Engineering Evaluation
For Proposed Amended Authority to Construct
And
Draft PSD Permit

Gateway Generating Station
Antioch, CA

Bay Area Air Quality Management District
Application 17182

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I Background

This is the Engineering Evaluation for the proposed amended Authority to Construct and Draft PSD Permit for the Gateway Generating Station (GGS). The GGS is a proposed 530-MW, natural-gas fired, combined-cycle merchant power plant, originally proposed by Mirant Delta, LLC as Contra Costa Unit No. 8, to be located at 3223 Wilbur Avenue in Antioch, CA. The project was originally certified by the California Energy Commission (CEC) on May 30, 2001. (The Engineering Evaluation/Determination of Compliance that was prepared at that time is incorporated in this document by reference.) The Authority to Construct was issued by the Bay Area Air Quality Management District (District) on July 24, 2001. The project was originally proposed by Mirant Delta, LLC and has since been acquired by Pacific Gas & Electric (PG&E) Company in late 2006. The CEC transferred the license for the project to PG&E. The District transferred the Authority to Construct for the project to PG&E. PG&E has evaluated the project as originally permitted and requested an amendment to the CEC license and the Authority to Construct. Permit Application No. 17182 is considered a major modification to a major source per Regulation 2-2-405 due to an increase in carbon monoxide emissions from the proposed amended Authority to Construct and proposed draft PSD permit. The document is required to be subject to a 30 day public comment period in accordance with Regulation 2-2-405 and the PSD regulations and the PSD delegation agreement.

The amendment of the Authority to Construct consists of:

- Replacing the wet cooling tower and replacing it with a dry cooling system.
- Reducing hourly emission rates of NO_x (as NO2), CO, and PM_{10} during normal operations to levels consistent with current Best Available Control Technology (BACT) levels for similar projects.
- Increasing startup emissions estimates based on data from facilities using identical turbines.
- Reducing the maximum hourly emissions of CO during startup to 900 lb/hour.
- Increasing the daily CO permit limit for the facility.
- Increasing annual CO permit limits for the facility based on data from facilities using identical turbines.
- Increasing the allowable commissioning emissions for the gas turbines and heat recovery steam generators (HRSGs).
- Replace the natural gas fired preheater with a smaller unit that is exempt from District permit requirements.

- Add a 300 HP Diesel Fire Pump engine to the facility.

The GGS will consist of two natural gas fired General Electric Frame 7FA combustion turbine generators (CTGs), one steam turbine generator (STG) and associated equipment, two supplementally fired heat recovery steam generators (HRSGs), a dry cooling system, a natural gas fired preheater, an oil water separator, and a 300 hp diesel fire pump engine.

This document is the engineering evaluation of the proposed amended BAAQMD Authority to Construct application number 17182. The document is also the statement of basis for the draft Prevention of Significant Deterioration (PSD) permit for the facility.

The document describes how the proposed GGS will comply with applicable federal, state, and BAAQMD regulations, including the Best Available Control Technology and emission offset requirements of the District New Source Review (NSR) regulation. Permit conditions necessary to insure compliance with applicable rules and regulations and air pollutant emission calculations are also included. This document includes a health risk assessment that estimates the impact of the project emissions on public health and a PSD air quality impact analysis, which shows that the project will not interfere with the attainment or maintenance of applicable ambient air quality standards.

Although the proposed Authority to Construct and draft PSD permit is an amendment to an existing Authority to Construct and PSD permit, the District has evaluated the project as a whole for compliance with applicable regulatory requirements, including elements that are covered under the existing permit and are not being changed.

The proposed amended Authority to Construct and draft PSD permit are subject to the public notice, public inspection, and 30-day public comment period requirements of District Regulation 2, Rule 2, Sections 406 and 407 and 40 C.F.R. sections 124.10 through 124.12. Interested members of the public are being provided a 30-day comment period during which they may review the proposed permit, the Engineering Evaluation, and all supporting materials and submit comments on any relevant issues. The District will consider any comments it received before issuing an amended Authority to Construct and Draft PSD Permit.

II Project Description

1. Permitted Equipment

PG&E is proposing a combined-cycle combustion turbine power generation facility with a nominal electrical output of 530 MW. As proposed, each natural gas fired combustion turbine generator (CTG) will have a nominal electrical output of 175 MW and the steam produced by the heat recovery steam generators (HRSGs) will feed to a steam turbine generator with a rated electrical output of 192 MW.

The GGS will consist of the following permitted equipment:

S-41 Combustion Turbine Generator (CTG) #1, General Electric Frame 7FA Model PG 7231 or equivalent, 1872 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-1 Selective Catalytic Reduction System (SCR) and A-2 Oxidation Catalyst

S-42 Heat Recovery Steam Generator (HRSG) #1, with Duct Burner Supplemental Firing System, 395 MMBtu/hr maximum rated capacity; Abated by A-1 Selective Catalytic Reduction (SCR) System and A-2 Oxidation Catalyst

S-43 Combustion Turbine Generator (CTG) #2, General Electric Frame 7FA Model PG 7231 or equivalent, 1872 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-3 Selective Catalytic Reduction System (SCR) and A-4 Oxidation Catalyst

S-44 Heat Recovery Steam Generator (HRSG) #2, with Duct Burner Supplemental Firing System, 395 MMBtu/hr maximum rated capacity; Abated by A-3 Selective Catalytic Reduction (SCR) System and A-4 Oxidation Catalyst

S-45 Natural Gas-fired Fuel Preheater (Exempt per Regulation 2-1-114)

S-46 Dry Cooling System (Exempt per 2-1-103)

S-47 Fire Pump Diesel Engine, Clarke JW6H-UF40, 300 hp, 2.02 MMBtu/hr rated heat input

S-48 Oil-Water Separator, Highland Tank, HTC, 8000 gallon

2. Equipment Operating Scenarios

Turbines and Heat Recovery Steam Generators

Because GGS will be a merchant power plant, the exact operation of the new gas turbine/HRSG power trains will be dictated by market circumstances and demand. However, the following general operating modes are expected to occur at the GGS:

Base Load: Maximum continuous output with duct firing

Load Following: Facility would be operated to meet contractual load and spot sale demand, with a total output less than the base load scenario

Partial Shutdown: Based upon contractual load and spot sale demand, it may be economically favorable to shutdown one or more turbine/HRSG power trains; this would occur during periods of low overall demand such as late evening and early morning hours

Full Shutdown: May be caused by equipment malfunction, fuel supply interruption, or transmission line disconnect or if market price of electricity falls below cost of generation

The table below outlines the maximum operating annual air pollutant emissions for this project. The carbon monoxide emissions have increased from 259.1 tons/year to 554.3 tons/year and the PM_{10} emissions have decreased slightly from 112.2 tons/year to 101.4 tons/year. Sulfur Oxides emissions have decreased slightly from 48.5 tons/year to 37.0 tons/year.

TABLE 1. MAXIMUM ANNUAL REGULATED CRITERIA AIR POLLUTANT EMISSIONS FOR THE FACILITY.

	NO_2 (ton/yr)	CO (ton/yr)	POC (ton/yr)	PM_{10} (ton/yr)	SO_2 (ton/yr)
Original Limits	**174.3**	**259.1**	**46.6**	**112.2**	**48.5**
New Limits	**174.3**	**554.3**	**46.6**	**101.7**	**37.0**

Original Limits are from Application No. 1000. The New Limits are for the revised Authority to Construct for this project. Emissions from Dewpoint Heater are not included in the new permit limits since the heater is exempt per Regulation 2, Rule 1, Section 114.

3. Air Pollution Control Strategies and Equipment

The proposed GGS includes sources that trigger the Best Available Control Technology (BACT) requirement of New Source Review (Regulation 2, Rule 2) for emissions of nitrogen oxides (NO_x as NO_2), carbon monoxide (CO), precursor organic compounds (POCs), sulfur dioxide (SO_2), and particulate matter of less than 10 microns in diameter[1] (PM_{10}).

a. Selective Catalytic Reduction with Ammonia Injection for the Control of NO_x

The gas turbines and HRSG duct burners each trigger BACT for NO_x emissions. The gas turbines will be equipped with dry low-NO_x (DLN) combustors, which minimize NO_x emissions by lowering peak flame temperature by premixing combustion air with a lean fuel mixture. The HRSGs will be equipped with low-NO_x duct burners, which are designed to minimize NO_x emissions. In addition, the combined NO_x emissions from the gas turbines and HRSGs will be further reduced through the use of selective catalytic reduction (SCR) systems with ammonia injection. The gas turbine and HRSG duct burner combined exhaust will achieve a BACT level NO_x emission limit of 2.0 ppmvd @ 15% O_2 (one hour average).

b. Oxidation Catalyst, Dry Low-NO_x (DLN) Combustors and Good Combustion Practices to control and minimize CO Emissions

The gas turbines and HRSG duct burners each trigger BACT for CO emissions. The gas turbines will be equipped with dry low-NO_x combustors, which operate on a lean fuel mixture that

[1] A subset of PM_{10} that has recently come under heightened regulatory scrutiny is particulate matter of less than 2.5 microns in diameter ($PM_{2.5}$). The majority of the particulate matter emitted from the GGP will have a diameter of less than 1 micron, and so it will be both PM_{10} and $PM_{2.5}$. The analysis in this document regarding PM_{10} is therefore equally applicable to $PM_{2.5}$.

minimizes incomplete combustion and CO emissions. The HRSGs will be equipped with low-NO_x duct burners which are also designed to minimize CO emissions. Furthermore, the gas turbines and HRSGs will be abated by oxidation catalysts which will oxidize the CO emissions to produce CO_2 and water. The gas turbine and HRSG duct burner combined exhaust will achieve a CO emission limit of 4.0 ppmvd @ 15% O_2 (three hour average).

c. Oxidation Catalyst, Dry Low-NO_x (DLN) Combustors and Good Combustion Practices to control and minimize POC Emissions

The Gas Turbines and HRSGs each trigger BACT for POC emissions. The gas turbines will utilize dry low-NO_x combustors which are designed to minimize incomplete combustion and therefore minimize POC emissions. The HRSGs will be equipped with low-NO_x burners, which are designed to minimize incomplete combustion and therefore minimize POC emissions. Furthermore, the turbines and HRSGs will be abated by oxidation catalysts which will also reduce POC emissions. The gas turbine and HRSG duct burner combined exhaust will achieve a POC emission limit of 2.0 ppmvd @ 15% O_2 (one hour average) which corresponds to an 0.00256 lb/MMBtu emission factor.

d. Exclusive Use of Clean-burning Natural gas to Minimize SO_2 and PM_{10} Emissions

The gas turbines and HRSG duct burners will burn exclusively PUC-regulated natural gas to minimize SO_2 and PM_{10} emissions. Because the SO_2 emission rate is proportional to the sulfur content of the fuel burned and is not dependent upon the burner type or other combustion characteristics, the use of “low sulfur content” natural gas will result in the lowest possible emission of SO_2. PM_{10} emissions are minimized through the use of best combustion practices and "clean burning" natural gas.

TABLE 2. SUMMARY OF CONTROL STRATEGIES AND EMISSION LIMITATIONS FOR GAS TURBINES AND HRSG DUCT BURNERS

Source	Control Strategy and Emission Limit[a]				
	NO_x	CO	POC	PM_{10}	SO_2
Gas Turbine & HRSG Power Trains	DLN Combustors/SCR	DLN Combustors/ Oxidation Catalyst	DLN Combustors/ Oxidation Catalyst	PUC-Regulated Natural Gas	PUC-Regulated Natural Gas
	2.0 ppmv (1 hour average)	4.0 ppmv (3 hour average)	2.0 ppmv (1 hour average)	12.0 lb/hr	5.86 lb/hr

[a] ppmv concentrations dry at 15% O_2

III Facility Emissions

The facility regulated air pollutant emissions and toxic air contaminant (TAC) emissions are presented in the following tables. Detailed emission calculations, including the derivations of emission factors are presented in the appendices.

Table 3 is a summary of the daily maximum regulated air pollutant emissions for the permitted sources at GGS. These emission rates are used to determine if the BACT requirement of the District New Source Review regulation (NSR; Regulation 2, Rule 2) is triggered on a pollutant-specific basis. Pursuant to Regulation 2-2-301.1, any new source that has the potential to emit 10 pounds or more per highest day of POC, NPOC, NO_x, SO_2, PM_{10}, or CO are subject to the BACT requirement for that pollutant.

TABLE 3. MAXIMUM DAILY REGULATED AIR POLLUTANT EMISSIONS FOR FACILITY.

	Pollutant (lb/day)				
Source	**Nitrogen Oxides (as NO_2)**	**Carbon Monoxide**	**Precursor Organic Compounds**	**Particulate Matter (PM_{10})**	**Sulfur Dioxide**
Total Gas Turbines and HRSGs[a,b]	1746.5	11465.6	382.4	576.0	282
Fire Pump Engine	2.86	0.39	0.15	0.074	0.004
Total Permitted Equipment (nonexempt)[c]	1749.4	11466.0	382.6	576.1	282

a NO_x, CO, and POC emission rates are based upon one 360 minute cold start-up and 18 hours of Gas Turbine /HRSG full load operation at maximum combined firing rate of 2094.4 MM BTU/hr in one day; PM_{10} and SO_2 emission rates are based upon 24 hours of Gas Turbine/HRSG operation at maximum combined firing rate of 2,094.4 MM BTU/hr in one day

b emission rates based upon 24 hr/day operation at maximum emission rates; see Appendices for emissions calculations

c emission rates based upon 1 hr/day for engine testing.

Table 4 is a summary of the maximum facility toxic air contaminant (TAC) emissions from new sources. These emissions are used as input data for air pollutant dispersion models used to assess the increased health risk to the public resulting from the project. The ammonia emissions shown are based upon a worst-case ammonia emission concentration of 10.0 ppmvd @ 15% O_2 due to ammonia slip from the A-1 and A-3 SCR Systems. The chronic and acute screening trigger levels shown are per Table 2-5.1 of Regulation 2, Rule 5.

TABLE 4. MAXIMUM FACILITY TOXIC AIR CONTAMINANT (TAC) EMISSIONS

Toxic Air Contaminant	Project lb/hour	Project lb/year	Acute Risk Screening Trigger Level (lb/hr)	Chronic Risk Screening Trigger Level (lb/yr)
1,3-Butadiene	5.22E-04	4.35E+00	None	1.10E+00
Acetaldehyde	5.63E-01	4.69E+03	None	6.40E+01
Acrolein	7.76E-02	6.47E+02	4.20E-04	2.30E+00
Ammonia	5.86E+01	4.89E+05	7.10E+00	7.70E+03
Benzene	5.46E-02	4.55E+02	2.90E+00	6.40E+00
Benzo(a)anthracene	9.28E-05	7.73E-01	None	None
Benzo(a)pyrene	5.71E-05	4.76E-01	None	1.10E-02
Benzo(b)fluoranthene	4.64E-05	3.87E-01	None	None
Benzo(k)fluoranthene	4.52E-05	3.76E-01	None	None
Chrysene	1.03E-04	8.62E-01	None	None
Dibenz(a,h)anthracene	9.65E-05	8.04E-01	None	None
Ethylbenzene	7.35E-02	6.12E+02	None	7.70E+04
Formaldehyde	1.88E+00	1.57E+04	2.10E-01	3.00E+01
Hexane	1.06E+00	8.86E+03	None	2.70E+05
Indeno(1,2,3-cd)pyrene	9.65E-05	8.04E-01	None	None
Naphthalene	6.82E-03	5.68E+01	None	None
Propylene	3.17E+00	2.64E+04	None	1.20E+05
Propylene Oxide	1.96E-01	1.64E+03	6.80E+00	4.90E+01
Toluene	2.92E-01	2.43E+03	8.20E+01	1.20E+04
Xylene (Total)	1.07E-01	8.93E+02	4.90E+01	2.70E+04
Diesel Particulate Matter	7.40E-02	3.70E+00	None	5.80E-01
Benzo(a)pyrene equivalents	1.88E-04	1.56E+00	None	1.10E-02

Table 5 is a summary of the maximum annual regulated air pollutant emissions for the facility from proposed permitted sources. Pursuant to the Prevention of Significant Deterioration (PSD) requirements of New Source Review (Regulation 2-2-304.1 and 2-2-305.1), a new major facility with maximum annual pollutant emissions in excess of any of the trigger levels shown must perform modeling to assess the net air quality impact of the proposed facility.

TABLE 5. MAXIMUM ANNUAL FACILITY REGULATED AIR POLLUTANT EMISSIONS

Pollutant	Permitted Source Emissions[a,b] (tons/year)	PSD Trigger[c] (tons/year)
Nitrogen Oxides (as NO_2)	174.3	100
Carbon Monoxide	554.3	100
Precursor Organic Compounds	46.6	N/A[d]
Particulate Matter (PM_{10})	101.7	100
Sulfur Dioxide[e]	37.0	100

[a] emission increases from proposed gas turbines and heat recovery steam generators, and fire pump diesel engine; specified as permit condition limit

[b] includes start-up and shutdown emissions for gas turbines

[c] for a new major facility

[d] there is no PSD requirement for POC since the BAAQMD is designated as nonattainment for the federal ambient air quality standard for ozone.

[e] Annual emissions are calculated based on annual average sulfur content of 0.75 grain per 100 scf in natural gas

The sulfuric acid mist (H_2SO_4) emissions from the Gateway Generating Station are estimated to be less than the PSD threshold of 7 tons per year. The applicant will conduct source testing to measure SO_2, SO_3, H_2SO_4 and ammonium sulfates. This testing is necessary because the conversion in turbines of fuel sulfur to SO_3, and then to H_2SO_4 is not well established. The applicant will estimate emissions of H_2SO_4 from the facility using heat input and lb/MMBtu emission factors developed during periodic source testing.

IV Statement of Compliance

The following section summarizes the applicable District, state and federal rules and regulations and describes how the proposed Gateway Generating Station will comply with those requirements.

Regulation 2, Rule 2; New Source Review

The primary requirements of New Source Review that apply to the proposed GGS facility are Section 2-2-301; "Best Available Control Technology Requirement", Section 2-2-302; "Offset Requirements, Precursor Organic Compounds and Nitrogen Oxides, NSR", and Section 2-2-404, "PSD Air Quality Analysis".

<u>1. Best Available Control Technology (BACT) Determinations</u>

Pursuant to Regulation 2-2-206, BACT[2] is defined as the more stringent of:

(a) "The most effective control device or technique which has been successfully utilized for the type of equipment comprising such a source; or

(b) The most stringent emission limitation achieved by an emission control device or technique for the type of equipment comprising such a source: or

(c) Any emission control device or technique determined to be technologically feasible and cost-effective by the APCO, or

(d) The most effective emission control limitation for the type of equipment comprising such a source which the EPA states, prior to or during the public comment period, is contained in an approved implementation plan of any state, unless the applicant demonstrates to the satisfaction of the APCO that such limitations are not achievable. Under no circumstances shall the emission control required be less stringent than the emission control required by any applicable provision of federal, state or District laws, rules or regulations."

The type of BACT described in definitions (a) and (b) must have been demonstrated in practice and approved by a local Air Pollution Control District, CARB, or the EPA and is referred to as "BACT 2". This type of BACT is termed "achieved in practice". The BACT category described in definition (c) is referred to as "technologically feasible/cost-effective" and it must be commercially available, demonstrated to be effective and reliable on a full-scale unit, and shown to be cost-effective on the basis of dollars per ton of pollutant abated. This is referred to as "BACT 1". BACT specifications (for both the "achieved in practice" and "technologically feasible/cost-effective" categories) for various source categories have been compiled in the BAAQMD BACT Guideline.

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[2] 40 C.F.R. Section 52.21 contains a substantively identical BACT requirement. The District's BACT analysis satisfies both District and federal regulatory requirements.

Gas Turbines and HRSGs

The following section includes BACT determinations by pollutant for the gas turbines and HRSG duct burners of the proposed GGS Project. Because each Gas Turbine and its associated HRSG will exhaust through a common stack and be subject to combined emission limitations, the BACT determinations will, in practice, apply to each Gas Turbine/HRSG power train as a combined unit.

Nitrogen Oxides (NO_x)

- Combustion Gas Turbines

  District BACT Guideline 89.1.6 specifies BACT 1 (technologically feasible/cost-effective) for NO_x for a combined cycle gas turbine with a rated output $\geq$ 40 MW as 2.0 ppmvd @ 15% O_2 averaged over one hour, typically achieved through the use of Selective Catalytic Reduction (SCR) with ammonia injection in conjunction with dry low-NO_x combustors. The EPA has accepted this BACT determination as federal LAER. This BACT determination has been imposed on recent BAAQMD permits issued for: East Altamont Energy Center (Application #2589), Pico Power Project (Application #6481), and Russell City Energy Center (Application #15487). In addition, Palomar Energy Project located in San Diego County, a 546 MW combined cycle power plant, recently started up (4/1/06) with a NO_x emission requirement of 2.0 ppmvd, @ 15% O_2, averaged over one hour.

  A NO_x emission concentration of 2.0 ppmvd, @ 15% O_2, averaged over one hour, has been established as "achieved-in-practice" BACT for NO_x based upon our review of CEM data for the ANP Blackstone power plant, a nominal 550-MW combined cycle facility. The ANP Blackstone power plant is located in Blackstone, Massachusetts and consists of two ABB GT-4 Gas Turbines rated at 180-MW each with unfired heat recovery steam generators. We reviewed CEM data for approximately 2,313 firing hours for unit 1 and 2,737 firing hours for unit 2 which occurred from April 2001 to April 2002. With the exception of start-up and shutdown periods, the NOx concentrations were below the 2.0 ppmvd limit by a sufficient margin to demonstrate consistent, continuous compliance.

  In accordance with design criteria specified by the applicant, each combustion gas turbine is designed to meet a NO_x emission concentration limit of 2.0 ppmvd NO_x @ 15% O_2, averaged over one hour during all operating modes except gas turbine start-ups and shutdowns. This meets the current District BACT 1 determination and meets or exceeds the current EPA and ARB BACT determinations for NO_x. Compliance with this emission limitation will be achieved through the use of dry low-NO_x combustors which utilize "lean-premixed" combustion technology to reduce the formation of NO_x and CO. The NO_x emissions from the turbine and HRSG will be abated through the use of a selective catalytic reduction (SCR) system with ammonia injection. The NO_x emission concentration will be verified by a CEM (continuous emissions monitor) located at the common stack for each gas turbine/HRSG power train.

- Heat Recovery Steam Generators (HRSGs)

Supplemental heat will be supplied to the HRSGs with low-NO_x duct burners, which are designed to minimize NO_x emissions. The duct burner exhaust gases will also be abated by the SCR system with ammonia injection and when combined with the gas turbine exhaust, will achieve NO_x emission concentrations of less than or equal to 2.0 ppmvd @ 15% O_2, averaged over one hour.

Top-Down BACT Analysis

The following "top-down" BACT analysis for NO_x has been prepared in accordance with EPA's 1990 Draft New Source Review Workshop Manual. A "top-down" BACT analysis takes into account energy, environmental, economic, and other costs associated with each alternative technology, and the benefit of reduced emissions that the technology would bring. Although this analysis is based upon a controlled NO_x emission concentration of 2.5 ppmv instead of the applicable NO_x emission rate of 2.0 ppmv, the District has determined that the conclusions of the analysis are applicable to this project.

Available Control Options and Technical Feasibility

In a March 24, 2000 letter sent to local air pollution control districts, EPA Region 9 stated that the $SCONO_x$ Catalytic Adsorption System should be included in any BACT/LAER analysis for combined cycle gas turbine power plant projects since it can achieve the BACT/LAER emission specification for NO_x of 2.5 ppmvd @ 15% O_2, averaged over one hour or 2.0 ppmvd @ 15% O_2, averaged over three hours. In this letter, EPA stated that ABB Alstom Power, the exclusive licensee for $SCONO_x$ applications, has conducted "full-scale damper testing" that demonstrates that $SCONO_x$ is technically feasible for gas turbines of the size proposed for the GGS Project. Stone & Webster Management Consultants, Inc. of Denver, Colorado was subsequently hired by ABB to conduct an independent technical review of the $SCONO_x$ technology as well as the full-scale damper testing program. According to the report by Stone & Webster, modifications to the actuators, fiberglass seals, and louver shaft-seal interface are being incorporated to resolve reliability and leakage problems observed with early SCONOx units. The previous concerns regarding reliability and leakage problems are reported to be resolved. The District will continue to monitor operating issues and reliability of sites utilizing SCONOx technology.

The control technology originally called SCONOx is now called EMx™ and has several licensees. The technology has been installed on several gas turbine installations and the technology appears to be improving in both performance and cost effectiveness.

The feasibility of the "scale-up" of the EMx system for large gas turbines (GE Frame 7FA) has not been demonstrated.

The District considers either SCR or EMx to be a acceptable control technologies for this project. The District would support the use of EMx technology if the applicant proposed to use it for this project.
We are providing the following analysis for informational purposes only. The analysis shown in Table 6 applies to a single GE Frame 7FA Gas Turbine equipped with DLN combustors and a

NO_x emission rate of 25 ppmvd @ 15% O_2. The following text discusses SCONOx which is now called EMx technology.

TABLE 6. TOP DOWN BACT ANALYSIS SUMMARY FOR NO_X

Control Alternative	Emissions[a] (ton/yr)	Emission Reduction[b] (ton/yr)	Total Annualized Cost[c] ($/yr)	Average Cost-Effectiveness ($/ton)	Incremental Cost-Effectiveness ($/ton)	Toxic Impacts	Adverse Environmental Impacts	Incremental Energy Impact (MM BTU/yr)
$SCONO_x$	788	709	4,122,889	5,815	N/A[d]	No	No	122,000[e]
SCR	788	709	1,557,125	2,196	-	Yes	No	67,900[e]

[a] based upon uncontrolled NO_x emission rate of 25 ppmvd @ 15% O_2, and annual firing rate of 17,436,780 MM BTU/yr

[b] based upon NO_x emission rate after abatement of 2.5 ppmvd @ 15% O_2, and annual firing rate of 17,436,780 MM BTU/yr

[c] "Cost Analysis for NO_x Control Alternatives for Stationary Gas Turbines", ONSITE SYCOM Energy Corporation, October 15, 1999

[d] does not apply since there is no difference in emission reduction quantity between alternatives

[e] "Towantic Energy Project Revised BACT Analysis", RW Beck, February 18, 2000; based upon increased fuel use to overcome catalyst bed back pressure

Energy Impacts

As shown in Table 6, the use of SCR does not result in any significant or unusual energy penalties or benefits when compared to $SCONO_x$. Although the operation and maintenance of $SCONO_x$ does result in a greater energy penalty when compared to that of SCR, this is not considered significant enough to eliminate $SCONO_x$ as a control alternative.

Economic Impacts

According to EPA's 1990 Draft New Source Review Workshop Manual, "Average and incremental cost effectiveness are the two economic criteria that are considered in the BACT analysis."

As shown in Table 6, the average cost-effectiveness of both SCR and $SCONO_x$ meet the current District cost-effectiveness guideline of $17,500 per ton of NO_x abated. However, the average cost-effectiveness of SCR is approximately 38% of the average cost-effectiveness of $SCONO_x$. These figures are based upon total annualized cost figures from a cost analysis conducted by ONSITE SYCOM Energy Corporation. Although $SCONO_x$ will result in greater economic impact as quantified by average cost-effectiveness, this impact is not considered adverse enough to eliminate $SCONO_x$ as a control alternative. See Appendices for ONSITE SYSCOM cost-effectiveness calculations.

Incremental cost-effectiveness does not apply since SCR and $SCONO_x$ both achieve the current BACT/LAER standard for NO_x of 2.0 ppmvd @ 15% O_2, averaged over one hour and therefore achieve the same NO_x emission reduction in tons per year.

Environmental Impacts

The use of SCR will result in ammonia emissions due to an allowable ammonia slip limit of 10 ppmvd @ 15% O_2. A health risk assessment using air dispersion modeling showed an acute hazard index of 0.056 and a chronic hazard index of 0.028 resulting from the emission of all non-carcinogenic compounds, including ammonia, from the gas turbines. In accordance with the District Regulation 2, Rule 5 and currently accepted practice, a hazard index of 1.0 or above is considered significant. Therefore, the toxic impact of the ammonia slip resulting from the use of SCR is deemed to be not significant and is not a sufficient reason to eliminate SCR as a control alternative.

The ammonia emissions resulting from the use of SCR may have another environmental impact through its potential to form secondary particulate matter such as ammonium nitrate. Because of the complex nature of the chemical reactions and dynamics involved in the formation of secondary particulates, it is difficult to estimate the amount of secondary particulate matter that will be formed from the emission of a given amount of ammonia. However, it is the opinion of the Research and Modeling section of the BAAQMD Planning Division that the formation of ammonium nitrate in the Bay Area air basin is limited by the formation of nitric acid and not driven by the amount of ammonia in the atmosphere. Therefore, ammonia emissions from the proposed SCR system are not expected to contribute significantly to the formation of secondary particulate matter within the BAAQMD. The potential impact on the formation of secondary particulate matter in the SJVAPCD is not known. This potential environmental impact is not considered adverse enough to justify the elimination of SCR as a control alternative.

A second potential environmental impact that may result from the use of SCR involves the storage and transport of ammonia. Although ammonia is toxic if swallowed or inhaled and can irritate or burn the skin, eyes, nose, or throat, it is a commonly used material that is typically handled safely and without incident. The GGS will utilize aqueous ammonia in a 19% (by weight) solution. Consequently, the GGS will be required to maintain a Risk Management Plan (RMP) and implement a Risk Management Program to prevent accidental releases of ammonia. The RMP provides information on the hazards of the substance handled at the facility and the programs in place to prevent and respond to accidental releases. The accident prevention and emergency response requirements reflect existing safety regulations and sound industry safety codes and standards. In addition, the CEC has modeled the health impacts arising from a catastrophic release of aqueous ammonia due to spontaneous storage tank failure at the proposed GGS facility and found that the impact would not be significant. Therefore, the potential environmental impact due to aqueous ammonia storage at the GGS does not justify the elimination of SCR as a control alternative.

The use of $SCONO_x$ will require approximately 360,000 gallons of water per year for catalyst cleaning. This environmental impact does not justify the elimination of $SCONO_x$ as a control alternative.

Conclusion

Both SCR and EMx ($SCONO_x$) can achieve the current accepted BACT/LAER specification for NO_x without causing significant energy, economic, or environmental impacts. Thus, neither can be eliminated as a viable control alternative. The only aspect of this analysis affected by the current NO_x BACT standard of 2.0 ppmvd @ 15% O_2, averaged over one hour is the cost of compliance. The increased cost of control for each technology is not expected to affect the conclusion of this analysis. Therefore, the applicant's proposed use of SCR to meet the NO_x BACT/LAER specification is acceptable.

Carbon Monoxide (CO)

BACT for CO will be analyzed within the context of two distinct operating modes for each gas turbine/HRSG power train. The first mode is firing of the gas turbine only over its entire operating range from minimum to maximum load. The second mode includes gas turbine firing at maximum load with HRSG duct burner firing.

- Combustion Gas Turbines and Heat Recovery Steam Generators (HRSGs)

District BACT Guideline 89.1.6 specifies BACT 2 (achieved in practice) for CO for combined cycle gas turbines with a rated output of $\geq$ 50 MW as a CO emission concentration of $\leq$ 4.0 ppmvd @ 15% O_2. This BACT specification is based upon the Sacramento Power Authority (Campbell Soup facility) located in Sacramento County, California. BACT 1 (technologically feasible/cost-effective) is currently not specified. This emission rate limit applies to all operating modes except gas turbine start-up and shutdown.

The applicant has agreed to a CO emission limit of 4.0 ppmvd @ 15% O_2, averaged over any rolling 3-hour period. This satisfies the current BACT 2 limitation as discussed above. Compliance with this emission limitation will be achieved through the use of dry low-NO_x combustors which utilize "lean-premixed" combustion technology to reduce the formation of NO_x and CO. CO emissions from the turbine and HRSG will be abated through the use of an oxidation catalyst. The CO emission concentration will be verified by a CEM located at the common stack for each gas turbine/HRSG power train.

Precursor Organic Compounds (POCs)

- Combustion Gas Turbines

There currently is no BACT 1 (technologically feasible/cost-effective) specification for POC for this source category. Currently, District BACT Guideline 89.1.6 specifies BACT 2 (achieved in practice) for POC for combined cycle gas turbines with an output rating $\geq$ 50 MW as 2.0 ppmv, dry @ 15% O_2, which is typically achieved through the use of dry-low NO_x combustors and/or an oxidation catalyst. This is based upon the Delta Energy Center and Metcalf Energy Center, which were recently permitted at a POC emission limit of 2.0 ppmvd @ 15% O_2.

The applicant has agreed to not exceed a POC stack concentration of 2.0 ppmvd @ 15% O_2 with the use of dry-low NO_x combustors and/or an oxidation catalyst. Thus the GGS satisfies the BACT requirement for POC emissions.

- Heat Recovery Steam Generators (HRSGs)

The HRSG duct burners will be of low-NO_x design, which minimizes incomplete combustion and therefore the POC emission rate. Each gas turbine/HRSG pair will achieve this emission limitation through the use of dry low-NO_x burners, good combustion practices and an oxidation catalyst.

Sulfur Dioxide (SO_2)

- Combustion Gas Turbines

District BACT Guideline 89.1.6 specifies BACT 2 (achieved in practice) for SO_2 for combined cycle gas turbines with an output rating of $\geq$ 50 MW as the exclusive use of clean-burning natural gas with a sulfur content of $\leq$ 1.0 grains per 100 scf. This corresponds to an SO_2 emission factor of 0.0028 lb/MM BTU. The proposed turbines will burn exclusively PUC-regulated natural gas with an expected average sulfur content of 0.75 grains per 100 scf, which will result in minimal SO_2 emissions. This meets the current BACT 2 specification for SO_2.

- Heat Recovery Steam Generators (HRSGs)

As is the case of the Gas Turbines, BACT for SO_2 for the HRSG duct burners is deemed to be the exclusive use of clean-burning natural gas with a sulfur content of $\leq$ 1.0 grains per 100 scf. The HRSGs will burn exclusively PUC-regulated natural gas with an average natural gas sulfur content of 0.75 grains per 100 scf. This meets the current BACT 2 specification for SO_2.

Particulate Matter (PM_{10})

- Combustion Gas Turbines

District BACT Guideline 89.1.6 specifies BACT for PM_{10} for combined cycle gas turbines with rated output of $\geq$ 50 MW as the exclusive use of clean-burning natural gas with a maximum sulfur content of $\leq$ 1.0 grains per 100 scf. The proposed turbines will utilize exclusively PUC-regulated natural gas with an average sulfur content of 0.75 gr/100 scf, which will result in minimal direct PM_{10} emissions and minimal formation of secondary PM_{10} such as ammonium sulfate.

- Heat Recovery Steam Generators (HRSGs)

BACT for PM_{10} for the HRSG duct burners is deemed to be the exclusive use of clean-burning natural gas with a maximum sulfur content of $\leq$ 1.0 grains per 100 scf. The HRSGs will burn exclusively PUC-regulated natural gas with an average natural gas sulfur content of 0.75 grains per 100 scf which will result in minimal direct PM_{10} emissions and minimal formation of secondary PM_{10} such as ammonium sulfate.

Fire Pump Diesel Engine

Based upon 24 hour per day operation under emergency conditions, the proposed fire pump diesel engine triggers BACT for NO_x, POC, and CO, since its potential to emit for each of those pollutants exceeds 10 pounds per day. The current District BACT limits and the specifications for the proposed engine are summarized in Table 7. The applicant will be required by permit conditions to select and install an engine that satisfies BACT for all pollutants listed.

TABLE 7. DISTRICT BACT LIMITS AND FIRE PUMP ENGINE SPECIFICATIONS

Pollutant	District BACT Specifications[a] (g/bhp-hr)	S-6 Engine[b] Specifications (g/bhp-hr)
NO_x (as NO_2)	6.9	4.32
CO	2.75	0.597
POC	1.5	0.227
SO_2	Ultra-Low Sulfur Oil	0.0055[c]
PM_{10}	Ultra-Low Sulfur Oil	0.112[c]

[a] BACT 2 (“achieved in practice”) per District BACT Guideline 96.1.2, “IC Engine – Compression Ignition $\geq$ 175 hp output rating”

[b] emission rates specified by applicant

[c] permit conditions will require the use of ultra-low sulfur oil (15 ppm by weight) at S-47 engine

Emission Offsets

General Requirements

Pursuant to Regulation 2-2-302, federally enforceable emission offsets are required for POC and NO_x (as NO_2) emission increases from permitted sources at facilities which will emit 15 tons per year or more on a pollutant-specific basis. For facilities that will emit more than 35 tons per year of NO_x (as NO_2), offsets must be provided by the applicant at a ratio of 1.15 to 1.0. Pursuant to Regulation 2-2-302.2, POC offsets may be used to offset emission increases of NO_x.

Pursuant to Regulation 2-2-303, offsets are required for PM10 and SO2 emission increases from permitted sources at facilities that will emit more than 1 ton per year since 1991 (although offsets are voluntary if the increases are less than 100 tons per year).

Timing for Provision of Offsets

Pursuant to District Regulation 2-2-311, the applicant surrendered the required valid emission reduction credits to mitigate the emission increases for the facility prior to the issuance of the Authority to Construct on May 14, 2003. Pursuant to District Regulation 2, Rule 3, “Power

Plants," the Authority to Construct was issued after the California Energy Commission issued the Certificate for the proposed power plant.

Offset Requirements by Pollutant

The applicable offset ratios and the quantity of offsets required are summarized in Table 8.

POC Offsets

Because the GGS will emit less than 35 tons of POC per year, the POC emissions were offset at a ratio of 1.0 to 1.0 pursuant to District Regulation 2-2-302.

NO_x Offsets

Because the GGS will emit greater than 35 tons per year of Nitrogen Oxides (NO_x) from permitted sources, the applicant provided emission reduction credits (ERCs) of NO_x at a ratio of 1.15 to 1.0 pursuant to District Regulation 2-2-302. Pursuant to District Regulation, 2-2-302.2, the applicant provided POC ERCs to offset the proposed NO_x emission increases at a ratio of 1.15 to 1.0.

PM_{10} Offsets

Because the total PM_{10} emissions from permitted sources will exceed 100 tons per year, the GGS does trigger the PM_{10} offset requirement of District Regulation 2-2-303.

SO_2 Offsets

Pursuant to Regulation 2-2-303, emission reduction credits are not required for the proposed SO_2 emission increases associated with this project since the facility SO_2 emissions will not exceed 100 tons per year. Regulation 2-2-303 allows for the voluntary offsetting of SO_2 emission increases of less than 100 tons per year. The applicant has opted not to provide such emission offsets.

Offset Package

Table 8 summarizes the offset obligation of the GGS. The emission reduction credits presented in Table 8 exist as federally-enforceable, banked emission reduction credits that have been reviewed for compliance with District Regulation 2, Rule 4, "Emissions Banking", and were subsequently issued as banking certificates by the BAAQMD under the applications cited in the table footnotes. If the quantity of offsets issued under any certificate exceeded 35 tons per year for any pollutant, the application was required to fulfill the public notice and public comment requirements of District Regulation 2-4-405. Accordingly, such applications were reviewed by the California Air Resources Board, U.S. EPA, and adjacent air pollution control districts to insure that all applicable federal, state, and local regulations were satisfied.

As indicated below, PG&E has surrendered valid emission reduction credits to offset the emission increases from the permitted sources proposed for the GGS project.

TABLE 8. EMISSION REDUCTION CREDITS SURRENDERED (TON/YR)

	POC[a]	NO_x[b]	PM_{10}[c]
Valid Emission Reduction Credits	53.6	200.5	112.2
Permitted Source Emission Limits	46.6	174.3	101.7
Offsets Required per BAAQMD Calculations	53.6[d]	200.5[d]	101.7

[a]From Banking Certificate # 693.

[b]From Banking Certificate # 693.

[c]SO_2 used at a ratio of 3:1. The following SO_2 Banking Certificates used:

#693	321.90 tons
#694	14.53 tons
#695	0.17 tons
Total	**336.60 tons** (PM_{10} equivalent 112.2 tons)

[d]Reflects applicable offset ratio of 1.15:1.0 pursuant to Regulation 2-2-302

[e]Reflects applicable offset ratio of 1.0:1.0 pursuant to Regulation 2-2-303

These Banking Certificates originated from the following locations:

Certificate	Company	Location	Original Issue Dates
#693	Gaylord Container	Antioch	6/8/84, 3/12/90, 7/15/93
#694	P G & E	Martinez	7/22/87
#695	Hudson ICS	San Leandro	4/9/97

PSD Air Quality Impact Analysis

The proposed amended Authority to Construct and draft PSD permit for the GGS project triggers the PSD air quality impact analysis requirements of 40 C.F.R. section 52.21 and District regulations for Carbon Monoxide, only. A PSD Air Quality Impact anaylsis for NOx and PM10 was conducted during the original permit proceeding in 2001. The District implements the federal PSD requirement pursuant to a Delegation Agreement with EPA Region IX.

Pursuant to BAAQMD Regulation 2-2-414.1, the applicant has submitted a modeling analysis that adequately estimates the air quality impacts from CO emissions due to the GGS project. The applicant's analysis was based on EPA-approved models and was performed in accordance with District Regulation 2-2-414.

Pursuant to Regulation 2-2-414.2, the District has found that the modeling analysis has demonstrated that the allowable emission increases from the GGS facility, in conjunction with all other applicable emissions, will not cause or contribute to a violation of applicable ambient air quality standards for NO_2, CO, and PM_{10} or an exceedance of any applicable PSD increment.

Pursuant to Regulation 2-2-417, the applicant has submitted an analysis of the impact of the proposed source and source-related growth on visibility, soils, and vegetation. The entire PSD air quality impact analysis is contained in Appendix B (Memo dated May 29, 2008 prepared by Irma Salinas, Air Toxics Section).

Pursuant to Regulation 2-2-306, a non-criteria pollutant PSD analysis is required for sulfuric acid mist emissions if the proposed facility will emit H_2SO_4 at rates in excess of 38 lb/day and 7 tons per year.

The sulfuric acid mist (H_2SO_4) emissions from the Gateway Generating Station are estimated to be less than the PSD threshold of 7 tons per year. The applicant will conduct source testing to measure SO_2, SO_3, H_2SO_4 and ammonium sulfates. This testing is necessary because the conversion in turbines of fuel sulfur to SO_3, and then to H_2SO_4 is not well established. The applicant will estimate emissions of H_2SO_4 from the facility using heat input and lb/MMBtu emission factors developed during the source testing.

TABLE 9. MAXIMUM PREDICTED AMBIENT IMPACTS OF PROPOSED GGS (μG/M^3).

Pollutant	Averaging Time	Commissioning Maximum Impact	Start-up	Inversion Break-up Fumigation Impact	Shoreline Fumigation Impact	Modeled Impact	Significant Air Quality Impact Level
CO	1-hour	**3305.3**	789.0	7.3	54.2	38.6	2000
	8-hour	**886.7**	219.6	6.9	17.5	8.1	500

The maximum modeled project impacts for 1-hour & 8-hour average CO exceeded their corresponding significance levels for air quality impacts per Regulation 2-2-233, further analysis to determine if the corresponding ambient air quality standards will be exceeded per District regulation 2-2-414 was performed. Table 10 summarizes the applicable ambient air quality standards, the maximum background concentrations, and the contribution from the proposed GGS for CO 1-hour and 8-hour impacts that exceeded the significance level. As shown in Table 10, the worst-case CO emissions from GGS will not cause or contribute to an exceedance of the California ambient air quality standards for 1-hour and 8-hr CO.

TABLE 10. APPLICABLE CALIFORNIA AND NATIONAL AMBIENT AIR QUALITY STANDARDS (AAQS) AND AMBIENT AIR QUALITY LEVELS FROM THE PROPOSED GGS (μG/M^3)

Pollutant	Averaging Time	Maximum Background	Maximum Project impact	Maximum Project impact plus maximum background	California Standards	National Standards
CO	1-hour	6299	3305	9604	23,000	40,000
	8-hour	3882	887	4769	10,000	10,000

Health Risk Assessment

Pursuant to the BAAQMD Risk Management Policy, a health risk screening must be conducted to determine the potential impact on public health resulting from the worst-case emissions of toxic air contaminants (TACs) from the GGS project. The potential TAC emissions (both carcinogenic and non-carcinogenic) from the GGS are summarized in Table 11. In accordance with the requirements of the BAAQMD Regulation 2-5 and Office of Health Hazard Assessment (OEHHA) guidelines, the impact on public health due to the emission of these compounds was assessed utilizing EPA approved air pollutant dispersion models.

TABLE 11. HEALTH RISK ASSESSMENT RESULTS

Receptor	Cancer Risk (risk in one million)	Chronic Non-Cancer Hazard Index (risk in one million)	Acute Non-Cancer Hazard Index (risk in one million)
Maximally Exposed Individual	0.82	0.028	0.056
Resident	0.41	0.028	0.056
Worker	0.82	0.008	0.056

The health risk assessment performed by the applicant has been reviewed by the District Toxics Evaluation Section and found to be in accordance with guidelines adopted by Cal/EPA's Office of Environmental Health Hazard Assessment (OEHHA), the California Air Resources Board (CARB), and the California Air Pollution Control Officers Association (CAPCOA). Pursuant to BAAQMD Regulation 2-5, the increased carcinogenic risk attributed to this project is considered to be not significant since it is less than 1.0 in one million. The chronic hazard index and the acute hazard index attributed to the emission of non-carcinogenic air contaminants is each considered to be not significant since each is less than 1.0. Therefore, the GGS facility is deemed to be in compliance with BAAQMD Regulation 2-5. Please see Appendix C (Memo dated May 29, 2008 prepared by Irma Salinas and Jane Lundquist, Air Toxics Section) for further discussion.

Other Applicable District Rules and Regulations

Regulation 1, Section 301: Public Nuisance

None of the project's proposed sources of air contaminants are expected to cause injury, detriment, nuisance, or annoyance to any considerable number of persons or the public with respect to any impacts resulting from the emission of air contaminants regulated by the District. In part, the PSD air quality impact analysis ensures that the proposed facility will comply with this Regulation by concluding that the Gateway Generating Station will not interfere with the attainment or maintenance of applicable federal or state health-based ambient air quality standards for NO_2, CO and PM_{10}.

Regulation 2, Rule 1, Sections 301 and 302: Authority to Construct and Permit to Operate

Pursuant to Regulation 2-1-301 and 2-1-302, the GGS has submitted an application to the District to obtain an Authority to Construct and Permit to Operate for all sources at the GGS facility.

Regulation 2, Rule 3: Power Plants

Pursuant to Regulation 2-3-403, the Final Determination of Compliance (FDOC) prepared in 2001 served as the APCO's decision that the proposed power plant will meet the requirements of all applicable District, state, and federal regulations. The FDOC prepared in 2001 contained proposed permit conditions to ensure compliance with those regulations. Pursuant to Regulation 2-3-304, the PDOC was subject to the public notice, public comment, and public inspection requirements contained in Regulation 2-2-406 and 407. The issuance of the FDOC was not considered a final determination of whether the facility can be constructed or operated.

This document serves as the proposed amended Authority to Construct and draft Draft PSD Permit for the project. The CEC is not undertaking a formal licensing proceeding for the amendment, and so the District is not preparing a Determination of Compliance for use by the CEC.

Regulation 2, Rule 5: New Source Review of Toxic Air Contaminants

A risk screening analysis was performed to estimate the health risk resulting from the toxic air contaminant (TAC) emissions from the GGS. Results from this analysis indicate that the maximally exposed individual cancer risk is estimated at 0.82 in a million, the chronic non-cancer hazard index at 0.028 in a million, and acute non-cancer hazard index at 0.056 in million. Therefore the GGS will be in compliance the requirements of Regulation 2-5-301. Furthermore, the proposed controls are considered to be toxic best available control technology (TBACT).

Regulation 2, Rule 6: Major Facility Review

Pursuant to Regulation 2, Rule 6, section 404.1, the owner/operator of the GGS shall submit an application to the District for a major facility review permit within 12 months after the facility becomes subject to Regulation 2, Rule 6. Pursuant to Regulation 2-6-212.1 and 2-6-218, the GGS will become subject to Regulation 2, Rule 6 upon completion of construction as demonstrated by first firing of the gas turbines.

Regulation 2, Rule 7: Acid Rain

The GGS gas turbine units and heat recovery steam generators will be subject to the requirements of Title IV of the federal Clean Air Act. The requirements of the Acid Rain Program are outlined in 40 CFR Part 72. The specifications for the type and operation of continuous emission monitors (CEMs) for pollutants that contribute to the formation of acid rain are given in 40 CFR Part 75. District Regulation 2, Rule 7 incorporates by reference the provisions of 40 CFR Part 72. The applicant has submitted a Title IV permit application pursuant to Regulation 2, Rule 7 and 40 C.F.R. Part 72.

Regulation 6: Particulate Matter and Visible Emissions

Through the use of dry low-NO_x burner technology and proper combustion practices, the combustion of natural gas at the proposed gas turbines, HRSG duct burners, auxiliary boiler, and emergency generator set is not expected to result in visible emissions. Specifically, the facility's combustion sources are expected to comply with Regulation 6, including sections 301 (Ringelmann No. 1 Limitation), 302 (Opacity Limitation) with visible emissions not to exceed 20% opacity, and 310 (Particulate Weight Limitation) with particulate matter emissions of less than 0.15 grains per dry standard cubic foot of exhaust gas volume. As calculated in accordance with Regulation 6-310.3, the grain loading resulting from the operation of each power train (Gas Turbine and HRSG Duct Burners) is 0.0013 gr/dscf @ 6% O_2. See Appendices for CTG/HRSG grain loading calculations.

Particulate matter emissions associated with the construction of the facility are exempt from District permit requirements but are subject to Regulation 6. However, the California Energy Commission has imposed requirements for construction activities including the use of water and/or chemical dust suppressants to minimize PM_{10} emissions and prevent visible particulate emissions.

Regulation 7: Odorous Substances

Regulation 7-302 prohibits the discharge of odorous substances which remain odorous beyond the facility property line after dilution with four parts odor-free air. Regulation 7-302 limits ammonia emissions to 5000 ppm. Because the ammonia slip emissions from the proposed CTG/HRSG power trains will each be limited by permit condition to 10 ppmvd @ 15% O_2, the facility is expected to comply with the requirements of Regulation 7.

Regulation 8: Organic Compounds

The gas turbines and HRSG duct burners are exempt from Regulation 8, Rule 2, "Miscellaneous Operations" per 8-2-110 since natural gas will be fired exclusively at those sources. The fire pump diesel engine will comply with Regulation 8-2-301 since its emissions will contain a total carbon concentration of less than 300 ppmv, dry.

The use of solvents for cleaning and maintenance at the GGS is expected to comply with Regulation 8, Rule 4, "General Solvent and Surface Coating Operations" section 302.1 by emitting less than 5 tons per year of volatile organic compounds.

Regulation 9: Inorganic Gaseous Pollutants

Regulation 9, Rule 1, Sulfur Dioxide

This regulation establishes emission limits for sulfur dioxide from all sources and applies to the combustion sources at this facility. Section 301 (Limitations on Ground Level Concentrations) prohibits emissions which would result in ground level SO_2 concentrations in excess of 0.5 ppm continuously for 3 consecutive minutes, 0.25 ppm averaged over 60 consecutive minutes, or 0.05 ppm averaged over 24 hours. Section 302 (General Emission Limitation) prohibits SO_2 emissions in excess of 300 ppmv (dry). With maximum projected SO_2 emissions of < 1 ppmv, the gas turbines, HRSG duct burners, and fire pump engine are not expected to cause ground level SO_2 concentrations in excess of the limits specified in Regulation 9-1-301 and should easily comply with section 302.

Regulation 9, Rule 3, Nitrogen Oxides from Heat Transfer Operations

The proposed combustion gas turbines (each rated at 1872 MM BTU/hr, HHV) and HRSG duct burners (each rated at 395 MM BTU/hr, HHV) shall comply with the Regulation 9-3-303 NO_x limit of 125 ppm by complying with a permit condition nitrogen oxide emission limit of 2.0 ppmvd @ 15% O_2. The proposed fire pump diesel engine is not subject to this regulation since it has a maximum heat input rating of approximately 2 MM BTU/hr, based upon a maximum rated output of 300 bhp.

Regulation 9, Rule 7, Nitrogen Oxides and Carbon Monoxide from Industrial, Institutional, and Commercial Boilers, Steam Generators, and Process Heaters

The proposed S-42 & S-44 HRSGs are subject to the emission concentration limits of Regulation 9, Rule 7, section 301 which limits NO_x emissions to 30 ppmv, dry @ 3% O_2 and CO emissions to 400 ppmv, dry @ 3% O_2. To determine if the HRSG duct burners comply with these NO_x emission limits, it would be necessary to install a NO_x CEM upstream of the HRSG duct burners since the HRSGs and turbines exhaust through a common stack. Because the combined exhaust from the turbines and HRSGs are subject to a much more stringent BACT limit of 2.0 ppmvd @ 15% O_2, it is reasonable to conclude that the HRSG duct burners comply with the emission limits of Regulation 9, Rule 7. As a practical matter, the HRSG duct burners are therefore subject to Regulation 9, Rule 9.

Regulation 9, Rule 8, Nitrogen Oxides and Carbon Monoxide from Stationary Internal Combustion Engines

The proposed 300 hp fire pump diesel engine is exempt from Sections 301, 302 and 502 of Regulation 9, Rule 8 per Regulation 9-8-110.3 until 2012, since it will be fired exclusively on diesel fuel. After 2012, the engine will meet the emissions limitations in Section 9-8-304. The proposed emergency generator will comply with Regulation 9-8-330 which allows emergency use for unlimited hours, and limits non-emergency use to 50 hours per year.

Regulation 9, Rule 9, Nitrogen Oxides from Stationary Gas Turbines

Because each of the proposed combustion gas turbines will be limited by permit condition to NO_x emissions of 2.0 ppmvd @ 15% O_2, they will comply with the Regulation 9-9-301.3 NO_x limitation of 9 ppmvd @ 15% O_2.

Regulation 10: Standards of Performance for New Stationary Sources

Regulation 10 incorporates by reference the provisions of Title 40 CFR Part 60. The applicable subparts of 40 CFR Part 60 include Subpart A, “General Provisions”, Subpart Da, “Standards of Performance for Electric Utility Steam Generating Units for which Construction is Commenced after September 18, 1978”, Subpart KKKK “Standards of Performance for Stationary Gas Turbines” and Subpart IIII “Standards of Performance for Stationary Compression Ignition Internal Combustion Engines. The proposed gas turbines and heat recovery steam generators comply with all applicable standards and limits proscribed by these regulations. The applicable emission limitations are summarized below:

Source	Requirement	Emission Limitation	Compliance Verification
Gas Turbines and HRSGs	Subpart Da		
	40 CFR 60.44a(a)(1)	0.2 lb NO_x/MM BTU, except during start-up, shutdown, or malfunction	Sources limited by permit condition to 0.0074 lb NO_x/MM BTU
	40 CFR 60.44a(a)(2)	25% reduction of potential NO_x emission concentration	SCR Systems will comply with this reduction requirement
	40 CFR 60.44a(d)(1)	1.6 lb NO_x/MW-hr	0.08 lb NO_x/MW-hr at nominal plant rating of 530 MW
	Subpart GG	Not Applicable	
	Subpart KKKK	0.39 lb NO_x/MW-hr, 0.59 lb SO_2/MW-hr	0.08 lb NO_x/MW-hr, 0.03 lb SO_2/MW-hr
Fire pump Diesel Engine	Subpart IIII		
		7.8 NMHC+NO_x, 2.6 CO, 0.40 PM_{10} (g/HP-hr) for 2008 and earlier engines	S-47 Fire pump Engine will comply with required emission limits.

State Requirements

GGS is subject to the Air Toxic "Hot Spots" Program contained in the California Health and Safety Code Section 44300 et seq. The facility will prepare inventory plans and reports as required.

The Fire Pump Engine is subject to and will be in compliance with the Airborne Toxic Control Measure (ATCM) for Stationary Compression Ignition Engines contained in Title 17 of the California Code of Regulations Section 93115. The allowable operating hours and recordkeeping requirements contained in the ATCM will be included in the Permit Conditions.

V Permit Conditions

The District is proposing the following permit conditions to ensure that the proposed project complies with all applicable District, state, and federal Regulations. The conditions limit operational parameters such as fuel use, stack gas emission concentrations, and mass emission rates. Permit conditions will also specify abatement device operation and performance levels. To aid enforcement efforts, conditions specifying emission monitoring, source testing, and record keeping requirements are included. Furthermore, pollutant mass emission limits (in units of lb/hr and lb/MM BTU of natural gas fired) will insure that daily and annual emission rate limitations are not exceeded.

To provide maximum operational flexibility, no limitations will be imposed on the type, or quantity of gas turbine start-ups or shutdowns. Instead, the facility must comply with daily and annual (consecutive twelve-month) mass emission limits at all times. Compliance with CO and NO_x limitations will be verified by continuous emission monitors (CEMs) that will be in operation during all turbine operating modes, including start-up, shutdown and combustor tuning. If the CO and NO_x CEMs are not capable of accurately assessing gas turbine start-up and shutdown mass emission rates due to variable O_2 content and the differing response times of the O_2 and NO_x monitors, then start-up and shutdown mass emission rates will be based upon annual source test results. Compliance with POC, SO_2, and PM_{10} mass emission limits will be verified by annual source testing.

In addition to permit conditions that apply to steady-state operation of each CTG/HRSG power train, the District is proposing conditions that govern equipment operation during the initial commissioning period when the CTG/HRSG power trains will operate without their SCR systems and/or oxidation catalysts in place. Commissioning activities include, but are not limited to, the testing of the gas turbines, adjustment of control systems, and the cleaning of the HRSG steam tubes. Permit conditions 1 through 12 apply to this commissioning period and are intended to minimize emissions during the commissioning period and insure that those emissions will not contribute to the exceedance of any applicable short-term ambient air quality standard.

Gateway Generating Station Permit Conditions

Definitions:

1-hour period: Any continuous 60-minute period beginning on the hour.
Calendar Day: Any continuous 24-hour period beginning at 12:00 AM or 0000 hours.
Year: Any consecutive twelve-month period of time
Heat Input: All heat inputs refer to the heat input at the higher heating value fuel.
Rolling 3-hour period: Any three-hour period that begins on the hour and does not include start-up or shutdown periods.
Firing Hours: Period of time during which fuel is flowing to a unit, measured in fifteen-minute increments.
MM Btu: million British thermal units
Gas Turbine Start-up Mode: The lesser of the first 360 minutes of continuous fuel flow to the Gas Turbine after fuel flow is initiated or the period of time from Gas Turbine fuel flow initiation until the Gas Turbine achieves two consecutive CEM data points in compliance with the emission concentration limits of conditions 20(b) and 20(d).
Gas Turbine Shutdown Mode: The lesser of the 60 minute period immediately prior to the termination of fuel flow to the Gas Turbine or the period of time from non-compliance with any requirement listed in Conditions 20(a) through 20(d) until termination of fuel flow to the Gas Turbine.
Specified PAHs: The polycyclic aromatic hydrocarbons listed below shall be considered to Specified PAHs for these permit conditions. Any emission limits for Specified PAHs refer to the sum of the emissions for all six of the following compounds.
Benzo[a]anthracene
Benzo[b]fluoranthene
Benzo[k]fluoranthene
Benzo[a]pyrene
Dibenzo[a,h]anthracene
Indeno[1,2,3-cd]pyrene
Corrected Concentration: The concentration of any pollutant (generally NO_x, CO, or NH_3) corrected to a standard stack gas oxygen concentration. For emission point P-11 (combined exhaust of S-41 Gas Turbine and S-42 HRSG duct burners) and emission point P-12 (combined exhaust of S-43 Gas Turbine and S-44 HRSG duct burners) the standard stack gas oxygen concentration is 15% O_2 by volume on a dry basis.
Commissioning Activities: All testing, adjustment, tuning, and calibration activities recommended by the equipment manufacturers and the GGS construction contractor to insure safe and reliable steady state operation of the gas turbines, heat recovery steam generators, steam turbine, and associated electrical delivery systems.
Commissioning Period: The Period shall commence when all mechanical, electrical, and control systems are installed and individual system start-up has been completed, or when a gas turbine is first fired, whichever occurs first. The

period shall terminate when the plant has completed performance testing and is available for commercial operation.

Combustor Tuning Activities: All testing, adjustment, tuning, and calibration activities recommended by the gas turbine manufacturer or an independent qualified contractor to insure safe and reliable steady state operation of the gas turbines. This includes, but is not limited to, adjusting the amount of fuel distributed between the combustion turbine's staged fuel systems to simultaneously minimize NO_x and CO production while minimizing combustor dynamics and ensuring combustor stability.

Combustor Tuning Period: The period, not to exceed 360 minutes, during which gas turbine combustor tuning activities are taking place.

Precursor Organic Compounds (POCs): Any compound of carbon, excluding methane, ethane, carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate

CEC CPM: California Energy Commission Compliance Program Manager

GGS: Gateway Generating Station

Applicability:

Conditions 1 through 12 shall only apply during the commissioning period as defined above. Unless otherwise indicated, Conditions 13 through 43 shall apply after the commissioning period has ended. Conditions 44 through 47 shall apply at all times.

Conditions for the Commissioning Period

1. The owner/operator of the GGS shall minimize emissions of carbon monoxide and nitrogen oxides from S-41 and S-43 Gas Turbines and S-42 and S-44 Heat Recovery Steam Generators (HRSGs) to the maximum extent possible during the commissioning period.

2. At the earliest feasible opportunity in accordance with the recommendations of the equipment manufacturers and the construction contractor, the S-41 & S-43 Gas Turbine combustors and S-42 & S-44 Heat Recovery Steam Generator duct burners shall be tuned to minimize the emissions of carbon monoxide and nitrogen oxides.

3. At the earliest feasible opportunity, in accordance with the recommendations of the equipment manufacturers and the construction contractor, the A-11 and A-13 SCR Systems and A-12 and A-14 CO Oxidation Catalyst Systems shall be installed, adjusted, and operated to minimize the emissions of carbon monoxide and nitrogen oxides from S-41 & S-43 Gas Turbines and S-42 & S-44 Heat Recovery Steam Generators.

4. Coincident with the as designed operation of A-11 & A-13 SCR Systems, pursuant to conditions 3, 10, 11, and 12, the Gas Turbines (S-41 & S-43) and the HRSGs (S-42 & S-44) shall comply with the NO_x and CO emission limitations specified in conditions 20(a) through 20(d).

5. The owner/operator of the GGS shall submit a plan to the District Engineering Division and the CEC CPM at least four weeks prior to first firing of S-41 or S-43 Gas Turbines describing the procedures to be followed during the commissioning of the gas turbines, HRSGs and gas-fired dewpoint heater. The plan shall include a description of each commissioning activity, the anticipated duration of each activity in hours, and the purpose of the activity. The activities described shall include, but not be limited to, the tuning of the Dry-Low-NO_x combustors, the installation and operation of the SCR systems and oxidation catalysts, the installation, calibration, and testing of the CO and NO_x continuous emission monitors, and any activities requiring the firing of the Gas Turbines (S-41 & S-43) and HRSGs (S-42 & S-44) without abatement by their respective SCR and CO Catalyst Systems.

6. During the commissioning period, the owner/operator of the GGS shall demonstrate compliance with conditions 8 through 11 through the use of properly operated and maintained continuous emission monitors and data recorders for the following parameters:

- firing hours for each gas turbine and each HRSG
- fuel flow rates to each train
- stack gas nitrogen oxide emission concentrations at P-11 and P-12
- stack gas carbon monoxide emission concentrations P-11 and P-12
- stack gas carbon dioxide or oxygen concentrations P-11 and P-12

The monitored parameters shall be recorded at least once every 15 minutes (excluding normal calibration periods or when the monitored source is not in operation) for the Gas Turbines (S-41 & S-43) and HRSGs (S-42 & S-44). The owner/operator shall use District-approved methods to calculate heat input rates, NO_x mass emission rates, carbon monoxide mass emission rates, and NO_x and CO emission concentrations, summarized for each clock hour and each calendar day. All records shall be retained on site for at least 5 years from the date of entry and made available to District personnel upon request.

7. The District-approved continuous emission monitors specified in condition 6 shall be installed, calibrated, and operational prior to first firing of the Gas Turbines (S-41 & S-43) and Heat Recovery Steam Generators (S-42 & S-44). After first firing of the turbines, the detection range of these continuous emission monitors shall be adjusted as necessary to accurately measure the resulting range of CO and NO_x emission concentrations. The type, specifications, and location of these monitors shall be subject to District review and approval.

8. The total number of firing hours of S-41 Gas Turbine and S-42 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-11 SCR System and/or A-12 Oxidation Catalyst System shall not exceed 300 hours during the commissioning period. Such operation of S-41 Gas Turbine and S-42 HRSG without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR or Oxidation Catalyst Systems fully operational. Upon completion of these activities, the owner/operator shall provide written notice to the District Permit Services and Enforcement Divisions and the unused balance of the 300 firing hours without abatement shall expire.

9. The total number of firing hours of S-43 Gas Turbine and S-44 Heat Recovery Steam Generator without abatement of nitrogen oxide emissions by A-13 SCR System and/or A-14 Oxidation Catalyst System shall not exceed 300 hours during the commissioning period. Such operation of S-43 Gas Turbine and S-44 HRSG without abatement shall be limited to discrete commissioning activities that can only be properly executed without the SCR or Oxidation Catalyst Systems fully operational. Upon completion of these activities, the owner/operator shall provide written notice to the District Permit Services and Enforcement Divisions and the unused balance of the 300 firing hours without abatement shall expire.

10. The total mass emissions of nitrogen oxides, carbon monoxide, precursor organic compounds, PM_{10}, and sulfur dioxide that are emitted by the Gas Turbines (S-41 & S-43) and Heat Recovery Steam Generators (S-42 & S-44) during the commissioning period shall accrue towards the consecutive twelve-month emission limitations specified in condition 24.

11. Combined pollutant mass emissions from the Gas Turbines (S-41 & S-43) and Heat Recovery Steam Generators (S-42 & S-44) shall not exceed the following limits during the commissioning period. These emission limits shall include emissions resulting from the start-up and shutdown of the Gas Turbines (S-41 & S-43).

NO_x (as NO_2)	8,400 pounds/calendar day	400 pounds/hour
CO	40,000 pounds/calendar day	4,000 pounds/hour
POC(as CH_4)	1,600 pounds/calendar day	
PM_{10}	432 pounds/calendar day	
SO_2	297 pounds/calendar day	

12. Prior to the end of the Commissioning Period, the Owner/Operator shall conduct a District and CEC approved source test using external continuous emission monitors to determine compliance with condition 21. The source test shall determine NO_x, CO, and POC emissions during start-up and shutdown of the gas turbines. The POC emissions shall be analyzed for methane and ethane to account for the presence of unburned natural gas. The source test shall include a minimum of three start-up and three shutdown periods. No later than twenty working days before the execution of the source tests, the Owner/Operator shall submit to the District and the CEC Compliance Program Manager (CPM) a detailed source test plan designed to satisfy the requirements of this condition. The District and the CEC CPM will notify the Owner/Operator of any necessary modifications to the plan within 20 working days of receipt of the plan; otherwise, the plan shall be deemed approved. The Owner/Operator shall incorporate the District and CEC CPM comments into the test plan. The Owner/Operator shall notify the District and the CEC CPM within seven (7) working days prior to the planned source testing date. Source test results shall be submitted to the District and the CEC CPM within 30 days of the source testing date.

Conditions for the Gas Turbines (S-41 & S-43) and the Heat Recovery Steam Generators (HRSGs; S-42 & S-44)

13. The Gas Turbines (S-41 and S-43) and HRSG Duct Burners (S-42 and S-44) shall be fired exclusively on PUC quality natural gas with a maximum sulfur content of 1 grain per 100 standard cubic feet. The owner/operator of GGS shall sample the natural gas from each supply source on a quarterly basis to determine the sulfur content of the gas using a District approved analytical procedure. PG&E sulfur data may be used to track the sulfur content in the natural gas delivered to GGS provided that such data can be demonstrated to be representative of the natural gas supplied to GGS. (BACT for SO_2 and PM_{10})

14. The combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-41 & S-42 and S-43 & S-44) shall not exceed 2,094.4 MM Btu per hour, averaged over any rolling 3-hour period. (PSD for NO_x)

15. The combined heat input rate to each power train consisting of a Gas Turbine and its associated HRSG (S-41 & S-42 and S-43 & S-44) shall not exceed 49,950 MM Btu per calendar day. (PSD for PM_{10})

16. The combined cumulative heat input rate for the Gas Turbines (S-41 & S-43) and the HRSGs (S-42 & S-44) shall not exceed 34,900,000 MM Btu per year. (Offsets)

17. The HRSG duct burners (S-42 and S-44) shall not be fired unless its associated Gas Turbine (S-41 and S-43, respectively) is in operation. (BACT for NO_x)

18. Except as provided in Condition No. 8, S-41 Gas Turbine and S-42 HRSG shall be abated by the properly operated and properly maintained A-11 Selective Catalytic Reduction (SCR) System whenever fuel is combusted at those sources and the A-11 catalyst bed has reached minimum operating temperature. (BACT for NO_x)

19. Except as provided in Condition No. 9, S-43 Gas Turbine and S-44 HRSG shall be abated by the properly operated and properly maintained A-13 Selective Catalytic Reduction (SCR) System whenever fuel is combusted at those sources and the A-13 catalyst bed has reached minimum operating temperature. (BACT for NO_x)

20. The Gas Turbines (S-41 & S-43) and HRSGs (S-42 & S- 44) shall comply with requirements (a) through (i) under all operating scenarios, including duct burner firing mode. Requirements (a) through (i) do not apply during a gas turbine start-up or shutdown. (BACT, PSD, and Regulation 2, Rule 5)
(a) Nitrogen oxide mass emissions (calculated in accordance with District approved methods as NO_2) at P-11 (the combined exhaust point for the S-41 Gas Turbine and the S-42 HRSG after abatement by A-11 SCR System) shall not exceed 15.2 pounds per hour or 0.0072 lb/MM Btu (HHV) of natural gas fired. Nitrogen oxide mass emissions (calculated in accordance with District approved methods as NO_2) at P-12 (the combined exhaust point for the S-43 Gas

Turbine and the S-44 HRSG after abatement by A-13 SCR System) shall not exceed 15.2 pounds per hour or 0.0072 lb./MM Btu (HHV) of natural gas fired. (PSD for NO_x)
(b) The nitrogen oxide emission concentration at emission points P-11 and P-12 each shall not exceed 2.0 ppmv, on a dry basis, corrected to 15% O_2, averaged over any 1-hour period. (BACT for NO_x)
(c) Carbon monoxide mass emissions at P-11 and P-12 each shall not exceed 0.0088 lb/MM Btu (HHV) of natural gas fired or 18.5 pounds per hour, averaged over any rolling 3-hour period. (PSD for CO)
(d) The carbon monoxide emission concentration at P-11 and P-12 each shall not exceed 4.0 ppmv, on a dry basis, corrected to 15% O_2, averaged over any rolling 3-hour period. (BACT for CO)
(e) Ammonia (NH_3) emission concentrations at P-11 and P-12 each shall not exceed 10.0 ppmv, on a dry basis, corrected to 15% O_2, averaged over any rolling 3-hour period. This ammonia emission concentration shall be verified by the continuous recording of the ammonia injection rate to A-11 and A-13 SCR Systems. The correlation between the gas turbine and HRSG heat input rates, A-11 and A-13 SCR System ammonia injection rates, and corresponding ammonia emission concentration at emission points P-11 and P-12 shall be determined in accordance with permit condition #29. (Regulation 2, Rule 5 for NH_3)
(f) Precursor organic compound (POC) mass emissions (as CH4) at P-11 and P-12 each shall not exceed 5.3 pounds per hour or 0.0025 lb./MM Btu of natural gas fired. (BACT)
(g) Sulfur dioxide (SO_2) mass emissions at P-11 and P-12 each shall not exceed 5.92 pounds per hour or 0.0028 lb./MM Btu of natural gas fired. (BACT)
(h) Particulate matter (PM_{10}) mass emissions at P-11 and P-12 each shall not exceed 11 pounds per hour or 0.0095 lb./MM Btu of natural gas fired when the HRSG duct burners are not in operation. Particulate matter (PM_{10}) mass emissions at P-11 and P-12 each shall not exceed 12 pounds per hour or 0.0065 lb./MM Btu of natural gas fired when the HRSG duct burners are in operation. (BACT)
(i) Compliance with the hourly NO_x emission limitations specified in condition 20(a) and 20(b) shall not be required during short-term excursions limited to a cumulative total of 10 hours per rolling 12-month period. Short-term excursions are defined as 15-minute periods designated by the owner/operator that are the direct result of transient load conditions, not to exceed four consecutive 15-minute periods, when the 15-minute average NO_x concentration exceeds 2.0 ppmv, dry @ 15% O_2. Examples of transient load conditions include, but are not limited to the following:

(1) Initiation/shutdown of combustion turbine inlet air cooling
(2) Rapid combustion turbine load changes
(3) Initiation/shutdown of HRSG duct burners

The maximum 1-hour average NO_x concentration for periods that include short-term excursions shall not exceed 30.0 ppmv, dry @ 15% O_2. All emissions during short-term excursions shall be included in all calculations of hourly, daily, and annual mass emission rates as required by this permit.

21. The regulated air pollutant mass emission rates from each of the Gas Turbines (S-41 and S-43) during a start- up or a shutdown or during a combustor tuning period shall not exceed the limits established below. (PSD)

	Start-Up or Combustor Tuning Period (lb/period)	Startup/Shutdown (lb/hr)
Oxides of Nitrogen (as NO_2)	600	160
Carbon Monoxide (CO)	5,400	900
Precursor Organic Compounds (as CH4)	96	16

22. The Gas Turbines (S-41 and S-43) shall not be in start-up mode simultaneously. (PSD)

23. Total combined emissions from the Gas Turbines and HRSGs (S-41, S-42, S-43, and S-44), including emissions generated during Gas Turbine start-ups, shutdowns and combustor tuning periods shall not exceed the following limits during any calendar day:
   (a) 1,746.5 pounds of NO_x (as NO_2) per day (CEQA)
   (b) 11,465.6 pounds of CO per day (PSD)
   (c) 382.4 pounds of POC (as CH4) per day (CEQA)
   (d) 576 pounds of PM_{10} per day (PSD)
   (e) 282 pounds of SO_2 per day (BACT)

24. Cumulative combined emissions from the Gas Turbines and HRSGs (S-41, S-42, S-43, and S-44) and the Diesel Fire Pump Engine (S-48), including emissions generated during gas turbine start-ups, shutdowns and combustor tuning periods shall not exceed the following limits during any consecutive twelve-month period:
   (a) 174.3 tons of NO_x (as NO_2) per year (Offsets, PSD)
   (b) 554.3 tons of CO per year (Cumulative Increase)
   (c) 46.6 tons of POC (as CH_4) per year (Offsets)
   (d) 101.7 tons of PM_{10} per year (Offsets, PSD)
   (e) 37.0 tons of SO_2 per year (Cumulative Increase)

25. Toxic Air Contaminant and HAP Emission Limits
The maximum projected annual toxic air contaminant emissions (per condition 28) from the Gas Turbines and HRSGs combined (S-41, S-42, S-43, and S-44) shall not exceed the following limits:

   15,700 pounds of formaldehyde per year
   455 pounds of benzene per year
   1.56 pounds of Specified polycyclic aromatic hydrocarbons (PAHs) per year

unless the following requirement is satisfied:

The owner/operator shall perform a health risk assessment using the emission rates determined by source test and the most current Bay Area Air Quality Management District approved procedures and unit risk factors in effect at the time of the analysis. This risk analysis shall be submitted to the District and the CEC CPM within 60 days of the source test date. The owner/operator may request that the District and the CEC CPM revise the carcinogenic compound emission limits specified above. If the owner/operator demonstrates to the satisfaction of the APCO that these revised emission limits will result in a cancer risk of not more than 10.0 in one million, the District and the CEC CPM may, at their discretion, adjust the carcinogenic compound emission limits listed above. (Regulation 2, Rule 5)

26. The owner/operator shall demonstrate compliance with conditions 14 through 17, 20(a) through 20(d), 20(i), 21, 23(a), 23(b), 24(a), and 24(b) by using properly operated and maintained continuous monitors (during all hours of operation including equipment Start-up, Shutdown and Combustor Tuning periods) for all of the following parameters:
(a) Firing Hours and Fuel Flow Rates for each of the following sources: S-41 & S-42 combined and S-43 & S-44 combined.
(b) Carbon Dioxide (CO_2) or Oxygen (O_2) concentrations, Nitrogen Oxides (NO_x) concentrations, and Carbon Monoxide (CO) concentrations at each of the following exhaust points: P-11 and P-12.
(c) Ammonia injection rate at A-11 and A-13 SCR Systems
The owner/operator shall record all of the above parameters every 15 minutes (excluding normal calibration periods) and shall summarize all of the above parameters for each clock hour. For each calendar day, the owner/operator shall calculate and record the total firing hours, the average hourly fuel flow rates, and average hourly pollutant emission concentrations. The owner/operator shall use the parameters measured above and District-approved calculation methods to calculate the following parameters:
(d) Heat Input Rate for each of the following sources: S-41 & S-42 combined and S-43 & S-44 combined.
(e) Corrected NO_x concentrations, NO_x mass emissions (as NO_2), corrected CO concentrations, and CO mass emissions at each of the following exhaust points: P-11 and P-12.
Applicable to emission points P-11 and P-12, the owner/operator shall record the parameters specified in conditions 26(e) and 26(f) at least once every 15 minutes (excluding normal calibration periods). As specified below, the owner/operator shall calculate and record the following data:
(f) total Heat Input Rate for every clock hour and the average hourly Heat Input Rate for every rolling 3-hour period.
(g) on an hourly basis, the cumulative total Heat Input Rate for each calendar day for the following: each Gas Turbine and associated HRSG combined and all four sources (S-41, S-42, S-43, and S-44) combined.
(h) the average NO_x mass emissions (as NO_2), CO mass emissions, and corrected NO_x and CO emission concentrations for every clock hour and for every rolling 3-hour period.
(i) on an hourly basis, the cumulative total NO_x mass emissions (as NO_2) and the cumulative total CO mass emissions, for each calendar day for the following: each Gas Turbine and associated HRSG combined, and all four sources (S-41, S-42, S-43, and S-44) combined.
(j) For each calendar day, the average hourly Heat Input Rates, Corrected NO_x emission concentrations, NO_x mass emissions (as NO_2), corrected CO emission concentrations, and CO mass emissions for each Gas Turbine and associated HRSG combined.
(k) on a daily basis, the cumulative total NO_x mass emissions (as NO_2) and cumulative total CO mass emissions, for the previous consecutive twelve month period for all four sources (S-41, S-42, S-43, and S-44) combined.
(1-520.1, 9-9-501, BACT, Offsets, NSPS, PSD, Cumulative Increase)

27. To demonstrate compliance with conditions 20(f), 20(g), 20(h), 23(c) through 23(e)., and 24(c) through 24(e), the owner/operator shall calculate and record on a daily basis, the Precursor Organic Compound (POC) mass emissions, Fine Particulate Matter (PM_{10}) mass emissions (including condensable particulate matter), and Sulfur Dioxide (SO_2) mass emissions from each power train. The owner/operator shall use the actual Heat Input Rates calculated pursuant to condition 26, actual Gas Turbine Start-up Times, actual Gas Turbine Shutdown Times, and CEC and District-approved emission factors to calculate these emissions. The calculated emissions shall be presented as follows:
(a) For each calendar day, POC, PM_{10}, and SO_2 emissions shall be summarized for: each power train (Gas Turbine and its respective HRSG combined) and all four sources (S-41, S-42, S-43, and S-44) combined.
(b) on a daily basis, the 365 day rolling average cumulative total POC, PM_{10}, and SO_2 mass emissions, for all four sources (S-41, S-42, S-43, and S-44) combined.
(Offsets, PSD, Cumulative Increase)

28. To demonstrate compliance with Condition 25, the owner/operator shall calculate and record on an annual basis the maximum projected annual emissions of Formaldehyde, Benzene, and Specified PAHs. Maximum projected annual emissions shall be calculated using the maximum Heat Input Rate of 34,900,000 MM Btu/year and the highest emission factor (pounds of pollutant per MM Btu of Heat Input) determined by any source test of the S-41 & S-43 Gas Turbines and/or S-42 & S-44 Heat Recovery Steam Generators. If this calculation method results in an unrealistic mass emission rate (the highest emission factor occurs at a low firing rate) the applicant may use an alternate calculation, subject to District approval. (Regulation 2, Rule 5)

29. Within 60 days of start-up of the GGS, the owner/operator shall conduct a District-approved source test on exhaust point P-11 or P-12 to determine the corrected ammonia (NH_3) emission concentration to determine compliance with condition 20(e). The source test shall determine the correlation between the heat input rates of the gas turbine and associated HRSG, A-11 or A-13 SCR System ammonia injection rate, and the corresponding NH_3 emission concentration at emission point P-11 or P-12. The source test shall be conducted over the expected operating range of the turbine and HRSG (including, but not limited to minimum, 70%, 85%, and 100% load) to establish the range of ammonia injection rates necessary to achieve NO_x emission reductions while maintaining ammonia slip levels. The owner/operator shall repeat the NH_3 source testing on an annual basis thereafter. Continuing compliance with condition 20(e) shall be demonstrated through calculations of corrected ammonia concentrations based upon the source test correlation and continuous records of ammonia injection rate. (Regulation 2, Rule 5)

30. Within 60 days of start-up of the GGS and on an annual basis thereafter, the owner/operator shall conduct a District-approved source test on exhaust points P-11 and P-12 while each Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum load to determine compliance with Conditions 20(a), (b), (c), (d), (f), (g), and (h), while each Gas Turbine and associated Heat Recovery Steam Generator are operating at minimum load to determine compliance with Conditions 20(c) and (d), and to verify the accuracy of the continuous emission monitors required in condition 26. The owner/operator shall test for (as a minimum): water content, stack gas flow rate, oxygen concentration, precursor

organic compound concentration and mass emissions, nitrogen oxide concentration and mass emissions (as NO_2), carbon monoxide concentration and mass emissions, sulfur dioxide concentration and mass emissions, methane, ethane, and particulate matter (PM_{10}) emissions including condensable particulate matter. Within 60 days of start up of the GGS and for two additional years there after, the owner/operator shall conduct a District approved source test on exhaust points P-11 and P-12 while each Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum load to determine the emissions of H2SO4, SO3, and ammonium sulfate. (BACT, offsets, PSD, Regulation 2, Rule 5)

31. The owner/operator shall obtain approval for all source test procedures from the District's Source Test Section and the CEC CPM prior to conducting any tests. The owner/operator shall comply with all applicable testing requirements for continuous emission monitors as specified in Volume V of the District's Manual of Procedures. The owner/operator shall notify the District's Source Test Section and the CEC CPM in writing of the source test protocols and projected test dates at least 7 days prior to the testing date(s). As indicated above, the Owner/Operator shall measure the contribution of condensable PM (back half) to the total PM_{10} emissions. However, the Owner/Operator may propose alternative measuring techniques to measure condensable PM such as the use of a dilution tunnel or other appropriate method used to capture semi-volatile organic compounds. Source test results shall be submitted to the District and the CEC CPM within 60 days of conducting the tests. (BACT)

32. Within 60 days of start-up of the GGS and on a biennial basis (once every two years) thereafter, the owner/operator shall conduct a District-approved source test on exhaust point P-11 or P-12 while the Gas Turbine and associated Heat Recovery Steam Generator are operating at maximum allowable operating rates to demonstrate compliance with Condition 25. If three consecutive biennial source tests demonstrate that the annual emission rates calculated pursuant to condition 28 for any of the compounds listed below are less than the BAAQMD Regulation 2, Rule 5 trigger levels shown, then the owner/operator may discontinue future testing for that pollutant:

Benzene	less than or equal	6.4 pounds/year
Formaldehyde	less than or equal	30 pounds/year
Specified PAHs	less than or equal	1.56 pounds/year

(Regulation 2, Rule 5)

33. The owner/operator of the GGS shall submit all reports (including, but not limited to monthly CEM reports, monitor breakdown reports, emission excess reports, equipment breakdown reports, etc.) as required by District Rules or Regulations and in accordance with all procedures and time limits specified in the Rule, Regulation, Manual of Procedures, or Enforcement Division Policies & Procedures Manual. (Regulation 2-6-502)

34. The owner/operator of the GGS shall maintain all records and reports on site for a minimum of 5 years. These records shall include but are not limited to: continuous monitoring records (firing hours, fuel flows, emission rates, monitor excesses, breakdowns, etc.), source test and analytical records, natural gas sulfur content analysis results, emission calculation records, records of plant upsets and related incidents. The owner/operator shall make all records and reports available to District and the CEC CPM staff upon request. (Regulation 2-6-501)

35. The owner/operator of the GGS shall notify the District and the CEC CPM of any violations of these permit conditions. Notification shall be submitted in a timely manner, in accordance with all applicable District Rules, Regulations, and the Manual of Procedures. Notwithstanding the notification and reporting requirements given in any District Rule, Regulation, or the Manual of Procedures, the owner/operator shall submit written notification (facsimile is acceptable) to the Enforcement Division within 96 hours of the violation of any permit condition. (Regulation 2-1-403)

36. The stack height of emission points P-11 and P-12 shall each be at least 195 feet above grade level at the stack base. (PSD, Regulation 2, Rule 5)

37. The Owner/Operator of GGS shall provide adequate stack sampling ports and platforms to enable the performance of source testing. The location and configuration of the stack sampling ports shall be subject to BAAQMD review and approval. (Regulation 1-501)

38. Within 180 days of the issuance of the Authority to Construct for the GGS, the Owner/Operator shall contact the BAAQMD Technical Services Division regarding requirements for the continuous monitors, sampling ports, platforms, and source tests required by conditions 26, 29, 30 and 32. All source testing and monitoring shall be conducted in accordance with the BAAQMD Manual of Procedures. (Regulation 1-501)

39. Prior to the issuance of the BAAQMD Authority to Construct for the GGS, the Owner/Operator shall demonstrate that valid emission reduction credits in the amount of 200.5 tons/year of Nitrogen Oxides, 53.6 tons/year of Precursor Organic Compounds or equivalent (as defined by District Regulations 2-2-302.1 and 2-2-302.2), and 101.7 tons of Particulate Matter less than 10 microns are under their control through enforceable contracts, option to purchase agreements, or equivalent binding legal documents. (Offsets)

40. Prior to the start of construction of the GGS, the Owner/Operator shall provide to the District valid emission reduction credit banking certificates in the amount of 200.5 tons/year of Nitrogen Oxides, 53.6 tons/year of Precursor Organic Compounds or equivalent as defined by District Regulations 2-2-302.1 and 2-2-302.2 and 101.7 tons of Particulate Matter less than 10 microns. (Offsets)

41. Pursuant to BAAQMD Regulation 2, Rule 6, section 404.1, the owner/operator of the GGS shall submit an application to the BAAQMD for a major facility review permit within 12 months of completing construction as demonstrated by the first firing of any gas turbine or HRSG duct burner. (Regulation 2-6-404.1)

42. Pursuant to 40 CFR Part 72.30(b)(2)(ii) of the federal Acid Rain Program, the owner/operator of the Gateway Generating Station shall submit an application for a Title IV operating permit S-44) in accordance with 40 C.F.R. Part 72. (Regulation 2, Rule 7)

43. The GGS shall comply with the continuous emission monitoring requirements of 40 CFR Part 75. (Regulation 2, Rule 7)

Conditions for S-47 Emergency Fire Pump Engine

44. The owner/operator shall not operate S-47 Fire Pump Diesel Engine more than 50 hours per year for reliability-related activities. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(2)(A)(3)or (e)(2)(B)(3), offsets)

45. The owner/operator shall operate S-47 Fire Pump Diesel Engine only for the following purposes: to mitigate emergency conditions, for emission testing to demonstrate compliance with a District, state or federal emission limit, or for reliability-related activities (maintenance and other testing, but excluding emission testing). Operating hours while mitigating emergency conditions or while emission testing to show compliance with District, state or federal emission limits is not limited. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection 9e)(2)(A)(3) or (e)(2)(B)(3))

46. The owner/operator shall operate S-47 Fire Pump Diesel Engine only when a non-resettable totalizing meter (with a minimum display capability of 9,999 hours) that measures the hours of operation for the engine is installed, operated and properly maintained. ("Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(G)(1), cumulative increase)

47. Records: The owner/operator shall maintain the following monthly records in a District-approved log for at least 60 months from the date of entry. Log entries shall be retained on-site, either at a central location or at the engine's location, and made immediately available to the District staff upon request.

Hours of operation for reliability-related activities (maintenance and testing).
Hours of operation for emission testing to show compliance with emission limits.
Hours of operation (emergency).
For each emergency, the nature of the emergency condition.
Fuel usage for each engine(s).

(Basis: "Stationary Diesel Engine ATCM" section 93115, title 17, CA Code of Regulations, subsection (e)(4)(I), cumulative increase)

VI Recommendation

The APCO has preliminarily concluded that the proposed Gateway Generating Station power plant, which is composed of the permitted sources listed below, complies with all applicable District, state and federal rules and regulations. The following sources will be subject to the permit conditions and BACT and offset requirements discussed previously.

S-41 Combustion Turbine Generator (CTG) #1, General Electric Frame 7FA Model PG 7231 or equivalent, 1872 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-1 Selective Catalytic Reduction System (SCR) and A-2 Oxidation Catalyst

S-42 Heat Recovery Steam Generator (HRSG) #1, with Duct Burner Supplemental Firing System, 395 MMBtu/hr maximum rated capacity; Abated by A-1 Selective Catalytic Reduction (SCR) System and A-2 Oxidation Catalyst

S-43 Combustion Turbine Generator (CTG) #2, General Electric Frame 7FA Model PG 7231 or equivalent, 1872 MMBtu/hr maximum rated capacity, natural gas fired only; abated by A-3 Selective Catalytic Reduction System (SCR) and A-4 Oxidation Catalyst

S-44 Heat Recovery Steam Generator (HRSG) #2, with Duct Burner Supplemental Firing System, 395 MMBtu/hr maximum rated capacity; Abated by A-3 Selective Catalytic Reduction (SCR) System and A-4 Oxidation Catalyst

S-45 Natural Gas-fired Fuel Preheater (Exempt)

S-46 Dry Cooling System (Exempt)

S-47 Fire Pump Diesel Engine, Clarke JW6H-UF40, 300 hp, 2.02 MMBtu/hr rated heat input

S-48 Oil-Water Separator, Highland Tank, HTC, 8000 gallon

This document is subject to the public notice, public comment, and public inspection requirements of District Regulations 2-2-405 through6 and 2-2-407 and 40 C.F.R. sections 124.10 and 124.11. Accordingly, a notice inviting written public comment will be published in a newspaper of general circulation in the area of the proposed Gateway Generating Station and mailed to certain entities. The public inspection and comment period will end 30 days after the date of such publication. Written comments on this document should be directed to:

Brian K. Lusher
Air Quality Engineer
Bay Area Air Quality Management District
939 Ellis Street
San Francisco CA 94109
blusher@baaqmd.gov

Appendix A

Emission Calculations

The following physical constants and standard conditions were utilized to derive the criteria-pollutant emission factors used to estimate and verify criteria pollutant and toxic air contaminant emissions submitted in the permit application. The criteria emission calculations were prepared by the applicant's consultant and are based on a combustion model. The District has verified these values using the calculations shown below. For the toxic air contaminants the District revised the calculation submitted by the applicant.

standard temperature[a]:	70°F
standard pressure[a]:	14.7 psia
molar volume:	386.8 dscf/lbmol
ambient oxygen concentration:	20.95%
dry flue gas factor[b]:	8743 dscf/MM Btu
natural gas higher heating value:	1050 Btu/dscf

[a] BAAQMD standard conditions per Regulation 1, Section 228.

[b] F-factor is based upon the assumption of complete stoichiometric combustion of natural gas. In effect, it is assumed that all excess air present before combustion is emitted in the exhaust gas stream. Value shown reflects the typical composition and heat content of utility-grade natural gas in San Francisco bay area.

Table A-1 summarizes the regulated air pollutant emission factors that were used to calculate mass emission rates for each source. All units are pounds per million Btu of natural gas fired based upon the high heating value (HHV). All emission factors are after abatement by applicable control equipment.

Table A-1
Controlled Regulated Air Pollutant Emission Factors for Gas Turbines and HRSGs

Pollutant	Source			
	Gas Turbine		Gas Turbine & HRSG Combined	
	lb/MM Btu	lb/hr	lb/MM Btu	lb/hr
Nitrogen Oxides (as NO_2)	0.00725[a]	13.57	0.00725[a]	15.18
Carbon Monoxide	0.00882[b]	16.51	0.00882[b]	18.47
Precursor Organic Compounds	0.00254	4.75	0.00254	5.32
Particulate Matter (PM_{10})	0.00588	11.00	0.00573	12.0
Sulfur Dioxide	0.0028	5.24	0.0028	5.86

[a] based upon stack concentration of 2.0 ppmvd NO_x @ 15% O_2 that reflects the use of dry low-NO_x combustors at the CTG, low-NO_x burners at the HRSG, and abatement by the proposed Selective Catalytic Reduction Systems with ammonia injection.

[b] based upon the permit condition emission limit of 4 ppmvd CO @ 15% O_2.that reflects abatement by proposed Oxidation Catalysts.

REGULATED AIR POLLUTANTS

NITROGEN OXIDE EMISSION FACTORS

Combustion Gas Turbine and Heat Recovery Steam Generator Combined

The combined NO_x emissions from the CTG and HRSG will be 2.0 ppmv, dry @ 15% O_2. This emission concentration will also apply when the HRSG duct burners are in operation. This concentration is converted to a mass emission factor as follows:

(2.0 ppmvd)(20.95 - 0)/(20.95 - 15) = 7.042 ppmv NO_x, dry @ 0% O_2

($7.042/10^6$)(1 lbmol/386.8 dscf)(46.01 lb NO_2/lbmol)(8743 dscf/MM Btu)

= **0.00732 lb NO_2/MM Btu**

Calculations shown below are based on 0.00725 lb NO_2/MMBtu emission factor submitted by the applicant.

The NO_x(as NO_2) mass emission rate based upon the maximum firing rate of the gas turbine alone is calculated as follows:

(0.00725 lb/MM Btu)(1872 MM Btu/hr) = **13.57 lb NO_x(as NO_2)/hr**

The NO_x mass emission rate when duct burner firing occurs is based upon the maximum combined firing rate of the gas turbine and HRSG and is calculated as follows:

(0.00725 lb/MM Btu)(395 MM Btu/hr) = **2.86 lb NO_x(as NO_2)/hr**

The NO_x mass emission rate when the gas turbine and duct burner firing is based upon the maximum combined firing rate of the gas turbine and HRSG and is calculated as follows:

(0.00725 lb/MM Btu)(2094.4 MM Btu/hr) = **15.18 lb NO_x(as NO_2)/hr**

CARBON MONOXIDE EMISSION FACTORS

Combustion Gas Turbine and Heat Recovery Steam Generator Combined

The combined CO emissions from the CTG and HRSG duct burner will be conditioned to a maximum controlled CO emission limit of 4 ppmv, dry @ 15% O_2 during all operating modes except gas turbine start-up and shutdown. The emission factor corresponding to this emission concentration is calculated as follows:

(4 ppmv)(20.95 - 0)/(20.95 - 15) = 14.08 ppmv, dry @ 0% O_2

($14.08/10^6$)(lbmol/386.8 dscf)(28 lb CO/lbmol)(8743 dscf/MM Btu)

= **0.0089 lb CO/MM Btu**

Calculations shown below are based on 0.00882 lb CO/MMBtu emission factor which is consistent with the information submitted by the applicant (18.5 lb/hr maximum).

The CO maximum mass emission rate based upon the maximum firing rate of the gas turbine alone is calculated as follows:

(0.00882 lb/MM Btu)(1872 MM Btu/hr) = **16.51 lb CO/hr**

The CO mass maximum emission rate when duct burner firing occurs at the maximum firing rate of the HRSG and is calculated as follows:

(0.00882 lb/MM Btu)(395 MM Btu/hr) = **3.48 lb CO/hr**

The CO mass emission rate when gas turbine and duct burner firing occurs is based upon the maximum combined firing rate of the CTG and HRSG and is calculated as follows:

(0.00882 lb/MM Btu)(2094.4 MM Btu/hr) = **18.47 lb CO/hr**

PRECURSOR ORGANIC COMPOUND (POC) EMISSION FACTORS

Combustion Gas Turbine

The POC emissions from the CTG and HRSG duct burner will be conditioned to a maximum controlled emission limit of 2 ppmv, dry @ 15% O_2 during all operating modes except gas turbine start-up and shutdown. The POC emission factor corresponding to this emission concentration is calculated as follows:

(2 ppmv)(20.95 - 0)/(20.95 - 15) = 7.085 ppmv, dry @ 0% O_2

($7.085/10^6$)(lbmol/386.8 dscf)(16 lb CH_4/lbmol)(8743 dscf/MM Btu)
= **0.00256 lb POC/MM Btu**

Calculations shown below are based on 0.00254 lb POC/MMBtu emission factor which is consistent with the information submitted by the applicant (5.3 lb/hr maximum).

The POC mass emission rate based upon the maximum firing rate of the gas turbine alone is calculated as follows:

(0.00254 lb/MM Btu)(1872 MM Btu/hr) = **4.75 lb POC/hr**

HRSG

The POC mass emission rate when duct burner firing occurs is based upon the maximum firing rate of the HRSG and is calculated as follows:

(0.00254 lb/MM Btu)(395 MM Btu/hr) = **1.00 lb POC/hr**

<u>Combustion Gas Turbine and Heat Recovery Steam Generator Combined</u>

The POC mass emission rate when duct burner firing occurs is based upon the maximum firing rate of the Gas Turbine and HRSG combined and is calculated as follows:

(0.00254 lb/MM Btu)(2094.4 MM Btu/hr) = **5.3 lb POC/hr**

PARTICULATE MATTER (PM_{10}) EMISSION FACTORS

<u>Combustion Gas Turbine and HRSG Combined</u>

The applicant has determined a PM_{10} emission factor of 0.0052 lb/MMBtu at maximum load for the gas turbine and HRSG. It is assumed that this PM_{10} emission factor includes secondary PM_{10} formation of particulate sulfates. The corresponding PM_{10} emission rate is:
(0.00573 lb/MMBtu)/(2094.4 MM Btu/hr) = **12.0 lb/hr**

Grain Loading Calculation for Gas Turbine and HRSG

PM-10 Maximum Emission Rate 12 lb/hr
Firing Rate 2094.4 MMBtu/hr
F-factor 8655 dscf/MMBtu
lb = 7000 grains
Regulation 6 O2 Concentration 6%
Ambient Air O2 Concentration 20.9%

grains/dscf = (12 lb/hr x 7000 grains/lb)/(2094.4 MMBtu/hr x (8655 dscf/MMBtu x 20.9/(20.9 - 6))

grains/dscf = 0.0013

HRSG

The PM_{10} emission factor is based upon the applicant's assumption of 1 lb/hr for the HRSG PM_{10} emission rate. The corresponding PM_{10} emission factor is therefore:
(1 lb PM_{10}/hr)/(395 MM Btu/hr) = **0.00253 lb PM_{10}/MM Btu**

SULFUR DIOXIDE EMISSION FACTORS

<u>Combustion Gas Turbine & Heat Recovery Steam Generator</u>

The SO_2 emission factor is based upon annual average natural gas sulfur content of 0.75 grains per 100 scf and a higher heating value of 1012 Btu/scf as specified by PG&E.

The sulfur emission factor is calculated as follows:
SO_2 lb/hr

Natural Gas 1 grains of S/100 scf for Maximum Hourly

SO_2 = (1 gr/100 scf)(lb/7000 gr)(1/1020 BTU/scf)(1 x 10E6 Btu/MMBtu)(64 lb SO_2/32 lb S) = 0.0028 lb/MMBtu

Natural Gas 0.75 grains of S/100 scf for Annual Average

SO_2 = (0.75 gr/100 scf)(lb/7000 gr)(1/1020 BTU/scf)(1 x 10E6 Btu/MMBtu)(64 lb SO_2/32 lb S) = 0.0021 lb/MMBtu

Max Hourly SO_2

The corresponding mass SO_2 emission rate at the maximum combined firing rate of 2094.4 MM Btu/hr is:
(0.0028 lb SO_2/MM Btu)(2094.4 MM Btu/hr) = 5.86 lb/hr

Annual Average SO_2

The corresponding SO_2 mass emission rate at the maximum gas turbine firing rate of 2094.4 MM Btu/hr is:
(0.0021 lb SO_2/MM Btu)(2094.4 MM Btu/hr) = 4.40 lb/hr

This maximum lb/MMBtu value is converted to an emission concentration as follows:
(0.0028 lb SO_2/MM Btu)(386.8 dscf/lb-mol)(lb-mol/64.06 lb SO_2)(10^6 Btu/8743 dscf)
= 1.93 ppmvd SO_2 @ 0% O_2

which is equivalent to:
(1.93 ppmvd)(20.95 - 15)/20.95 = 0.55 ppmv SO_2, dry @ 15% O_2

Gateway Generating Station
Plant No. 18143
Application No. 17182
BAAQMD 051208

lb/hour values calculated by Sierrra Research using combustion modeling prepared for the Gateway Generating Station

Unit	Mode	NOx lb/hr	CO lb/hr	POC lb/hr
Turbine 1	Base	13.40	16.31	4.67
Turbine 2	Base	13.40	16.31	4.67
Turbine 1	Peak	15.18	18.49	5.29
Turbine 2	Peak	15.18	18.49	5.29
Turbine 1	Startup/Shutdown	100.00	900.00	16.00
Turbine 2	Startup/Shutdown	100.00	900.00	16.00
Turbine 1	Startup/Shutdown Max Hourly	160.00		
Turbine 2	Startup/Shutdown Max Hourly	160.00		

Case 1: Summer Peaking Operation (Maximum Daily NOx, CO and VOC emissions)

Unit	Mode	Worst Case hrs/day	hrs/year	NOx lb/day	NOx tons/year	CO lb/day	CO tons/year	POC lb/day	POC tons/year
Turbine 1	Base	0	1130	0	7.57	0	9.22	0	2.64
Turbine 2	Base	0	1130	0	7.57	0	9.22	0	2.64
Turbine 1	Peak	18	4960	273.24	37.65	332.82	45.86	95.22	13.12
Turbine 2	Peak	18	4960	273.24	37.65	332.82	45.86	95.22	13.12
Turbine 1	Startup/Shutdown	6	330	600	16.50	5400	148.50	96.00	2.64
Turbine 2	Startup/Shutdown	6	330	600	16.50	5400	148.50	96.00	2.64
Total Turbines + Ductburner				1746.5	123.4	11465.6	407.1	382.4	36.8

Case 2: Year Round Operation, Weekly Startups (Maximum Annual CO Emissions)

Unit	Mode	Worst Case hrs/day	hrs/year	NOx lb/day	NOx tons/year	CO lb/day	CO tons/year	POC lb/day	POC tons/year
Turbine 1	Base	6	324	80.4	2.17	97.86	2.64	28.02	0.76
Turbine 2	Base	6	324	80.4	2.17	97.86	2.64	28.02	0.76
Turbine 1	Peak	12	4380	182.16	33.24	221.88	40.49	63.48	11.59
Turbine 2	Peak	12	4380	182.16	33.24	221.88	40.49	63.48	11.59
Turbine 1	Startup/Shutdown	6	520	600.0	26.00	5400	234.00	96.00	4.16
Turbine 2	Startup/Shutdown	6	520	600.0	26.00	5400	234.00	96.00	4.16
Total Turbines + Ductburner				1725.1	122.8	11439.5	554.3	375.0	33.0

Case 3: Year Round Peaking Operation (Maximum Annual NOx and VOC Emissions)

Unit	Mode	Worst Case hrs/day	hrs/year	NOx lb/day	NOx tons/year	CO lb/day	CO tons/year	POC lb/day	POC tons/year
Turbine 1	Base	7	1825	93.8	12.23	114.17	14.88	32.69	4.26
Turbine 2	Base	7	1825	93.8	12.23	114.17	14.88	32.69	4.26
Turbine 1	Peak	16	5840	242.88	44.33	295.84	53.99	84.64	15.45
Turbine 2	Peak	16	5840	242.88	44.33	295.84	53.99	84.64	15.45
Turbine 1	Startup/Shutdown	1	365	160.0	18.25	900	164.25	16.00	2.92
Turbine 2	Startup/Shutdown	1	365	160.0	18.25	900	164.25	16.00	2.92
Total Turbines + Ductburner				993.4	149.6	2620.0	466.2	266.7	45.3

Case 4: Year Round Operation, no startups

Unit	Mode	Worst Case hrs/day	hrs/year	NOx lb/day	NOx tons/year	CO lb/day	CO tons/year	POC lb/day	POC tons/year
Turbine 1	Base	1.5	3660	20.1	24.52	24.465	29.85	7.005	8.55
Turbine 2	Base	1.5	3660	20.1	24.52	24.465	29.85	7.005	8.55
Turbine 1	Peak	22.5	5100	341.55	38.71	416.025	47.15	119.03	13.49
Turbine 2	Peak	22.5	5100	341.55	38.71	416.025	47.15	119.03	13.49
Turbine 1	Startup/Shutdown	0	0	0.0	0.00	0	0.00	0.00	0.00
Turbine 2	Startup/Shutdown	0	0	0.0	0.00	0	0.00	0.00	0.00
Total Turbines + Ductburner				723.3	126.5	881.0	154.0	252.1	44.1

Toxic Air Contaminant	Project lb/hour	Project lb/year	Acute Risk Screening Trigger Level (lb/hr)	Chronic Risk Screening Trigger Level (lb/yr)
1,3-Butadiene	5.22E-04	4.35E+00	None	1.10E+00
Acetaldehyde	5.63E-01	4.69E+03	None	6.40E+01
Acrolein	7.76E-02	6.47E+02	4.20E-04	2.30E+00
Ammonia	5.86E+01	4.89E+05	7.10E+00	7.70E+03
Benzene	5.46E-02	4.55E+02	2.90E+00	6.40E+00
Benzo(a)anthracene	9.28E-05	7.73E-01	None	None
Benzo(a)pyrene	5.71E-05	4.76E-01	None	1.10E-02
Benzo(b)fluoranthene	4.64E-05	3.87E-01	None	None
Benzo(k)fluoranthene	4.52E-05	3.76E-01	None	None
Chrysene	1.03E-04	8.62E-01	None	None
Dibenz(a,h)anthracene	9.65E-05	8.04E-01	None	None
Ethylbenzene	7.35E-02	6.12E+02	None	7.70E+04
Formaldehyde	1.88E+00	1.57E+04	2.10E-01	3.00E+01
Hexane	1.06E+00	8.86E+03	None	2.70E+05
Indeno(1,2,3-cd)pyrene	9.65E-05	8.04E-01	None	None
Naphthalene	6.82E-03	5.68E+01	None	None
Propylene	3.17E+00	2.64E+04	None	1.20E+05
Propylene Oxide	1.96E-01	1.64E+03	6.80E+00	4.90E+01
Toluene	2.92E-01	2.43E+03	8.20E+01	1.20E+04
Xylene (Total)	1.07E-01	8.93E+02	4.90E+01	2.70E+04
Sulfuric Acid Mist (H2SO4)	9.00E-01	5.61E+03	2.60E-01	3.90E+01
Diesel Particulate Matter	7.40E-02	3.70E+00	None	5.80E-01
Benzo(a)pyrene equivalents	1.88E-04	1.56E+00	None	1.10E-02

Notes:

Diesel Particulate Matter is a surrogate for all air toxics emitted by the diesel engine and is used to evaluate health risk impacts from the fire pump engine.

Emissions from the dew point heater are not included since this source is exempt from District permit requirements.

PAH impacts are evaluated as Benzo(a)pyrene equivalents.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hour	Per Turbine Firing Rate MMBtu/year	Per Turbine lb/hour	Per Turbine lb/year	Total CT lb/hour	Total CT lb/year
1,3-Butadiene	1.25E-07	2094.4	17450000	2.61E-04	2.17E+00	5.22E-04	4.35E+00
Acetaldehyde	1.34E-04			2.81E-01	2.34E+03	5.63E-01	4.69E+03
Acrolein	1.85E-05			3.88E-02	3.23E+02	7.76E-02	6.47E+02
Ammonia	1.40E-02			2.93E+01	2.44E+05	5.86E+01	4.89E+05
Benzene	1.30E-05			2.73E-02	2.28E+02	5.46E-02	4.55E+02
Benzo(a)anthracene	2.22E-08			4.64E-05	3.87E-01	9.28E-05	7.73E-01
Benzo(a)pyrene	1.36E-08			2.85E-05	2.38E-01	5.71E-05	4.76E-01
Benzo(b)fluoranthene	1.11E-08			2.32E-05	1.93E-01	4.64E-05	3.87E-01
Benzo(k)fluoranthene	1.08E-08			2.26E-05	1.88E-01	4.52E-05	3.76E-01
Chrysene	2.47E-08			5.17E-05	4.31E-01	1.03E-04	8.62E-01
Dibenz(a,h)anthracene	2.30E-08			4.83E-05	4.02E-01	9.65E-05	8.04E-01
Ethylbenzene	1.75E-05			3.68E-02	3.06E+02	7.35E-02	6.12E+02
Formaldehyde	4.50E-04			9.42E-01	7.85E+03	1.88E+00	1.57E+04
Hexane	2.54E-04			5.32E-01	4.43E+03	1.06E+00	8.86E+03
Indeno(1,2,3-cd)pyrene	2.30E-08			4.83E-05	4.02E-01	9.65E-05	8.04E-01
Naphthalene	1.63E-06			3.41E-03	2.84E+01	6.82E-03	5.68E+01
Propylene	7.56E-04			1.58E+00	1.32E+04	3.17E+00	2.64E+04
Propylene Oxide	4.69E-05			9.81E-02	8.18E+02	1.96E-01	1.64E+03
Toluene	6.96E-05			1.46E-01	1.21E+03	2.92E-01	2.43E+03
Xylene (Total)	2.56E-05			5.36E-02	4.47E+02	1.07E-01	8.93E+02
Sulfuric Acid Mist (H2SO4)				4.50E-01	2.81E+03	9.00E-01	5.61E+03
Benzo(a)pyrene equivalents	4.48E-08			9.38E-05	7.81E-01	1.88E-04	1.56E+00

Formaldehyde emissions reflect 50% destruction due to oxidation catalyst.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

Toxic Air Contaminant	EF lb/MMBtu	Per Turbine Firing Rate MMBtu/hr	Per Turbine Firing Rate MMBtu/yr	Per Turbine lb/hour	Per Turbine lb/year	Total CT lb/hour	Total CT lb/year
1,3-Butadiene	1.25E-07	2094.4	17450000	2.61E-04	2.17E+00	5.22E-04	4.35E+00
Acetaldehyde	1.34E-04			2.81E-01	2.34E+03	5.63E-01	4.69E+03
Acrolein	1.85E-05			3.88E-02	3.23E+02	7.76E-02	6.47E+02
Ammonia	1.40E-02			2.93E+01	2.44E+05	5.86E+01	4.89E+05
Benzene	1.30E-05			2.73E-02	2.28E+02	5.46E-02	4.55E+02
Benzo(a)anthracene	2.22E-08			4.64E-05	3.87E-01	9.28E-05	7.73E-01
Benzo(a)pyrene	1.36E-08			2.85E-05	2.38E-01	5.71E-05	4.76E-01
Benzo(b)fluoranthene	1.11E-08			2.32E-05	1.93E-01	4.64E-05	3.87E-01
Benzo(k)fluoranthene	1.08E-08			2.26E-05	1.88E-01	4.52E-05	3.76E-01
Chrysene	2.47E-08			5.17E-05	4.31E-01	1.03E-04	8.62E-01
Dibenz(a,h)anthracene	2.30E-08			4.83E-05	4.02E-01	9.65E-05	8.04E-01
Ethylbenzene	1.75E-05			3.68E-02	3.06E+02	7.35E-02	6.12E+02
Formaldehyde	4.50E-04			9.42E-01	7.85E+03	1.88E+00	1.57E+04
Hexane	2.54E-04			5.32E-01	4.43E+03	1.06E+00	8.86E+03
Indeno(1,2,3-cd)pyrene	2.30E-08			4.83E-05	4.02E-01	9.65E-05	8.04E-01
Naphthalene	1.63E-06			3.41E-03	2.84E+01	6.82E-03	5.68E+01
Propylene	7.56E-04			1.58E+00	1.32E+04	3.17E+00	2.64E+04
Propylene Oxide	4.69E-05			9.81E-02	8.18E+02	1.96E-01	1.64E+03
Toluene	6.96E-05			1.46E-01	1.21E+03	2.92E-01	2.43E+03
Xylene (Total)	2.56E-05			5.36E-02	4.47E+02	1.07E-01	8.93E+02
Sulfuric Acid Mist (H2SO4)				4.50E-01	2.81E+03	9.00E-01	5.61E+03
Benzo(a)pyrene equiv.	4.48E-08			9.38E-05	7.81E-01	1.88E-04	1.56E+00

Formaldehyde emissions reflect 50% destruction due to oxidation catalyst.

	Equivalency Factor
Benzo(a)anthracene	0.1
Benzo(a)pyrene	1
Benzo(b)fluoranthrene	0.1
Benzo(k)fluoranthene	0.1
Chrysene	0.01
Dibenz(a,h)anthracene	1.05
Indeno(1,2,3-cd)pyrene	0.1

Ammonia lb/MMBtu = ppm x 1/molar volume x MW x Fd x 20.9/(20.9 - %O2)

ppm = 10 ppm @15%O2 limit
molar volume = 386.8 dscf/lbmol @ 14.696 psia, 70 deg. F
MW = molecular weight, lb/lb-mol
Fd = 8743 dscf/MMBtu for Natural Gas @ 70 deg. F

Ammonia lb/MMBtu = 10 E-06 ft3 of NH3/ft3 stack gas x 1/386.8 dscf/lb-mol x 17 lb/lb-mol x 8743 dscf/MMBtu x 20.9/(20.9 - 15)
Ammonia lb/MMBtu = 0.014

CATEF Gas Turbine TAC Emission Factors

ID	System Type	Material Type	SCC	APC Device	Other Description	CAS	Substance	Max Emission factor	Mean	Median	Unit	lb/MMBtu
4543	Turbine	Natural gas	20200203	COC/SCR	None	106-99-0	1,3-Butadiene	1.33E-04	1.27E-04	1.24E-04	lbs/MMcf	1.25E-07
4568	Turbine	Natural gas	20200203	COC/SCR	None	75-07-0	Acetaldehyde	5.11E-01	1.37E-01	5.38E-02	lbs/MMcf	1.34E-04
4573	Turbine	Natural gas	20200203	COC/SCR	None	107-02-8	Acrolein	6.93E-02	1.89E-02	1.09E-02	lbs/MMcf	1.85E-05
4584	Turbine	Natural gas	20200203	COC/SCR	None	71-43-2	Benzene	4.72E-02	1.33E-02	1.01E-02	lbs/MMcf	1.30E-05
4593	Turbine	Natural gas	20200203	COC/SCR	None	56-55-6	Benzo(a)anthracene	1.34E-04	2.26E-05	3.61E-06	lbs/MMcf	2.22E-08
4598	Turbine	Natural gas	20200203	COC/SCR	None	50-32-8	Benzo(a)pyrene	9.16E-05	1.39E-05	2.57E-06	lbs/MMcf	1.36E-08
4603	Turbine	Natural gas	20200203	COC/SCR	None	205-99-2	Benzo(b)fluoranthene	6.72E-05	1.13E-05	2.87E-06	lbs/MMcf	1.11E-08
4618	Turbine	Natural gas	20200203	COC/SCR	None	207-08-9	Benzo(k)fluoranthene	6.72E-05	1.10E-05	2.87E-06	lbs/MMcf	1.08E-08
4623	Turbine	Natural gas	20200203	COC/SCR	None	218-01-9	Chrysene	1.50E-04	2.52E-05	4.99E-06	lbs/MMcf	2.47E-08
4628	Turbine	Natural gas	20200203	COC/SCR	None	53-70-3	Dibenz(a,h)anthracene	1.34E-04	2.35E-05	3.03E-06	lbs/MMcf	2.30E-08
4633	Turbine	Natural gas	20200203	COC/SCR	None	100-41-4	Ethylbenzene	5.70E-02	1.79E-02	9.74E-03	lbs/MMcf	1.75E-05
4648	Turbine	Natural gas	20200203	COC/SCR	None	50-00-0	Formaldehyde	6.87E+00	9.17E-01	1.12E-01	lbs/MMcf	8.99E-04
4653	Turbine	Natural gas	20200203	COC/SCR	None	110-54-3	Hexane	3.82E-01	2.59E-01	2.19E-01	lbs/MMcf	2.54E-04
4658	Turbine	Natural gas	20200203	COC/SCR	None	193-39-5	Indeno(1,2,3-cd)pyrene	1.34E-04	2.35E-05	2.87E-06	lbs/MMcf	2.30E-08

4663	Turbine	Natural gas	20200203	COC/SCR	None	91-20-3	Naphthalene	7.88E-03	1.66E-03	9.26E-04	lbs/MMcf	1.63E-06
4678	Turbine	Natural gas	20200203	COC/SCR	None	115-07-1	Propylene	2.00E+00	7.71E-01	5.71E-01	lbs/MMcf	7.56E-04
4683	Turbine	Natural gas	20200203	COC/SCR	None	75-56-9	Propylene Oxide	5.87E-02	4.78E-02	4.48E-02	lbs/MMcf	4.69E-05
4693	Turbine	Natural gas	20200203	COC/SCR	None	108-88-3	Toluene	1.68E-01	7.10E-02	5.91E-02	lbs/MMcf	6.96E-05
4708	Turbine	Natural gas	20200203	COC/SCR	None	1330-20-7	Xylene (Total)	6.26E-02	2.61E-02	1.93E-02	lbs/MMcf	2.56E-05

Natural Gas 1020 Btu/scf

Appendix B

PSD Modeling Results

OFFICE MEMORANDUM

May 29, 2008

TO: Brian Lusher

VIA: Glen Long GEL
Scott Lutz SH
Brian Bateman
Barry Young
Doug Hall

FROM: Irma Salinas IS

SUBJECT: Pacific Gas & Electric Company; Gateway Generating Station Project, Plant #18143 (Antioch, Ca)
PSD Modeling Analysis (Permit Application # 17182)

I have reviewed the modeling analysis report prepared by Sierra Research and submitted by Pacific Gas & Electric for the Gateway Generating Station Project. The attached document summarizes my findings.

Based upon the emission estimates provided in the December 2007 submittal, the proposed project would meet national ambient air quality standards for CO; and California ambient air quality standards (CAAQS) for CO. The proposed project does not cause a new exceedance of the standards and the California Clean Air Act does not require a plan to attain the state CAAQ PM_{10} standards.

The air quality impact analysis was based on EPA approved models and calculation procedures, and was performed in accordance with Section 414 of the District's NSR Rule (Regulation 2, Rule 2).

SUMMARY OF AIR QUALITY IMPACT ANALYSIS FOR

Gateway Generating Station

May 29, 2008

BACKGROUND

Pacific Gas & Electric has submitted a permit application (# 17182) for a proposed 530 MW combined cycle power plant, the Gateway Generating Station (GGS). The facility is to consist of two natural gas-fired turbines with supplemental fired heat recovery steam generators, a dew point heater, and a diesel fire pump engine. The proposed project will result in an increase in air pollutant emission of CO triggering regulatory requirements for an air quality impact analysis.

AIR QUALITY IMPACT ANALYSIS REQUIREMENTS

Requirements for air quality impact analysis are given in the District's New Source Review (NSR) Rule: Regulation 2, Rule 2.

The criteria pollutant annual worst case emission increases for the Project are listed in Table I, along with the corresponding significant emission rates for air quality impact analysis.

TABLE I
Comparison of proposed project's annual worst case emissions to significant emission rates for air quality impact analysis

Pollutant	Proposed Project's Emissions (tons/year)	Proposed Project's Emissions after offsets (tons/year)	Significant Emission Rate (tons/year) (Reg-2-2-304 to 2-2-306)	EPA PSD Significant Emission Rates for major stationary sources (tons/year)
NO_x	174.3	0	100	40
CO	555.1	555.1	100	100
PM_{10}	101.7	-10.5	100	15
SO_2	37.0	37.0	100	40

Table I indicates that the proposed project emissions exceed District significant emission levels for carbon monoxide (CO). The source is classified as a major stationary source as defined under the Federal Clean Air Act. Therefore, the air quality impact must be investigated for all pollutants emitted in quantities larger than the EPA PSD significant emission rates (shown in the last column in Table I). Table I shows that the CO ambient impacts from the project must be modeled. The detailed requirements for an air quality impact analysis for these pollutants are given in Sections 304, 305 and 306 of the District's NSR Rule and 40 CFR 51.166 of the Code of Federal Regulations.

The District's NSR Rule also contains requirements for certain additional impact analyses associated with air pollutant emissions. An applicant for a permit that requires an air quality impact analysis must also, according to Section 417 of the NSR Rule, provide an analysis of the impact of the source and source-related growth on visibility, soils and vegetation.

AIR QUALITY IMPACT ANALYSIS SUMMARY

The required contents of an air quality impact analysis are specified in Section 414 of Regulation 2 Rule 2. According to subsection 414.1, if the maximum air quality impacts of a new or modified stationary source do not exceed significance levels for air quality impacts, as defined in Section 2-2-233, no further analysis is required. (Consistent with EPA regulations, it is assumed that emission increases will not interfere with the attainment or maintenance of AAQS, or cause an exceedance of a PSD increment if the resulting maximum air quality impacts are less than specified significance levels). If the maximum impact for a particular pollutant is predicted to exceed the significance impact level, a full impact analysis is required involving estimation of background pollutant concentrations and, if applicable, a PSD increment consumption analysis. EPA also requires a Class I increment analysis of any PSD source which increases NO_2 or PM_{10} concentrations by 1 $\mu g/m^3$ or more (24-hour average) in a Class I area.

Air Quality Modeling Methodology

Maximum ambient concentrations of CO were estimated for various plume dispersion scenarios using established modeling procedures. The plume dispersion scenarios addressed include simple terrain impacts (for receptors located below stack height), complex terrain impacts (for receptors located at or above stack height) and impacts due to building downwash.

Emissions from the turbines and burners will be exhausted from two 195 foot exhaust stacks, a dew point heater with a release height of 15 feet and the fire pump will be exhausted from a 10 feet 8 inches exhaust stack. Table II contains the emission rates used in each of the modeling scenarios: turbine commissioning, turbine startup, maximum 1-hour and maximum 8-hour. Commissioning is the original startup of the turbines and only occurs during the initial operation of the equipment after installation. Startup conditions were modeled with one turbine in startup mode, while the other turbine was in normal operation.

The EPA models SCREEN3 (version 96043) and AERMOD were used in the air quality impacts analysis. A land use analysis showed that the rural dispersion coefficients were required for the analysis. The models were run using three years of meteorological data (2004 through 2006) collected less than ½ mile northwest from the project site at the BAAQMD's Contra Costa Power Plant meteorological monitoring station. Because the exhaust stacks are less than Good Engineering Practice (GEP) stack height, ambient impacts due to building downwash were evaluated. Because complex terrain was located nearby, complex terrain impacts were considered.

TABLE II
Averaging period emission rates used in modeling analysis (g/s)

Pollutant Source	Max. (1-hour)	Commis-sioning[1] (1-hour)	Start-up[2] (1-hour)	Start-up[2] (8-hour)	Max. (8-hour)
CO					
Turbine/Duct Burner 1	2.33	252.0	113.4	85.6	2.33
Turbine/Duct Burner 2	2.33	252.0	2.33	85.6	2.33
Fire Pump	2.67E-2	—	—	3.33E-3	3.33E-3
Dew point Heater	2.41E-2	—	2.41E-2	2.41E-2	2.41E-2

[1]Commissioning is the original startup of a turbine and only occurs during the initial operation of the equipment after installation.
[2]Start-up is the beginning of any of the subsequent duty cycles to bring one turbine from idle status up to power production. Both turbines will not be in startup mode at the same time.

Air Quality Modeling Results

The maximum predicted ambient impacts of the various modeling procedures described above are summarized in Table III for the averaging periods for which AAQS and PSD increments have been set. Shown in Figure 1 are the locations of the maximum modeled impacts.

Also shown in Table III are the corresponding significant ambient impact levels listed in Section 233 of the District's NSR Rule. In accordance with Regulation 2-2-414 further analysis is required only for those pollutants for which the modeled impact is above the significant air quality impact level. Further analysis is required for both the one-hour and eight-hour CO concentrations.

TABLE III
Maximum predicted ambient impacts of proposed project (μg/m^3)
[maximums are in bold type]

Pollutant	Averaging Time	Commissioning Maximum Impact	Startup	Max.	Start-up (8-hour)	Inversion Break-up Fumigation Impact	Shoreline Fumigation Impact	Significant Air Quality Impact Level
CO	1-hour	**3305.3**	789.		—	7.3	54.2	2000
	8-hour	**886.7**	219.		227.6	6.9	17.5	500

Background Air Quality Levels

Regulation 2-2-111 entitled “Exemption, PSD Monitoring,” exempts an applicant from the requirement of monitoring background concentrations in the impact area (section 414.3) provided the impacts from the proposed project are less than specified levels. Table IV lists the applicable exemption standard and the maximum impact from the proposed facility. As shown, the modeled eight-hour CO impact is above the preconstruction monitoring exemption level. Section 2.4 of Ambient Monitoring Guidelines for Prevention of Significant Deterioration (PSD) (EPA-450/4-87) states, however, that existing monitoring data may be used if the existing monitor is within or not further than 1 km away from the area of maximum air pollutant concentration from existing sources. To ensure that the maximum background concentrations from exiting sources are used in this analysis, the maximum one- and eight-hour average CO concentrations reported over all BAAQMD monitoring stations from the past four years are listed in Table V.

TABLE IV
PSD monitoring exemption level and maximum impact
from the proposed project for CO (μg/m^3)

Pollutant	Averaging Time	Exemption Level	Maximum Impact from Proposed Project
CO	8- hour	575	886.7

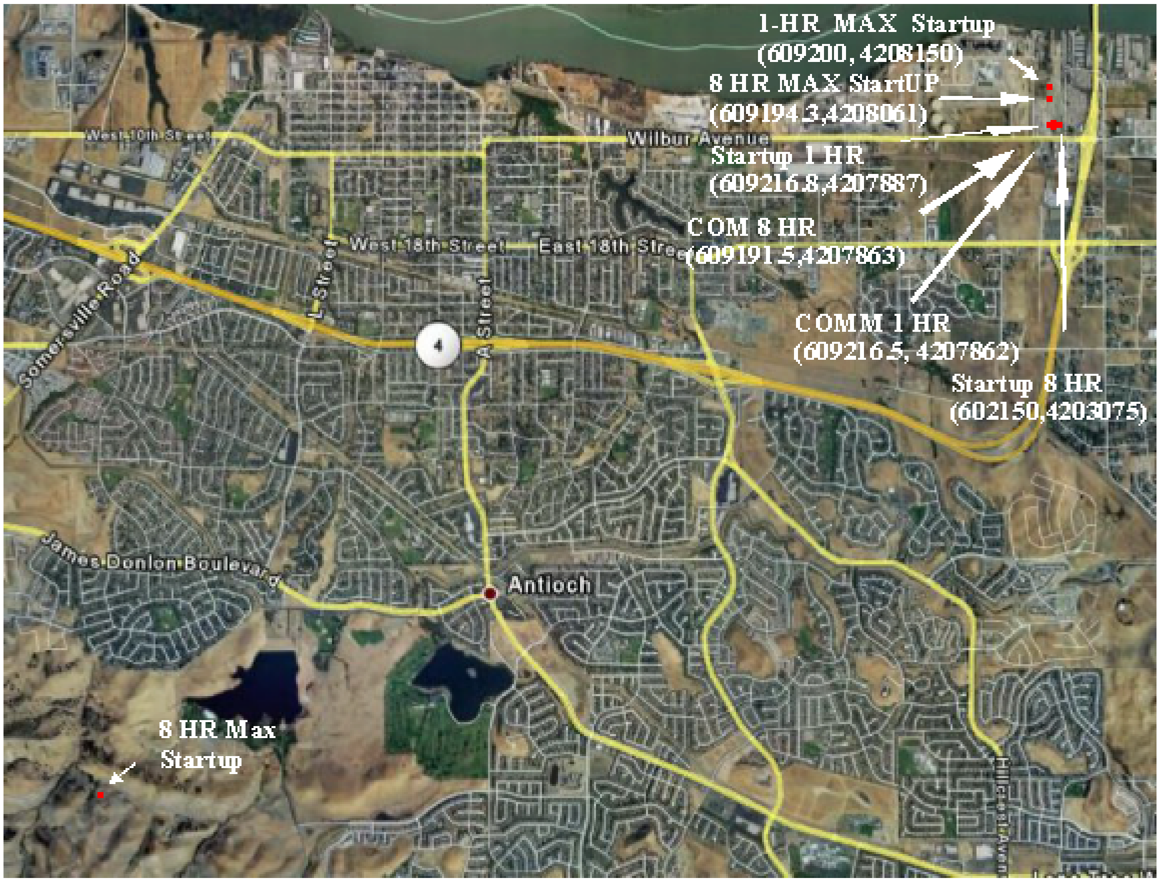

FIGURE 1. Location of project maximum impacts.

The highest one-hour CO concentration occurred at the Redwood City station in 2007 while the highest eight-hour average CO concentration occurred at the Vallejo-304 Tuolumne Street station in 2004. The eight-hour average concentration were taken from the ADAM Californian Air Resources Board web site (http://www.arb.ca.gov/adam/cgi-bin/db2www/adamtop4b.d2w/start) while the one-hour average concentrations were from the BAAQMD's archive of air quality data (gate1.baaqmd.gov).

TABLE V **Background CO (μg/m^3) at the Monitoring Station for the Past Four Years (maximum is in bold type)**		
Year	CO Highest one-hour	CO Highest 8-hour
2004	5039	**3882**
2005	5153	3562
2006	5153	3367
2007	**6299**	3104

Table VI below contains the comparison of the ambient standards with the proposed project impacts added to the maximum background concentrations that required further analysis. The proposed project will not cause an exceedance of the National Ambient Air Quality Standards. The California Ambient Air Quality (CAAQ) Standards will not be exceeded for CO.

TABLE VI
California and national ambient air quality standard and ambient air quality level from the proposed project (μg/m^3)

Pollutant	Averaging Time	Maximum Background	Maximum Impact from Proposed Project	Maximum combined impact plus maximum background	California Standard	National Standard
CO	1-hour	6299	3305	9604	23,000	40,000
	8-hour	3882	887	4769	10,000	10,000

PSD Increment Consumption Analysis

The EPA has not established PSD increments for CO. Therefore, this analysis is not required.

CLASS I PSD INCREMENT ANALYSIS

EPA requires an increment analysis of any PSD source within 100 km of a Class I area which increases NO_2 or PM_{10} concentrations by 1 μg/m^3 or more (24-hour average) inside the Class I area. This analysis is not required as Point Reyes National Seashore is located roughly 81.2 km southwest of the project and the facility is applying offsets so that there is no increase in NO_2 or PM_{10}.

VISIBILITY, SOILS AND VEGETATION IMPACT ANALYSIS

Visibility impacts were not investigated because there was no net increase in PM or NO_2 emissions.

Maximum project CO concentrations would be less than all of the applicable State and national primary and secondary ambient air quality standards, which are designed to protect the public welfare form any known or anticipated effects, including plant damage. Therefore, the facility's impact on soils and vegetation would be insignificant.

CONCLUSIONS

The results of the air quality impact analysis indicate that the proposed project would not interfere with the attainment or maintenance of applicable AAQS for CO. The analysis was based on EPA approved models and calculation procedures and was performed in accordance with Section 414 of the District's NSR Rule.

Appendix C

Health Risk Assessment Results

INTEROFFICE MEMORANDUM
May 20, 2008

TO:	Brian Lusher	Via:	Scott B. Lutz SBL
FROM:	Irma Salinas/Jane Lundquist JHL		Daphne Y. Chong DYC

SUBJECT: Health Risk Assessment for PG&E Gateway Generating Station, Antioch, Plant #18143, Application #17182, Two Gas Turbine Generators and One Fire Pump Diesel Engine

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We have completed a health risk assessment for the above referenced permit application. The analysis estimates the incremental health risk resulting from toxic air contaminant (TAC) emissions from two gas turbine generators and one fire pump diesel engine. Results from the health risk assessment indicate that, for this project, the maximum incremental cancer risk is estimated at **0.8 in a million**, the chronic hazard index is **0.03**, and the acute hazard index is **0.06**. In accordance with the District's Regulation 2, Rule 5, these risk levels are considered acceptable.

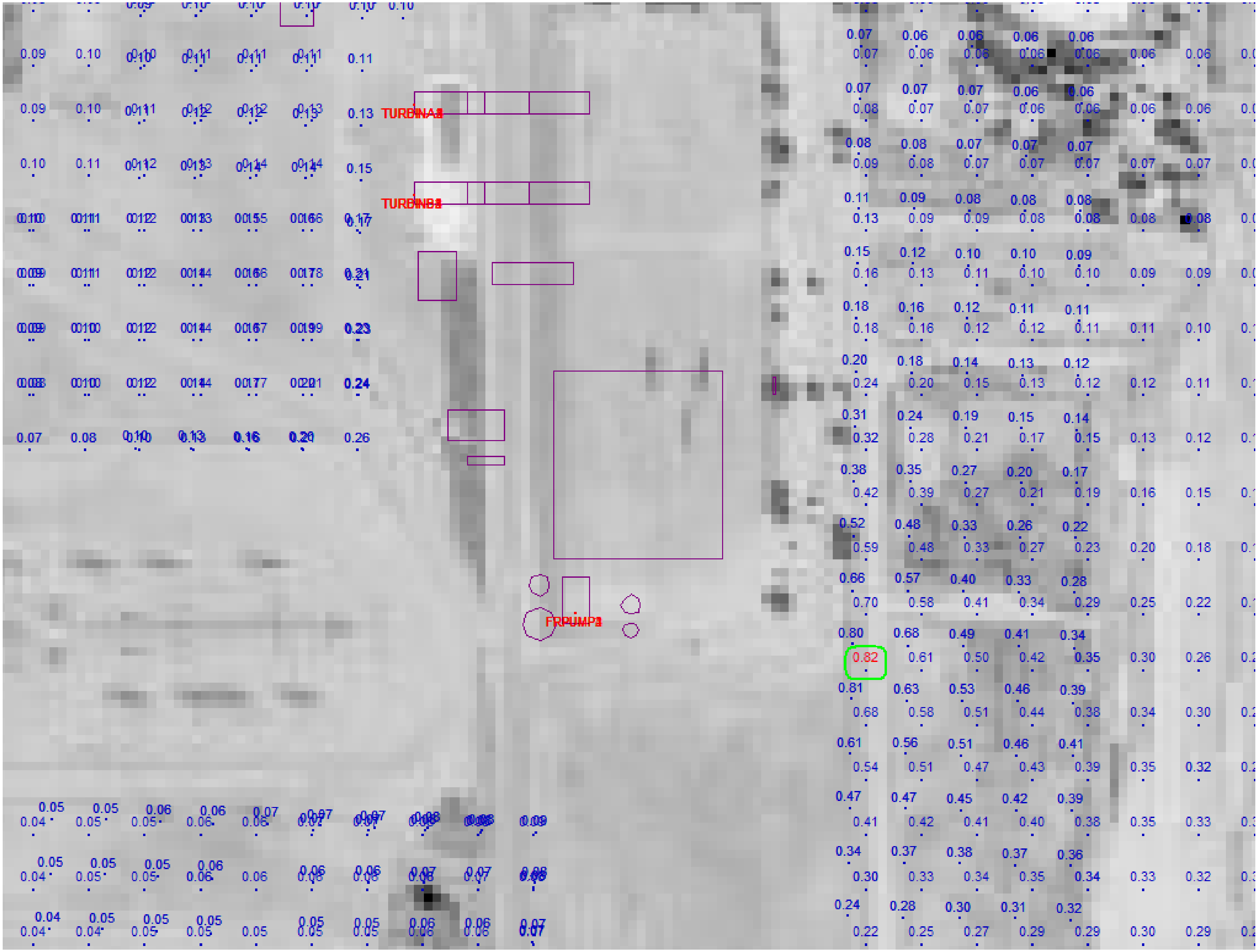
EMISSIONS: The health risk value weighted emissions were entered into the model so that the modeled results are in terms of cancer risk, chronic hazard index and acute hazard index. The attached Table 1 shows the TAC emission rates, health values and health value weighted emission used in this analysis. The chronic and acute weighted emissions for hazard indices were conservatively calculated summing all weighted emissions regardless of the target organ that is affected by the pollutant. Acrolein was not included in this analysis. The District currently does not conduct a HRSA for emissions of acrolein because CARB does not have certified emission factors or an analytical test method for acrolein and thus the appropriate tools needed to implement and enforce acrolein emission limits are not available.

MODELING: AERMOD atmospheric dispersion model runs were executed to estimate the chronic and acute health risks. The meteorological data, terrain data, source and building parameters that were used in the PSD analysis for this project were also used in this health risk assessment.

HEALTH RISK: The health risk assessment was performed in accordance with the California Office of Environmental Health Hazard Assessment (OEHHA) guidelines. PAH as benzo(a)pyrene, which is a multipathway substance, was also evaluated for non-inhalation pathway exposures (soil ingestion and dermal exposure). The health risk results are presented below.

Receptor	NAD27 UTM_E	NAD27 UTM_N	Cancer Risk in a million	Year	Comment
Resident	609975	4207550	0.38	2006	Agricultural area assumed to be residential
Resident	609975	4207550	0.41	2005	Agricultural area assumed to be residential
Resident	609900	4207550	0.36	2004	Agricultural area assumed to be residential
Worker	609200	4208000	0.80	2006	East fence line near fire pump
Worker	609200	4208000	**0.82**	2005	East fence line near fire pump
Worker	609193.3	4207987	0.78	2004	East fence line near fire pump
			Chronic HI		
Resident	609975	4207550	0.026	2006	Agricultural area assumed to be residential
Resident	609975	4207550	**0.028**	2005	Agricultural area assumed to be residential
Resident	609925	4207550	0.025	2004	Agricultural area assumed to be residential
Worker	609725	4207775	0.007	2006	Near Highway 160 and Wilbur Ave
Worker	609725	4207750	0.008	2005	Near Highway 160 and Wilbur Ave
Worker	609600	4207825	0.007	2004	Near Highway 160 and Wilbur Ave
			Acute HI		
Receptor	609290.1	4207762	0.042	2006	Near southeast fence line
Receptor	609241.1	4207837	**0.056**	2005	Southeast fence line
Receptor	609265.8	4207812	0.055	2004	Near southeast fence line

Gateway HRA impacts P# 18143 A# 17182 Worker Cancer Risk C:\riskscreens\Gateway\HealthRisks0519_2005_OTHER.GRF

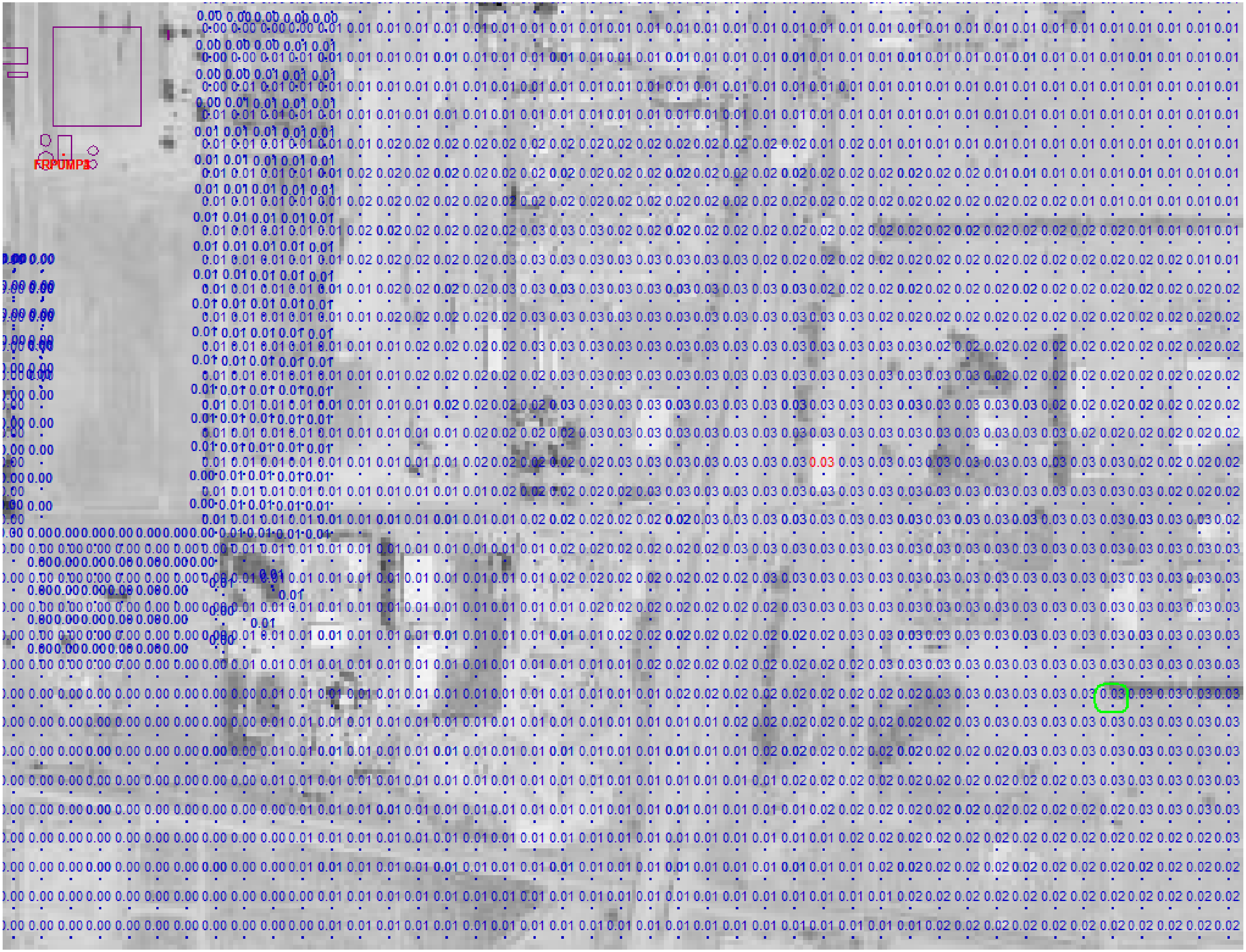


Scale: 1" = 53.3 Meters PERIOD VALUES FOR GROUP: CNCR_WRK Max = 0.8188 (609200, 4208000)

Gateway HRA impacts P# 18143 A# 17182

Residential Chronic Hazard Index

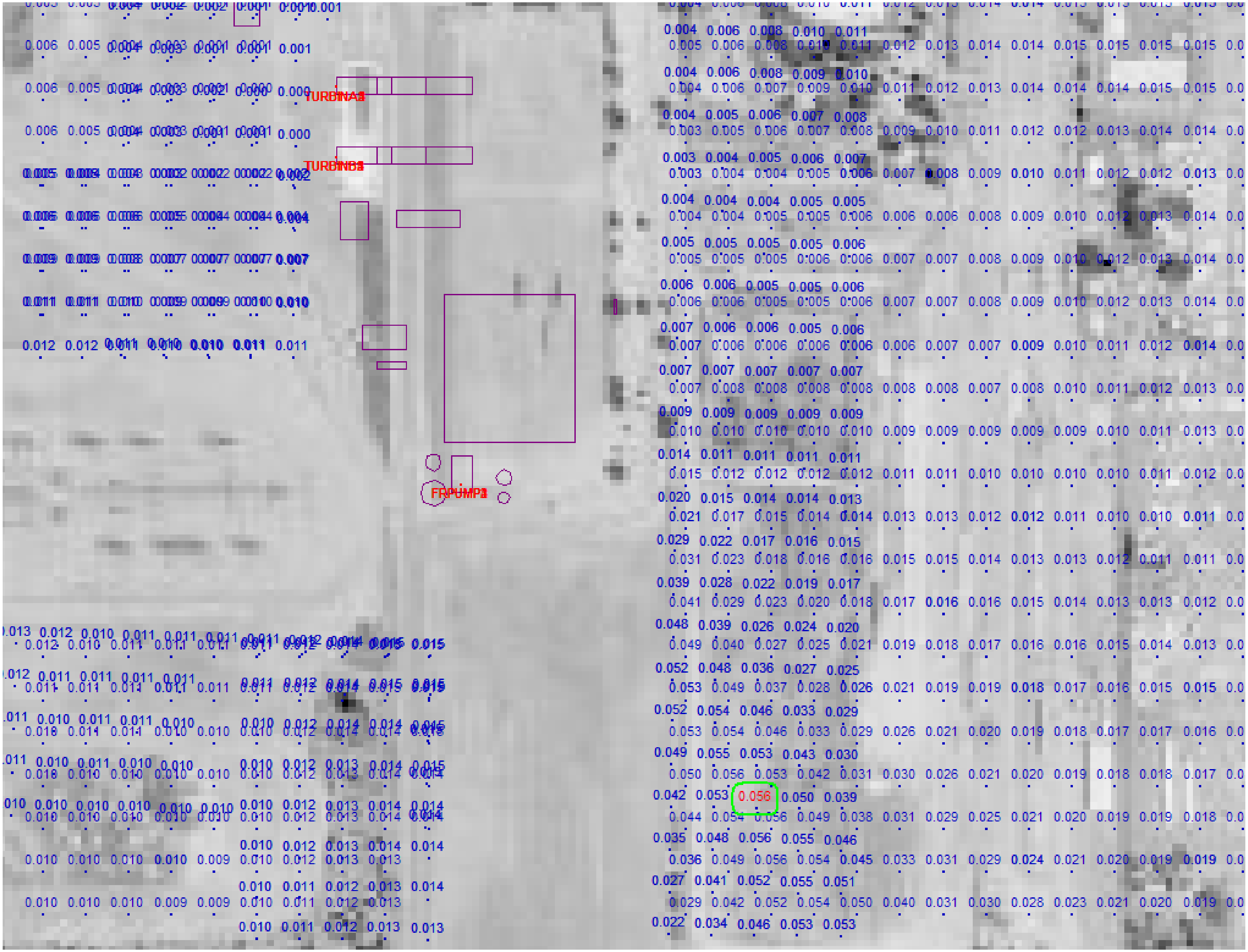
C:\riskscreens\Gateway\HealthRisks0519_2005_OTHER.GRF



Scale: 1" = 101.2 Meters

PERIOD VALUES FOR GROUP: CHI_RES

Max = 0.03213 (609725, 4207750)



Scale: 1" = 68.4 Meters HIGH 1ST HIGH 1-HR VALUES FOR GROUP: AHI Max = 0.05602 (609241.1, 4207837)

Input File - C:\riskscreens\Gateway\HealthRisks0519_2005_OTHER.DTA
Output File - C:\riskscreens\Gateway\HealthRisks0519_2005_OTHER.LST
Met File - C:\riskscreens\Gateway\GATEA05.SFC

*** AERMOD - VERSION 07026 ***   *** Gateway HRA impacts P# 18143 A# 17182
***   05/19/08
***
***   14:48:43

*** MODEL SETUP OPTIONS SUMMARY ***

- -

**Model Is Setup For Calculation of Average CONCentration Values.
-- DEPOSITION LOGIC --
**Model Uses NO DRY DEPLETION. DDPLETE = F
**Model Uses NO WET DEPLETION. WDPLETE = F
**NO GAS DRY DEPOSITION Data Provided.
**Model Uses RURAL Dispersion Only.
**Model Uses Regulatory DEFAULT Options:

1. Stack-tip Downwash.
2. Model Accounts for ELEVated Terrain Effects.
3. Use Calms Processing Routine.
4. Use Missing Data Processing Routine.
5. No Exponential Decay

**Model Assumes No FLAGPOLE Receptor Heights.
**Model Calculates 1 Short Term Average(s) of: 1-HR
and Calculates PERIOD Averages
**This Run Includes: 14 Source(s);   19 Source Group(s); and   10861 Receptor(s)
**Misc. Inputs: Base Elev. for Pot. Temp. Profile (m MSL) =   3.00 ; Decay Coef. =   0.000 ; Rot. Angle =   0.0

*** POINT SOURCE DATA ***

SOURCE ID	NUMBER PART. CATS.	EMISSION RATE (GRAMS/SEC)	X (METERS)	Y (METERS)	BASE ELEV. (METERS)	STACK HEIGHT (METERS)	STACK TEMP. (DEG.K)	STACK EXIT VEL. (M/SEC)	STACK DIAMETER (METERS)	BLDG EXISTS	URBAN SOURCE	CAP/ HOR	EMIS RATE SCALAR VARY BY
TURBINA1	0	0.22600E+01	608996.0	4208257.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINA2	0	0.19200E+00	608996.0	4208257.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINA3	0	0.50700E+00	608996.0	4208257.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINA4	0	0.44700E-01	608996.0	4208257.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINA5	0	0.58000E-02	608996.0	4208257.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINB1	0	0.22600E+01	608996.0	4208216.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINB2	0	0.19200E+00	608996.0	4208216.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINB3	0	0.50700E+00	608996.0	4208216.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINB4	0	0.44700E-01	608996.0	4208216.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
TURBINB5	0	0.58000E-02	608996.0	4208216.5	4.3	59.44	355.22	19.92	5.11	YES	NO	NO	
FRPUMP1	0	0.19000E-01	609069.0	4208026.0	4.3	3.40	683.00	44.10	0.15	YES	NO	NO	
FRPUMP2	0	0.11400E-04	609069.0	4208026.0	4.3	3.40	683.00	44.10	0.15	YES	NO	NO	
FRPUMP3	0	0.15700E-01	609069.0	4208026.0	4.3	3.40	683.00	44.10	0.15	YES	NO	NO	
FRPUMP4	0	0.11200E-04	609069.0	4208026.0	4.3	3.40	683.00	44.10	0.15	YES	NO	NO	

```
 *** AERMOD - VERSION 07026 ***    *** Gateway HRA impacts  P# 18143  A# 17182
***        05/19/08
                                   ***
***        14:48:43
```

*** SOURCE IDs DEFINING SOURCE GROUPS ***

GROUP ID	SOURCE IDs
CNCR_RES	TURBINA1, TURBINB1, FRPUMP1 ,
CNCR_WRK	TURBINA3, TURBINB3, FRPUMP3 ,
CHI_RES	TURBINA2, TURBINB2, FRPUMP2 ,
CHI_WRK	TURBINA4, TURBINB4, FRPUMP4 ,
AHI	TURBINA5, TURBINB5,

*** DIRECTION SPECIFIC BUILDING DIMENSIONS ***

SOURCE ID: TURBINA1
SOURCE ID: TURBINA2
SOURCE ID: TURBINA3
SOURCE ID: TURBINA4
SOURCE ID: TURBINA5

IFV	BH	BW	BL	XADJ	YADJ	IFV	BH	BW	BL	XADJ	YADJ
1	28.0,	25.4,	14.0,	-4.4,	-11.7,	2	28.0,	26.0,	17.6,	-4.2,	-11.1,
3	28.0,	25.8,	20.7,	-3.9,	-10.1,	4	28.0,	24.8,	23.1,	-3.5,	-8.9,
5	28.0,	23.1,	24.8,	-2.9,	-7.3,	6	28.0,	20.7,	25.8,	-2.2,	-5.6,
7	28.0,	17.6,	26.0,	-1.5,	-3.6,	8	28.0,	14.0,	25.4,	-0.8,	-1.6,
9	28.0,	10.0,	24.0,	0.0,	0.5,	10	28.0,	14.0,	25.4,	-1.0,	2.6,
11	28.0,	17.6,	26.0,	-1.9,	4.6,	12	28.0,	20.7,	25.8,	-2.8,	6.4,
13	28.0,	23.1,	24.8,	-3.5,	8.1,	14	44.7,	94.5,	87.2,	-220.0,	52.7,
15	44.7,	98.9,	77.3,	-221.5,	21.3,	16	44.7,	100.3,	65.0,	-216.3,	-10.8,
17	44.7,	98.7,	50.8,	-204.5,	-42.5,	18	28.0,	24.0,	10.0,	-5.5,	12.0,
19	28.0,	25.4,	14.0,	-9.6,	11.7,	20	28.0,	26.0,	17.6,	-13.4,	11.1,
21	28.0,	25.8,	20.7,	-16.8,	10.1,	22	28.0,	24.8,	23.1,	-19.6,	8.9,
23	28.0,	23.1,	24.8,	-21.9,	7.3,	24	28.0,	20.7,	25.8,	-23.5,	5.6,
25	28.0,	17.6,	26.0,	-24.4,	3.6,	26	28.0,	14.0,	25.4,	-24.6,	1.6,
27	28.0,	10.0,	24.0,	-24.0,	-0.5,	28	28.0,	14.0,	25.4,	-24.4,	-2.6,
29	28.0,	17.6,	26.0,	-24.1,	-4.6,	30	28.0,	20.7,	25.8,	-23.0,	-6.4,
31	39.0,	114.7,	113.5,	-239.9,	61.1,	32	39.0,	113.5,	114.7,	-248.3,	28.4,
33	39.0,	108.8,	112.5,	-249.2,	-5.2,	34	39.0,	100.8,	106.8,	-242.5,	-38.7,
35	28.0,	25.4,	14.0,	-8.6,	-11.9,	36	28.0,	24.0,	10.0,	-4.5,	-12.0,

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                                         *** DIRECTION SPECIFIC BUILDING DIMENSIONS ***
SOURCE ID: TURBINB1
SOURCE ID: TURBINB2
SOURCE ID: TURBINB3
SOURCE ID: TURBINB4
SOURCE ID: TURBINB5
 IFV    BH      BW      BL     XADJ    YADJ     IFV    BH      BW      BL     XADJ    YADJ
   1   28.0,   25.4,   14.0,   36.0,   -4.6,      2   28.0,   26.0,   17.6,   34.3,    2.9,
   3   28.0,   25.8,   20.7,   31.6,   10.4,      4   28.0,   24.8,   23.1,   28.0,   17.5,
   5   28.0,   23.1,   24.8,   -2.9,   -7.3,      6   28.0,   20.7,   25.8,   -2.2,   -5.6,
   7   28.0,   17.6,   26.0,   -1.5,   -3.6,      8   28.0,   14.0,   25.4,   -0.8,   -1.6,
   9   28.0,   10.0,   24.0,    0.0,    0.5,     10   28.0,   14.0,   25.4,   -1.0,    2.6,
  11   28.0,   17.6,   26.0,   -1.9,    4.6,     12   28.0,   20.7,   25.8,   -2.8,    6.4,
  13   28.0,   23.1,   24.8,   -3.5,    8.1,     14   28.0,   24.8,   23.1,   -4.2,    9.5,
  15   44.7,   98.9,   77.3, -257.0,   41.8,     16   44.7,  100.3,   65.0, -254.8,    3.2,
  17   44.7,   98.7,   50.8, -244.9,  -35.4,     18   28.0,   24.0,   10.0,  -46.5,   12.0,
  19   28.0,   25.4,   14.0,  -50.0,    4.6,     20   28.0,   26.0,   17.6,  -51.9,   -2.9,
  21   28.0,   25.8,   20.7,  -52.3,  -10.4,     22   28.0,   24.8,   23.1,  -51.0,  -17.5,
  23   28.0,   23.1,   24.8,  -21.9,    7.3,     24   28.0,   20.7,   25.8,  -23.5,    5.6,
  25   28.0,   17.6,   26.0,  -24.4,    3.6,     26   28.0,   14.0,   25.4,  -24.6,    1.6,
  27   28.0,   10.0,   24.0,  -24.0,   -0.5,     28   28.0,   14.0,   25.4,  -24.4,   -2.6,
  29   28.0,   17.6,   26.0,  -24.1,   -4.6,     30   39.0,  112.5,  108.8, -203.6,   56.5,
  31   39.0,  114.7,  113.5, -213.5,   29.7,     32   39.0,  113.5,  114.7, -216.9,    2.0,
  33   39.0,  108.8,  112.5, -213.7,  -25.7,     34   39.0,  100.8,  106.8, -204.0,  -52.7,
  35   28.0,   25.4,   14.0,   31.8,  -19.0,     36   28.0,   24.0,   10.0,   36.5,  -12.0,
SOURCE ID: FRPUMP1
SOURCE ID: FRPUMP2
SOURCE ID: FRPUMP3
SOURCE ID: FRPUMP4
 IFV    BH      BW      BL     XADJ    YADJ     IFV    BH      BW      BL     XADJ    YADJ
   1   39.0,   89.8,   97.9,   21.9,  -15.9,      2   39.0,  100.8,  106.8,   19.1,   -3.4,
   3   39.0,  108.8,  112.5,   15.8,    9.2,      4   39.0,  113.5,  114.7,   12.0,   21.6,
   5   39.0,  114.7,  113.5,    7.8,   33.3,      6   39.0,  112.5,  108.8,    3.3,   44.0,
   7   39.0,  106.8,  100.8,   -1.2,   53.4,      8   39.0,   97.9,   89.8,   -5.7,   61.1,
   9    5.2,   15.0,   15.0,  -24.0,   -5.5,     10    5.2,   14.8,   14.8,  -22.6,   -8.2,
  11   39.0,  106.8,  100.8,  -47.0,   72.5,     12   39.0,  112.5,  108.8,  -63.7,   72.0,
  13   39.0,  114.7,  113.5,  -78.4,   69.3,     14   39.0,  113.5,  114.7,  -90.7,   64.5,
  15   39.0,  108.8,  112.5, -100.3,   57.8,     16   39.0,  100.8,  106.8, -106.8,   49.2,
  17   39.0,   89.8,   97.9, -110.1,   39.2,     18   39.0,   76.0,   86.0, -110.0,   28.0,
  19   39.0,   89.8,   97.9, -119.8,   15.9,     20   39.0,  100.8,  106.8, -125.9,    3.4,
  21   39.0,  108.8,  112.5, -128.3,   -9.2,     22   39.0,  113.5,  114.7, -126.7,  -21.6,
  23   39.0,  114.7,  113.5, -121.3,  -33.3,     24   39.0,  112.5,  108.8, -112.2,  -44.0,
  25   39.0,  106.8,  100.8,  -99.6,  -53.4,     26   39.0,   97.9,   89.8,  -84.1,  -61.1,
  27    6.4,    9.0,    9.0,  -29.0,   -3.5,     28    5.2,   14.8,   14.8,    7.8,    8.2,
  29   39.0,  106.8,  100.8,  -53.8,  -72.5,     30   39.0,  112.5,  108.8,  -45.2,  -72.0,
  31   39.0,  114.7,  113.5,  -35.1,  -69.3,     32   39.0,  113.5,  114.7,  -24.0,  -64.5,
  33   39.0,  108.8,  112.5,  -12.2,  -57.8,     34   39.0,  100.8,  106.8,    0.0,  -49.2,
  35   39.0,   89.8,   97.9,   12.2,  -39.2,     36   39.0,   76.0,   86.0,   24.0,  -28.0,
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*** AERMOD - VERSION 07026 ***   *** Gateway HRA impacts P# 18143 A# 17182 ***   05/19/08
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***   14:48:43

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION   VALUES FOR SOURCE GROUP: CNCR_RES ***
INCLUDING SOURCE(S):   TURBINA1, TURBINB1, FRPUMP1 ,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF OTHER   IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
609150.00	4207550.00	0.07423	609175.00	4207550.00	0.08010
609200.00	4207550.00	0.08656	609225.00	4207550.00	0.09283
609250.00	4207550.00	0.09902	609275.00	4207550.00	0.10478
609300.00	4207550.00	0.11071	609325.00	4207550.00	0.11717
609350.00	4207550.00	0.12402	609375.00	4207550.00	0.13125
609400.00	4207550.00	0.13937	609425.00	4207550.00	0.14841
609450.00	4207550.00	0.15869	609475.00	4207550.00	0.16921
609500.00	4207550.00	0.18094	609525.00	4207550.00	0.19387
609550.00	4207550.00	0.20667	609575.00	4207550.00	0.21932
609600.00	4207550.00	0.23406	609625.00	4207550.00	0.25067
609650.00	4207550.00	0.26840	609675.00	4207550.00	0.28939
609700.00	4207550.00	0.30601	609725.00	4207550.00	0.32200
609750.00	4207550.00	0.33910	609775.00	4207550.00	0.35359
609800.00	4207550.00	0.36697	609825.00	4207550.00	0.37777
609850.00	4207550.00	0.38791	609875.00	4207550.00	0.39622
609900.00	4207550.00	0.40226	609925.00	4207550.00	0.40542
609950.00	4207550.00	0.40756	609975.00	4207550.00	0.40813 residential cancer risk
610000.00	4207550.00	0.40596	610025.00	4207550.00	0.40378
610050.00	4207550.00	0.39876	610075.00	4207550.00	0.39340
610100.00	4207550.00	0.38649	610125.00	4207550.00	0.38029
610150.00	4207550.00	0.37182	610175.00	4207550.00	0.36356
610200.00	4207550.00	0.35494	610225.00	4207550.00	0.34608
610250.00	4207550.00	0.33705	610275.00	4207550.00	0.32711
610300.00	4207550.00	0.31856	610325.00	4207550.00	0.30862
610350.00	4207550.00	0.30034	610375.00	4207550.00	0.29086
610400.00	4207550.00	0.28235	610425.00	4207550.00	0.27382
610450.00	4207550.00	0.26594	610475.00	4207550.00	0.25774
610500.00	4207550.00	0.25064	610525.00	4207550.00	0.24362
610550.00	4207550.00	0.23685	610575.00	4207550.00	0.23010
610600.00	4207550.00	0.22349	610625.00	4207550.00	0.21714
610650.00	4207550.00	0.21102	608300.00	4207575.00	0.04037
608325.00	4207575.00	0.04049	608350.00	4207575.00	0.04068

608375.00	4207575.00	0.04094	608400.00	4207575.00	0.04116
608425.00	4207575.00	0.04131	608450.00	4207575.00	0.04144
608475.00	4207575.00	0.04148	608500.00	4207575.00	0.04155
608525.00	4207575.00	0.04152	608550.00	4207575.00	0.04148
608575.00	4207575.00	0.04150	608600.00	4207575.00	0.04136
608625.00	4207575.00	0.04109	608650.00	4207575.00	0.04086
608675.00	4207575.00	0.04065	608700.00	4207575.00	0.04038
608725.00	4207575.00	0.04028	608750.00	4207575.00	0.04022

*** AERMOD - VERSION 07026 *** *** Gateway HRA impacts P# 18143 A# 17182 ***
*** 05/19/08
***
*** 14:48:43

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: CNCR_WRK ***
INCLUDING SOURCE(S): TURBINA3, TURBINB3, FRPUMP3 ,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
608100.00	4207700.00	0.01422	608200.00	4207700.00	0.01515
608300.00	4207700.00	0.01655	608400.00	4207700.00	0.01829
608500.00	4207700.00	0.02031	608600.00	4207700.00	0.02263
608700.00	4207700.00	0.02423	608800.00	4207700.00	0.02438
608900.00	4207700.00	0.02489	609000.00	4207700.00	0.03036
609200.00	4207700.00	0.06111	609300.00	4207700.00	0.07823
609400.00	4207700.00	0.10957	609500.00	4207700.00	0.14584
609600.00	4207700.00	0.16894	609700.00	4207700.00	0.17661
609800.00	4207700.00	0.16675	609900.00	4207700.00	0.14880
610000.00	4207700.00	0.12997	610100.00	4207700.00	0.11255
608100.00	4207800.00	0.01476	608200.00	4207800.00	0.01556
608300.00	4207800.00	0.01637	608400.00	4207800.00	0.01850
608500.00	4207800.00	0.02102	608600.00	4207800.00	0.02432
608700.00	4207800.00	0.02899	608800.00	4207800.00	0.03335
608900.00	4207800.00	0.03516	609000.00	4207800.00	0.04019
609200.00	4207800.00	0.09919	609300.00	4207800.00	0.15679
609400.00	4207800.00	0.20507	609500.00	4207800.00	0.22279
609600.00	4207800.00	0.21211	609700.00	4207800.00	0.18341
609800.00	4207800.00	0.15291	609900.00	4207800.00	0.12345
610000.00	4207800.00	0.10255	610100.00	4207800.00	0.08567
608100.00	4207900.00	0.01590	608200.00	4207900.00	0.01667
608300.00	4207900.00	0.01771	608400.00	4207900.00	0.01989
608500.00	4207900.00	0.02198	608600.00	4207900.00	0.02529
608700.00	4207900.00	0.03068	608800.00	4207900.00	0.04029
608900.00	4207900.00	0.05514	609000.00	4207900.00	0.06422
609200.00	4207900.00	0.30196	609300.00	4207900.00	0.34112
609400.00	4207900.00	0.28797	609500.00	4207900.00	0.23029
609600.00	4207900.00	0.17639	609700.00	4207900.00	0.13618
609800.00	4207900.00	0.10753	609900.00	4207900.00	0.08710
610000.00	4207900.00	0.07364	610100.00	4207900.00	0.06410
608100.00	4208000.00	0.01380	608200.00	4208000.00	0.01491
608300.00	4208000.00	0.01646	608400.00	4208000.00	0.01838

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         608500.00    4208000.00         0.02095                            609200.00    4208000.00
0.81880 worker cancer risk
         609300.00    4208000.00         0.35041                            609400.00    4208000.00
0.20295
         609500.00    4208000.00         0.13762                            609600.00    4208000.00
0.10335
         609700.00    4208000.00         0.08625                            609800.00    4208000.00
0.07255
         609900.00    4208000.00         0.06514                            610000.00    4208000.00
0.05949
         610100.00    4208000.00         0.05519                            608100.00    4208100.00
0.01112
         608200.00    4208100.00         0.01163                            608300.00    4208100.00
0.01268
         608400.00    4208100.00         0.01404                            608500.00    4208100.00
0.01583
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*** AERMOD - VERSION 07026 *** *** Gateway HRA impacts P# 18143 A# 17182 *** 05/19/08
***
*** 14:48:43

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: CHI_RES ***
INCLUDING SOURCE(S): TURBINA2, TURBINB2, FRPUMP2 ,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
609150.00	4207550.00	0.00400	609175.00	4207550.00	0.00430
609200.00	4207550.00	0.00462	609225.00	4207550.00	0.00497
609250.00	4207550.00	0.00536	609275.00	4207550.00	0.00579
609300.00	4207550.00	0.00626	609325.00	4207550.00	0.00677
609350.00	4207550.00	0.00733	609375.00	4207550.00	0.00792
609400.00	4207550.00	0.00853	609425.00	4207550.00	0.00918
609450.00	4207550.00	0.00985	609475.00	4207550.00	0.01056
609500.00	4207550.00	0.01133	609525.00	4207550.00	0.01217
609550.00	4207550.00	0.01305	609575.00	4207550.00	0.01398
609600.00	4207550.00	0.01502	609625.00	4207550.00	0.01615
609650.00	4207550.00	0.01737	609675.00	4207550.00	0.01877
609700.00	4207550.00	0.01995	609725.00	4207550.00	0.02118
609750.00	4207550.00	0.02249	609775.00	4207550.00	0.02363
609800.00	4207550.00	0.02467	609825.00	4207550.00	0.02561
609850.00	4207550.00	0.02641	609875.00	4207550.00	0.02708
609900.00	4207550.00	0.02760	609925.00	4207550.00	0.02797
609950.00	4207550.00	0.02820	609975.00	4207550.00	0.02830 residential chronic HI
610000.00	4207550.00	0.02827	610025.00	4207550.00	0.02813
610050.00	4207550.00	0.02789	610075.00	4207550.00	0.02756
610100.00	4207550.00	0.02716	610125.00	4207550.00	0.02669
610150.00	4207550.00	0.02616	610175.00	4207550.00	0.02560
610200.00	4207550.00	0.02500	610225.00	4207550.00	0.02438
610250.00	4207550.00	0.02374	610275.00	4207550.00	0.02309
610300.00	4207550.00	0.02244	610325.00	4207550.00	0.02180
610350.00	4207550.00	0.02116	610375.00	4207550.00	0.02053
610400.00	4207550.00	0.01991	610425.00	4207550.00	0.01931
610450.00	4207550.00	0.01873	610475.00	4207550.00	0.01819
610500.00	4207550.00	0.01767	610525.00	4207550.00	0.01716
610550.00	4207550.00	0.01666	610575.00	4207550.00	0.01618
610600.00	4207550.00	0.01571	610625.00	4207550.00	0.01525
610650.00	4207550.00	0.01481	608300.00	4207575.00	0.00248
608325.00	4207575.00	0.00247	608350.00	4207575.00	0.00245

608375.00	4207575.00	0.00244	608400.00	4207575.00	0.00242
608425.00	4207575.00	0.00240	608450.00	4207575.00	0.00238
608475.00	4207575.00	0.00237	608500.00	4207575.00	0.00235
608525.00	4207575.00	0.00233	608550.00	4207575.00	0.00231
608575.00	4207575.00	0.00229	608600.00	4207575.00	0.00227
608625.00	4207575.00	0.00225	608650.00	4207575.00	0.00223
608675.00	4207575.00	0.00221	608700.00	4207575.00	0.00219
608725.00	4207575.00	0.00218	608750.00	4207575.00	0.00217

*** AERMOD - VERSION 07026 *** *** Gateway HRA impacts P# 18143 A# 17182 *** 05/19/08 ***
*** 14:48:43

*** THE PERIOD (8760 HRS) AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: CHI_WRK ***
INCLUDING SOURCE(S): TURBINA4, TURBINB4, FRPUMP4 ,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	X-COORD (M)	Y-COORD (M)	CONC
608300.00	4207750.00	0.00060	608325.00	4207750.00	0.00059
608350.00	4207750.00	0.00059	608375.00	4207750.00	0.00059
608400.00	4207750.00	0.00059	608425.00	4207750.00	0.00058
608450.00	4207750.00	0.00058	608475.00	4207750.00	0.00057
608500.00	4207750.00	0.00057	608525.00	4207750.00	0.00056
608550.00	4207750.00	0.00055	608575.00	4207750.00	0.00055
608600.00	4207750.00	0.00054	608625.00	4207750.00	0.00053
608650.00	4207750.00	0.00052	608675.00	4207750.00	0.00051
608700.00	4207750.00	0.00050	608725.00	4207750.00	0.00050
608750.00	4207750.00	0.00049	608775.00	4207750.00	0.00048
608800.00	4207750.00	0.00047	608825.00	4207750.00	0.00047
608850.00	4207750.00	0.00047	608875.00	4207750.00	0.00047
608900.00	4207750.00	0.00048	608925.00	4207750.00	0.00049
608950.00	4207750.00	0.00051	608975.00	4207750.00	0.00054
609000.00	4207750.00	0.00058	609025.00	4207750.00	0.00063
609200.00	4207750.00	0.00126	609225.00	4207750.00	0.00143
609250.00	4207750.00	0.00162	609275.00	4207750.00	0.00183
609300.00	4207750.00	0.00206	609325.00	4207750.00	0.00230
609350.00	4207750.00	0.00256	609375.00	4207750.00	0.00287
609400.00	4207750.00	0.00321	609425.00	4207750.00	0.00361
609450.00	4207750.00	0.00406	609475.00	4207750.00	0.00454
609500.00	4207750.00	0.00505	609525.00	4207750.00	0.00553
609550.00	4207750.00	0.00597	609575.00	4207750.00	0.00638
609600.00	4207750.00	0.00673	609625.00	4207750.00	0.00698
609650.00	4207750.00	0.00720	609675.00	4207750.00	0.00736
609700.00	4207750.00	0.00750	609725.00	4207750.00	0.00753 worker chronic HI
609750.00	4207750.00	0.00747	609775.00	4207750.00	0.00739
609800.00	4207750.00	0.00726	609825.00	4207750.00	0.00711
609850.00	4207750.00	0.00693	609875.00	4207750.00	0.00674
609900.00	4207750.00	0.00653	609925.00	4207750.00	0.00633
609950.00	4207750.00	0.00612	609975.00	4207750.00	0.00591
610000.00	4207750.00	0.00571	610025.00	4207750.00	0.00551

610050.00	4207750.00	0.00532	610075.00	4207750.00	0.00514
610100.00	4207750.00	0.00496	610125.00	4207750.00	0.00478
610150.00	4207750.00	0.00461	610175.00	4207750.00	0.00446
610200.00	4207750.00	0.00431	610225.00	4207750.00	0.00416
610250.00	4207750.00	0.00402	610275.00	4207750.00	0.00389
610300.00	4207750.00	0.00376	610325.00	4207750.00	0.00364
610350.00	4207750.00	0.00354	610375.00	4207750.00	0.00344
610400.00	4207750.00	0.00334	610425.00	4207750.00	0.00325

*** AERMOD - VERSION 07026 *** *** Gateway HRA impacts P# 18143 A# 17182 *** 05/19/08
***
*** 14:48:43

*** THE 1ST HIGHEST 1-HR AVERAGE CONCENTRATION VALUES FOR SOURCE GROUP: AHI ***
INCLUDING SOURCE(S): TURBINA5, TURBINB5,
*** DISCRETE CARTESIAN RECEPTOR POINTS ***
** CONC OF OTHER IN MICROGRAMS/M**3 **

X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)		X-COORD (M)	Y-COORD (M)	CONC	(YYMMDDHH)
609242.50	4207936.00	0.02645	(05071112)		609242.19	4207911.50	0.03635	(05071111)
609241.81	4207886.50	0.04588	(05071111)		609241.50	4207862.00	0.05265	(05071111)
609241.12	4207837.00	0.05602	(05071111)	acute HI	609240.75	4207812.50	0.05570	(05071111)
609240.44	4207787.50	0.05190	(05071111)		609240.06	4207762.50	0.04561	(05071111)
609239.69	4207738.00	0.03868	(05071111)		609239.38	4207713.00	0.03176	(05071111)
609239.00	4207688.50	0.02548	(05071111)		609265.50	4208548.00	0.01255	(05042712)
609244.62	4208582.00	0.01363	(05042714)		609214.19	4208597.00	0.01466	(05042715)
609275.62	4208506.00	0.01076	(05050911)		609275.31	4208481.50	0.01103	(05050911)
609274.94	4208456.50	0.01087	(05050911)		609274.56	4208432.00	0.01022	(05050911)
609274.25	4208407.00	0.00972	(05052814)		609273.88	4208382.00	0.00891	(05052814)
609273.50	4208357.50	0.00885	(05052812)		609273.19	4208332.50	0.00891	(05052812)
609272.81	4208308.00	0.00922	(05050512)		609272.44	4208283.00	0.00977	(05050512)
609272.12	4208258.00	0.00895	(05050512)		609271.75	4208233.50	0.00745	(05061609)
609271.38	4208208.50	0.00576	(05061609)		609271.06	4208184.00	0.00496	(05083115)
609270.69	4208159.00	0.00540	(05083115)		609270.38	4208134.00	0.00535	(05083115)
609270.00	4208109.50	0.00544	(05071214)		609269.62	4208084.50	0.00709	(05112212)
609269.31	4208060.00	0.00916	(05112212)		609268.94	4208035.00	0.01138	(05112212)
609268.56	4208010.50	0.01353	(05112212)		609268.25	4207985.50	0.01558	(05112212)
609267.88	4207960.50	0.01856	(05071210)		609267.50	4207936.00	0.02382	(05071210)
609267.19	4207911.00	0.02723	(05071210)		609266.81	4207886.50	0.03319	(05071111)
609266.44	4207861.50	0.04257	(05071111)		609266.12	4207836.50	0.05009	(05071111)
609265.75	4207812.00	0.05464	(05071111)		609265.38	4207787.00	0.05521	(05071111)
609265.06	4207762.50	0.05263	(05071111)		609264.69	4207737.50	0.04782	(05071111)
609264.38	4207712.50	0.04187	(05071111)		609264.00	4207688.00	0.03563	(05071111)
609289.81	4208549.00	0.01216	(05042712)		609267.50	4208585.50	0.01360	(05042714)
609223.94	4208619.50	0.01528	(05042715)		609181.44	4208615.00	0.01597	(05042715)
609300.62	4208506.00	0.01165	(05050911)		609300.25	4208481.00	0.01167	(05050911)
609299.94	4208456.00	0.01123	(05050911)		609299.56	4208431.50	0.01106	(05052814)
609299.25	4208406.50	0.01070	(05052814)		609298.88	4208382.00	0.00955	(05052814)
609298.50	4208357.00	0.01003	(05052812)		609298.19	4208332.00	0.00989	(05052812)
609297.81	4208307.50	0.01078	(05050512)		609297.44	4208282.50	0.01112	(05050512)
609297.12	4208258.00	0.01013	(05050512)		609296.75	4208233.00	0.00842	(05061609)

609296.38	4208208.50	0.00669	(05061609)	609296.06	4208183.50	0.00545	(05083115)
609295.69	4208158.50	0.00598	(05083115)	609295.31	4208134.00	0.00604	(05083115)
609295.00	4208109.00	0.00565	(05083115)	609294.62	4208084.50	0.00710	(05071214)
609294.25	4208059.50	0.00902	(05112212)	609293.94	4208034.50	0.01114	(05112212)
609293.56	4208010.00	0.01322	(05112212)	609293.25	4207985.00	0.01524	(05112212)
609292.88	4207960.50	0.01703	(05112212)	609292.50	4207935.50	0.01963	(05071210)
609292.19	4207910.50	0.02505	(05071210)	609291.81	4207886.00	0.02856	(05071210)
609291.44	4207861.00	0.03026	(05081111)	609291.12	4207836.50	0.03853	(05071111)

Appendix D

BACT Cost-Effectiveness Data

ONSITE SYCOM
Energy Corporation

Cost Analysis of NO_x Control Alternatives for Stationary Gas Turbines

Contract No. DE-FC02-97CHIO877

Prepared for:

U.S. Department of Energy
Environmental Programs
Chicago Operations Office
9800 South Cass Avenue
Chicago, IL 60439

Prepared by:

ONSITE SYCOM Energy Corporation
701 Palomar Airport Road,
Suite 200
Carlsbad, California 92009

October 15, 1999

TABLE A-5
1999 CONVENTIONAL SCR COST COMPARISON

				5 MW Class	25 MW Class	150 MW Class
Turbine Model				Solar Centaur 50	GE LM2500	GE Frame 7FA
Turbine Output				4.2 MW	23 MW	161 MW
Direct Capital Costs (DC):			Source			
Purchased Equip. Cost (PE):			MHIA			
Basic Equipment (A):			MHIA	$240,000	$660,000	$2,100,000
Ammonia injection skid and storage	0.00 x A		MHIA	included	included	included
Instrumentation	0.00 x A		OAQPS	included	included	included
Taxes and freight:	0.08 A x B		OAQPS	$19,015	$52,746	$169,530
PE Total:				$256,704	$712,066	$2,288,649
Direct Installation Costs (DI):*						
Foundation & supports:	0.08 x PE		OAQPS	$20,536	$56,965	$183,092
Handling and erection:	0.14 x PE		OAQPS	$35,939	$99,689	$320,411
Electrical:	0.04 x PE		OAQPS	$10,268	$28,483	$91,546
Piping:	0.02 x PE		OAQPS	$5,134	$14,241	$45,773
Insulation:	0.01 x PE		OAQPS	$2,567	$7,121	$22,886
Painting:	0.01 x PE		OAQPS	$2,567	$7,121	$22,886
DI Total:				$77,011	$213,620	$686,595
DC Total:				$333,716	$925,686	$2,975,244
Indirect Costs (IC):						
Engineering:	0.10 x PE		OAQPS	$25,670	$71,207	$100,000
Construction and field expenses:	0.05 x PE		OAQPS	$12,835	$35,603	$114,432
Contractor fees:	0.10 x PE		OAQPS	$25,670	$71,207	$228,865
Start-up:	0.02 x PE		OAQPS	$5,134	$14,241	$45,773
Performance testing:	0.01 x PE		OAQPS	$2,567	$7,121	$22,886
Contingencies:	0.03 x PE		OAQPS	$7,701	$21,362	$68,659
IC Total:				$79,578	$220,741	$580,616
Total Capital Investment (TCI = DC + IC):				$413,294	$1,146,427	$3,555,861
Direct Annual Costs (DAC):						
Operating Costs (O):	24 hrs/day, 7 days/week, 50 weeks/yr					
Operator:	0.5 hr/shift:	25 $/hr for operator pay	OAQPS	$13,125	$13,125	$13,125
Supervisor:	15% of operator		OAQPS	$1,969	$1,969	$1,969
Maintenance Costs (M):						
Labor:	0.5 hr/shift	25 $/hr for labor pay	OAQPS	$13,125	$13,125	$13,125
Material:	100% of labor cost:		OAQPS	$13,125	$13,125	$13,125
Utility Costs:	0% thermal eff	600 (F) operating temp				
Gas usage	0.0 (MMcf/yr)	1,000 (Btu/ft3) heat value				
Gas cost	3,000 ($/MMcf)		variable			
Perf. loss:	0.5%					
Electricity cost	0.06 ($/kwh) performance loss cost penalty		variable	$10,584	$57,960	$405,720
Catalyst replace:	assume 30 ft^3 catalyst per MW, $400/$ft^3$, 7 yr. life		MHIA	$10,352	$56,690	$396,833
Catalyst dispose:	$15/$ft^3$*30 ft^3/MW*MW*.2054 (7 yr amortized)		OAQPS	$388	$2,126	$14,881
Ammonia:	360 ($/ton) [tons NH_3 = tons NO_x * (17/46)]		variable	$3,510	$14,820	$108,257
NH_3 inject skid:	5 (kW) blower	5 kw (NH_3/H_2O pump)	MHIA	$5,040	$7,560	$27,720
Total DAC:				$71,219	$180,500	$994,755
Indirect Annual Costs (IAC):						
Overhead:	60% of O&M		OAQPS	$24,806	$24,806	$24,806
Administrative:	0.02 x TCI		OAQPS	$8,266	$22,929	$71,117
Insurance:	0.01 x TCI		OAQPS	$4,133	$11,464	$35,559
Property tax:	0.01 x TCI		OAQPS	$4,133	$11,464	$35,559
Capital recovery:	10% interest rate, 0.13 x TCI	15 yrs - period	OAQPS	$52,976	$143,272	$415,329
Total IAC:				$94,314	$213,935	$582,370
Total Annual Cost (DAC + IAC):				$165,533	$394,435	$1,577,125
NO_x Emission Rate (tons/yr) at 42 ppm:				33.4	141.0	1030.0
NO_x Removed (tons/yr) at 9 ppm,	79% removal efficiency			26.4	111.4	813.7
Cost Effectiveness ($/ton):				**$6,274**	**$3,541**	**$1,938**
Electricity Cost Impact (¢/kwh):				**0.489**	**0.204**	**0.117**

*Assume modular SCR is inserted into existing HRSG spool piece

REVISED
BEST AVAILABLE CONTROL
TECHNOLOGY ANALYSIS

TOWANTIC ENERGY PROJECT

FEBRUARY 2000

R·W·BECK

1998). This value is derived by a formula specified by CTDEP. The Project's maximum emission rate will be 10 ppm, or 43 percent of the allowable MASC limit.

The use of an SCR for NO_x control in combination with an oxidation catalyst for control of CO may increase particulate emissions in the form of ammonium bi-sulfates. Due to the insignificant amount of sulfur in natural gas fuel this impact will be extremely small. During oil-fired operation (the Project will be limited to 720 hours per year of oil-fired operation) the estimated amount of ammonium bi-sulfate emissions will increase particulate emissions by approximately 60 pounds per hour. This increase has only a minor effect on the maximum predicted air quality impacts from the Project, which are well within National Ambient Air Quality Standards.

An environmental benefit of SCR, when combined with a CO Oxidation Catalyst (Section 1.3), is a decrease in emissions of VOCs. Although the Project is not required to include VOCs in the PSD review as discussed in Section 1.1, the use of an SCR and CO Oxidation Catalyst will ensure that VOC emissions are minimal. The reduction in VOC emissions from SCR/CO Oxidation Catalyst is comparable to that from $SCONO_x$™.

ENERGY ANALYSIS

Use of SCR for NO_x control has an energy penalty due to the energy required to force combustion gases through the SCR reactor. There are other energy requirements associated with chemical transport and operation of equipment, pumps and motors but these are relatively small. Operation of the SCR for the Towantic Project is estimated to reduce electrical output by 1.46 MW or 11,510 MWh of electricity per year[1]. Not only is the electrical output reduced but the fuel use is increased by 135,800 MCF of gas per year.

1.2.4.1.3 ECONOMIC ANALYSIS

Table 3 presents the capital and annualized cost for the SCR control option downstream of a DLN combustor. The costs are itemized to include capital cost of equipment and operation costs for personnel, maintenance, replacement parts (primarily catalyst), energy penalties and ammonia. All costs are for two GE Frame 7FA gas turbine units, each including one HRSG, which includes the SCR unit.

[1] Based on annual capacity factor of 90%.

issues, poses a serious concern as to whether the Project could secure final construction approval from the Council.

As with the SCR/CO Oxidation Catalyst, $SCONO_x^{TM}$ will reduce VOC emissions along with NO_x and CO. The Project is not required to include VOCs in the PSD review, as discussed in Section 1.1, however, $SCONO_x^{TM}$ does have the added benefit of decreasing VOC emissions. The reduction in VOC emissions from $SCONO_x^{TM}$ is comparable to that from SCR/CO Oxidation Catalyst.

1.2.4.2 .2 ENERGY ANALYSIS

Use of $SCONO_x^{TM}$ for NO_x control has an energy penalty due to the energy required to force combustion gases through the $SCONO_x^{TM}$ reactor (pressure drop). Pressure drop through the $SCONO_x^{TM}$ unit is estimated at 5.25 inches by the manufacturer. This is compared to approximately 3.5 inches of pressure drop for a combined SCR and CO catalyst installed in a HRSG. The pressure drop of 5.25 inches reduces the total plant output by approximately 2.19 MW or 17,266 MWh per year. Not only is the electrical output reduced but the fuel use is increased by 202,200 MCF of gas per year.

Production of the steam used in the regeneration process also imposes a penalty in that the steam is not available to generate electricity. Based on the manufacturer's estimate of low-pressure steam requirements of 15,000 pounds per hour at 600°F and 20 psig, the steam turbine capability of the Project will be reduced by approximately 2.5 MW or 19,710 MWh per year.

The additional energy requirements of the $SCONO_x^{TM}$ system (relative to other NO_x control technology) means that the incremental amount of energy will not be supplied by the Project to meet energy needs in the service area. Other power plants will make-up the difference (approximately 4.2 MW) and this will result in a proportional increase in air pollution emissions. These other power plants may emit at levels equal to or greater than the Project.

As with any mechanical system, there are energy requirements associated with the operation of equipment, pumps and motors but these are relatively small. Finally, the $SCONO_x^{TM}$ system consumes 200 pounds per hour of natural gas total for regeneration of the catalyst plus leakage. This results in an annual natural gas consumption of 41,800 MCF.

1.2.4.2.3 ECONOMIC ANALYSIS

Table 4 presents the capital and annualized cost for the $SCONO_x^{TM}$ control option downstream of a DLN combustor. The costs are itemized to include capital cost of equipment and operation costs for personnel, maintenance, replacement parts (primarily catalyst) and energy costs. These costs are based on general information provided during a meeting with representatives from ABB Environmental. ABB Environmental was not able to provide a specific cost quote for a $SCONO_x^{TM}$ system for a GE 7FA combustion turbine with a HRSG. The projected capital costs are based on a $SCONO_x^{TM}$ system designed for an ABB GT-24 unit adjusted for the GE 7FA. The $SCONO_x^{TM}$ system also reduces