126, 424 Leonard St, Brooklyn	0.03 $\mu g/m^3$	1.5 $\mu g/m^3$

Notes:

1. MTA = Metropolitan Transit Authority; JHS = Junior High School
2. $\mu g/m^3$ = micrograms per cubic meter
3. The short-term CO, PM_{10}, and SO_2 background concentrations (1-hour, 3-hour, 8-hour, and 24-hour) are the highest of the second-high values.
4. The annual NO_2 and SO_2 background concentrations are the highest of the annual mean values.
5. The 24-hour $PM_{2.5}$ background concentration is the 3-year average of the 98th percentile values.
6. The annual $PM_{2.5}$ background concentration is the 3-year average of the annual mean values.
7. New Jersey (NJ) PM_{10} values were examined only for 2006-2007, when the City values were not available. The NJ values are high and may not be representative.
8. Background values selected were the highest values meeting the above criteria from among the monitors in New York, New York, over the most recent 3-year period (2005-2007).

Table 5.3-4 2005-2007 Background Concentration Summary for the SPIP

Pollutant	Averaging Period	NAAQS	Background Concentrations		
			Brooklyn Kings County	New York City	New York City & Jersey City
CO	1-hour	35 ppm (40,000 μg/m^3)	5.4 ppm 6,289 μg/m^3	5.4 ppm 6,289 μg/m^3	-
	8-hour	9 ppm (10,000 μg/m^3)	2.5 ppm 2,912 μg/m^3	2.5 ppm 2,912 μg/m^3	-
NO_2	Annual	0.053 ppm (100 μg/m^3)	NM	0.037 ppm 70.8 μg/m^3	-
$PM_{2.5}$	24-hour	35 μg/m^3	37.0 μg/m^3	41.7 μg/m^3	-
	Annual	15 μg/m^3	14.1 μg/m^3	15.9 μg/m^3	-
PM_{10}	24-hour	150 μg/m^3	20 μg/m^3	29 μg/m^3	52 μg/m^3
SO_2	3-hour	0.5 ppm (1,300 μg/m^3)	NM	0.067 ppm 178 μg/m^3	-
	24-hour	0.14 ppm (365 μg/m^3)	NM	0.042 ppm 112 μg/m^3	-
	Annual	0.030 ppm (80 μg/m^3)	NM	0.013 ppm 35 μg/m^3	-
O_3	8-hour	0.08 ppm (160 μg/m^3) (current) 0.075 ppm (150 μg/m^3) (pending, effective May 27, 2008, or later)	NM	0.090 ppm 179 μg/m^3	-
Pb	Quarterly Average	1.5 μg/m^3	0.03 μg/m^3	0.03 μg/m^3	-

Note:

1. NM = Not Measured

6.0 AIR QUALITY MODELING

The following section describes the air modeling methodology and results that were used to determine the air impacts from the SPIP.

6.1 Model Selection Factors

Several variables were utilized for the air quality modeling for the SPIP. Variables to be used in the SPIP air quality modeling included the dispersion environment, local topography, and stack height and cavity region determination.

6.1.1 Dispersion Environment

Land use within a three kilometer radius of the SPIP was classified in accordance with the NYSDEC recommended method.[5] This classification is necessary to determine whether rural or urban dispersion coefficients should be used in the dispersion modeling analysis. If more than 50% of the area is classified as urban, urban dispersion parameters should be used in the modeling. If more than 50% of the area is classified as rural, then rural dispersion parameters should be used in the modeling.

Information contained on the USGS topographic maps of the area (Brooklyn and Jersey City quadrangles) was sufficient to make the urban/rural determination. Although there are rural areas within three kilometers of the SPIP, the area is urban. Therefore, urban dispersion coefficients were used in the screening modeling analysis.

NYSDEC requested that inversion break-up and shoreline fumigation also be modeled. Since SCREEN3 only allows fumigation to be modeled using rural dispersion coefficients, the area was designated as rural only for modeling fumigation.

6.1.2 Good Engineering Practice Stack Height Determination

Federal stack height regulations limit the stack height used in performing dispersion modeling to calculate air quality impact of a source for regulatory purposes. Sources must be modeled at their actual physical height unless that height exceeds their calculated Good Engineering Practice (GEP) stack height. If the physical stack height is less than the GEP formula height, the actual stack height is input to the model and the potential for the plume to be affected by aerodynamic wakes (air flow affected by a building or other structure) created by nearby buildings must be evaluated in the dispersion modeling analysis.

A GEP stack height analysis was performed in accordance with “Guideline for Determination of Good Engineering Practice Stack Height”.[6] A GEP stack height is defined as the greater of 65 meters (213 feet), measured from the base elevation of the stack or the formula height determined from the following equation:

[5] Auer, A. H., 1978. Correlation of Land Use and Cover with Meteorological Anomalies, Journal of Applied Meteorology, 17: 636-643.

[6] U.S. EPA, 1985. Guidelines for Determination of Good Engineering Practice Stack Height (Technical Support Document for the Stack Height Regulations), Document Number EPA-450/4-80-023R. Office of Air Quality Planning and Standards, Research Triangle Park, NC. June.

Height = H + 1.5L

Where

H = height of the nearby structure which maximizes height
L = lesser dimension (height or projected width) of the building

The GEP formula height is based on the "nearby" buildings that result in the greatest justifiable height. For the purposes of determining the maximum GEP formula height, "nearby" is limited to five building heights or widths, whichever is less, from the trailing edge of the building.

A GEP analysis was performed with the Building Profile Input Program for structures at and near the SPIP. A manufacturing warehouse south of the pier is the tallest nearby structure. The warehouse is a squat structure, with a projected width greater than the height. The warehouse is 170' wide, 470' long and 54' high. The proposed stack will be located approximately 140 feet from the warehouse. As a squat structure, the warehouse will be controlling for determining the GEP formula height. The GEP formula height based on the warehouse is 135 feet.

The proposed stack will be less than the GEP formula height, requiring building downwash to be assessed in the modeling analysis.

6.1.3 Cavity Region

The cavity region (the region near a building where air flow can cause the plume to be trapped) created by a building can extend out to three times the lesser of the building height or width. Cavity impacts need to be analyzed for these lesser downwind distances when the stack height is less than the cavity height. The cavity height can extend up to the structure height plus one-half the lesser of the structure height or projected width.

The warehouse will result in the highest cavity height and the greatest cavity region extent. The cavity region created by the 54-foot warehouse could extend 162 feet from the structure and 81 feet above the ground. The stack will be located approximately 140 feet from the closest edge of the warehouse. However, the 100-foot stack is taller than the cavity region created from the warehouse, precluding entrapment of emissions within the cavity.

6.1.4 Local Topography

Local topography plays a role in the selection of an appropriate dispersion model. Dispersion models can be divided into two categories: (1) those applicable to areas where terrain is less than the height of the top of the stack (simple terrain), and (2) those applicable to areas where terrain is greater than the height of the plume (complex terrain). The closest complex terrain to the station is found approximately 1.1 kilometers to the southeast.

6.2 Models Selected For Use

The dispersion environment, potential for aerodynamic building downwash effects on ground-level concentrations, and the local topography help to determine the appropriate models for use in a dispersion modeling analysis. Simple terrain models are used to calculate concentrations in simple terrain (below stack-top elevation) and up to plume height in complex terrain. Complex terrain models are used to calculate concentrations in complex terrain (above stack-top elevation).

Based on stack heights that are less than the GEP formula height, and terrain above stack top elevation one kilometer from the stack, preliminary screening modeling was performed with U.S. EPA's SCREEN3 model (dated 96043).

SCREEN3 can be applied to simulate calculated 1-hour, ground-level calculations for single sources. The model incorporates the effects of building downwash in both the cavity and wake regions. The SCREEN3 model calculates 1-hour concentrations in simple terrain using the ISCST3 algorithms. For complex terrain elevations, the SCREEN3 model calculates a 24-hour concentration using the VALLEY model. The VALLEY model concentrations are based on six hours of persistent meteorological conditions, and allow the plume to come no closer than 10 meters to the ground. The SCREEN3 model also makes an ISCST3 calculation for intermediate terrain receptors. Intermediate terrain receptors have elevations that are greater than stack-top elevation but less than plume height. The higher of the VALLEY and ISCST3 calculations is used in the screening results. SCREEN3 also has the capability to calculate inversion break-up and shoreline fumigation concentrations.

6.3 SCREEN3 Modeling

6.3.1 Operating and Stack Parameters

SCREEN3 was applied to determine the maximum, modeled pollution concentration for the turbine. Screening was performed for the flue gas characteristics for a range of loads (50%, 75%, and 100% of the fuel firing rate) and ambient temperatures (-5^o, 59^o and 105^o F) for both fuel oil and natural gas firing. The three ambient temperatures represent the minimum, average and maximum temperatures that would be expected throughout the year. Stack exit velocities and temperatures for fuel oil firing are presented in Table 6.3.1-1. Natural gas firing parameters are present in Table 6.3.1-2.

The stack exit height will be 100 feet above grade. The inner exit diameter is 13.5 feet (4.11 meters).

Table 6.3.1-1 SPIP Stack Parameters & Emission Inputs for ULSD Firing

GE LMS100 Stack Parameters & Emission Inputs									
Stack Height	100.00	feet							
Stack Height	30.48	meters							
Stack Diameter	13.50	feet							
Stack Diameter	4.11	meters							
Exhaust Area	143.14	sq feet							
Reference Temp	68.00	^oF							
Case Number	**100B**	**103**	**103B**	**101B**	**104**	**104B**	**102B**	**105**	**105B**
Load (%)	100	100	100	75	75	75	50	50	50
Ambient Temp (^oF)	-5	59	105	-5	59	105	-5	59	105
Air+Gas Flow (lb/hr)	1,735,367	1,677,347	1,421,523	1,465,832	1,435,489	1,211,705	1,164,578	1,138,054	983,166
Air+Gas Flow mol wt	28.65	28.56	28.52	28.70	28.62	28.56	28.75	28.67	28.61
Exhaust Flow (scfm)	388,733	376,913	319,962	327,828	321,914	272,314	260,005	254,777	220,588
Exhaust Flow (acfm)	888,103	889,453	786,060	750,325	748,120	669,148	603,017	601,053	547,317
Exit Velocity (ft/sec)	103.408	103.565	91.527	87.366	87.109	77.914	70.214	69.985	63.728
Exit Velocity (m/sec)	31.519	31.567	27.897	26.629	26.551	23.748	21.401	21.331	19.424
Exhaust Temp (^oF)	746.3	786.0	837.2	748.5	767.1	837.4	764.6	785.6	850.1
Exhaust Temp (K)	670.0	692.0	720.5	671.2	681.5	720.6	680.1	691.8	727.6
Emissions (lb/hr)									
NO_X	11.28	11.42	9.55	8.93	8.95	7.62	6.58	6.60	5.70
CO	11.77	11.92	9.96	9.32	9.34	7.95	6.86	6.89	5.95
$PM_{10}/PM_{2.5}$	28.59	28.83	24.71	22.73	22.62	19.79	16.92	16.85	14.92
NH_3	11.91	12.06	10.08	9.43	9.45	8.05	6.94	6.97	6.02
Sulfur from Turbine		0.65			0.51			0.37	
SO_2	1.28	1.29	1.08	1.01	1.01	0.86	0.74	0.75	0.64
VOCs	4.85	4.70	3.99	4.09	4.01	3.39	3.24	3.18	2.75
H_2SO_4	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6.3.1-1 SPIP Stack Parameters & Emission Inputs for ULSD Firing (Continued)

GE LMS100 Stack Parameters & Emission Inputs									
Emissions (grams/second)									
NO_X	1.42156	1.43886	1.20276	1.12517	1.12824	0.96012	0.82857	0.83160	0.71826
CO	1.48337	1.50141	1.25505	1.17409	1.17729	1.00187	0.86460	0.86776	0.74949
$PM_{10}/PM_{2.5}$	3.60228	3.63305	3.11341	2.86394	2.85064	2.49350	2.13189	2.12339	1.87989
NH_3	1.50103	1.51929	1.26999	1.18806	1.19131	1.01379	0.87489	0.87809	0.75841
SO_2	0.16128	0.16248	0.13608	0.12726	0.12749	0.10836	0.09324	0.09398	0.08064
VOCs	0.61048	0.59192	0.50248	0.51483	0.50555	0.42765	0.40832	0.40011	0.34642
H_2SO_4	NA	NA	NA	NA	NA	NA	NA	NA	NA
Emissions (ppmvd @ 15% O_2)									
NO_X	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
CO	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
NH_3	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
VOCs	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0

Notes:
1. Maximum Liquid Fuel Sulfur Content = 0.0015% Sulfur by weight
2. Liquid Fuel = 18,400 BTU/lb LHV = 19,504 BTU/lb HHV
3. msl = mean sea level

Table 6.3.1-2 SPIP Stack Parameters & Emission Inputs for Natural Gas Firing

GE LMS100 Stack Parameters & Emission Inputs									
Stack Height	100.00	feet							
Stack Height	30.48	meters							
Stack Diameter	13.50	feet							
Stack Diameter	4.11	meters							
Exhaust Area	143.14	sq feet							
Reference Temp	68.00	^oF							
Case Number	**300**	**203**	**303**	**301**	**204**	**304**	**302**	**205**	**305**
Load (%)	100	100	100	75	75	75	50	50	50
Ambient Temp (^oF)	-5	59	105	-5	59	105	-5	59	105
Air+Gas Flow (lb/hr)	1,732,698	1,699,142	1,465,993	1,463,575	1,456,181	1,253,267	1,162,871	1,155,972	999,715
Air+Gas Flow mol wt	28.12	28.05	27.92	28.23	28.15	28.05	28.35	28.24	28.16
Exhaust Flow (scfm)	395,492	388,830	336,986	332,754	332,008	286,778	263,263	262,765	227,856
Exhaust Flow (acfm)	889,507	909,052	818,089	750,933	763,964	693,096	602,841	613,438	560,757
Exit Velocity (ft/sec)	103.572	105.847	95.256	87.436	88.954	80.702	70.193	71.427	65.293
Exit Velocity (m/sec)	31.569	32.262	29.034	26.651	27.113	24.598	21.395	21.771	19.901
Exhaust Temp (^oF)	727.5	774.4	821.8	731.5	755.0	816.1	749.1	772.6	839.4
Exhaust Temp (K)	659.6	685.6	711.9	661.8	674.8	708.8	671.5	684.6	721.7
Emissions (lb/hr)									
NO_X	7.75	8.09	6.88	6.16	6.34	5.49	4.56	4.66	4.11
CO	11.32	11.82	10.05	8.99	9.26	8.01	6.65	6.81	6.00
$PM_{10}/PM_{2.5}$	7.78	8.43	8.46	7.60	7.88	8.04	7.48	7.69	7.81
NH_3	5.73	5.98	5.09	4.55	4.68	4.05	3.37	3.45	3.03
Sulfur from Turbine		1.05			0.82			0.61	
SO_2	1.91	2.10	1.70	1.51	1.64	1.35	1.11	1.21	1.01
VOCs	3.94	3.59	3.02	3.32	3.06	1.86	2.56	1.90	1.14
H_2SO_4	NA	NA	NA	NA	NA	NA	NA	NA	NA

Table 6.3.1-2 SPIP Stack Parameters & Emission Inputs for Natural Gas Firing (Continued)

GE LMS100 Stack Parameters & Emission Inputs									
Emissions (g/sec)									
NO_X	0.97657	1.01925	0.86713	0.77577	0.79860	0.69113	0.57395	0.58778	0.51729
CO	1.42665	1.48900	1.26677	1.13330	1.16665	1.00966	0.83846	0.85867	0.75570
$PM_{10}/PM_{2.5}$	0.98072	1.06260	1.06623	0.95759	0.99230	1.01302	0.94216	0.96879	0.98442
NH_3	0.72182	0.75336	0.64092	0.57340	0.59027	0.51084	0.42422	0.43444	0.38235
SO_2	0.24047	0.26414	0.21385	0.19047	0.20707	0.16992	0.14031	0.15246	0.12679
VOCs	0.49688	0.45187	0.38104	0.41806	0.38583	0.23419	0.32248	0.23934	0.14313
H_2SO_4									
Emissions (ppmvd @ 15% O_2)									
NO_X	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
CO	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0
NH_3	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
VOCs	4.0	3.7	3.6	4.0	3.7	2.6	3.9	2.9	2.0

Notes:
1. Natural Gas = 20,823 BTU/lb LHV = 22,905 BTU/lb HHV
2. Natural Gas Maximum Fuel Sulfur Content = 0.85 grains of Sulfur per 100 standard cubic feet

6.3.2 Screening Model Application

The SCREEN3 dispersion model was applied in accordance with the recommendations made in U.S. EPA's "Guideline on Air Quality Models"[7] (U.S. EPA, 1999) to assess the magnitude of maximum pollutant concentrations from the LMS100 over a range of operating loads and ambient temperatures. SCREEN3 was applied using urban dispersion parameters, default meteorology, building downwash and terrain elevations. For fumigation calculations only, rural dispersion parameters were used, as required by the model. The model was applied for the full set of 54 default meteorological conditions, encompassing all stability classes and a range of wind speeds. The screening meteorological conditions are presented in Table 6.3.2-1. Default mixing heights are dependent upon the wind speed. The SCREEN3 mixing heights are presented in Table 6.3.2-2. Table 6.3.2-3 presents the distances and terrain elevations used in the SCREEN3 simple terrain analysis.

Simple terrain screening receptors were located along a single radial. As the stack is located on a pier in Gowanus Bay, all potential receptors were assumed to be located in ambient air. Receptors were placed at 10-meter spacing out to 100 meters, 50-meter spacing out to 500 meters, 100-meter spacing out to 2 kilometers, 200-meter spacing out to 4 kilometers, and 500-meter spacing out to 10 kilometers. Receptor elevations reflect the maximum terrain height found for a given distance, over all wind directions. The closest complex terrain receptor is located 1.1 kilometers from the station. For the simple terrain screening analysis, the stack-top elevation was assigned as the receptor elevation for all distances beyond 1.1 kilometers. SCREEN3 receptor terrain height values are based on the difference between the actual terrain elevation and the stack base elevation.

Table 6.3.2-4 presents the terrain elevations and distances used in the SCREEN3 complex terrain screening analysis. The complex terrain receptors were based on the closest distance to the SPIP for which elevations ranging from stack-top to the maximum elevation found within 10 kilometers. The closest complex terrain is found 1.1 kilometers from the station, with elevations extending to 107 meters (352 feet) above stack-base elevation at 7.5 kilometers.

Table 6.3.2-1 Stability Class/Wind Speed Combinations Used for the Screening Modeling

Stability Class	Wind Speed (meters/second)
A	1, 1.5, 2, 2.5, 3
B	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5
C	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 8, 10
D	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5, 8, 10, 15, 20
E	1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5
F	1, 1.5, 2, 2.5, 3, 3.5, 4

[7] U.S. EPA, 1999. Guideline on Air Quality Models, (Revised) EPA450/12-78-027R, Office of Air Quality Planning and Standards. Research Triangle Park, NC.

Table 6.3.2-2 Wind Speed/Mixing Height Combinations Used for the Screening Modeling

Wind Speed (meters/second)	Mixing Height (meters)
1	320
1.5	480
2	640
2.5	800
3	960
3.5	1,120
4	1,280
4.5	1,440
5	1,600
8	2,560
10	3,200
15	4,800
20	6,400

Table 6.3.2-3 Simple Terrain Screening Receptor Elevations and Distances and Elevations

Distance (kilometers)	Elevation (meters above stack base)
0.01-0.3	0
0.35	1
0.4	2
0.45	2
0.5	4
0.6	7
0.7	9
0.8	14
0.9	18
1.0	30
1.1-10	31

Table 6.3.2-4 Complex Terrain Screening Receptor Elevations and Distances

Elevation (meters above stack base)	Distance (kilometers)
31	1.1
40	1.2
52	1.3
59	1.4
60	1.5
65	1.6-4.0
86	4.5
94	5.0-7.0
107	7.5-10.0

6.3.3 Scaling Factors

The SCREEN3 model calculates one-hour concentrations at simple terrain locations. The model calculates 24-hour concentrations in complex terrain. The VALLEY complex terrain concentrations are based on six hours of persistent meteorological conditions.

NAAQS have been established for various averaging periods. Short-term 1-hour and 8-hour standards have been established for CO. An annual standard has been established for NO_2. Annual, 3-hour, and 24-hour standards have been established for SO_2. Annual and 24-hour standards have been established for $PM_{2.5}$. A 24-hour standard has been established for PM_{10}. To estimate concentrations for the other averaging periods, scaling factors of 0.9, 0.7, 0.4, and 0.08 were applied to the 1-hour averages to derive 3-hour, 8-hour, 24-hour, and annual average estimates, respectively.

The 24-hour VALLEY complex terrain results were first scaled to one-hour concentrations using a scaling factor of 4.0. The same scaling factors described above were then applied to the 1-hour estimates to obtain estimates for averaging periods other than the 24-hour average.

6.3.4 Screening Results

A screening modeling analysis was performed using the SCREEN3 model for the flue gas characteristics of the turbine at ambient temperatures of -5°F, 59°F, and 105°F at 50%, 75%, and 100% of the design capacity, for both ULSD and natural gas firing. Screening modeling was performed to determine the maximum, modeled screening concentrations for comparison to the significant impact levels (SILs) for both simple and complex terrain. The SIL is a de minimis threshold applied to individual facilities that apply for a permit to emit a regulated pollutant in an area that meets the NAAQS.

Table 6.3.4-1 presents the maximum 1-hour simple terrain normalized and pollutant concentrations for each load condition, fuel, and ambient temperature for the simple terrain analysis for each of the fuels. Pollutant concentrations were determined by scaling the normalized 1-hour concentrations by the emission rates presented in the tables. To estimate concentrations for other averaging periods, scaling factors presented in Section 6.3.3 were applied to the one-hour averages.

Table 6.3.4-1 also presents the maximum 24-hour complex terrain normalized and pollutant concentrations for each load condition, fuel, and ambient temperature for the complex terrain analysis. Pollutant concentrations were determined by scaling the normalized 1-hour concentrations by the emission rates presented in the tables. To estimate concentrations for other averaging periods, scaling factors presented in Section 6.3.3 were applied to the one-hour averages.

6.3.5 Elevated Receptor Evaluation

As requested by NYSDEC, the area within a two kilometer radius from the SPIP was evaluated to determine if any elevated receptors were present. Based on guidance from NYSDEC, buildings that were greater than two stories in elevation were identified through examination of aerial photography and on site visual verification. Those buildings that had the potential to have balconies or roof top gardens or other outdoor rooftop patio areas were identified. NYSDEC indicated they were not concerned with intake vents on buildings or the nearby federal prison building and other commercial warehousing as there was limited likelihood of exposure. The receptors identified in Table 6.3.5-1 and shown on Figure 6.3.5-1 were evaluated as representative for the area. Results of this evaluation as shown in Table 6.3.5-2 indicated that results are below SILs.

6.3.6 Shoreline Fumigation Evaluation

The SCREEN3 model was also run in the fumigation configuration to evaluate possible effects from the land—water interface. Results are presented in Table 6.3.6-1. Fumigation values were calculated to be below all SILs.

Shoreline fumigation values were calculated according to EPA guidelines that allow for the adjustment of the 1-hour fumigation value when comparing the results for averaging periods greater than 1 hour, assuming fumigation lasts for 1.5 hours of any day.[8] Fumigation values have been adjusted with simple terrain values calculated at the same respective ambient temperature, using the worst-case condition, which is operating at 100% load, firing oil. The adjustment consists of using a weighted average of 1.5 hours of the fumigation value and 22.5 hours of the simple terrain value. The resulting highest 24-hour PM_{10} fumigation impact is 4.98 $\mu g/m^3$, based on full load operation on oil at -5° F. The highest annual PM_{10} impact is 0.995

[8] U.S. EPA, 1992., Screening Procedures for Estimating the Air Quality Impact of Stationary Sources, Revised, Document Number EPA-454/R-92-019 Office of Air and Radiation, Office of Air Quality Planning and Standards, Research Triangle Park, NC, October, Section 4.5.3 Fumigation.

μg/m^3, based on the same operating case. The highest annual concentration for 59° F is 0.99 μg/m^3 (oil, 100% load). In all cases the predicted fumigation impacts are below SILs.

6.3.7 Screening Analysis Conclusions

The purpose of the SCREEN3 modeling analyses was to determine the maximum, modeled screening concentrations from the turbine for comparison to the SILs. As shown in Tables 6.3.4-1 and 6.3.5-2, the maximum, modeled screening concentrations are less than the SILs for all pollutants and averaging periods. The net emissions of $PM_{2.5}$ from the LMS100 will be below the 15 TPY (expected to be reduced to 10 TPY) threshold levels in NYSDEC policy guidance CP-33 and therefore this policy guidance including the corresponding SIL, does not apply. Predicted impacts from the LMS100 are below SILs and by definition will not cause or contribute to any exceedance of PSD increments or NAAQS. Additional modeling is not required to demonstrate compliance with PSD increments or NAAQS.

Table 6.3.4-1 Ground-Level SCREEN3 Modeling Results with Stack Height =100 feet

Case		100B	103	103B	101B	104	104B	102B	105	105B	300	203	303	301	204	304	302	205	305		
Load		100	100	100	75	75	75	50	50	50	100	100	100	75	75	75	50	50	50		
Temp		-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105		
Fuel		Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas		
Emissions (grams/second)																					
NO_X		1.4216	1.4389	1.2028	1.1252	1.1282	0.9601	0.8286	0.8316	0.7183	0.9766	1.0193	0.8671	0.7758	0.7986	0.6911	0.5739	0.5878	0.5173		
CO		1.4834	1.5014	1.2550	1.1741	1.1773	1.0019	0.8646	0.8678	0.7495	1.4266	1.4890	1.2668	1.1333	1.1666	1.0097	0.8385	0.8587	0.7557		
$PM_{10}/PM_{2.5}$		3.6023	3.6331	3.1134	2.8639	2.8506	2.4935	2.1319	2.1234	1.8799	0.9807	1.0626	1.0662	0.9576	0.9923	1.0130	0.9422	0.9688	0.9844		
SO_2		0.1613	0.1625	0.1361	0.1273	0.1275	0.1084	0.0932	0.0940	0.0806	0.2405	0.2641	0.2139	0.1905	0.2071	0.1699	0.1403	0.1525	0.1268		
SCREEN3 Results																				**Max**	**SIL**
Simple Terrain																					
Emission Rate (grams/second)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
1-hr Conc ($\mu g/m^3$)		3.376	3.341	3.701	3.915	3.909	4.204	4.576	4.569	4.843	3.386	3.279	3.584	3.927	3.853	4.111	4.59	4.518	4.748		
NO_X	1-hr	4.80	4.81	4.45	4.41	4.41	4.04	3.79	3.80	3.48	3.31	3.34	3.11	3.05	3.08	2.84	2.63	2.66	2.46		
	Annual	0.38	0.38	0.36	0.35	0.35	0.32	0.30	0.30	0.28	0.26	0.27	0.25	0.24	0.25	0.23	0.21	0.21	0.20	0.38	1
CO	1-hr	5.01	5.02	4.64	4.60	4.60	4.21	3.96	3.96	3.63	4.83	4.88	4.54	4.45	4.50	4.15	3.85	3.88	3.59	5.02	2000
	8-hr	3.51	3.51	3.25	3.22	3.22	2.95	2.77	2.78	2.54	3.38	3.42	3.18	3.12	3.15	2.91	2.69	2.72	2.51	3.51	500
PM_{10}	1-hr	12.16	12.14	11.52	11.21	11.14	10.48	9.76	9.70	9.10	3.32	3.48	3.82	3.76	3.82	4.16	4.32	4.38	4.67		
	24-hr	4.86	4.86	4.61	4.48	4.46	4.19	3.90	3.88	3.64	1.33	1.39	1.53	1.50	1.53	1.67	1.73	1.75	1.87	4.86	5
	Annual	0.97	0.97	0.92	0.90	0.89	0.84	0.78	0.78	0.73	0.27	0.28	0.31	0.30	0.31	0.33	0.35	0.35	0.37	0.97	1
$PM_{2.5}$	1-hr	12.16	12.14	11.52	11.21	11.14	10.48	9.76	9.70	9.10	3.32	3.48	3.82	3.76	3.82	4.16	4.32	4.38	4.67		
	24-hr	4.86	4.86	4.61	4.48	4.46	4.19	3.90	3.88	3.64	1.33	1.39	1.53	1.50	1.53	1.67	1.73	1.75	1.87	NA	NA
	Annual	0.97	0.97	0.92	0.90	0.89	0.84	0.78	0.78	0.73	0.27	0.28	0.31	0.30	0.31	0.33	0.35	0.35	0.37	NA	NA
SO_2	1-hr	0.54	0.54	0.50	0.50	0.50	0.46	0.43	0.43	0.39	0.81	0.87	0.77	0.75	0.80	0.70	0.64	0.69	0.60		
	3-hr	0.49	0.49	0.45	0.45	0.45	0.41	0.38	0.39	0.35	0.73	0.78	0.69	0.67	0.72	0.63	0.58	0.62	0.54	0.78	25
	24-hr	0.22	0.22	0.20	0.20	0.20	0.18	0.17	0.17	0.16	0.33	0.35	0.31	0.30	0.32	0.28	0.26	0.28	0.24	0.35	5
	Annual	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.03	0.03	0.07	0.07	0.06	0.06	0.06	0.06	0.05	0.06	0.05	0.07	1

Table 6.3.4-1 Ground-Level SCREEN3 Modeling Results with Stack Height =100 feet (Continued)

Case		8	103	103B	101B	104	104B	102B	105	105B	300	203	303	301	204	304	302	205	305		
Complex Terrain																					
Emission Rate (grams/second)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
1-hr Conc ($\mu g/m^3$)		1.0788	1.05	1.1576	1.2772	1.2664	1.358	1.5588	1.5452	1.6296	1.0908	1.034	1.1212	1.29	1.2496	1.3272	1.5732	1.5272	1.602		
24-hr Conc ($\mu g/m^3$)		0.2697	0.2625	0.2894	0.3193	0.3166	0.3395	0.3897	0.3863	0.4074	0.2727	0.2585	0.2803	0.3225	0.3124	0.3318	0.3933	0.3818	0.4005		
NO_X	1-hr	1.53	1.51	1.39	1.44	1.43	1.30	1.29	1.28	1.17	1.07	1.05	0.97	1.00	1.00	0.92	0.90	0.90	0.83		
	Annual	0.12	0.12	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.09	0.08	0.08	0.08	0.08	0.07	0.07	0.07	0.07	0.12	1
CO	1-hr	1.60	1.58	1.45	1.50	1.49	1.36	1.35	1.34	1.22	1.56	1.54	1.42	1.46	1.46	1.34	1.32	1.31	1.21	1.60	2000
	8-hr	1.12	1.10	1.02	1.05	1.04	0.95	0.94	0.94	0.85	1.09	1.08	0.99	1.02	1.02	0.94	0.92	0.92	0.85	1.12	500
PM_{10}	1-hr	3.89	3.81	3.60	3.66	3.61	3.39	3.32	3.28	3.06	1.07	1.10	1.20	1.24	1.24	1.34	1.48	1.48	1.58		
	24-hr	0.97	0.95	0.90	0.91	0.90	0.85	0.83	0.82	0.77	0.27	0.27	0.30	0.31	0.31	0.34	0.37	0.37	0.39	0.97	5
	Annual	0.31	0.31	0.29	0.29	0.29	0.27	0.27	0.26	0.25	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13	0.31	1
$PM_{2.5}$	1-hr	3.89	3.81	3.60	3.66	3.61	3.39	3.32	3.28	3.06	1.07	1.10	1.20	1.24	1.24	1.34	1.48	1.48	1.58		
	24-hr	0.97	0.95	0.90	0.91	0.90	0.85	0.83	0.82	0.77	0.27	0.27	0.30	0.31	0.31	0.34	0.37	0.37	0.39	NA	NA
	Annual	0.31	0.31	0.29	0.29	0.29	0.27	0.27	0.26	0.25	0.09	0.09	0.10	0.10	0.10	0.11	0.12	0.12	0.13	NA	NA
SO_2	1-hr	0.17	0.17	0.16	0.16	0.16	0.15	0.15	0.15	0.13	0.26	0.27	0.24	0.25	0.26	0.23	0.22	0.23	0.20		
	3-hr	0.16	0.15	0.14	0.15	0.15	0.13	0.13	0.13	0.12	0.24	0.25	0.22	0.22	0.23	0.20	0.20	0.21	0.18	0.25	25
	24-hr	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.07	0.07	0.06	0.06	0.06	0.06	0.06	0.06	0.05	0.07	5
	Annual	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02	1

Table 6.3.5-1 Elevated Building Receptors Modeled

Distance from Stack (m)	Number of Stories	Balconies [1]	Latitude	Longitude
453	4	No	40.65889	-74.0017
467	3	No	40.66199	-73.9969
505	6	No	40.66118	-73.9968
531	2	Yes	40.65828	-74.0009
541	9	Yes	40.66174	-73.9961
571	9	Yes	40.66242	-73.9956
610	9	Yes	40.66293	-73.9951
659	11	Yes	40.66339	-73.9945
672	4	No	40.66166	-73.9945
678	4	No	40.66218	-73.9943
890	2 to 6	No	40.65508	-74.0003
905	6	Yes	40.65491	-74.0005
991	4	Yes	40.65411	-74.0038
1096	4	Yes	40.65309	-74.0029
1259	3	No	40.65171	-74.0043
1281	4 or higher	No	40.65214	-74.0076
1335	4 or higher	No	40.65176	-74.0081
1375	9	No	40.6685	-73.9909
1416	4 or higher	No	40.65123	-74.0089
1591	2	Yes	40.64862	-74.0022
1613	3	No	40.64849	-74.0005
1617	2	Yes	40.64839	-74.0019
1644	4	No	40.64816	-74.0015
1649	4	Yes	40.67753	-74.006
1679	2	Yes	40.64786	-74.001
1696	8	Yes	40.67236	-73.9865
1709	2	Yes	40.67673	-74.0113
1711	3	No	40.64944	-74.0062
1753	4	No	40.64721	-74.0007
1849	4	No	40.64649	-74.0057
1855	4	No	40.67807	-74.0117
1867	4	No	40.6777	-74.0129
1872	4	No	40.64624	-74.0053
1924	8	Yes	40.67398	-73.9848
2028	2 to 3	No	40.64607	-74.0115
2173	5	No	40.68025	-74.0143
2173	4	No	40.68025	-74.0143

Note:
[1] - Based on photo interpretation and limited field check

Table 6.3.5-2 Elevated SCREEN3 Modeling Results with Stack Height =100 feet

Case		100B	103	103B	101B	104	104B	102B	105	105B	300	203	303	301	204	304	302	205	305		
Load		100	100	100	75	75	75	50	50	50	100	100	100	75	75	75	50	50	50		
Temp		-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105		
Fuel		Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas		
Emissions (grams/second)																					
NO_X		1.4216	1.4389	1.2028	1.1252	1.1282	0.9601	0.8286	0.8316	0.7183	0.9766	1.0193	0.8671	0.7758	0.7986	0.6911	0.5739	0.5878	0.5173		
CO		1.4834	1.5014	1.2550	1.1741	1.1773	1.0019	0.8646	0.8678	0.7495	1.4266	1.4890	1.2668	1.1333	1.1666	1.0097	0.8385	0.8587	0.7557		
$PM_{10}/PM_{2.5}$		3.6023	3.6331	3.1134	2.8639	2.8506	2.4935	2.1319	2.1234	1.8799	0.9807	1.0626	1.0662	0.9576	0.9923	1.0130	0.9422	0.9688	0.9844		
SO_2		0.1613	0.1625	0.1361	0.1273	0.1275	0.1084	0.0932	0.0940	0.0806	0.2405	0.2641	0.2139	0.1905	0.2071	0.1699	0.1403	0.1525	0.1268		
SCREEN3 Results																					
Elevated Receptor in Simple Terrain																					
Emission Rate (grams/second)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
1-hr Conc ($\mu g/m^3$)																					
Stories:	2	2.032	2.017	2.099	2.172	2.169	2.254	2.579	2.557	2.693	2.038	2.009	2.063	2.178	2.153	2.226	2.602	2.528	2.649		
	3	2.035	2.021	2.102	2.175	2.171	2.267	2.592	2.57	2.707	2.041	2.013	2.067	2.18	2.155	2.228	2.615	2.541	2.662		
	4	2.04	2.026	2.106	2.178	2.174	2.284	2.61	2.588	2.725	2.046	2.018	2.071	2.183	2.159	2.234	2.634	2.559	2.681		
	5	1.846	1.799	1.977	2.174	2.156	2.307	2.634	2.612	2.75	1.866	1.772	1.916	2.195	2.129	2.256	2.658	2.583	2.705		
	6	1.789	1.778	1.897	2.098	2.079	2.234	2.574	2.551	2.695	1.793	1.771	1.835	2.12	2.051	2.182	2.599	2.521	2.648		
	7	1.798	1.751	1.932	2.135	2.117	2.273	2.617	2.593	2.739	1.818	1.726	1.87	2.158	2.088	2.221	2.642	2.563	2.691		
	8	1.836	1.787	1.973	2.179	2.16	2.318	2.665	2.642	2.788	1.857	1.759	1.909	2.201	2.131	2.265	2.69	2.611	2.741		
	9	1.682	1.638	1.802	1.983	1.966	2.114	2.448	2.425	2.567	1.7	1.623	1.746	2.002	1.941	2.063	2.472	2.395	2.521		
	10	1.304	1.297	1.4656	1.514	1.51	1.544	1.612	1.608	1.639	1.306	1.294	1.316	1.519	1.504	1.533	1.617	1.602	1.626		
	11	1.298	1.292	1.474	1.52	1.516	1.55	1.617	1.612	1.648	1.301	1.289	1.31	1.525	1.51	1.539	1.623	1.606	1.636		
Maximum		2.04	2.026	2.106	2.179	2.174	2.318	2.665	2.642	2.788	2.046	2.018	2.071	2.201	2.159	2.265	2.69	2.611	2.741		

Table 6.3.5-2 Elevated SCREEN3 Modeling Results with Stack Height =100 feet (Continued)

																				Max	**SIL**
NO_X	1-hr	2.90	2.92	2.53	2.45	2.45	2.23	2.21	2.20	2.00	2.00	2.06	1.80	1.71	1.72	1.57	1.54	1.53	1.42		
	Annual	0.23	0.23	0.20	0.20	0.20	0.18	0.18	0.18	0.16	0.16	0.16	0.14	0.14	0.14	0.13	0.12	0.12	0.11	0.23	1
CO	1-hr	3.03	3.04	2.64	2.56	2.56	2.32	2.30	2.29	2.09	2.92	3.00	2.62	2.49	2.52	2.29	2.26	2.24	2.07	3.04	2000
	8-hr	2.12	2.13	1.85	1.79	1.79	1.63	1.61	1.60	1.46	2.04	2.10	1.84	1.75	1.76	1.60	1.58	1.57	1.45	2.13	500
PM_{10}	1-hr	7.35	7.36	6.56	6.24	6.20	5.78	5.68	5.61	5.24	2.01	2.14	2.21	2.11	2.14	2.29	2.53	2.53	2.70		
	24-hr	2.94	2.94	2.62	2.50	2.48	2.31	2.27	2.24	2.10	0.80	0.86	0.88	0.84	0.86	0.92	1.01	1.01	1.08	2.94	5
	Annual	0.59	0.59	0.52	0.50	0.50	0.46	0.45	0.45	0.42	0.16	0.17	0.18	0.17	0.17	0.18	0.20	0.20	0.22	0.59	1
$PM_{2.5}$	1-hr	7.35	7.36	6.56	6.24	6.20	5.78	5.68	5.61	5.24	2.01	2.14	2.21	2.11	2.14	2.29	2.53	2.53	2.70		
	24-hr	2.94	2.94	2.62	2.50	2.48	2.31	2.27	2.24	2.10	0.80	0.86	0.88	0.84	0.86	0.92	1.01	1.01	1.08	NA	NA
	Annual	0.59	0.59	0.52	0.50	0.50	0.46	0.45	0.45	0.42	0.16	0.17	0.18	0.17	0.17	0.18	0.20	0.20	0.22	NA	NA
SO_2	1-hr	0.33	0.33	0.29	0.28	0.28	0.25	0.25	0.25	0.22	0.49	0.53	0.44	0.42	0.45	0.38	0.38	0.40	0.35		
	3-hr	0.30	0.30	0.26	0.25	0.25	0.23	0.22	0.22	0.20	0.44	0.48	0.40	0.38	0.40	0.35	0.34	0.36	0.31	0.48	25
	24-hr	0.13	0.13	0.11	0.11	0.11	0.10	0.10	0.10	0.09	0.20	0.21	0.18	0.17	0.18	0.15	0.15	0.16	0.14	0.21	5
	Annual	0.03	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.04	0.04	0.04	0.03	0.04	0.03	0.03	0.03	0.03	0.04	1

Table 6.3.6-1 SCREEN3 Fumigation Modeling Results at Stack Height =100 feet

Case		100B	103	103B	101B	104	104B	102B	105	105B	300	203	303	301	204	304	302	205	305		
Load		100	100	100	75	75	75	50	50	50	100	100	100	75	75	75	50	50	50		
Temp		-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105	-5	59	105		
Fuel		Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Oil	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas	Gas		
Emissions (grams/second)																					
NO_X		1.4216	1.4389	1.2028	1.1252	1.1282	0.9601	0.8286	0.8316	0.7183	0.9766	1.0193	0.8671	0.7758	0.7986	0.6911	0.5739	0.5878	0.5173		
CO		1.4834	1.5014	1.2550	1.1741	1.1773	1.0019	0.8646	0.8678	0.7495	1.4266	1.4890	1.2668	1.1333	1.1666	1.0097	0.8385	0.8587	0.7557		
$PM_{10}/PM_{2.5}$		3.6023	3.6331	3.1134	2.8639	2.8506	2.4935	2.1319	2.1234	1.8799	0.9807	1.0626	1.0662	0.9576	0.9923	1.0130	0.9422	0.9688	0.9844		
SO_2		0.1613	0.1625	0.1361	0.1273	0.1275	0.1084	0.0932	0.0940	0.0806	0.2405	0.2641	0.2139	0.1905	0.2071	0.1699	0.1403	0.1525	0.1268		
SCREEN3 Results																				**Max**	**SIL**
Inversion Break-Up																					
Emission Rate (grams/second)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1		
1-hr Conc ($\mu g/m^3$)		0.7587	0.7449	0.7964	0.8531	0.8479	0.8912	0.9857	0.9793	1.019	0.7645	0.7371	0.7789	0.8592	0.84	0.8766	0.9925	0.9708	1.006		
NO_X	1-hr	1.08	1.07	0.96	0.96	0.96	0.86	0.82	0.81	0.73	0.75	0.75	0.68	0.67	0.67	0.61	0.57	0.57	0.52		
	Annual	0.09	0.09	0.08	0.08	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.09	1
CO	1-hr	1.13	1.12	1.00	1.00	1.00	0.89	0.85	0.85	0.76	1.09	1.10	0.99	0.97	0.98	0.89	0.83	0.83	0.76	1.13	2000
	8-hr	0.79	0.78	0.70	0.70	0.70	0.63	0.60	0.59	0.53	0.76	0.77	0.69	0.68	0.69	0.62	0.58	0.58	0.53	0.79	500
PM_{10}	1-hr	2.73	2.71	2.48	2.44	2.42	2.22	2.10	2.08	1.92	0.75	0.78	0.83	0.82	0.83	0.89	0.94	0.94	0.99		
	24-hr	1.09	1.08	0.99	0.98	0.97	0.89	0.84	0.83	0.77	0.30	0.31	0.33	0.33	0.33	0.36	0.37	0.38	0.40	1.09	5
	Annual	0.22	0.22	0.20	0.20	0.19	0.18	0.17	0.17	0.15	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	0.22	1
$PM_{2.5}$	1-hr	2.73	2.71	2.48	2.44	2.42	2.22	2.10	2.08	1.92	0.75	0.78	0.83	0.82	0.83	0.89	0.94	0.94	0.99		
	24-hr	1.09	1.08	0.99	0.98	0.97	0.89	0.84	0.83	0.77	0.30	0.31	0.33	0.33	0.33	0.36	0.37	0.38	0.40	NA	NA
	Annual	0.22	0.22	0.20	0.20	0.19	0.18	0.17	0.17	0.153	0.06	0.06	0.07	0.07	0.07	0.07	0.07	0.08	0.08	NA	NA
SO_2	1-hr	0.12	0.12	0.11	0.11	0.11	0.10	0.09	0.09	0.08	0.18	0.19	0.17	0.16	0.17	0.15	0.14	0.15	0.13		
	3-hr	0.11	0.11	0.10	0.10	0.10	0.09	0.08	0.08	0.07	0.17	0.18	0.15	0.15	0.16	0.13	0.13	0.13	0.11	0.18	25
	24-hr	0.05	0.05	0.04	0.04	0.04	0.04	0.04	0.04	0.03	0.07	0.08	0.07	0.07	0.07	0.06	0.06	0.06	0.05	0.08	5
	Annual	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02	1

Table 6.3.6-1 SCREEN3 Fumigation Modeling Results at Stack Height =100 feet (Continued)

Case		100B	103	103B	101B	104	104B0	102B	105	105B	300	203	303	301	204	304	302	205	305		
Shoreline																					
Emission Rate (grams/second)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	**Max**	**SIL**
1-hr Conc ($\mu g/m^3$)		4.624	4.536	4.867	5.233	5.199	5.479	6.095	6.052	6.316	4.661	4.486	4.754	5.272	5.148	5.385	6.140	5.997	6.230		
NO_X	1-hr	6.57	6.53	5.85	5.89	5.87	5.26	5.05	5.03	4.54	4.55	4.57	4.12	4.09	4.11	3.72	3.52	3.52	3.22		
	Annual	0.53	0.52	0.47	0.47	0.47	0.42	0.40	0.40	0.36	0.36	0.37	0.33	0.33	0.33	0.30	0.28	0.28	0.26	0.53	1
CO	1-hr	6.86	6.81	6.11	6.14	6.12	5.49	5.27	5.25	4.73	6.65	6.68	6.02	5.97	6.01	5.44	5.15	5.15	4.71	6.86	2000
	8-hr	4.80	4.77	4.28	4.30	4.28	3.84	3.69	3.68	3.31	4.65	4.68	4.22	4.18	4.20	3.81	3.60	3.60	3.30	4.80	500
PM_{10}	1-hr	16.66	16.48	15.15	14.99	14.82	13.66	12.99	12.85	11.87	4.57	4.77	5.07	5.05	5.11	5.46	5.78	5.81	6.13		
	1-hr simple	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52		
	1-hr Adj 24	12.44	12.41	11.75	12.34	12.31	11.65	12.21	12.18	11.54	11.69	11.68	11.12	11.72	11.70	11.14	11.76	11.74	11.18		
	24-hr	4.98	4.96	4.70	4.93	4.92	4.66	4.88	4.87	4.62	4.67	4.67	4.45	4.69	4.68	4.46	4.70	4.70	4.47	4.98	5.00
	Annual	0.995	0.99	0.94	0.99	0.98	0.93	0.98	0.97	0.92	0.93	0.93	0.89	0.94	0.94	0.89	0.94	0.94	0.89	0.995	1
$PM_{2.5}$	1-hr	16.66	16.48	15.15	14.99	14.82	13.66	12.99	12.85	11.87	4.57	4.77	5.07	5.05	5.11	5.46	5.78	5.81	6.13		
	1-hr simple	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52	12.16	12.14	11.52		
	1-hr A 24	12.44	12.41	11.75	12.34	12.31	11.65	12.21	12.18	11.54	11.69	11.68	11.12	11.72	11.70	11.14	11.76	11.74	11.18		
	24-hr	4.98	4.96	4.70	4.93	4.92	4.66	4.88	4.87	4.62	4.67	4.67	4.45	4.69	4.68	4.46	4.70	4.70	4.47	NA	NA
	Annual	0.995	0.99	0.94	0.99	0.98	0.93	0.98	0.97	0.92	0.93	0.93	0.89	0.94	0.94	0.89	0.94	0.94	0.89	NA	NA
SO_2	1-hr	0.75	0.74	0.66	0.67	0.66	0.59	0.57	0.57	0.51	1.12	1.18	1.02	1.00	1.07	0.92	0.86	0.91	0.79		
	3-hr	0.67	0.66	0.60	0.60	0.60	0.53	0.51	0.51	0.46	1.01	1.07	0.91	0.90	0.96	0.82	0.78	0.82	0.71	1.07	25
	24-hr	0.30	0.29	0.26	0.27	0.27	0.24	0.23	0.23	0.20	0.45	0.47	0.41	0.40	0.43	0.37	0.34	0.37	0.32	0.47	5
	Annual	0.06	0.06	0.05	0.05	0.05	0.05	0.05	0.05	0.04	0.09	0.09	0.08	0.08	0.09	0.07	0.07	0.07	0.06	0.09	1

7.0 ACRONYMS AND ABBREVIATIONS

Abbreviation	Definition
$\mu g/m^3$	Micrograms per cubic meter
ADR	Acid Deposition Reduction
AGC	Astoria Generating Company, L.P., a USPowerGen Company
Btu	British Thermal Units
CAIR	Clean Air Interstate Rule
CFR	Code of Federal Regulations
CO	Carbon Monoxide
CO_2	Carbon Dioxide
GE	General Electric
GEP	Good Engineering Practice
H_2SO_4	Sulfuric Acid
HHV	High Heating Value of Fuel
lbs	Pounds
LMS100	General Electric LMS100™ combustion turbine / electric generator set
MMBtu	Million British Thermal Units
msl	Mean Sea Level
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NSR	Nonattainment New Source Review
NGS	Narrows Generating Station
NH_3	Ammonia
NO_2	Nitrogen Dioxide
NO_X	Nitrogen Oxides
NSR	New Source Review
NYCRR	New York State Codes, Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
O_2	Oxygen
O_3	Ozone
Pb	Lead
PM	Particulate Matter
PM_{10}	Particulate Matter with an Aerodynamic Diameter of 10 Microns or Less
$PM_{2.5}$	Particulate Matter with an Aerodynamic Diameter of 2.5 Microns or Less
ppm	Parts per Million
ppmvd	Parts per Million, Volumetric Dry

Abbreviation	Definition
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
SCR	Selective Catalytic Reduction
SIL	Significant Impact Level
SO_2	Sulfur Dioxide
SO_X	Sulfur Oxides
SPIP	South Pier Improvement Project
TPY	Tons Per Year
U.S. EPA	United States Environmental Protection Agency
ULSD	Ultra Low Sulfur Diesel
USGS	U.S. Geological Survey
VOC	Volatile Organic Compound