APPENDIX J
AIR QUALITY DATA AND MODELING PROTOCOL

APPENDIX J1
AIR QUALITY MODELING PROTOCOL FOR THE WILLOW PASS GENERATING STATION

AIR QUALITY MODELING PROTOCOL FOR THE WILLOW PASS GENERATING STATION
PITTSBURG, CALIFORNIA

Prepared For:

- Bay Area Air Quality Management District

- California Energy Commission

- National Park Service

Prepared on behalf of:

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Appendix A Annual Windrose for the Onsite Pittsburg Meteorological Station

$\mu g/m^3$	micrograms per cubic meter
°C	degrees Celsius
AAQS	Ambient Air Quality Standards
AERMOD	American Meteorological Society/Environmental Protection Agency Regulatory Model
AFC	Application for Certification
AQRV	Air quality related values
ARB	Air Resources Board
ATC	Authority to construct
BAAQMD	Bay Area Air Quality Management District
BACT	Best available control technology
BPIP	Building profile input program
BPIP-Prime	Building Parameter Input Program – Prime
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CEC	California Energy Commission
CO	carbon monoxide
CTG	Combustion turbine generator
DAT	Deposition analysis threshold
DEM	digital elevation models
DOC	Determination of compliance
EC	element carbon
FLAG	Federal Land Managers' Air Quality Related Values Workgroup
FLM	Federal Land Manager
GE	General Electric
GEP	good engineering practice
H_2S	hydrogen sulfide
HARP	Hotspots analysis and reporting program
HHV	higher heating value
HI	hazard index
HNO_3	nitric acid
HRA	Health risk assessment
HRSA	Health Risk Screening Analysis
HRSG	Heat recovery steam generator
ISCST3	Industrial Source Complex Short Term 3rd version
IWAQM	Interagency Workgroup on Air Quality Modeling
kg/ha-yr	kilogram per hectare per year
km	kilometers
LAC	level of acceptable change
LCC	Lambert Conformal Conic
LORS	Laws, ordinances, regulations, and standards
LULC	Land Use Land Cover
MEI	Maximally exposed individual
MICR	maximum individual cancer risk
MM5	mesoscale meteorological model version 5
MW	megawatt

NAAQS	National Ambient Air Quality Standards
$(NH_4)_2SO_4$	Ammonium sulfate
NH_4NO_3	ammonium nitrate
NNSR	Non-attainment New Source Review
NO_2	Nitrogen dioxide
NO_3	nitrate
NO_x	Nitrogen oxides
NPS	National Park Service
NSR	New source review
NWS	National Weather Service
O_3	ozone
OEHHA	Office of Environmental Health Hazard Assessment
OLM	ozone limiting method
Pb	lead
PG&E	Pacific Gas & Electric
PM_{10}	particulate matter less than 10 μm in diameter
$PM_{2.5}$	particulate matter less than 2.5 μm in diameter
PMS	Particulate Matter Speciation
ppb	parts per billion
ppm	parts per million
PPP	Pittsburg Power Plant
PSD	Prevention of significant deterioration
PTC	Permit to Construct
RH	relative humidity
ROC	Reactive organic compound
SCR	Selective catalytic reduction
SIL	Significant impact level
SO_2	Sulfur dioxide
SO_4	sulfate
SOA	Secondary organic aerosol
SO_x	sulfur oxide
STG	steam turbine generator
TAC	toxic air contaminants
the Project	Willow Pass Generating Station
tpy	tons per year
ULN	ultra dry low NO_X
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator
VOC	volatile organic compounds

SECTION 1 INTRODUCTION

1.1 BACKGROUND

The Willow Pass Generating Station (the Project) will be a nominal 500-megawatt (MW) combined cycle power plant to be constructed on the existing Pittsburg Power Plant (PPP) site in Pittsburg, California. The Project will be owned and operated by a wholly owned subsidiary of Mirant California, LLC. The Project will be permitted as a base-loaded facility consisting of two natural gas-fired combustion turbine-electrical generators (CTGs) and two condensing steam turbine generators (STGs). Each CTG will exhaust through a duct-fired heat recovery steam generator (HRSG).

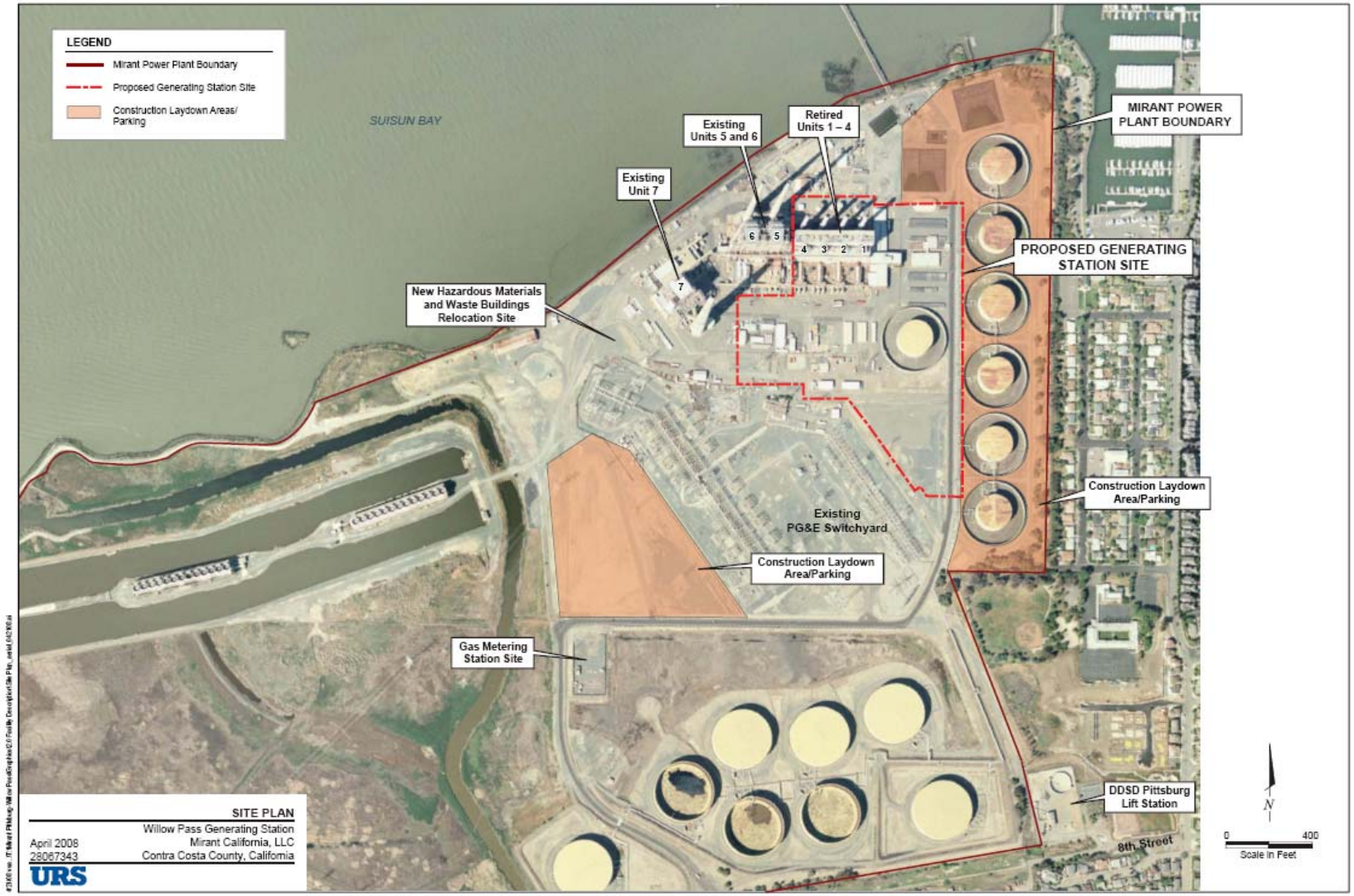
The Project is located completely within the property of the existing Pittsburg Power Plant, which is at 696 West 10th Street, Pittsburg, CA, 94565 (see Figure 1).

The Project is subject to the site licensing requirements of the California Energy Commission (CEC). The CEC will coordinate its independent air quality evaluations with the Bay Area Air Quality Management District (BAAQMD) through the Determination of Compliance (DOC) process. The Project will be a Major Source, as this term is defined in the United States Environmental Protection Agency's (USEPA) Prevention of Significant Deterioration (PSD) regulations, because it is a categorical source (fossil-fuel fired steam electric plant of more than 250 MMBtu/hr heat input) and will have a potential to emit more than 100 tons per year (tpy) of carbon monoxide (CO), particulate matter of diameter less than or equal to 10 microns (PM_{10}) and nitrogen oxides (NO_x). The Project's sulfur oxides (SO_x) emissions are expected to be less than the significant emission level or 40 tons per year. Thus PSD analyses are required for the criteria pollutants which the proposed Project's Potential to Emit exceed the PSD significant emission levels.

Since the Project triggers PSD review, the air dispersion modeling for this project will be conducted in conformance with PSD requirements. For example, worst-case predicted impacts will be compared with the applicable monitoring exemption limits to demonstrate that the Project will be exempt from the requirements relating to pre-construction ambient air quality monitoring. The PSD regulations apply only to those pollutants for which the project area is in attainment of the National Ambient Air Quality Standards (NAAQS). State and local new source review (NSR) and non-attainment NSR (NNSR) regulations potentially apply to all criteria pollutants, depending on the quantity of pollutants emitted.

The area around the Project is classified as attainment with respect to the NAAQS for nitrogen dioxide (NO_2), CO, and sulfur dioxide (SO_2), unclassified for particulate matter with diameter less than 2.5 micrometers and 10 micrometers ($PM_{2.5}$ and PM_{10}, respectively), and non-attainment for ozone (O_3). With respect to the California Ambient Air Quality Standards (CAAQS), the area around the Project is classified as attainment for NO_2, CO, sulfates, lead (Pb), hydrogen sulfide (H_2S), and SO_2, and non-attainment for O_3, PM_{10}, and $PM_{2.5}$. NO_x and SO_x are regulated as PM_{10} precursors, and NO_x and volatile organic compounds (VOC) as O_3 precursors. Project emissions of non-attainment pollutants and their precursors will be offset to satisfy federal and local NNSR regulations.

Figure 1
General Vicinity – Willow Pass Generating Station



1.2 PURPOSE

The CEC, BAAQMD and EPA all require the use of atmospheric dispersion modeling to demonstrate that a new power generation facility or modification to an existing facility will comply with applicable air quality standards. These agencies also require an assessment of the potential impacts on human health from the toxic air contaminants that may be emitted by such projects. In addition, CEC power plant siting regulations require modeling to evaluate the cumulative impacts of the proposed project with other new and reasonably foreseeable projects within 6 miles of the project site.

This document summarizes the procedures that are proposed for the air dispersion modeling for project certification and permitting. Modeling of both operation and construction emissions due to the proposed Project will be performed in accordance with CEC and BAAQMD guidance. This protocol is being submitted to the CEC and BAAQMD for their review and comment prior to completion of the applicable permit applications. BAAQMD has been delegated the authority to review the PSD permits by EPA and will thus conduct the PSD review for EPA. The protocol will also be provided to the National Park Service for review of the Class I analyses conducted to obtain a PSD permit for the proposed Project. The proposed model selection and modeling approach is based on review of applicable regulations and agency guidance documents, and recent discussions with staffs of the responsible agencies.

SECTION 2 PROJECT DESCRIPTION

2.1 PROJECT LOCATION

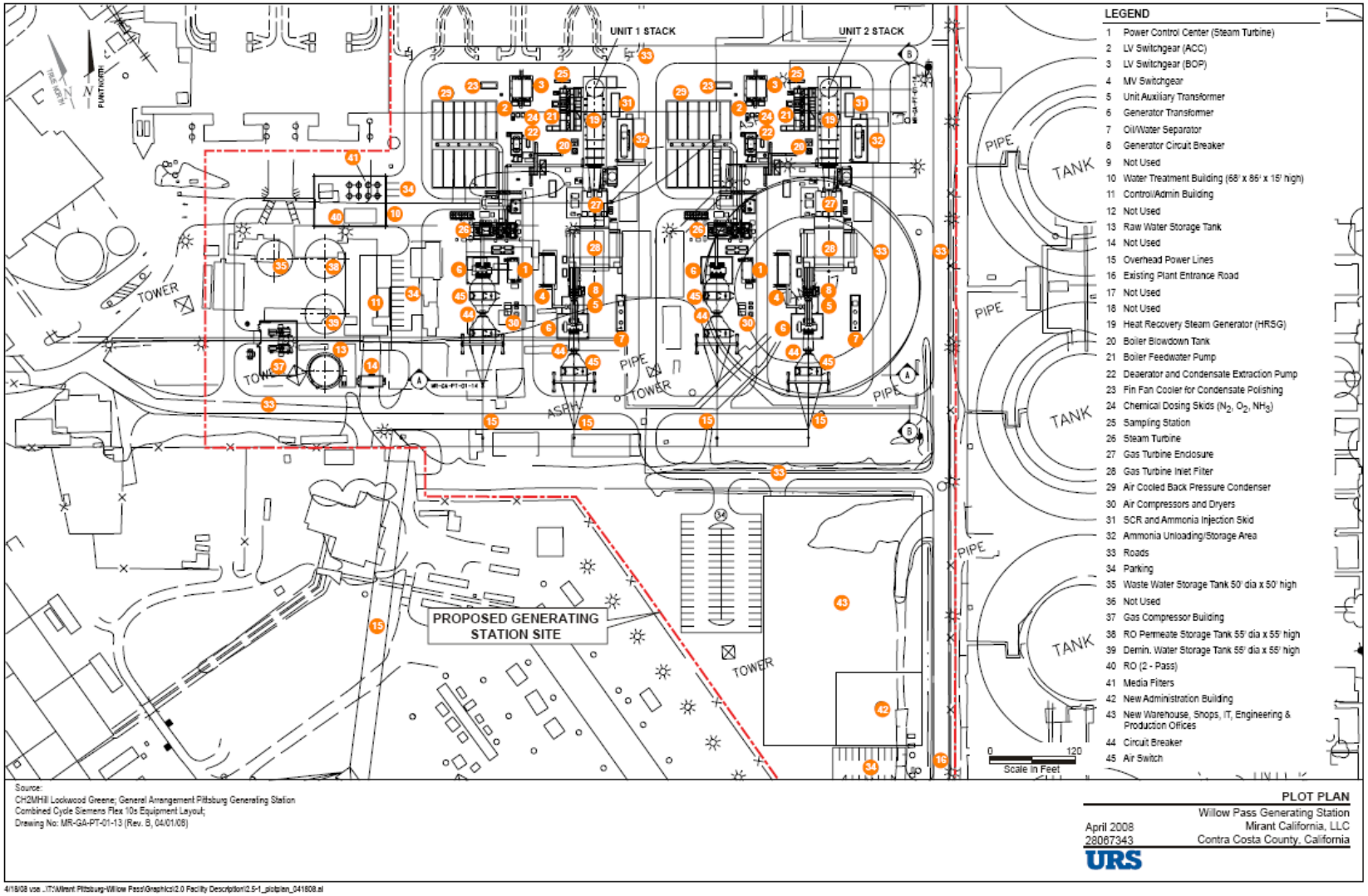
The proposed Project will be constructed entirely within the existing Mirant Pittsburg Power Plant (PPP) site, located at 696 West 10th Street, Pittsburg, California. The proposed new generation units will be located on approximately 17 acres in the east central portion of the existing 1,000-acre PPP site. The demolition of the existing PPP Units 1-4, unused fuel oil storage Tank 7, administrative building, hazardous materials storage building, hazardous waste building and ancillary facilities will be required to create room for the proposed Project. These structures will be demolished as part of the Project. Figure 1 shows the locations of the proposed Project and existing structures.

2.2 DESCRIPTION OF THE PROPOSED SOURCES

The proposed project will consist of a 500 MW combined cycle electric generating facility with two power blocks. Each power block will contain one Siemens Flex Plant 10 combustion turbine generator, one heat recovery steam generator (HRSG), one steam turbine generator and one air cooled condenser (ACC), and associated auxiliary systems and equipment. Figure 2 shows the layout of the proposed Project, including the locations of all major new and existing equipment.

Fuel for the CTGs and HRSGs will be exclusively pipeline-quality natural gas. The maximum fuel flow rate for each power block will be approximately 2,300 MMBtu/hr (higher heating value, HHV). Each CTG will be equipped with ultra dry low NO_X (ULN) combustors, power augmentation, and inlet air evaporative cooler. An additional post-combustion NO_X control system, a selective catalytic reduction (SCR) system, will be provided in each HRSG to further reduce the NO_X emissions to the atmosphere. The SCR system for each HRSG will operate with aqueous ammonia injected into the exhaust gas stream upstream of a catalyst bed to reduce NO_X to inert nitrogen and water. An oxidation catalyst system will also be incorporated into the HRSG to control emissions of CO and VOC.

Figure 2
Willow Pass Generating Station Plot Plan and Fenceline



SECTION 3 REGULATORY SETTING

3.1 CALIFORNIA ENERGY COMMISSION REQUIREMENTS

For projects with electrical power generation capacity greater than 50 MW, CEC requires that applicants prepare a comprehensive Application for Certification (AFC) document addressing the proposed project's environmental and engineering features. An AFC must include the following air quality information (CEC, 1997):

- A description of the Project, including project emissions of air pollutants and greenhouse gases, fuel type(s), control technologies and stack characteristics;
- The basis for all emission estimates and/or calculations;
- An analysis of Best Available Control Technology (BACT) according to Bay Area Air Quality Management District (BAAQMD) Rules;
- Existing baseline air quality data for all regulated pollutants;
- Existing meteorological data, including temperature, wind speed and direction, and mixing height;
- A listing of applicable laws, ordinances, regulations, standards (LORS), and a determination of compliance with all applicable LORS;
- An emissions offset strategy;
- An air quality impact assessment (i.e., a demonstration of compliance with national and state ambient air quality standards [AAQS] and PSD review, when required) and protocol for the assessment of cumulative impacts of the proposed project along with recently permitted projects and those currently under construction within a 10 km radius; and
- An analysis of human exposure to air toxics (i.e., health risk assessment [HRA]).

For the Project, the air quality impact assessment, the cumulative impacts assessment, and the HRA will be performed using dispersion models.

3.2 BAY AREA AIR QUALITY MANAGEMENT DISTRICT REQUIREMENTS

The BAAQMD has promulgated NSR requirements under Regulation 2, Rule 2. In general, all equipment with the potential to emit air pollutants is subject to the requirements of this rule, which has the following major requirements that potentially apply to new sources such as the Project:

- Installation of BACT.
- Ambient air quality impact modeling to demonstrate compliance with NAAQS and CAAQS and to evaluate impacts to plume visibility in Class I areas near the proposed source(s).
- Emission offsets.
- Statewide compliance for all applicant-owned or operated facilities in California.

Assembly Bill 2588, California Air Toxics Hot Spots Program and BAAQMD Regulation 2, Rule 5 establish allowable incremental health risks for new or modified sources of toxic air contaminant (TAC) emissions. The BAAQMD rule specifies limits for maximum individual cancer risk (MICR), and non-carcinogenic acute and chronic hazard indices (HI) for new or modified sources of TAC emissions. The health risks resulting from project emissions, as demonstrated by means of an approved health risk assessment, must not exceed established threshold values.

3.3 U.S. ENVIRONMENTAL PROTECTION AGENCY REQUIREMENTS

USEPA has promulgated PSD regulations applicable to new Major Sources and Major Modifications to existing Major Sources. The Project will be a Major Source because it is a fossil-fuel fired steam electric plant of more than 250 MMBtu/hr heat input and will have the potential to emit more than 100 tpy of NO_x, PM_{10} and CO. Many of the PSD requirements are the same as the AFC and BAAQMD Regulation 2, Rule 2 requirements described above (e.g., project description, BACT, ambient air quality standards analysis). The BAAQMD will review the PSD application for EPA, although the National Park Service will review the Class I area analyses. However, PSD permits require the following additional analyses:

- An analysis of the potential impacts from the new emissions from the Project relative to PSD Significant Impact Levels (SILs) and PSD Increments;
- An analysis of air quality related values (AQRV) to ensure the protection of visibility in federal Class I National Parks and National Wilderness Areas within 100 km of the proposed project;
- An evaluation of potential impacts on soils and vegetation of commercial and recreational value; and
- An evaluation of potential growth-inducing impacts.

However, as discussed further in Section 5 of this protocol, the National Park Service (NPS) is considering a policy change that would allow projects to be screened out of the requirement to conduct a Class I PSD increment analysis and Air Quality Related Values (AQRV) analysis under certain conditions. If adopted, this policy would specifically allow projects to avoid these analyses if the ratio of the combined annual project emissions rates (tons per year) for NO_x, PM and SO_x to the distance (kilometers) between the source and the nearest Class I area is less than a threshold value. Thus, depending on the final screening criteria adopted by NPS, the portion of this protocol dealing with Class I increment and AQRV analysis for the Point Reyes National Seashore may not apply to the Willow Pass Generating Station.

SECTION 4 AIR QUALITY IMPACT ANALYSIS FOR CLASS II AREAS

This section describes the dispersion models and modeling techniques that will be used in performing the near-field criteria pollutant impact analysis for the Project. The objectives of the modeling are to demonstrate that air emissions from the Project will not cause incremental impacts that exceed the Class II PSD Significant Impact Levels (SILs), nor contribute to exceedances of state or federal ambient air quality standards.

In November 2005, the USEPA officially recognized the American Meteorological Society/ Environmental Protection Agency Regulatory Model (AERMOD) as the preferred dispersion model for regulatory applications, replacing the Industrial Source Complex Short Term 3 (ISCST3) model. Also, both CEC and BAAQMD staff recommend the use of AERMOD for power plant licensing/permitting analyses. Accordingly, AERMOD (Version 07026) will be used for the dispersion modeling associated with the Project.

4.1 TURBINE SCREENING MODELING

An initial screening modeling analysis will be conducted to determine the turbine stack parameters for the most important sources of the operational project, i.e., the CTGs/HRSGs, that correspond to maximum ground-level pollutant concentrations. This information will be obtained by running a series of AERMOD simulations with the full meteorological input data set (see Section 4.6) with source inputs representing a range of different load conditions and ambient temperatures. The stack parameters that align with the highest offsite impact from these sources for each pollutant and averaging time period will be used in the subsequent refined modeling simulations.

4.2 REFINED MODELING

The purpose of the refined modeling analysis is to demonstrate that air emissions from the Project will not cause or contribute to an ambient air quality violation. The AERMOD model (version 07026) will be used for the refined modeling of criteria pollutants. Specific modeling procedures that will be used for evaluating project impacts versus the state and federal ambient air quality standards, PSD significance thresholds and applicable health risk criteria are discussed below. Table 4-1 shows the regulatory criteria that will be used to evaluate the significance of predicted pollutant concentrations. Refined modeling using AERMOD will be conducted to evaluate impacts from both the construction and operational phases of the Project.

Analysis of land uses adjacent to the Project was conducted in accordance with Section 8.2.8 of the Guideline on Air Quality Models (EPA-450/2-78-027R and Auer [1978]), EPA AERMOD implementation guide (2004), and its addendum (2006). Based on the Auer land use procedure, more than 50 percent of the area within a 3-km radius of the Project is classified as rural. This classification is at least, in part, a result of the Project's proximity to Suisun Bay across the entire northern PPP site boundary. Since the Auer classification scheme requires more than 50 percent of the area within the 3-km radius around a proposed new source to be non-rural for an urban classification, the rural mode will be used in the AERMOD modeling analyses. All regulatory default options will be used, including building and stack tip downwash, default wind speed profiles, exclusion of deposition and gravitational settling, consideration of buoyant plume rise, and complex terrain.

Table 4-1
Relevant Ambient Air Quality Standards and Significance Levels

Pollutant	Averaging Time	CAAQS (a, b)	NAAQS (b, c)	PSD Class II Significance Impact Levels ($\mu g/m^3$)	PSD Significant Emission Rates (tpy)	PSD Increments ($\mu g/m^3$)	
						Class I	Class II
CO	8-hour	9.0 ppm (10,000 $\mu g/m^3$)	9.0 ppm (10,000 $\mu g/m^3$)	500	100		
	1-hour	20 ppm (23,000 $\mu g/m^3$)	35 ppm (40,000 $\mu g/m^3$)	2,000			
NO_2	Annual	0.030 ppm (56 $\mu g/m^3$)	0.053 ppm (100 $\mu g/m^3$)	1	40	2.5	25
	1-hour	0.18 ppm (338 $\mu g/m^3$)		19[d]			
SO_2	Annual		0.03 ppm (80 $\mu g/m^3$)	1	40	2	20
	24-hour	0.04 ppm (105 $\mu g/m^3$)	0.14 ppm (365 $\mu g/m^3$)	5		5	91
	3-hour		0.5 ppm (1,300 $\mu g/m^3$)	25		25	512
	1-hour	0.25 ppm (655 $\mu g/m^3$)					
PM_{10}	Annual	20 $\mu g/m^3$	See footnote[e]	1	15	4	17
	24-hour	50 $\mu g/m^3$	150 $\mu g/m^3$	5		8	30
$PM_{2.5}$	Annual	12 $\mu g/m^3$	15 $\mu g/m^3$				
	24-hour		35 $\mu g/m^3$				
O_3	8-hour	0.07 ppm (137 $\mu g/m^3$)	0.075 ppm (147 $\mu g/m^3$)	See footnote[f]			
	1-hour	0.09 ppm (180 $\mu g/m^3$)	See footnote[g]				

Notes:

a. California standards for ozone (as volatile organic compound), carbon monoxide, sulfur dioxide (1-hour), nitrogen dioxide, and PM_{10}, are values that are not to be exceeded. The visibility standard is not to be equaled or exceeded.

b. Concentrations are expressed first in units in which they were promulgated. Equivalent units are given in parentheses and based on a reference temperature of 25°C and a reference pressure of 760 mm of mercury. All measurements of air quality area to be corrected to a reference temperature of 25°C and a reference pressure of 760 mm of mercury (1,013.2 millibars).

c. National standards, other than those for ozone and based on annual averages, are not to be exceeded more than once a year. The ozone standard is attained when the expected number of days per calendar year with maximum hourly avg concentrations above the standard is ≤ 1.

d. Per BAAQMD Rule 2-2-233, June 15, 1994 .

e. The federal annual PM_{10} standard was revoked by USEPA on October 17, 2006.

f. Modeling is required for any net increase of 100 tons per year or more of ROC subject to PSD.

g. The federal 1-hour ozone standard was revoked by USEPA on June 15, 2005.

4.2.1 PSD Modeling Analyses

As the proposed Project will trigger PSD as a Major Source, modeling will be required to determine whether its incremental impacts on ambient levels of attainment pollutants (NO_2, SO_2 and CO) will exceed Class II significant impact levels, or SILs. If these SILs were predicted to be exceeded, then a modeling analysis would be required to include all increment consuming sources that have been installed since the local PSD baseline date. However, it is anticipated that the increased emissions of these pollutants due to the Project will not cause incremental effects above the federal SILs.

4.2.2 Ambient Air Quality Standards Analysis

Compliance with the BAAQMD Regulation 2, Rule 2 modeling requirements for attainment pollutants will be demonstrated by modeling to determine the maximum ground-level concentrations of the proposed Project among all receptors, and adding conservative background concentrations, based on recent data from the most representative BAAQMD air quality monitoring station. The Project will not be considered to cause or contribute to a near-field ambient air quality violation unless impacts from these sources combined with the background concentration exceed the most stringent ambient air quality standard.

NO_2 impact estimates for both the 1-hour and annual averaging times will be modeled by executing AERMOD with the USEPA ozone limiting method (OLM) option for both hourly and annual impacts. Hourly ozone measurement data collected at the Pittsburg BAAQMD air quality monitoring station for the same years corresponding to the meteorological input data will be used when conducting the OLM modeling.

Note that emissions reduction credits will be obtained by the applicant to provide at least a one-to-one offsetting of all Project emissions increases of all non-attainment pollutants and their precursors (i.e., NO_x, reactive organic compound [ROC], PM_{10} and SO_2).

4.2.3 Health Risk Assessment Analysis

Both CEC and BAAQMD require a HRA to evaluate potential health effects of TAC emissions from the operation of the Project. Contaminants emitted by the Project with potential carcinogenic effects or chronic and/or acute non-carcinogenic effects will be considered. This health risk assessment will be performed following the Office of Environmental Health Hazard Assessment (OEHHA), Air Toxics Hot Spots Program Risk Assessment Guidelines (OEHHA, 2003) and BAAQMD Air Toxics NSR Program Health Risk Screening Analysis (HRSA) Guidelines (BAAQMD, 2005). As recommended by the OEHHA Guidelines, the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP) will be used to perform an OEHHA Tier 1 health risk assessment for the Project. HARP includes two modules: a dispersion module and a risk module. The HARP dispersion module incorporates the USEPA ISCST3 air dispersion model, and the HARP risk module implements the latest Risk Assessment Guidelines developed by OEHHA. For consistency with the criteria pollutant modeling, the dispersion modeling will be conducted with AERMOD. The Air Resources Board (ARB) has created a beta version software package, HARP File Converter, to convert AERMOD dispersion results into a format that can be read into the HARP risk module. Thus HARP with AERMOD will be used for this HRA.

First, ground-level concentrations from the Project emissions will be estimated using the AERMOD dispersion model. The dispersion modeling analysis will be consistent with, and use similar input parameters as the modeling approach discussed above for the AAQS analyses using AERMOD. The same five-year meteorological data set that will be used for the criteria pollutant air quality impact assessment will be used in the HRA (see meteorological discussion in Section 4.6.1). The maximum 1-hour and annual impacts determined by AERMOD will be used in the HARP model to estimate the corresponding health risks.

Incremental cancer risk will be estimated using the "Derived (Adjusted)" calculation method. For the calculation of cancer risk, the duration of exposure to project emissions will be assumed to be 24 hours per day, 365 days per year, for 70 years, at all receptors. Chronic non-cancer risks will be calculated by means of the "Derived (OEHHA)" method. No drinking water reservoirs are near the Project; thus the drinking water consumption pathway will not be included in this analysis. All other pathways including cattle/dairy consumption and fish consumption will be included in the HRA and the selection of these pathway parameters will be discussed. Default rural values for home grown produce, local pig, chicken and egg consumption, dermal absorption, soil ingestion and mother's milk will be used in the HRA

The HRA performed by means of the HARP model will follow the following steps:

- Define the location of the maximally exposed individual (MEI) (i.e., the location where the highest carcinogenic risk due to emission sources of the Project may occur);
- Define the locations of the maximum chronic non-carcinogenic health effects and the maximum acute health effects; and
- Calculate concentrations and health effects at locations of maximum impact for each pollutant.

4.3 MODELING EMISSIONS INVENTORY

4.3.1 Operational Project Sources

Operational emissions from the Project will be dominated by the CTGs with HRSGs. The conceptual plant design includes SCR for NO_x and oxidation catalysts for CO that will comply with recent BACT determinations for similar projects in California and elsewhere. Emissions of SO_2 and PM_{10} will be maintained at low levels, owing to the exclusive use of interstate pipeline quality natural gas as fuel for the gas turbines and HRSGs. Table 4-2 summarizes the estimated annual emissions from the two CTG/HRSGs for each criteria pollutant. This table does not include the small contribution to project emissions that will come from the diesel powered fire water pump. However, emissions from the fire water pump will be included in the dispersion modeling conducted for the Project.

Table 4-2
Approximate Annual Pollutant Emissions from the two Turbines/HRSGs

Pollutant	Annual Emissions (tpy)
	2 Turbines/HRSGs
NO_x	77
CO	142
SO_2	11
PM_{10}	39
VOC	29

4.3.2 Project Construction Sources

Temporary construction emissions will result from heavy equipment exhaust (primarily NO_x and diesel particulate emissions), fugitive dust (PM_{10}) from demolition, earthmoving activities and vehicle traffic on paved and unpaved surfaces. A detailed Excel Workbook will be created to estimate criteria pollutant emissions for non-overlapping phases of Project demolition and construction, based on information from the Project design engineers on the equipment use by month throughout the construction schedule, and the area extent of ground disturbance that will occur during different construction phases. Depending on the magnitude of emissions for different pollutants and the proximity of construction activities to the property boundary for each phase, emission scenarios representing reasonable worst-case demolition and/or construction activities, including emissions from combustion equipment and fugitive dust, for each averaging time will be selected for subsequent dispersion modeling to ensure that maximum off-site air quality impacts due to these temporary activities will be assessed. Two separate construction scenarios will be modeled: a demolition phase and a construction phase. The selected emissions scenarios will be modeled using AERMOD with the same meteorological input data used for the modeling of the Project's operational emissions. Fugitive dust from the construction site, including the corridors for new transmission lines, gas lines or water pipelines, parking areas and lay-down areas will be modeled as area or volume sources. Fuel burning equipment will be represented as point sources deployed in appropriate locations within the project site. Ultra-low sulfur diesel fuel (15 ppm by weight or less) will be utilized on any emission calculations for construction equipment used at the Project site.

4.3.3 Toxic Air Contaminant Sources

TACs will also be emitted from the operational Project due to combustion of natural gas in the CTG/HRSGs. However, only small quantities of TACs will be emitted from these sources - primarily benzene, formaldehyde, and polycyclic aromatic hydrocarbons, since natural gas will be the only fuel used in the CTG/HRSG trains. Emission estimates for TACs from the CTG/HRSGs will be based on emission factors obtained from standard CARB, and EPA factors and/or vendor data, if available. Diesel particulate emissions from the fire water pump will be estimated using vendor data or USEPA emission factors.

4.3.4 Cumulative Impact Analysis Including Off-Property Sources

A cumulative modeling analysis will be performed using AERMOD to evaluate the combined impacts of the Project emissions increases with those of any other new sources within 6 miles from the Project that are currently either under construction, undergoing permitting or expected to be permitted in the near future. Requests will be made to the BAAQMD, Contra Costa County Planning Department, the City of Pittsburg, and adjacent cities to request information that will be used to develop lists of all such new or planned emission sources. When received, these lists will be forwarded to CEC for review. Based on this information, and the CEC response, additional sources may be included in the cumulative source modeling analysis.

Since the Project will be located within the site property of the existing operational PPP, anther set of cumulative modeling runs will be conducted to evaluate the plant-wide impacts of emissions from the existing PPP units with those of the Project. Thus two cumulative modeling analyses will be conducted, one to assess plant-wide impacts and another to assess impacts from the Project, existing PPP sources and new or anticipated sources within a 10 kilometer radius of the Project. This dual modeling approach is consistent with CEC's guidance for cumulative impact analyses on other recent California projects where new generating units have been proposed on an existing power plant site.

4.4 BUILDING WAKE EFFECTS

The effect of building wakes (i.e., downwash) upon the stack plumes of emission sources at the facility will be evaluated in accordance with USEPA guidance (USEPA, 1985). Direction-specific building data will be generated for stacks below good engineering practice (GEP) stack height using the most recent version of USEPA Building Parameter Input Program – Prime (BPIP-Prime). Appropriate information will be provided in the AFC and other permit applications that describe the input assumptions and output results from the BPIP-Prime model.

4.5 RECEPTOR GRID

The receptor grids that will be used in the AERMOD modeling analyses described in this protocol for operational sources will be as follows:

- 25-meter spacing along the fenceline and extending from the fenceline out to 100 meters beyond the property line;
- 100-meter spacing from 100 m to 1 km beyond the property line;
- 500-meter spacing within 1 to 5 km of project sources; and
- 1,000-meter spacing within 5 to 10 km of project sources.

During the refined modeling analysis for operational Project emissions, if a maximum predicted concentration for a particular pollutant and averaging time is located within a portion of the receptor grid with spacing greater than 25 meters, a supplemental dense receptor grid will be placed around the original maximum concentration point and the model will be rerun. The dense grid will use 25-meter spacing and will extend to the next grid point in all directions from the original point of maximum concentration.

Due to the large computation time required to run AERMOD, this receptor grid, with the additional dense nested grid points, was determined to best balance the need to predict maximum pollutant concentrations and allow the all operational modeling runs to be completed in a reasonably timely manner.

Because construction emission sources release pollutants to the atmosphere from small equipment exhaust stacks or from soil disturbances at ground level, maximum predicted construction impacts for all pollutants and averaging times will occur within the first kilometer from the Project boundary. Accordingly, only the portion of the above grid out to a distance of 1 km will be used for the construction modeling.

For the HRA, boundary receptors will be placed every 25 meters along the property fence line. Grid receptors will be spaced every 100 meters out to 10 kilometers from the site in every direction. Any risks calculated by the HARP model at onsite grid receptors will be ignored.

Certain groups of individuals may be more susceptible to health risks due to chemical exposure, including children, pregnant women, the elderly, and people with chronic illnesses who could have higher sensitivity to toxic pollutants. Consequently, sensitive receptors, such as schools (public and private), day care facilities, convalescent homes, parks, and hospitals will receive particular attention in the health risk analysis. All sensitive receptors located within a 3-mile radius of the site will be included in the HRA.

Census receptors out to 10 km will be included; these receptors are located in the populated areas nearest to the proposed Project. Discrete receptors will also be placed at the locations of nearby residences.

A detailed project map will be provided in the AFC showing the locations of the grid receptors. Actual Universal Transverse Mercator (UTM) coordinates will be used. The CAAQS and NAAQS apply to all locations outside the applicant's facility (i.e., everywhere where public access is not under the control of the applicant). Therefore, the fenceline will be placed along the facility's property boundary, and the receptors will be placed on and outside of the fenceline.

4.6 METEOROLOGICAL AND AIR QUALITY DATA

4.6.1 Meteorological Data

Onsite meteorological data have been collected on the PPP site for many years by Pacific Gas and Electric (PG&E). Excellent data capture occurred for the years 2002 through 2005, and thus these years were selected to be used to create the AERMET data input file.

The USEPA Meteorological Monitoring Guidance for Regulatory Modeling Applications (USEPA, 2000) outlines how to determine if site specific meteorological data are representative and thus acceptable for input for air quality modeling. The guidance states "in general, for use in air quality modeling applications, meteorological data should be representative of conditions affecting the transport and dispersion of pollutants in the "area of interest" as determined by the locations of the sources and receptors being modeled".

Both the Project and the meteorological station are located on the southern bank of Suisun Bay within the boundary of the PPP site and are the same distances from prominent terrain features in the surrounding

area. Wind and temperature data would be the same at both the meteorological station and the Project, thus the meteorological station and the Project are within the area of interest.

The 2002 through 2005 data set represents data collection over four years. Although only one year of onsite data are required, a four-year data set was selected to better represent project site conditions, as well as to capture worst-case meteorological conditions. The meteorological station was re-calibrated annually to ensure quality data were collected.

In processing the data for input into AERMOD, additional parameters typically not collected at site-specific stations are required; thus, the onsite data are supplemented with data from the nearest National Weather Service (NWS) station. Surface data will be obtained from the Concord Buchanan Field Airport for the same years, as the onsite data, 2002-2005. This station is approximately 15 kilometers southwest of the Project and is surrounded by suburban areas, in rolling terrain. The terrain immediately surrounding the Project site can be categorized as suburban with rolling hills; thus the land use and the location with respect to near-field terrain features are similar. Cloud cover information from Concord Buchanan Field Airport data will be used in modeling; however, Concord surface winds will not be substituted for missing hours in the PPP onsite meteorological data sets.

The Oakland Airport upper air data monitoring station is located approximately 45 kilometers southwest of the Project. This is the closest upper air station and was determined the most representative data available for use in this modeling analysis. The MODIFY option will be used for Oakland upper air data AERMET processing in order to perform some preliminary quality control as the data are extracted.

The land use surrounding the PG&E meteorological station and the Project can primarily be split into 2 categories, water with scattered wetlands to the north and suburban residential to the south. The AERSURFACE model was used to determine the surface characteristics from land cover data from United States Geological Survey (USGS).

AERSURFACE calculates that surface roughness from the land cover data for a 1 kilometer radius around the meteorological tower and the albedo and Bowen ratio from a 10 by 10 kilometer area around the meteorological tower adhering to the recommendations from the AERMOD Implementation Guide (USEPA, 2008). Representative surface moisture input will be determined for each month of every year using Antioch Pump Plant 3 meteorological station precipitation data, and use of the percentile method specified in the AERSURFACE User's Guide. The surface moisture determinations are provided by BAAQMD in Table 4-3. Months assigned to each season will be as follows: Spring— February and March; Summer—April through July; Fall—August through October; Winter (not receiving continuous snow cover)—November through January. The seasonal variability of the surface characteristics are presented in Table 4-4 for all surface moisture conditions (average, wet or dry), although only the moisture condition matching the data in Table 4-3 will be input in the model. These are the surface characteristics that will be used for input into AERMET.

An annual wind rose based on the four years of onsite meteorological data is provided as Appendix A to this protocol document. Winds blow predominantly from the west.

Table 4-3
Surface Moisture Conditions for Years 2002-2005

Surface moisture condition by month for the Antioch Pump Plant 3 Station												
Year	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
2002	dry	dry	avg	dry	dry	dry	dry	dry	dry	dry	avg	wet
2003	avg	dry	avg	wet	wet	dry	dry	wet	dry	dry	avg	wet
2004	avg	wet	dry	dry	avg	dry	dry	dry	dry	wet	avg	wet
2005	wet	avg	wet	avg	avg	wet	dry	dry	dry	dry	dry	wet

Note: Surface moisture conditions provided by BAAQMD

Table 4-4
Land Use Characteristics used in AERMET

Month	Sector	Range	Land Use Characteristics				
			Albedo (α)	Bowen Ratio (β) Average Surface Moisture	Bowen Ratio (β) Dry Surface Moisture	Bowen Ratio (β) Wet Surface Moisture	Surface Roughness (Z_o) (m)
Jan	1	90°-270°	0.15	0.35	0.57	0.26	0.023
Jan	2	270°-90°	0.15	0.35	0.57	0.26	0.007
Feb	1	90°-270°	0.14	0.27	0.47	0.23	0.025
Feb	2	270°-90°	0.14	0.27	0.47	0.23	0.007
Mar	1	90°-270°	0.14	0.27	0.47	0.23	0.025
Mar	2	270°-90°	0.14	0.27	0.47	0.23	0.007
Apr	1	90°-270°	0.14	0.31	0.54	0.24	0.026
Apr	2	270°-90°	0.14	0.31	0.54	0.24	0.007
May	1	90°-270°	0.14	0.31	0.54	0.24	0.026
May	2	270°-90°	0.14	0.31	0.54	0.24	0.007
Jun	1	90°-270°	0.14	0.31	0.54	0.24	0.026
Jun	2	270°-90°	0.14	0.31	0.54	0.24	0.007
Jul	1	90°-270°	0.14	0.31	0.54	0.24	0.026
Jul	2	270°-90°	0.14	0.31	0.54	0.24	0.007
Aug	1	90°-270°	0.14	0.35	0.57	0.26	0.026
Aug	2	270°-90°	0.14	0.35	0.57	0.26	0.007
Sep	1	90°-270°	0.14	0.35	0.57	0.26	0.026
Sep	2	270°-90°	0.14	0.35	0.57	0.26	0.007
Oct	1	90°-270°	0.14	0.35	0.57	0.26	0.026
Oct	2	270°-90°	0.14	0.35	0.57	0.26	0.007
Nov	1	90°-270°	0.15	0.35	0.57	0.26	0.023
Nov	2	270°-90°	0.15	0.35	0.57	0.26	0.007
Dec	1	90°-270°	0.15	0.35	0.57	0.26	0.023
Dec	2	270°-90°	0.15	0.35	0.57	0.26	0.007

4.6.2 Air Quality Monitoring Data

Air quality monitoring data to represent existing air quality in the Project area were obtained from the USEPA AirData (2006) and the CARB-California Air Quality Data website (2006). The most recent three years of data (2004-2006) from the Pittsburg, Concord, and Bethel Island monitoring stations were collected to determine the most representative baseline concentrations for each air pollutant and averaging period addressed in the California and National ambient air quality standards. The maximum concentration recorded at these monitoring stations over the three-year period will be used as a conservative representation of existing air quality condition at the site of the proposed Project.

The Pittsburg monitoring station is located approximately half a mile south of the Project site and monitors all criteria pollutants except $PM_{2.5}$. The Concord station is approximately 10 miles southwest of the site and also monitors all pollutants. The Bethel Island station is located to the east-southeast approximately 14 miles from the site and monitors all criteria pollutants except $PM_{2.5}$.

The selected maximum baseline concentrations for all pollutants are summarized in Table 4-5. These data will be added to the modeled maximum impacts due to project emissions for each pollutant and averaging time, and the totals will then be compared with the applicable AAQS. This is a conservative approach because it assumes that the highest recorded background values and the modeled maximum impacts occur at the same time and location for each pollutant and averaging time, a highly unlikely scenario. Note that the maximum background concentrations of PM_{10} and $PM_{2.5}$ currently exceed the corresponding CAAQS and NAAQS.

Table 4-5
Highest Monitored Pollutant Concentrations near the Project Site (2004 – 2006)

Pollutant	Averaging Time	Highest Monitoring Concentration	Monitoring Station	Year
CO	1 hour	4.1 ppm (4,715 μg/m^3)	Pittsburg	2004
	8 hour	2.0 ppm (2,222 μg/m^3)	Concord	2004
NO_2	1 hour	0.065 ppm (122.1 μg/m^3)	Concord	2004
	Annual	0.012 ppm (22.4 μg/m^3)	Concord	2004
SO_2	1 hour	0.090 ppm (235.8 μg/m^3)	Concord	2004
	3 hour	0.044 ppm (114.4 μg/m^3)	Concord	2004
	24 hour	0.010 ppm (26.3 μg/m^3)	Concord	2004
	Annual	0.002 ppm (5.3 μg/m^3)	Concord	2004
PM_{10} (Non-attainment area)	24 hour	84 μg/m^3	Concord	2006
	Annual	22 μg/m^3	Pittsburg	2004
$PM_{2.5}$ (Non-attainment area)	24 hour	74 μg/m^3	Concord	2004
	Annual	12 μg/m^3	Concord	2004

4.7 FUMIGATION MODELING

Fumigation can occur when a stable layer of air lies a short distance above the release point of a plume and unstable air lies below. Especially on sunny mornings with light winds, the heating of the earth's surface causes a layer of turbulence, which grows in depth over time and may intersect an elevated exhaust plume. The transition from stable to unstable surroundings can rapidly draw a plume down to ground level and create relatively high pollutant concentrations for a short period. Typically, a fumigation analysis is conducted using SCREEN3 when the project site is rural and the stack height is greater than 10 meters.

A fumigation analysis will be performed using the USEPA model SCREEN3. The SCREEN3 model will be used to calculate concentrations from both inversion breakup fumigation and shoreline fumigation. A unit emission rate will be used (1 gram per second) in the fumigation modeling to represent the project emissions and the model results will be scaled to reflect expected plant emissions for each pollutant. Since SCREEN3 only models the impacts from one source, the entire project emissions will be emitted from a single representative stack with the same stack parameters as each CTG/HRSG, per USEPA guidance (USEPA, 1992).

To calculate the inversion breakup fumigation, the thermal internal boundary layer (TIBL) factor in the SCREEN3 model will be set to 6. A range of TIBL factors from 2 to 6 will be used to determine the highest impact from shoreline fumigation.

Fumigation concentrations will be calculated for 1-, 3- and 8-hour averaging times using USEPA-approved conversion factors. These multiple-hour model predictions are conservative since fumigation is a transitory condition that would most likely affect a given receptor location for only a few minutes at a time.

SECTION 5 AIR QUALITY IMPACT ANALYSIS FOR CLASS I AREAS

Note: An email received by URS on January 28, 2008 from John Notar of the U.S. National Park Service indicated that the NPS is considering a policy change that would allow projects to be exempted from a Class I increment analysis and Air Quality Related Values Analysis, if the ratio of the project's annual emissions of NO_x, PM_{10} and SO_x (tons per year) to the distance of the project site to the nearest Class I area (in kilometers) is below a certain threshold value. Based on a distance of about 73 kilometers from the Project site to the Point Reyes National Seashore and projected annual emissions of 77, 39 and 11 tons per year for NO_x, PM_{10} and SO_x, respectively, the screening ratio for the Willow Pass Generating Station is about 1.74, which appears to be below the screening ratio threshold currently being considered. In the event that NPS determines that the project can be exempted from the Class I area analyses on this basis, then a letter to BAAQMD will be provided by NPS stating that such analyses are not required. In that case, this section of the protocol will become inoperative. However, a full description of the Class I analyses that would be conducted is provided below to cover the possibility that such a decision by NPS may not be forthcoming in time to affect the modeling analysis for this project.

An evaluation of potential impacts in Class I areas within 100 km of the Project will be conducted, because the potential emissions increases of some pollutants will be sufficiently high to be considered a Major Source, thus triggering the federal PSD program. A Major Source must evaluate impacts to visibility and other air quality related values (AQRV) at all Class I areas that are located within a 100-km radius of the facility. All pollutants for which Project emissions are above the Major Source threshold (in this case, 100 tpy) and all pollutants for which emissions are above the PSD Significant Emissions Rates must be evaluated. This section describes the dispersion models and modeling techniques that will be used in performing the Class I area air quality analyses for the Project. The objectives of the modeling are to demonstrate that air emissions from the Project will not cause or contribute to a PSD increment exceedance or cause a significant impact on visibility, regional haze or sulfur or nitrogen deposition in any Class I area.

One Class I area is located within 100 kilometers of the Project site: Point Reyes National Seashore. The nearest edge of the Point Reyes National Seashore is located approximately 73 kilometers from the Project, since this is more than 50 km and less than 100 km from the proposed facility, only far-field AQRV analyses will need to be completed. The CALMET/CALPUFF (full-CALPUFF) model will be used to evaluate potential impacts in the Point Reyes National Seashore Class I area, including potential air quality impacts, sulfur and nitrogen deposition, and impacts to visibility.

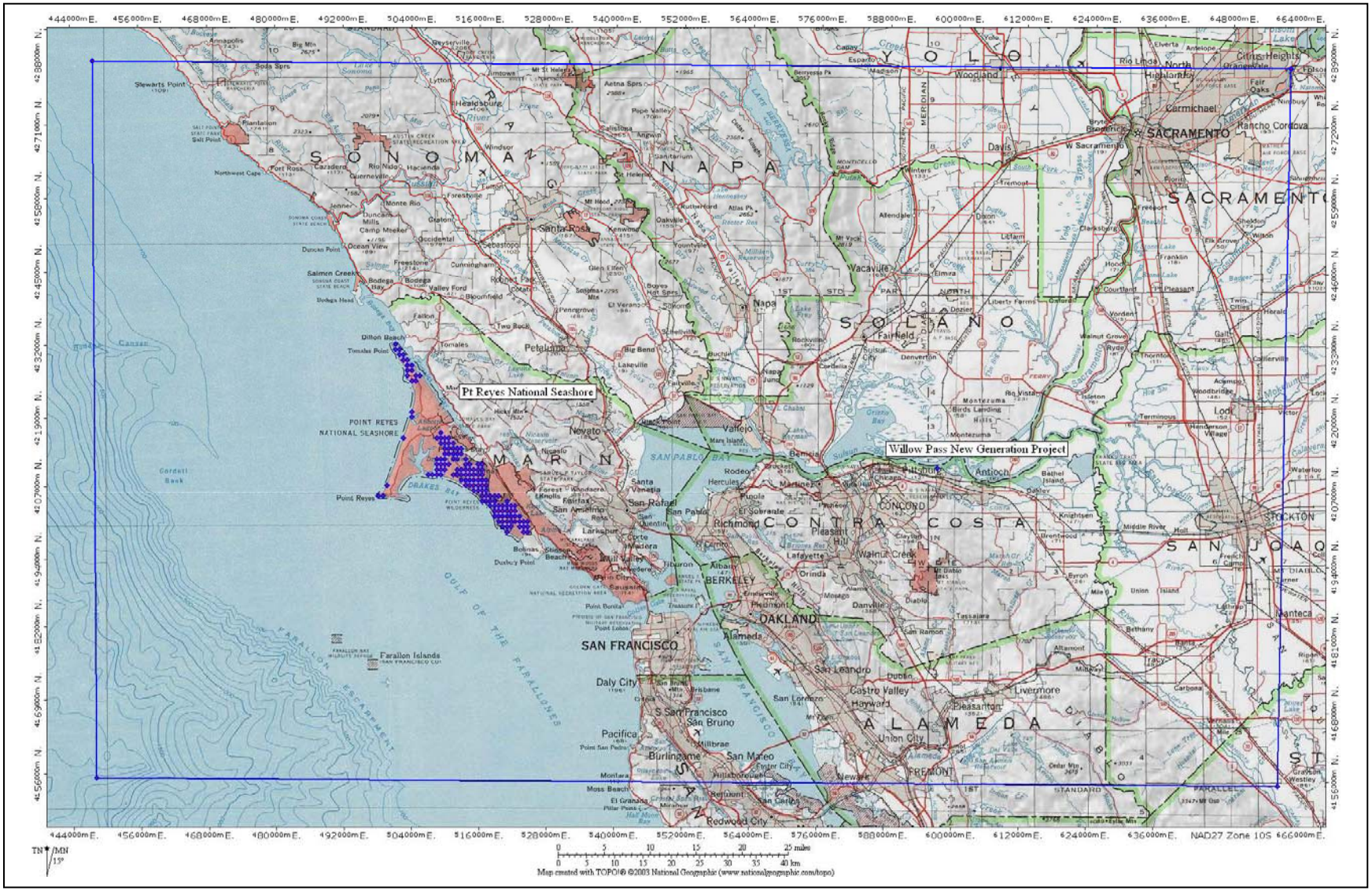
Figure 3 shows the location of this Class I area relative to the proposed Project site and Table 5-1 lists the distances from Project to the closest and farthest points within the Class I area. The federal authority in charge of the Point Reyes National Seashore is the National Park Service (NPS). The AQRV analyses for this Class I area will be conducted in a manner consistent with guidance from the NPS and the United States Forest Service (USFS), following the procedures set forth in the Federal Land Managers' Air Quality Related Values Workgroup (FLAG) Phase I Report (USFS, 2000) and the Calpuff Reviewer's Guideline (USFS and NPS, 2005).

The CALPUFF modeling domain selected for the modeling analyses will extend approximately 40 km past the farthest edge of Point Reyes National Seashore in order to reduce the probability that mass will be lost from the model calculations due to possible wind recirculation (Figure 3).

Table 5-1
Class I Areas within 100-km Radius of the Proposed Project

Class I area	Distance from the Project (km)	
Point Reyes National Seashore	Closest	73
	Farthest	99

Figure 3
Calpuff Domain and Receptors For the Class I Area Nearest to the Project



5.1 NEAR-FIELD CLASS I AREAS AIR QUALITY IMPACT ANALYSIS

There are no Class I Areas that are completely or partially within 50 km of the proposed Project location; therefore, no near field AQRV analyses are necessary.

5.2 FAR-FIELD CLASS I AREA AIR QUALITY IMPACT ANALYSIS: CALPUFF MODELING

The CALPUFF model will be used in conjunction with the CALMET diagnostic meteorological model to analyze visibility, PSD increment and sulfur and nitrogen deposition impacts in the Class I area located within 100 km from the proposed Project site. CALPUFF is a transport and dispersion model that simulates the advection and dispersion of "puffs" of material emitted from modeled sources. CALPUFF can incorporate three-dimensionally varying wind fields, wet and dry deposition, and atmospheric gas and particle phase chemistry. The CALMET model is used to prepare the necessary gridded wind fields for use in the CALPUFF model. CALMET can also accept as input; mesoscale meteorological (MM5) data, surface station, upper air, precipitation, cloud cover, and over-water meteorological data (all in a variety of input formats). These data are merged and the effects of terrain and land cover types are simulated. This process results in the generation of a gridded 3-dimensional wind field that accounts for the effects of slope flows, terrain blocking effects, flow channeling, and spatially varying land uses.

The USEPA-approved regulatory air quality dispersion model CALPUFF (version 5.8) will be used. In addition, all supporting Version 5 editions of the pre- and post-processors will be used. Recommendations from the regulatory guidance documents listed below will be followed.

- *Federal Land Managers Air Quality Related Values Workgroup (FLAG) Phase 1 Report. (USEPA December 2000),* and
- *Interagency Workgroup on Air Quality Modeling (IWAQM), Phase 2 Summary Report and Recommendations for Modeling Long Range Transport Impacts. (USEPA December 1998)*, and
- *Calpuff Reviewer's Guide (Draft), (USFS and NPS, 2005).*

Model options will be based on guidance from the Federal Land Manager (FLM) and from the above documents and direct discussions with NPS air quality staff.

Electronic copies of the model input and output files generated by this and all other modeling analyses described in this protocol will be provided with the final application.

5.2.1 CALPUFF/CALMET Description

5.2.1.1 Location and Land-Use

The CALMET and CALPUFF models incorporate assumptions regarding land-use classification, leaf-area index, and surface roughness length to estimate deposition of emitted materials during atmospheric transport. U.S. Geological Survey (USGS) 1:250,000 scale digital elevation models (DEMs) and Land Use Land Cover (LULC) classification files will be used to develop the geophysical input files required

by the CALMET model. Outputs of the terrain pre-processor (TERREL) and land use pre-processor (CTGPROC) will be combined in the geo-physical preprocessor (MAKEGEO) to prepare the CALMET geo-physical input file. The CALMET model will incorporate the necessary parameters in the CALMET output files for use in the CALPUFF model.

The CALPUFF modeling domain will extend from the Project site approximately 140 km to the west, 125 km to the north, 60 km to the east, and 115 km to the south. The grid-cells over this domain will be 4 kilometers by 4 kilometers. The modeling domain will be specified using the Lambert Conformal Conic (LCC) projection system.

5.2.1.2 Meteorological Data

Pursuant to Federal Land Manager (FLM) guidance, a three-year meteorological data set will be developed for the Class I area modeling analysis using a combination of surface station and mesoscale meteorological (MM5) data for 2001-2003. Hourly CALMET data will be derived from the MM5 data for these three, years, which will be obtained from the WRAP BART modeling for the Nevada-Utah domain. Surface meteorological, precipitation and ozone data will also be obtained from the WRAP BART modeling for the Nevada-Utah domain. Upper air data from the Oakland Airport station will also be included.

CALMET wind fields will be generated using a combination of the MM5 data sets augmented with the surface data from the National Weather Service (NWS) stations described above. Per IWAQM guidance, the MM5 data will be interpolated to the CALMET fine-scale grid to create the initial-guess wind fields (IPROG = 14 for MM5).

5.2.1.3 Other Model Options

Size parameters for dry deposition of nitrate, sulfate, and PM_{10} particles will be based on default CALPUFF model options. Chemical parameters for gaseous dry deposition and wet scavenging coefficients will be based on default values presented in the CALPUFF User's Guide. For the CALPUFF runs that incorporate deposition and chemical transformation rates (i.e. deposition and visibility), the full chemistry option of CALPUFF will be activated (MCHEM = 1). The nighttime loss rates for SO_2, NO_x and nitric acid (HNO_3) will be set at 0.2 percent per hour, 2 percent per hour and 2 percent per hour, respectively. CALPUFF will also be configured to allow predictions of SO_2, sulfate (SO_4), NO_x, HNO_3, nitrate (NO_3) and PM_{10} using the MESOPUFF II chemical transformation module.

Hourly ozone concentration files for the CALPUFF modeling will be obtained from the WRAP BART modeling data for the Nevada-Utah domain. Only data from the ozone monitoring stations within the Project domain will be used.

Per the FLAG guidance, the background ammonia concentration for Pt Reyes National Seashore will be set to 0.5 ppb, which is representative for forests.

The regulatory default setting for MDISP=3 which utilizes the Pasquill-Gifford dispersion coefficients will be used in the CALPUFF modeling.

5.2.1.4 Receptors

Discrete receptors for the CALPUFF modeling within the Point Reyes National Seashore will be obtained from the NPS Class One Area receptor database. No modifications to the receptor locations or heights provided in the database will be made. Latitude/Longitude coordinates of the Class I receptors will be converted to LCC coordinates based on the domain setup shown in CALMET options. These receptors are shown in Figure 3.

5.2.2 Far-Field Class I Areas Visibility and Regional Haze Analysis

For the analysis of visibility effects due to the Project's emissions of air pollutants, CALPUFF requires project emission rate inputs for six pollutant species, i.e., directly emitted PM_{10}, NO_x, and SO_2, and secondary SO_4, HNO_3, and NO_3. The maximum 24-hour emission rates of PM_{10}, NO_x and SO_2 from all sources of the Project will be used for the visibility impacts analysis. The turbine/HRSG emissions of SO_2 will be speciated to SO_2 and SO_4 as indicated in the NPS Particulate Matter Speciation (PMS) guidelines for natural gas turbines (NPS, 2006). The total turbine/HRSG PM_{10} emissions will be speciated to elemental carbon and organic carbon [emitted as Secondary Organic Aerosol (SOA)] per the PMS. Direct emissions of the remaining species, HNO_3 and NO_3, are assumed to be zero for the natural gas turbine/HRSGs. The fire water pump emissions will be modeled without speciation.

Modeled impacts will be converted to visibility impacts using the CALPOST post processor. CALPOST will be used to post-process estimated 24-hour concentrations of ammonium nitrate, ammonium sulfate, element carbon (EC), and SOA into extinction coefficient values for each day at each modeled receptor.

CALPUFF also requires a background light extinction reference level. The analysis will be run using the FLAG recommended background extinction values for the specific Class I area under consideration. The background extinction coefficient is composed of hygroscopic scattering components, wherein the addition of water enhances particle light-scattering efficiencies, non-hygroscopic scattering components and Rayleigh scattering. Ammonium sulfate and ammonium nitrate compose the hygroscopic scattering components, while organic aerosols, soils, coarse particles, particle absorption from elemental carbon and absorption from gases (primarily from nitrogen dioxide) compose the non-hygroscopic scattering components.

In accordance with the FLAG guideline the total background extinction coefficient is calculated for the Class I area using the following equation:

$$b_{ext} = b_{hygro} \cdot f(RH) + b_{non\text{-}hygro} + b_{Ray}$$

where:

b_{hygro} = the hygroscopic scattering component (Mm^{-1})
$= 3[(NH_4)_2SO_4 + NH_4NO_3]$
$b_{non\text{-}hygro}$ = the non-hygroscopic scattering component (Mm^{-1})
$= b_{OC} + b_{Soil} + b_{Course} + b_{ap} + b_{ag}$
b_{Ray} = the Rayleigh scattering component (Mm^{-1}) = 10 Mm^{-1} (FLAG)
f(RH) = relative humidity adjustment factor

In the CALPOST post-processing program, the monthly background concentration of ammonium sulfate is set to one third of the hygroscopic scattering component, and the monthly background concentration of soil particles is set to the non-hygroscopic scattering component, as recommended in the FLAG report.

The FLAG relative humidity (RH) adjustment factors (MVISBK=2) and the RHMAX = 95 % will be used as suggested by the NPS FLM.

The extinction coefficient percent change (background extinction coefficient vs. modeled extinction coefficient), predicted by CALPUFF will be compared to the level of acceptable change (LAC) of 5%. If the change in extinction is greater than 5%, but less than 10%, the conditions surrounding that prediction will be examined to determine if inclement weather may obscure actual viewing of the plume in the Class I area.

5.2.3 PSD Class I Significance Analysis

A PSD analysis of incremental air pollutant concentrations in the Class I area will be required because the Project will be a Major Source as defined in the PSD regulations. Accordingly, the maximum predicted incremental criteria pollutant concentrations from the Project sources in the Class I area will be compared with the proposed PSD significant impact level for Class I areas (see Table 5-2) for each pollutant as a reference point.

Table 5-2
FLAG Proposed Class I Significance Impact Levels

Parameter	Modeled Scenario					
Concentration	NO_x	PM_{10}		SO_2		
	Annual	24-hour	Annual	3-hour	24-hour	Annual
Threshold	0.1	0.3	0.2	1	0.2	0.1

CALPUFF will be used to model ambient air concentrations of NO_2, PM_{10}, and SO_2 in the Class I Area for comparison with the PSD Class I significant impact levels. All NO_2, SO_2 and PM_{10}, sources of the proposed project will be modeled at the full potential-to-emit (PTE) in the CALPUFF PSD modeling for each averaging time. The full chemistry option of CALPUFF will be activated (MCHEM =1, MESOPUFF II scheme), and deposition options will also be turned on (MWET = 1 and MDRY = 1).

5.2.4 Deposition Analysis

CALPUFF will be used to evaluate the potential for nitrogen and sulfur deposition in the Class I area due to Project emissions of nitrogen and sulfur oxides emissions. Total deposition rates for each pollutant will be obtained by summing the modeled wet and/or dry deposition rates. The annual avg PTE emission rates for Project sources will be used in this analysis, since annual deposition rates are to be estimated.

For sulfur deposition, the wet and dry fluxes of SO_2 and SO_4 are calculated, normalized by the molecular weight of sulfur, and expressed as total sulfur. Total nitrogen deposition is the sum of nitrogen

contributed by wet and dry fluxes of HNO_3, nitrate (NO_3), ammonium nitrate (NH_4NO_3), ammonium sulfate ($(NH_4)_2SO_4$) and the dry flux of NO_x.

The total modeled nitrogen and sulfur deposition rates will be compared with the NPS/USFS deposition analysis thresholds (DAT) for western states. The DAT for nitrogen and sulfur are each 0.005 kilogram per hectare per year (kg/ha-yr), which converts to 1.59E-11 $g/m^2/s$.

5.2.5 Soils and Vegetation

Class I Areas may contain sensitive species within their different vegetative ecosystems. Sensitive species are impacted primarily by ozone but may also be impacted by nitrogen and sulfur compounds. Acidity in rain, snow, cloudwater, and dry deposition can affect soil fertility and nutrient cycling processes in watersheds, and can result in acidification of lakes and streams with low buffering capacity. Therefore, the soil and vegetation analysis will be conducted using the CALPUFF model to predict total sulfur and nitrogen deposition rates. In order to protect sensitive species, the USFS (Peterson et al, 1992) recommends that short-term maximum SO_2 levels should not exceed 40 to 50 parts per billion (ppb). Annual avg SO_2 concentrations should not exceed 8 to 12 ppb, and annual avg NO_2 concentration should not exceed 15 ppb.

SECTION 6 PRESENTATION OF MODELING RESULTS

Two separate permit documents will be created with the results of the air quality analyses, an AFC for the CEC, and a permit to construction (PTC)/PSD application for the BAAQMD and EPA. The results from all of the air quality analyses to evaluate the construction and operational impacts of the Project will be summarized in the AFC, along with the two cumulative impact analyses. The results from the operational impact analyses and Class I area analyses will be summarized in the PTC/PSD application. The HRA results will be summarized in both applications.

6.1 PSD, NAAQS AND CAAQS ANALYSES

The results of the PSD and AAQS analyses to evaluate the construction and operational impacts of the Project will be presented in summary tables. A figure indicating the locations of the maximum predicted pollutant concentrations for each applicable pollutant and averaging time will be provided. The maximum modeled values of NO_2, SO_2 and CO will be compared with current Class II and proposed Class I SILs. If the model impact exceeds the SILs, the background concentrations (see Section 4.6.2) will be added to the maximum modeled values from the Project sources to yield total concentrations, which will be compared with the NAAQS and CAAQS. Isopleth drawing showing the predicted spatial distributions of criteria pollutant concentrations near the proposed Project will be prepared. The cumulative impact values from both the plant-wide and plant-wide plus new sources within 6 miles analyses will be added to the background concentrations for the corresponding pollutants and averaging times for comparison with the NAAQS and CAAQS.

6.2 HEALTH RISK ASSESSMENT ANALYSIS

Maps depicting the following data will be prepared:

- The locations of sensitive receptors, including schools, pre-schools, hospitals, etc., within a 3-mile radius of the Project, and the nearby residences included in the HRA;
- Isopleths for any areas where predicted exposures to air toxics result in estimated chronic non-cancer impacts and acute impacts equal to or exceeding a hazard index of 1; and
- Isopleths for any areas where exposures to air toxics lead to an estimated carcinogenic risk equal to or greater than one in one million.

Health risk assessment modeling results will be summarized to include maximum annual (chronic, carcinogenic, and non-carcinogenic) and hourly (acute) adverse health effects from the Project's toxic air contaminant emissions. Health risk values will be calculated and presented in the summary table for the points of maximum impact and the sensitive receptors with the maximum risk values.

6.3 CLASS I ANALYSIS

The results of the visibility, PSD, deposition, soil and vegetation analyses to evaluate the operational impacts of the Project will be presented in summary tables and compared with all relevant significance thresholds.

6.4 DATA SUBMITTAL

Electronic copies of the modeling input and output files for all the analyses described in this protocol will be provided to BAAQMD, CEC and National Park Service.

SECTION 7 REFERENCES

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Annual Windrose for the Onsite Pittsburg Meteorological Station

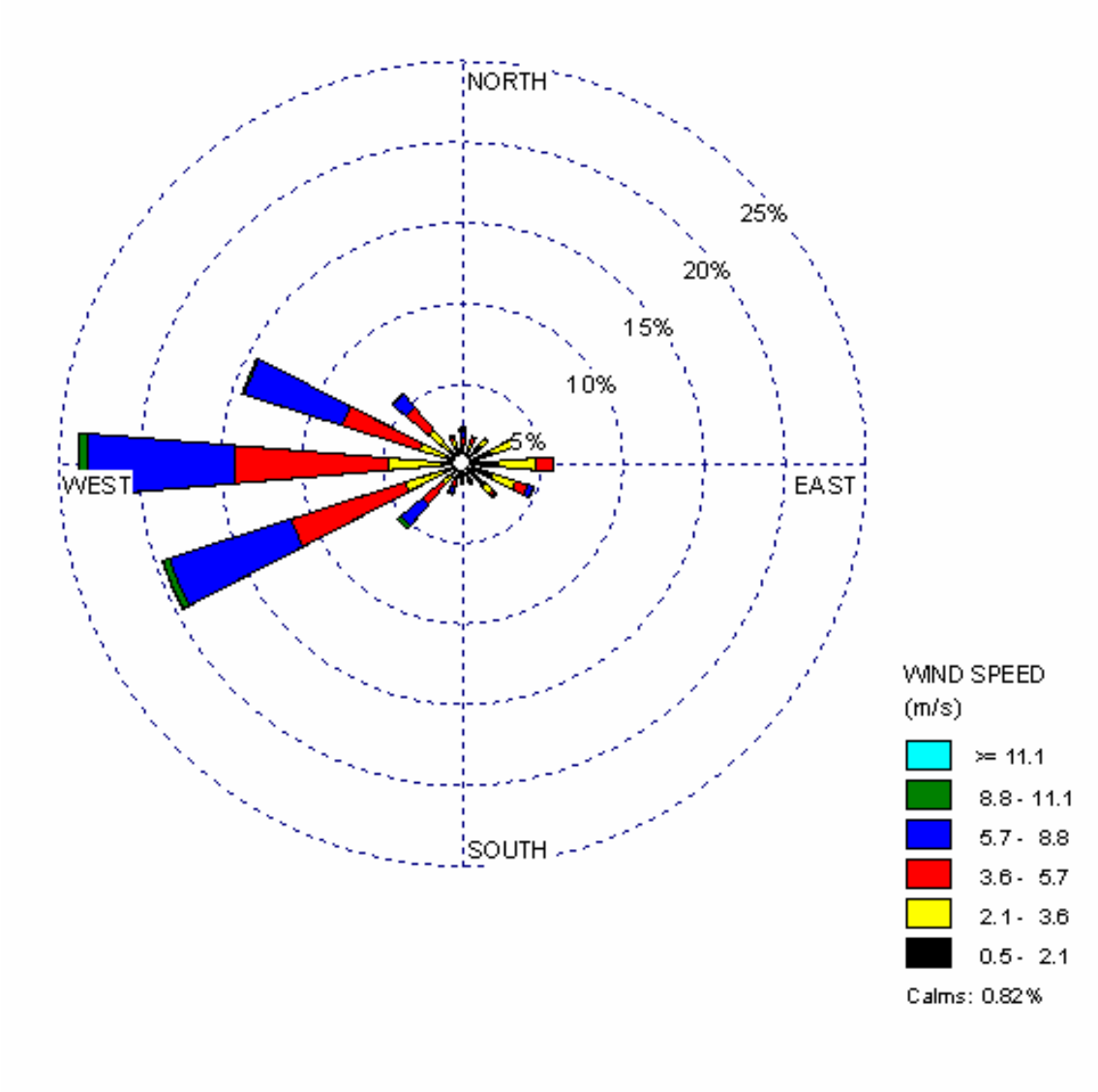
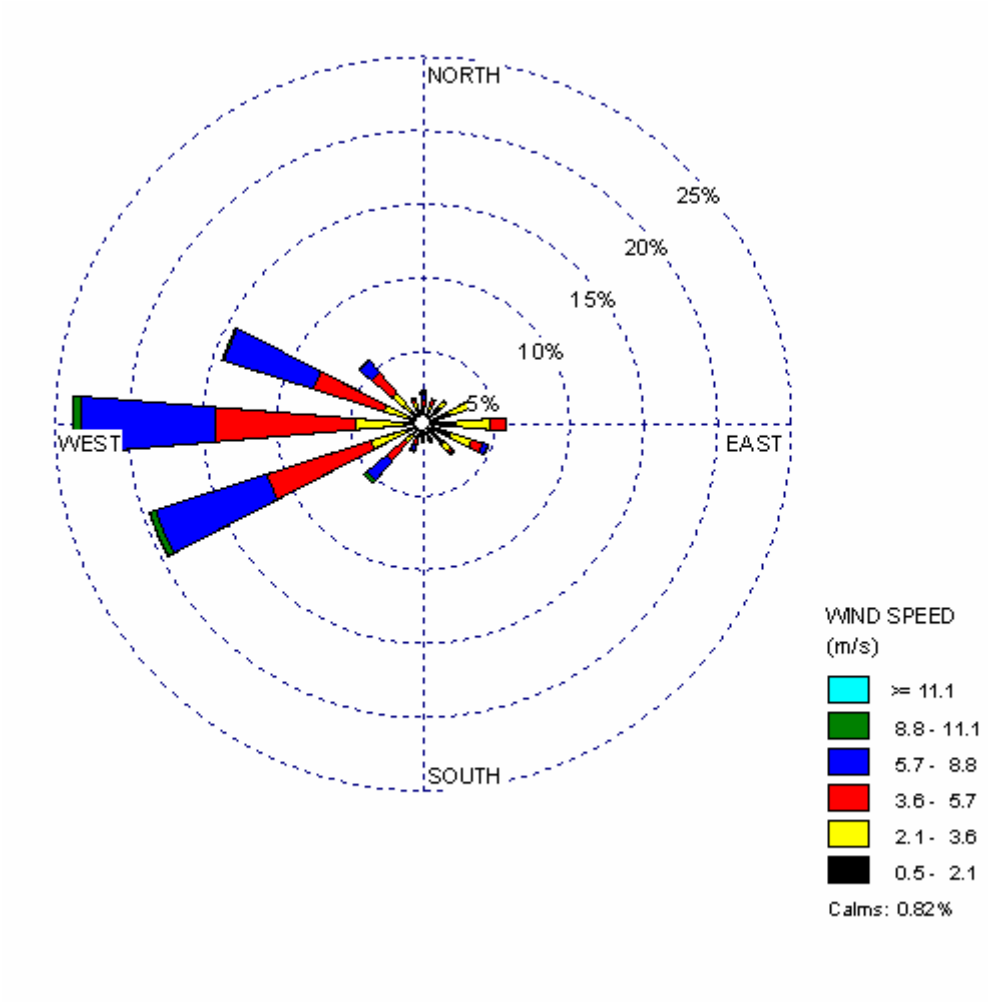


Figure A-1 Annual Windrose for the Onsite Pittsburg Meteorological Station for 2002-2005

APPENDIX J2
WIND ROSES AND FREQUENCY DISTRIBUTIONS



Annual wind rose for Pittsburg Onsite Meteorological Station
Data taken from 2002-2005 for all months.

Displays wind speed, direction (blowing from)

Station ID: 72493 Run ID:
Year: 2002 2003 2004 2005
Date Range: Jan 1 - 31-Dec ANNUAL

Time Range: 00:00 - 23:00

Frequency Distribution
(Count)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	342	92	136	151	73	20	814
11.25 - 33.75	365	133	99	56	2	4	659
33.75 - 56.25	581	149	35	6	0	0	771
56.25 - 78.75	683	544	160	7	0	0	1394
78.75 - 101.25	783	834	374	10	0	0	2001
101.25 - 123.75	722	511	274	123	21	4	1655
123.75 - 146.25	693	180	74	41	9	4	1001
146.25 - 168.75	398	46	45	17	5	1	512
168.75 - 191.25	273	51	57	47	14	7	449
191.25 - 213.75	274	131	164	124	38	1	732
213.75 - 236.25	302	299	587	593	88	19	1888
236.25 - 258.75	412	919	2589	2760	156	6	6842
258.75 - 281.25	507	1111	3340	3173	184	2	8317
281.25 - 303.75	380	628	1747	2222	51	0	5028
303.75 - 326.25	433	550	631	388	16	0	2018
326.25 - 348.75	354	204	68	38	6	0	670
Sub-Total:	7502	6382	10380	9756	663	68	34751
Calms:							289
Missing/Incomplete:							0
Total:							35040

Frequency of Calm Winds: 0.82%
Average Wind Speed: 4.33 m/s

Station ID: 72493 Run ID:
Year: 2002 2003 2004 2005
Date Range: Jan 1 - 31-Dec ANNUAL

Time Range: 00:00 - 23:00

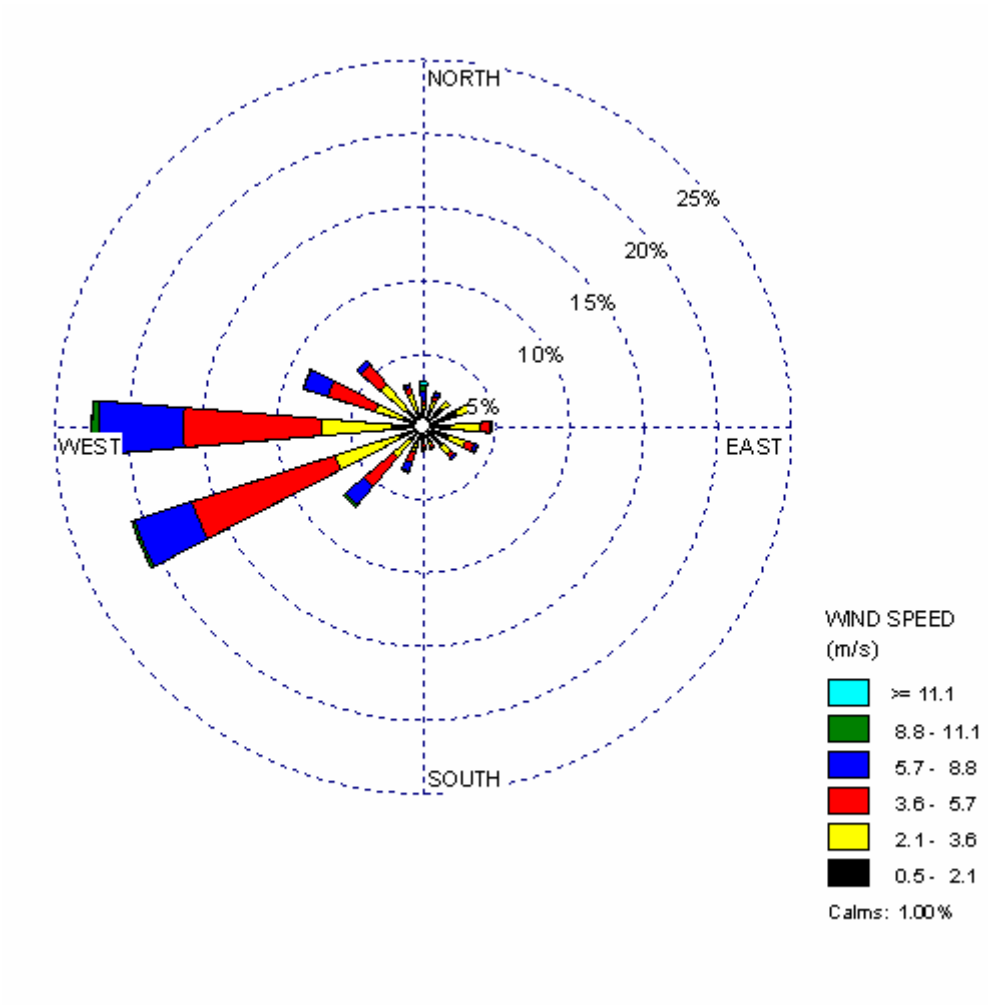
Frequency Distribution
(Normalized)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	0.00976	0.002626	0.003881	0.004309	0.002083	0.000571	0.023231
11.25 - 33.75	0.010417	0.003796	0.002825	0.001598	0.000057	0.000114	0.018807
33.75 - 56.25	0.016581	0.004252	0.000999	0.000171	0	0	0.022003
56.25 - 78.75	0.019492	0.015525	0.004566	0.0002	0	0	0.039783
78.75 - 101.25	0.022346	0.023801	0.010674	0.000285	0	0	0.057106
101.25 - 123.75	0.020605	0.014583	0.00782	0.00351	0.000599	0.000114	0.047232
123.75 - 146.25	0.019777	0.005137	0.002112	0.00117	0.000257	0.000114	0.028567
146.25 - 168.75	0.011358	0.001313	0.001284	0.000485	0.000143	0.000029	0.014612
168.75 - 191.25	0.007791	0.001455	0.001627	0.001341	0.0004	0.0002	0.012814
191.25 - 213.75	0.00782	0.003739	0.00468	0.003539	0.001084	0.000029	0.02089
213.75 - 236.25	0.008619	0.008533	0.016752	0.016924	0.002511	0.000542	0.053881
236.25 - 258.75	0.011758	0.026227	0.073887	0.078767	0.004452	0.000171	0.195263
258.75 - 281.25	0.014469	0.031707	0.09532	0.090554	0.005251	0.000057	0.237357
281.25 - 303.75	0.010845	0.017922	0.049857	0.063413	0.001455	0	0.143493
303.75 - 326.25	0.012357	0.015696	0.018008	0.011073	0.000457	0	0.057591
326.25 - 348.75	0.010103	0.005822	0.001941	0.001084	0.000171	0	0.019121
Sub-Total:	0.214098	0.182135	0.296233	0.278425	0.018921	0.001941	0.991752
Calms:							0.008248
Missing/Incomplete:							0
Total:							1

Frequency of Calm Winds: 0.82%

Average Wind Speed: 4.33 m/s



Spring wind rose for Pittsburg Onsite Meteorological Station
Data taken from 2002-2005 for Feb, Mar., and Apr.

Displays wind speed, direction (blowing from)

Station ID: 72493 R un ID:
Year: 2002 2003 2004 2005
Date Range: Feb 1 - 30-Apr SPRING
Time Range: 00:00 - 23:00

FrequencyDistribution
(Count)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	93	34	27	60	36	16	266
11.25 - 33.75	114	50	24	28	2	4	222
33.75 - 56.25	156	46	3	0	0	0	205
56.25 - 78.75	212	121	36	4	0	0	373
78.75 - 101.25	158	177	60	6	0	0	401
101.25 - 123.75	164	99	54	18	7	0	342
123.75 - 146.25	156	56	27	17	2	0	258
146.25 - 168.75	98	20	18	7	0	0	143
168.75 - 191.25	77	23	23	15	4	1	143
191.25 - 213.75	101	60	62	54	10	0	287
213.75 - 236.25	92	142	228	140	11	0	613
236.25 - 258.75	156	388	872	347	17	1	1781
258.75 - 281.25	185	412	796	492	38	1	1924
281.25 - 303.75	123	176	289	146	6	0	740
303.75 - 326.25	142	189	149	35	0	0	515
326.25 - 348.75	112	99	35	17	6	0	269
Sub-Total:	2139	2092	2703	1386	139	23	8482
Calms:							86
Missing/Incomplete:							0
Total:							8568

Frequency of Calm Winds: 1.00%
Average Wind Speed: 3.79 m/s

Station ID: 72493 R un ID:

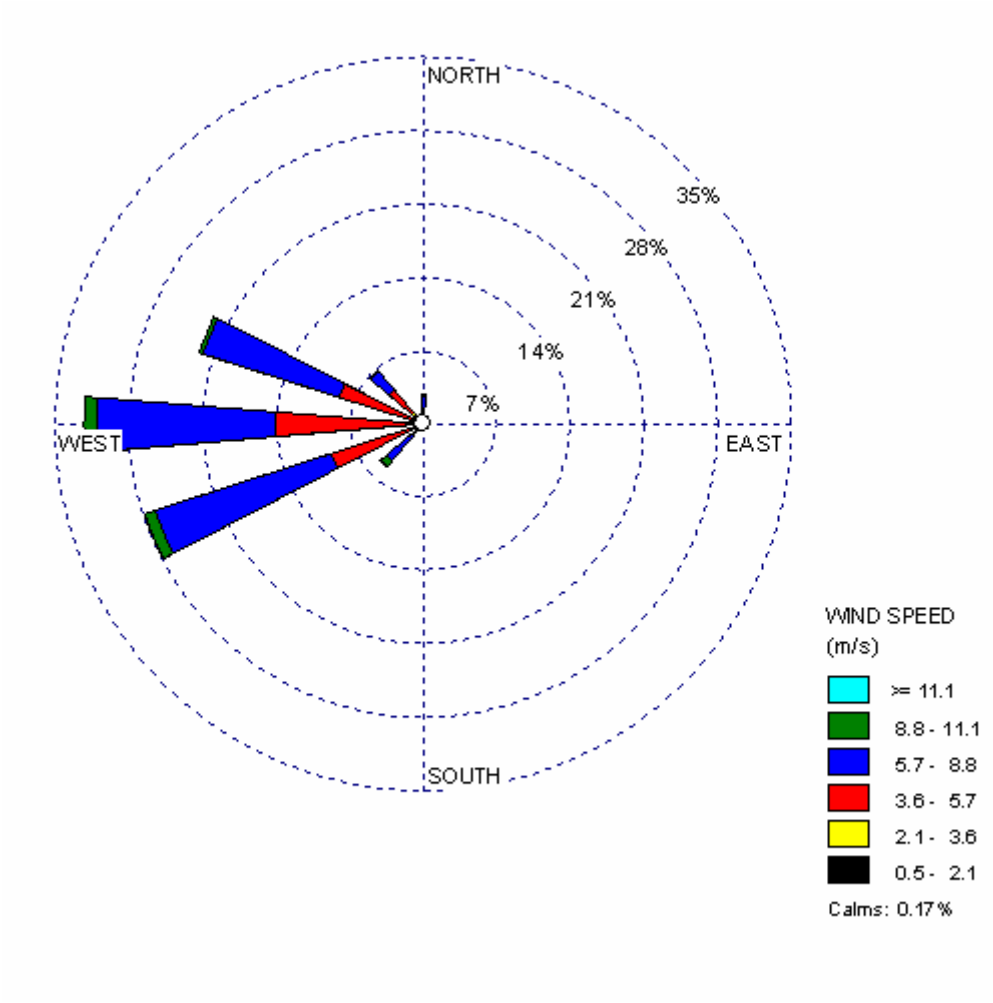
Year: 2002 2003
2004 2005
Date Range: Feb 1 - 30-Apr SPRING
Time Range: 00:00 - 23:00

Frequency Distribution
(Normalized)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	0.010854	0.003968	0.003151	0.007003	0.004202	0.001867	0.031046
11.25 - 33.75	0.013305	0.005836	0.002801	0.003268	0.000233	0.000467	0.02591
33.75 - 56.25	0.018207	0.005369	0.00035	0	0	0	0.023926
56.25 - 78.75	0.024743	0.014122	0.004202	0.000467	0	0	0.043534
78.75 - 101.25	0.018441	0.020658	0.007003	0.0007	0	0	0.046802
101.25 - 123.75	0.019141	0.011555	0.006303	0.002101	0.000817	0	0.039916
123.75 - 146.25	0.018207	0.006536	0.003151	0.001984	0.000233	0	0.030112
146.25 - 168.75	0.011438	0.002334	0.002101	0.000817	0	0	0.01669
168.75 - 191.25	0.008987	0.002684	0.002684	0.001751	0.000467	0.000117	0.01669
191.25 - 213.75	0.011788	0.007003	0.007236	0.006303	0.001167	0	0.033497
213.75 - 236.25	0.010738	0.016573	0.026611	0.01634	0.001284	0	0.071545
236.25 - 258.75	0.018207	0.045285	0.101774	0.0405	0.001984	0.000117	0.207866
258.75 - 281.25	0.021592	0.048086	0.092904	0.057423	0.004435	0.000117	0.224556
281.25 - 303.75	0.014356	0.020542	0.03373	0.01704	0.0007	0	0.086368
303.75 - 326.25	0.016573	0.022059	0.01739	0.004085	0	0	0.060107
326.25 - 348.75	0.013072	0.011555	0.004085	0.001984	0.0007	0	0.031396
Sub-Total:	0.24965	0.244164	0.315476	0.161765	0.016223	0.002684	0.989963
Calms:							0.010037
Missing/Incomplete:							0
Total:							1

Frequency of Calm Winds: 1.00%
Average Wind Speed: 3.79 m/s



Summer wind rose for Pittsburg Onsite Meteorological Station
Data taken from 2002-2005 for May, Jun., Jul.

Displays wind speed, direction (blowing from)

Year: 2002 2003
2004 2005
Date Range: May 1
- 31-July SUMMER
Time Range: 00:00
- 23:00

Frequency Distribution (Count)

	Speed m/s						
Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	16	15	60	142	15	3	251
11.25 - 33.75	12	2	2	2	0	0	18
33.75 - 56.25	11	1	0	0	0	0	12
56.25 - 78.75	7	4	0	0	0	0	11
78.75 - 101.25	11	2	0	1	0	0	14
101.25 - 123.75	3	3	11	5	1	0	23
123.75 - 146.25	9	5	2	1	0	0	17
146.25 - 168.75	4	1	1	0	0	0	6
168.75 - 191.25	5	6	7	3	0	0	21
191.25 - 213.75	5	9	8	11	4	0	37
213.75 - 236.25	10	24	89	291	55	16	485
236.25 - 258.75	11	75	730	1545	93	5	2459
258.75 - 281.25	9	129	1105	1492	106	0	2841
281.25 - 303.75	20	88	638	1196	34	0	1976
303.75 - 326.25	24	113	240	210	12	0	599
326.25 - 348.75	18	20	6	3	0	0	47
Sub-Total:	175	497	2899	4902	320	24	8817
Calms:							15
Missing/Incomplete:							32
Total:							8864

Frequency of Calm Winds: 0.17%
Average Wind Speed: 6.03 m/s

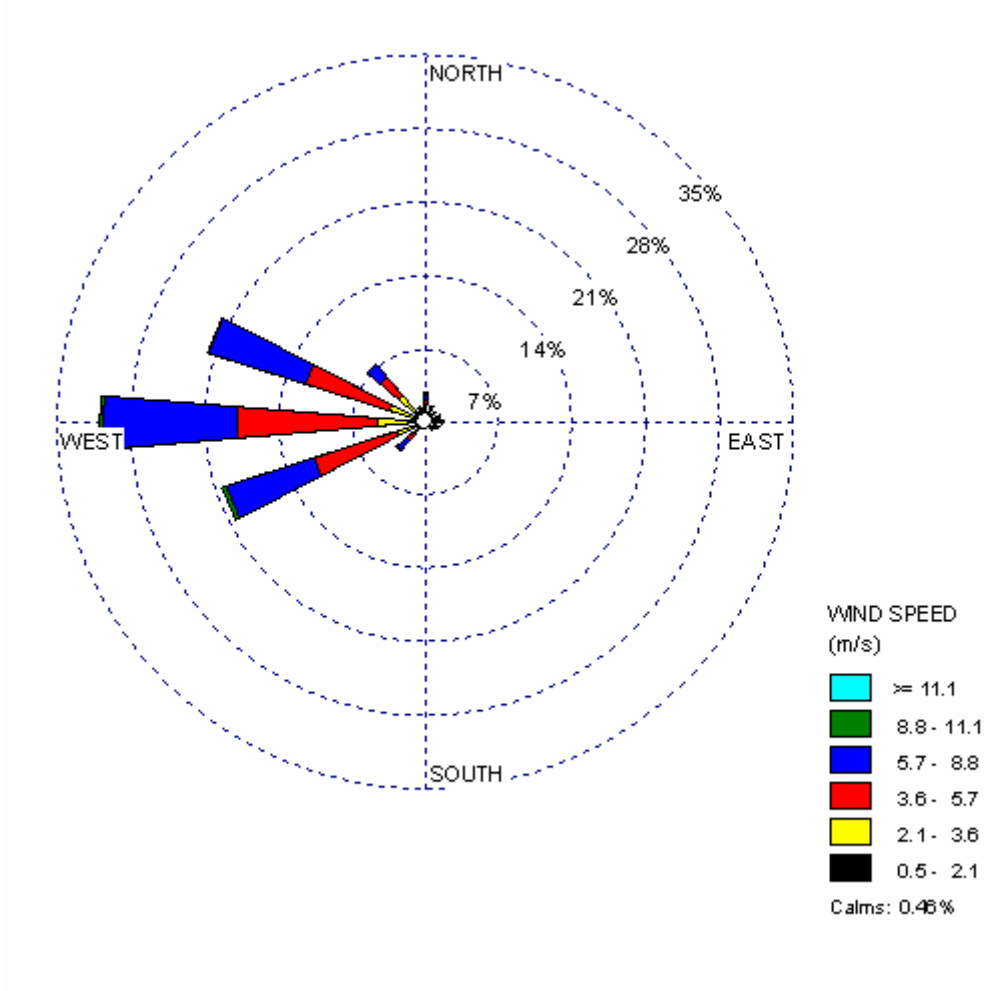
Station ID: 72493 Run ID:
Year: 2002 2003
2004 2005
Date Range: May 1
- 31-Jul SUMMER
Time Range: 00:00
- 23:00

Frequency Distribution (Normalized)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	0.001812	0.001698	0.006793	0.016078	0.001698	0.00034	0.028419
11.25 - 33.75	0.001359	0.000226	0.000226	0.000226	0	0	0.002038
33.75 - 56.25	0.001245	0.000113	0	0	0	0	0.001359
56.25 - 78.75	0.000793	0.000453	0	0	0	0	0.001245
78.75 - 101.25	0.001245	0.000226	0	0.000113	0	0	0.001585
101.25 - 123.75	0.00034	0.00034	0.001245	0.000566	0.000113	0	0.002604
123.75 - 146.25	0.001019	0.000566	0.000226	0.000113	0	0	0.001925
146.25 - 168.75	0.000453	0.000113	0.000113	0	0	0	0.000679
168.75 - 191.25	0.000566	0.000679	0.000793	0.00034	0	0	0.002378
191.25 - 213.75	0.000566	0.001019	0.000906	0.001245	0.000453	0	0.004189
213.75 - 236.25	0.001132	0.002717	0.010077	0.032948	0.006227	0.001812	0.054914
236.25 - 258.75	0.001245	0.008492	0.082654	0.174932	0.01053	0.000566	0.278419
258.75 - 281.25	0.001019	0.014606	0.125113	0.168931	0.012002	0	0.321671
281.25 - 303.75	0.002264	0.009964	0.072237	0.135417	0.00385	0	0.223732
303.75 - 326.25	0.002717	0.012794	0.027174	0.023777	0.001359	0	0.067822
326.25 - 348.75	0.002038	0.002264	0.000679	0.00034	0	0	0.005322
Sub-Total:	0.019814	0.056273	0.328238	0.555027	0.036232	0.002717	0.994698
Calms:							0.001692
Missing/Incomplete:							0.00361
Total:							1

Frequency of Calm Winds: 0.17%
Average Wind Speed: 6.03 m/s



Fall wind rose for Pittsburg Onsite Meteorological Station
Data taken from 2002-2005 for Aug., Sep., Oct..

Displays wind speed, direction (blowing from)

Station ID: 72493 R un ID:
Year: 2002 2003
200 4 2005
Date Range: Aug 1 - 31-Oct FALL
Time Range: 00:00 - 23:00

Frequency Distribution

(Count)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	83	23	83	48	16	0	253
11.25 - 33.75	64	32	51	12	0	0	159
33.75 - 56.25	87	15	23	6	0	0	131
56.25 - 78.75	84	45	9	3	0	0	141
78.75 - 101.25	95	56	8	0	0	0	159
101.25 - 123.75	80	37	6	7	0	0	130
123.75 - 146.25	76	10	4	4	1	0	95
146.25 - 168.75	51	8	3	0	1	0	63
168.75 - 191.25	40	4	5	6	0	0	55
191.25 - 213.75	30	11	7	3	0	0	51
213.75 - 236.25	50	42	114	108	13	1	328
236.25 - 258.75	62	196	727	771	38	0	1794
258.75 - 281.25	95	307	1180	1114	29	1	2726
281.25 - 303.75	87	235	736	849	10	0	1917
303.75 - 326.25	118	182	203	140	4	0	647
326.25 - 348.75	85	43	11	3	0	0	142
Sub-Total:	1187	1246	3170	3074	112	2	8791
Calms:							41
Missing/Incomplete:							0
Total:							8832

Frequency of Calm Winds: 0.46%
Average Wind Speed: 4.80 m/s

Station ID: 72493 R un ID:
Year: 2002 2003 2004 2005
Date Range: Aug 1 - 31-Oct FALL
Time Range: 00:00 - 23:00

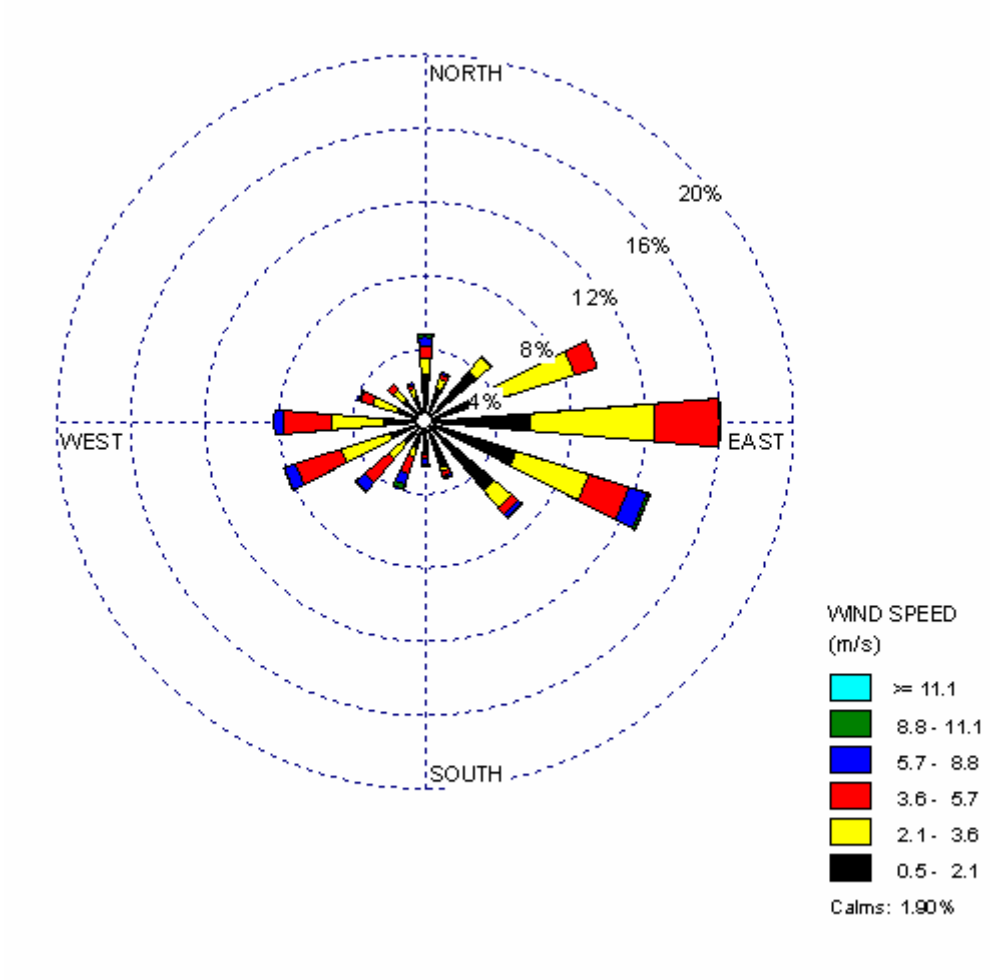
Frequency Distribution

(Normalized)

Speed m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	0.009398	0.002604	0.009398	0.005435	0.001812	0	0.028646
11.25 - 33.75	0.007246	0.003623	0.005774	0.001359	0	0	0.018003
33.75 - 56.25	0.009851	0.001698	0.002604	0.000679	0	0	0.014832
56.25 - 78.75	0.009511	0.005095	0.001019	0.00034	0	0	0.015965
78.75 - 101.25	0.010756	0.006341	0.000906	0	0	0	0.018003
101.25 - 123.75	0.009058	0.004189	0.000679	0.000793	0	0	0.014719
123.75 - 146.25	0.008605	0.001132	0.000453	0.000453	0.000113	0	0.010756
146.25 - 168.75	0.005774	0.000906	0.00034	0	0.000113	0	0.007133
168.75 - 191.25	0.004529	0.000453	0.000566	0.000679	0	0	0.006227
191.25 - 213.75	0.003397	0.001245	0.000793	0.00034	0	0	0.005774
213.75 - 236.25	0.005661	0.004755	0.012908	0.012228	0.001472	0.000113	0.037138
236.25 - 258.75	0.00702	0.022192	0.082314	0.087296	0.004303	0	0.203125
258.75 - 281.25	0.010756	0.03476	0.133605	0.126132	0.003284	0.000113	0.30865
281.25 - 303.75	0.009851	0.026608	0.083333	0.096128	0.001132	0	0.217052
303.75 - 326.25	0.013361	0.020607	0.022985	0.015851	0.000453	0	0.073256
326.25 - 348.75	0.009624	0.004869	0.001245	0.00034	0	0	0.016078
Sub-Total:	0.134398	0.141078	0.358922	0.348053	0.012681	0.000226	0.995358
Calms:							0.004642
Missing/Incomplete:							0
Total:							1

Frequency of Calm Winds: 0.46%
Average Wind Speed: 4.80 m/s



Winter wind rose for Pittsburg Onsite Meteorological Station
Data taken from 2002-2005 for Dec., Jan., Feb.

Displays wind speed, direction (blowing from)

Station ID: 72493 R un ID:
Year: 2002 2003 2004 2005
Date Range: Dec., Jan., Fe. WINTER
Time Range: 00:00 - 23:00

Fr equency Distribution
(Count)

Speed
m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	228	84	52	45	16	4	429
11.25 - 33.75	172	49	23	13	0	0	257
33.75 - 56.25	322	89	9	0	0	0	420
56.25 - 78.75	377	374	114	0	0	0	865
78.75 - 101.25	505	593	307	3	0	0	1408
101.25 - 123.75	459	365	200	89	13	4	1130
123.75 - 146.25	435	110	40	17	6	4	612
146.25 - 168.75	237	18	23	10	4	1	293
168.75 - 191.25	147	15	20	25	10	4	221
191.25 - 213.75	134	46	86	54	24	1	345
213.75 - 236.25	142	91	151	52	5	1	442
236.25 - 258.75	178	248	228	57	3	0	714
258.75 - 281.25	205	249	223	47	0	0	724
281.25 - 303.75	145	123	61	11	0	0	340
303.75 - 326.25	145	63	31	1	0	0	240
326.25 - 348.75	133	41	13	14	0	0	201
Sub-Total:	3964	2558	1581	438	81	19	8641
Calms:							167
Missing/Incomplete:							32
Total:							8840

Frequency of Calm Winds: 1.90%
Average Wind Speed: 2.66 m/s

Station ID: 72493 R un ID:
Year: 2002 2003 2004 2005
Date Range: Dec., Jan., Feb. WINTER
Time Range: 00:00 - 23:00

Fr equency Distribution
(Normaliz ed)

Speed
m/s

Wind Direction	0.5 - 2.1	2.1 - 3.6	3.6 - 5.7	5.7 - 8.8	8.8 - 11.1	>= 11.1	Total
348.75 - 11.25	0.025886	0.009537	0.005904	0.005109	0.001817	0.000454	0.048706
11.25 - 33.75	0.019528	0.005563	0.002611	0.001476	0	0	0.029178
33.75 - 56.25	0.036558	0.010104	0.001022	0	0	0	0.047684
56.25 - 78.75	0.042802	0.042461	0.012943	0	0	0	0.098206
78.75 - 101.25	0.057334	0.067325	0.034855	0.000341	0	0	0.159855
101.25 - 123.75	0.052112	0.04144	0.022707	0.010104	0.001476	0.000454	0.128292
123.75 - 146.25	0.049387	0.012489	0.004541	0.00193	0.000681	0.000454	0.069482
146.25 - 168.75	0.026907	0.002044	0.002611	0.001135	0.000454	0.000114	0.033265
168.75 - 191.25	0.016689	0.001703	0.002271	0.002838	0.001135	0.000454	0.025091
191.25 - 213.75	0.015213	0.005223	0.009764	0.006131	0.002725	0.000114	0.039169
213.75 - 236.25	0.016122	0.010332	0.017144	0.005904	0.000568	0.000114	0.050182
236.25 - 258.75	0.020209	0.028156	0.025886	0.006471	0.000341	0	0.081063
258.75 - 281.25	0.023274	0.02827	0.025318	0.005336	0	0	0.082198
281.25 - 303.75	0.016462	0.013965	0.006926	0.001249	0	0	0.038601
303.75 - 326.25	0.016462	0.007153	0.00352	0.000114	0	0	0.027248
326.25 - 348.75	0.0151	0.004655	0.001476	0.001589	0	0	0.02282
Sub-Total:	0.450045	0.290418	0.179496	0.049728	0.009196	0.002157	0.977489
Calms:							0.018891
Missing/Incomplete:							0.00362
Total:							1

Frequency of Calm Winds: 1.90%
Average Wind Speed: 2.66 m/s

APPENDIX J3
CONSTRUCTION EMISSIONS

Mirant-Willow Pass Generating Station
Construction Equipment List

6/26/2008																																								
				Year			Year												Year												Year							
				2009			2010												2011												2012							
				1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	
Construction Equipment	**% Usage**	**HP**	**Fuel**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Total per Eq**
On-Road Vehicles																																								
Concrete Pumper Truck	15%	350	Dsl			1	1	1	1													1	1	1	1	1	1	1	1	1	1								14
Dump Truck	35%	300	Dsl			1	1	1	1													1	2	2	2	2	2	2	2	1	1	1	1						23
Dump Truck (30 Ton)	100%	300	Dsl							10	1	1	1																										13
Fuel/Lube Truck	25%	150	Gas	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	32
Pickup truck	75%	150	Gas	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	3	3	3	3	3	3	3	3	3	2	2	82
Water Truck	50%	300	Dsl	1	1	1	1	1	1													1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	22
Off-Road Vehicles																																							0
Air Compressor	80%	50	Gas	1	1	1	1	1	2	2	2	1	1	1	1	1	1	1	1			1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	41
Articulating Boom Manlift (120, 80, 60 and 40 Ft.)	70%	75	Gas				2	2	4	4	6	6	6	6	6	8	12	12	10	10	10	12	12	12	12	12	12	8	8	8	8	6	6	6	4	2	2	234
Backhoe Loader	40%	80	Dsl			2	2	2	2	2	1	1	1	1	1							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	31
Jumping Jack Compactors	60%	7.5	Gas								2	2	2										1	1	2	2	2	2	2	2	2	2	2					26
150 Ton Crawler Crane	50%	300	Dsl	1	1	1		1	1	1	1	1	1	1	1	1														1	1	1	1	1	1	1	1	20
M2250 Crawler Crane	25%	500	Dsl						1	1	1																			1	1	1	1	1	1			9
Hydraulic Crane (45 Ton)	65%	250	Dsl	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1									1	1	1	1	1	1	1	1	26
Hydraulic Crane (55 Ton)	65%	300	Dsl	1	1	1	1	1	2	2	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	38
Bull Dozer	80%	300	Dsl																				1	1	1	1	1	1										6
Bull Dozer w/ripper	80%	300	Dsl							1																												1
Hydraulic Excavator	85%	250	Dsl			2	2	2	2	4	2	2	2	1	1							1	1	2	2	2	2	2	2	2	2	1	1					40
Forklift	75%	40	Gas	1	1	1	1	2	2	2	3	2	2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	3	3	3	3	2	2	57
Front End Loader	70%	130	Dsl		1	1	1	1	1	2	2	2	2	1	1	1						1	2	2	2	2	2	2	2	2	2	2	2					39
Light Plant	30%	25	Gas		1	1	1	1									1	1	1	1																		8
Tractor	50%	195	Dsl	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	34
Vibratory Roller	80%	125	Gas			1	1	1	1														1	1	1	1	1	1	1	1	1	1	1					15
Walk Behind Vibratory Roller	60%	25	Gas			1	1	1	1		1	1	1										1	1	2	2	2	2	2	1	1	1	1					23
Welder (Diesel)	70%	25	Dsl	2	2	2	1	1	1	2	2	3	3	2	2	2	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	53
Total per month				**12**	**14**	**22**	**22**	**24**	**28**	**38**	**30**	**28**	**28**	**20**	**20**	**20**	**23**	**23**	**19**	**17**	**16**	**27**	**33**	**34**	**36**	**37**	**37**	**33**	**32**	**33**	**33**	**31**	**33**	**25**	**23**	**18**	**18**	**887**

Mirant-Willow Pass Generating Station
Construction Equipment List

6/26/2008

Equipment Description		% usage	hp	Emission Factors (lbs/hr) [with the % usage factor included]								
				CO	CO_2	CH_4	N_2O	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROG[1]
On-Road Vehicles	**Fuel Class**											
Concrete Pumper Truck	HHDT-DSL	15	350	0.044	10.468	0.000	0.000	0.091	0.006	0.006	0.00010	0.021
Dump Truck	HHDT-DSL	35	300	0.103	24.425	0.001	0.000	0.212	0.015	0.013	0.00023	0.049
Dump Truck (30 ton)	HHDT-DSL	100	300	0.295	69.786	0.002	0.001	0.607	0.042	0.038	0.00066	0.139
Fuel/Lube Truck	MHD-GAS	25	150	0.150	9.217	0.000	0.000	0.012	0.000	0.000	0.00009	0.012
Pickup truck, 1 ton	MHD-GAS	75	150	0.451	27.650	0.001	0.001	0.035	0.001	0.001	0.00028	0.036
Water Truck	HHDT-DSL	50	300	0.148	34.893	0.001	0.001	0.304	0.021	0.019	0.00033	0.069
Off-Road Vehicles	**SCAB Eq Name**											
Air Compressor. GAS	Air Compressors	80	50	4.046	27.077	0.009	0.009	0.226	0.002	0.002	0.00033	0.162
Articulating Boom Manlift (120, 80, 60 and 40 Ft.), GAS	Aerial Lifts	70	75	1.859	24.952	0.003	0.007	0.150	0.002	0.002	0.00027	0.062
Backhoe loader	Tractors/Loaders/Backhoes	40	80	0.147	15.804	0.001	0.000	0.176	0.017	0.016	0.00019	0.049
Compactors, Jumping Jack , GAS	Plate Compactors	60	7.5	0.758	1.562	0.002	0.002	0.018	0.006	0.005	0.00005	0.034
Crane, 150 Ton, Crawler	Cranes	50	300	0.218	62.874	0.005	0.002	0.712	0.027	0.025	0.00068	0.072
Crane, 330 Ton, Crawler, M2250	Cranes	25	500	0.179	45.025	0.004	0.001	0.469	0.018	0.017	0.00044	0.048
Crane, 45 Ton Hydraulic	Cranes	65	250	0.238	72.903	0.005	0.002	0.852	0.033	0.030	0.00082	0.085
Crane, 55 Ton Hydraulic	Cranes	65	300	0.284	81.736	0.007	0.002	0.925	0.036	0.033	0.00089	0.093
Dozer	Rubber Tired Dozers	80	300	0.816	159.811	0.008	0.003	2.176	0.095	0.087	0.00174	0.245
Dozer w/Ripper	Rubber Tired Dozers	80	300	0.816	159.811	0.008	0.003	2.176	0.095	0.087	0.00174	0.245
Excavator, Hydraulic	Excavators	85	250	0.352	134.880	0.007	0.002	1.364	0.047	0.043	0.00152	0.130
Forklift, GAS	Forklifts	75	40	4.048	11.518	0.004	0.006	0.089	0.002	0.002	0.00017	0.067
Front End Loader	Tractors/Loaders/Backhoes	70	130	0.285	42.530	0.003	0.001	0.480	0.039	0.036	0.00049	0.073
Light Plant, GAS	Other Construction Equipment	30	25	1.803	2.761	0.002	0.002	0.026	0.002	0.001	0.00007	0.038
Tractor, Farm	Off-Highway Tractors	50	195	0.392	65.209	0.003	0.001	0.916	0.049	0.045	0.00073	0.115
Vibratory Roller, GAS	Rollers	80	125	4.653	65.792	0.016	0.018	0.770	0.005	0.005	0.00063	0.288
Walk behind Vibratory Roller, GAS	Rollers	60	25	4.562	15.244	0.008	0.006	0.074	0.001	0.001	0.00023	0.137
Welder	Welders	70	25	0.048	7.900	0.001	0.000	0.078	0.006	0.005	0.00010	0.019

Note:

[1] Assuming ROGs are equivalent to VOCs

- Emission factors for on-road vehicles are based on results from Emfac Emissions Model 2007 Version 2.3 (HHDT-DSL=heavy heavy-duty trucks-diesel; MHD-GAS=medium heavy duty-GAS). EMFAC scenario year was 2009 and the selected area was Contra Costa County. PM_{10} values include break wear and tire wear.
- Emission factors for off-road diesel equipment are based on the maximum emission factors from 2009 to 2012 of the South Coast Air Quality Management District (AQMD) data . Linear interpolation was used to calculate the emission factor for horse power values that were not listed.
- Emission factors for off-road gasoline equipment are based on the maximum emission factors from 2009 to 2012 using OFFROAD2007 Dated December 15, 2007. Linear interpolation was used to calculate the emission factor for horse power values that were not listed.

- CO_2 emissions for off-road equipment were estimated using USEPA AP-42 Chapter 3.3 - Gasoline and Diesel Industrial Engines, and Chapter 3.4 - Large Stationary Diesel and All Stationary Dual-fuel Engines
- $PM_{2.5}$ emission factors were determined by multiplying PM_{10} numbers by a "$PM_{2.5}$ fraction of PM_{10}" value. Fractional values for $PM_{2.5}$ were taken from the SCAQMD guidance: Final - Methodology to Calculate $PM_{2.5}$ and $PM_{2.5}$ Significance

On-Road Vehicles:
- $PM_{2.5}$ Fraction of PM_{10}, Brake wear: 0.429
- $PM_{2.5}$ Fraction of PM_{10}, Diesel: 0.920
- PM2.5 Fraction of PM10, Tire wear: 0.250

Off-Road Vehicles:
- PM2.5 Fraction of PM10, Diesel: 0.920

- CH_4 and N_2O factors for on-road vehicles are derived from California Climate Action Registry General Reporting Protocol Version 2.2 (March 2007), Table C.4 using the mileage accrual rates by age table from EMFAC2007 Version 2.3, November 1, 2006, California Air Resources Board, normalized accrual rates (annual odometer mileage weighted by population) for LDT, MHD, and HHD diesel fueled trucks in the San Joaquin Valley Air Basin. These emissions are in g/mile. On-road vehicles are limited to 10 mph, which is used to convert to lb/hr
- CH_4 and N_2O factors for off-road equipment are derived from California Climate Action Registry General Reporting Protocol Version 2.2 (March 2007), Table C.6 (distillate fuel factors for the industrial sector) using the following to convert from kg/gallon to lb/hp-hour, and then multiplying by the rated horsepower rating: 1 gallon/137,000 Btu, 7,000 Btu/hp-hour, and 2.2046 lb/kg.

Mirant-Willow Pass Generating Station
Monthly Emissions During Consturction

Month	CO		CO_2		CH_4		N_2O		NO_x		PM_{10}		$PM_{2.5}$		SO_x		ROG	
	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)	Monthly Emissions (tons)	12-Month Total (tons)
October, 2009	1.16	NA	48.02	NA	0.00	NA	0.00	NA	0.47	NA	0.02	NA	0.02	NA	0.00	NA	0.09	NA
November, 2009	1.39	NA	53.00	NA	0.00	NA	0.00	NA	0.52	NA	0.02	NA	0.02	NA	0.00	NA	0.10	NA
December, 2009	2.53	NA	98.90	NA	0.01	NA	0.01	NA	0.99	NA	0.04	NA	0.04	NA	0.00	NA	0.19	NA
January, 2010	2.91	NA	96.61	NA	0.01	NA	0.01	NA	0.94	NA	0.04	NA	0.04	NA	0.00	NA	0.20	NA
February, 2010	3.38	NA	104.79	NA	0.01	NA	0.01	NA	1.02	NA	0.04	NA	0.04	NA	0.00	NA	0.21	NA
March, 2010	4.08	NA	126.90	NA	0.01	NA	0.01	NA	1.23	NA	0.05	NA	0.04	NA	0.00	NA	0.25	NA
April, 2010	3.56	NA	239.87	NA	0.01	NA	0.01	NA	2.34	NA	0.11	NA	0.10	NA	0.00	NA	0.41	NA
May, 2010	4.58	NA	121.58	NA	0.01	NA	0.01	NA	1.13	NA	0.05	NA	0.04	NA	0.00	NA	0.25	NA
June, 2010	3.68	NA	113.25	NA	0.01	NA	0.01	NA	1.06	NA	0.05	NA	0.04	NA	0.00	NA	0.22	NA
July, 2010	3.68	NA	113.25	NA	0.01	NA	0.01	NA	1.06	NA	0.05	NA	0.04	NA	0.00	NA	0.22	NA
August, 2010	2.45	NA	81.90	NA	0.01	NA	0.01	NA	0.76	NA	0.03	NA	0.03	NA	0.00	NA	0.15	NA
September, 2010	2.45	35.84	81.90	1,279.97	0.01	0.11	0.01	0.09	0.76	12.28	0.03	0.53	0.03	0.49	0.00	0.01	0.15	2.42
October, 2010	2.81	37.49	70.82	1,302.77	0.01	0.12	0.01	0.10	0.62	12.43	0.02	0.54	0.02	0.49	0.00	0.01	0.14	2.48
November, 2010	3.77	39.87	70.50	1,320.28	0.01	0.12	0.01	0.11	0.56	12.47	0.02	0.53	0.02	0.48	0.00	0.01	0.16	2.54
December, 2010	3.77	41.11	70.50	1,291.88	0.01	0.12	0.01	0.11	0.56	12.03	0.02	0.51	0.02	0.46	0.00	0.01	0.16	2.50
January, 2011	3.32	41.53	55.16	1,250.43	0.01	0.12	0.01	0.12	0.42	11.51	0.01	0.48	0.01	0.44	0.00	0.01	0.13	2.44
February, 2011	2.86	41.02	51.16	1,196.80	0.01	0.11	0.01	0.12	0.39	10.88	0.01	0.45	0.01	0.41	0.00	0.01	0.11	2.34
March, 2011	2.66	39.60	50.86	1,120.76	0.01	0.11	0.01	0.11	0.39	10.03	0.01	0.41	0.01	0.38	0.00	0.01	0.11	2.19
April, 2011	3.71	39.74	93.28	974.17	0.01	0.10	0.01	0.11	0.75	8.44	0.03	0.33	0.03	0.30	0.00	0.01	0.19	1.97
May, 2011	4.94	40.10	127.31	979.91	0.01	0.10	0.01	0.12	1.16	8.46	0.05	0.33	0.04	0.30	0.00	0.01	0.28	2.01
June, 2011	4.98	41.40	142.15	1,008.81	0.01	0.10	0.02	0.12	1.31	8.71	0.05	0.33	0.05	0.30	0.00	0.01	0.29	2.08
July, 2011	5.56	43.28	144.00	1,039.56	0.01	0.11	0.02	0.13	1.32	8.97	0.05	0.34	0.05	0.31	0.00	0.01	0.31	2.18
August, 2011	6.01	46.84	145.27	1,102.92	0.02	0.11	0.02	0.14	1.33	9.54	0.05	0.36	0.05	0.33	0.00	0.01	0.32	2.35
September, 2011	6.01	50.39	145.27	1,166.29	0.02	0.12	0.02	0.15	1.33	10.11	0.05	0.38	0.05	0.35	0.00	0.01	0.32	2.52
October, 2011	5.19	52.77	134.29	1,229.76	0.01	0.13	0.01	0.15	1.26	10.75	0.05	0.41	0.05	0.38	0.00	0.01	0.29	2.67
November, 2011	5.10	54.10	116.71	1,275.96	0.01	0.13	0.01	0.15	1.02	11.21	0.04	0.44	0.04	0.40	0.00	0.01	0.27	2.78
December, 2011	4.66	54.98	132.23	1,337.69	0.01	0.14	0.01	0.16	1.21	11.86	0.05	0.47	0.04	0.43	0.00	0.01	0.27	2.89
January, 2012	4.66	56.32	132.23	1,414.77	0.01	0.15	0.01	0.16	1.21	12.66	0.05	0.50	0.04	0.46	0.00	0.02	0.27	3.03
February, 2012	5.09	58.55	115.00	1,478.60	0.01	0.15	0.01	0.17	1.05	13.33	0.04	0.53	0.04	0.49	0.00	0.02	0.26	3.18
March, 2012	5.13	61.01	124.86	1,552.61	0.01	0.16	0.01	0.17	1.17	14.11	0.05	0.57	0.04	0.52	0.00	0.02	0.27	3.35
April, 2012	3.84	61.14	88.72	1,548.04	0.01	0.16	0.01	0.17	0.79	14.15	0.03	0.57	0.03	0.52	0.00	0.02	0.18	3.34
May, 2012	3.43	59.63	83.23	1,503.96	0.01	0.16	0.01	0.16	0.76	13.75	0.03	0.55	0.03	0.51	0.00	0.02	0.17	3.23
June, 2012	2.50	57.16	68.48	1,430.30	0.01	0.15	0.01	0.15	0.66	13.10	0.03	0.53	0.02	0.48	0.00	0.02	0.14	3.08
July, 2012	2.50	54.10	68.48	1,354.78	0.01	0.14	0.01	0.14	0.66	12.44	0.03	0.50	0.02	0.46	0.00	0.01	0.14	2.91
August, 2012	0.57	48.67	15.37	1,224.88	0.00	0.13	0.00	0.13	0.11	11.23	0.00	0.45	0.00	0.41	0.00	0.01	0.00	2.59
Maximum (100 % load)	**6.01**	**61.14**	**239.87**	**1,552.61**	**0.02**	**0.16**	**0.02**	**0.17**	**2.34**	**14.15**	**0.11**	**0.57**	**0.10**	**0.52**	**0.00**	**0.02**	**0.41**	**3.35**
Average	**3.91**	**48.19**	**103.37**	**1,266.08**	**0.01**	**0.13**	**0.01**	**0.14**	**0.93**	**11.43**	**0.04**	**0.46**	**0.03**	**0.42**	**0.00**	**0.01**	**0.21**	**2.63**
Average (75% load)	**4.50**	**45.86**	**179.90**	**1,164.45**	**0.01**	**0.12**	**0.01**	**0.13**	**1.76**	**10.61**	**0.09**	**0.43**	**0.08**	**0.39**	**0.00**	**0.01**	**0.31**	**2.51**

Note:
[1] Assuming ROGs are equivalent to VOCs
- Assuming 75% operational average load

Fugitive Dust PM_{10} and $PM_{2.5}$ Calculation		
Emission factor	1.30	lb/hr-acre
Hours per day	10.00	hr/day
Days per month	22.00	days/month
Months per year	12.00	months/year
Total acreage disturbed	25	acres
Percent disturbed at any one time	25%	
Average acreage	6.36	acre
Unmitigated PM10 emissions	10.92	tons/year
Unmitigated PM2.5 emissions	2.27	tons/year
Mitigation factor	83.23	percent
Mitigated PM10 emissions	1.83	tons/year
Mitigated PM2.5 emissions	0.38	tons/year

Note:

- Emission factor: 1.3 lb/hour-acre of ground disturbance - emission factor for fugitive dust emissions recommended in a study conducted by Midwest Research Institute (MRI, 1996) for an average level of earthmoving construction activities based on 0.11 ton/acre-month and 168 hours per month of construction.

- Assumed work schedule: 10 (hours/day), 22 (days/month), and 12 (months/year) (or 2,640 work hours/year) (Information provided by Applicant)

- Daily ground disturbance: 7 (acres) - based on the assumption that 25 percent of total acreage is disturbed per day (URBEMIS2007 (Version 9.2) model)

- Earth moving activity is expected to last for 13 months, which means that in one year it is possible for earthmoving activities to take place each month. Therefore, the worst-case annual fugitive dust emissions, were calculated by multiplying the monthly fugitive dust emission rate by 12 months.

- $PM_{2.5}$ values were calculated according to the South Coast AQMD's recommended method, which is to use a conversion factor to obtain the $PM_{2.5}$ emissions directly from PM10 emissions. Conversion factors are published as Appendix A of the Methodology to Calculate Particulate Matter $(PM)_{2.5}$ and $PM_{2.5}$ Significance Thresholds from October 2006.

- Limiting vehicle speed to 15 mph or less: about 57% control efficiency for unpaved roads (WRAP Fugitive Dust Handbook)

- Watering (every 3 hours to the disturbed areas): at least 61% efficiency for general construction activities (WRAP Fugitive Dust Handbook)

- Mitigated emissions calculated as unmitigated emissions (ton/year) x (100 - 83.23)/100

Transportation Information

-Total HHDT miles/year = 57,600
-Total LDA peak miles/year = 1,425,600

Comment

Truck miles based on the assumption that they will travel 15 miles/trip, there will be an average of 16 1-way trips/day and 20days/month of truck delivery

Passenger vehicle miles based on the assumption that they will travel an average 15 miles/trip , there will be an average of 360 1-way trips/day and 22 days/month of construction

DATA FROM EMFAC2007

Equipment Description	Vehicle Miles Traveled per Day	Tons Per Day					
		CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROG
Heavy-Heavy Duty Diesel Truck 2009	405,000	2.24	7.92	0.32	0.28	0.01	0.55
Passenger Vehicles 2009	13,268,000	61.54	5.32	0.48	0.27	0.06	6.59

Note:

- Emission factors for on-road, heavy-heavy-duty vehicles and light duty autos are based on results from Emfac Emissions Model 2007 Version 2.3. The values are the projected values for the HHDT and LDA vehicles within Contra Costa County in the respective year
- $PM_{2.5}$ emission factors were determined by multiplying PM_{10} numbers by a "$PM_{2.5}$ fraction of PM_{10}" value. Fractional values for $PM_{2.5}$ were taken from the SCAQMD guidance: Final - Methodology to Calculate $PM_{2.5}$ and PM2.5 Significance Thresholds, October 2006: Appendix A-Updatec
  - $PM_{2.5}$ Fraction of PM_{10}, Brake wear: 0.429
  - $PM_{2.5}$ Fraction of PM_{10}, Diesel: 0.920
  - $PM_{2.5}$ Fraction of PM_{10}, Tire wear: 0.250

CALCULATION OF EMISSION FACTOR

Equipment Description	Pounds per Mile					
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROG
Heavy-Heavy Duty Diesel Truck 2009	1.11E-02	3.91E-02	1.58E-03	1.36E-03	4.94E-05	2.72E-03
Passenger Vehicles 2009	9.28E-03	8.02E-04	7.24E-05	4.11E-05	9.04E-06	9.93E-04

Note:

- The following equation was used to obtain the emission factors:

$$EF = ER / VMT * 2000$$

Where: EF= emission factor in pounds per mile
ER = Emission Rate in tons per day
VMT = Average vehicle miles traveled per day in Contra Costa county

EMISSIONS

Equipment Description	Tons Emitted Per Year					
	CO	NO_x	PM_{10}	$PM_{2.5}$	SO_x	ROG
Heavy-Heavy Duty Diesel Truck 2009	0.32	1.13	0.05	0.04	0.0014	0.08
Passenger Vehicles 2009	6.61	0.57	0.05	0.029	0.0064	0.71
TOTAL	6.93	1.70	0.10	0.07	0.0079	0.79

Note:

- The following equation was used to obtain the emission factors:

$$M = EF * D / 2000$$

Where: M = Mass emissions rate from refinery related activities in tons per year
EF= emission factor in pounds per mile
D = Distance traveled by trucks to the refinery in miles per year.

Entrained Dust Calculation - Dry Paved Road

$$E = k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C$$

Entrained Dust Calculation - Natural Mitigation With Precipitation Correction Factor

$$E_{ext} = \left[k\left(\frac{sL}{2}\right)^{0.65}\left(\frac{W}{3}\right)^{1.5} - C\right]\left(1 - \frac{P}{4N}\right)$$

Entrained dust estimates calculated using guidance from AP 42, Fifth Edition, Volume I Chapter 13.2.1: Paved Roads

Where:
E = particulate emission factor
Ext = annual or other long-term average emission factor
k = particle size multiplier for particle size range and units of interest
sLa = arterial (major street/highway) road surface silt loading
sLc = collector road surface silt loading
W = average weight (tons) of the vehicles traveling the road
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.
P = number of "wet" days with at least 0.01 in of precipitation during the averaging period
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly)
VMT = vehicle mile traveled

Paved Roads PM_{10} Delivery Trucks

Equation Values			Source
k =	0.016	lb/VMT	AP 42, Table 13.2-1.1: default k value for PM_{10}
sLa =	0.035	g/m^2	Silt loading values based on silt loadings measured by MRI in the South Coast Air Quality Management District
sLc =	0.035	g/m^2	
			Muleski, Greg. Improvement of Specific Emission Factors (BACM Project No. 1), Final Report. Midwest Research Institute. March 29, 1996.
W =	23.25	ton	Average fleet weight is based on the assumption from the average weight of HHDT (EMFAC2007): 46500 lbs
C =	0.00047	lb/VMT	AP 42, Table 13.2-1.2: default C value for PM_{10}
P =	56	wet days	From WRCC Antioch meteorological station
N =	365	days	
Annual VMT arterial highway =	57,600	miles/year	Total annual VMT is calculated based on assumption of 15 miles/one way,16 1-way trips/day at 20 days/month
Annual VMT paved road onsite collector =	1,728	miles/year	Total annual VMT is calculated based on assumption of .45 miles/one way,16 1-way trips/day at 20 days/month

Road Surface	VMT	E	Base Emissions	Corrected[1]	Ext	Mitigated Emissions	Corrected[1]
	mile/yr	lb/VMT	ton/yr	ton/yr	lb/VMT	ton/yr	ton/yr
Arterial	57,600	0.0244213	0.70	0.70	0.0234846	0.68	0.68
Collector	1,728	0.0244213	0.02	0.02	0.0234846	0.02	0.02
Totals Delivery trucks				**0.72**			**0.70**

Note:
[1] AP 42, Fifth Edition, Volume I Chapter 13.2.1, page 13.2.1-5. "There may be situations where low silt loading and/or low average weight will yield calculated negative emissions from equation 1. If this occurs, the emissions calculated from equati

Paved Roads $PM_{2.5}$ Delivery Trucks

Equation Values			Source
k =	0.0024	lb/VMT	AP 42, Table 13.2-1.1: default k value for $PM_{2.5}$
sLa =	0.035	g/m^2	Silt loading values based on silt loadings measured by MRI in the South Coast Air Quality Management District
sLc =	0.035	g/m^2	
			Muleski, Greg. Improvement of Specific Emission Factors (BACM Project No. 1), Final Report. Midwest Research Institute. March 29, 1996.
W =	23.25	ton	lbs
C =	0.00036	lb/VMT	AP 42, Table 13.2-1.2: default C value for $PM_{2.5}$
P =	56	wet days	From WRCC Antioch meteorological station when >=0.10 in.
N =	365	days	
Annual VMT arterial highway =	57,600	miles/year	days/month
Annual VMT paved road onsite collector =	1,766	miles/year	Total annual VMT is calculated based on assumption of .46 miles/one way,16 1-way trips/day at 20 days/month

Road Surface	VMT	E	Base Emissions	Corrected[1]	Ext	Mitigated Emissions	Corrected[1]
	mile/yr	lb/VMT	ton/yr	ton/yr	lb/VMT	ton/yr	ton/yr
Arterial	57,600	0.0033737	0.10	0.10	0.0032443	0.09	0.09
Collector	1,766	0.0033737	0.00	0.00	0.0032443	0.00	0.00
Totals				**1.001E-01**			**9.630E-02**

Note: 1 AP 42, Fifth Edition, Volume I Chapter 13.2.1, page 13.2.1-5. "There may be situations where low silt loading and/or low average weight will yield calculated negative from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero."

Entrained Dust Calculation - Dry Paved Road

$$E = k\left(\frac{sL}{2}\right)^{0.65} \times \left(\frac{W}{3}\right)^{1.5} - C$$

Entrained Dust Calculation - Natural Mitigation With Precipitation Correction Factor

$$E_{ext} = \left[k\left(\frac{sL}{2}\right)^{0.65}\left(\frac{W}{3}\right)^{1.5} - C\right]\left(1 - \frac{P}{4N}\right)$$

Entrained dust estimates calculated using guidance from AP 42, Fifth Edition, Volume I Chapter 13.2.1: Paved Roads

Where:
E = particulate emission factor
Ext = annual or other long-term average emission factor
k = particle size multiplier for particle size range and units of interest
sLa = arterial (major street/highway) road surface silt loading
sLc = collector road surface silt loading
W = average weight (tons) of the vehicles traveling the road
C = emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear.
P = number of "wet" days with at least 0.01 in of precipitation during the averaging period
N = number of days in the averaging period (e.g., 365 for annual, 91 for seasonal, 30 for monthly)
VMT = vehicle mile traveled

Paved Roads PM_{10} Passenger Vehicles

Equation Values			Source
k =	0.016	lb/VMT	AP 42, Table 13.2-1.1: default k value for PM_{10}
sLa =	0.035	g/m^2	Silt loading values based on silt loadings measured by MRI in the South Coast Air Quality Management District
sLc =	0.035	g/m^2	
			Muleski, Greg. Improvement of Specific Emission Factors (BACM Project No. 1), Final Report. Midwest Research Institute. March 29, 1996.
W =	2	ton	Assumed average passenger vehicle weight
C =	0.00047	lb/VMT	AP 42, Table 13.2-1.2: default C value for PM_{10}
P =	56	wet days	From WRCC Antioch meteorological station
N =	365	days	
Annual VMT arterial highway =	1,425,600	miles/year	Total annual VMT is calculated based on assumption of 15 miles/one way,360 1-way trips/day at 22days/month
Annual VMT paved road onsite collector =	42,768	miles/year	Total annual VMT is calculated based on assumption of .4 miles/one way,360 1-way trips/day at 22days/month

Road Surface	VMT	E	Base Emissions	Corrected[1]	Ext	Mitigated Emissions	Corrected[1]
	mile/yr	lb/VMT	ton/yr	ton/yr	lb/VMT	ton/yr	ton/yr
Arterial	1,425,600	0.000158	0.11	0.11	0.0001519	0.11	0.11
Collector	42,768	0.000158	0.00	0.00	0.0001519	0.00	0.00
Totals				**0.12**			**0.11**

Note:

Paved Roads $PM_{2.5}$ Passenger Vehicles

Equation Values			Source
k =	0.0024	lb/VMT	AP 42, Table 13.2-1.1: default k value for $PM_{2.5}$
sLa =	0.035	g/m^2	Silt loading values based on silt loadings measured by MRI in the South Coast Air Quality Management District
sLc =	0.035	g/m^2	
			Muleski, Greg. Improvement of Specific Emission Factors (BACM Project No. 1), Final Report. Midwest Research Institute. March 29, 1996.
W =	2	ton	Assumed average passenger vehicle weight
C =	0.00036	lb/VMT	AP 42, Table 13.2-1.2: default C value for $PM_{2.5}$
P =	56	wet days	From WRCC Antioch meteorological station when >=0.10 in.
N =	365	days	
Annual VMT arterial highway =	1,425,600	miles/year	Total annual VMT is calculated based on assumption of 15 miles/one way,360 1-way trips/day at 22days/month
Annual VMT paved road onsite collector =	42,768	miles/year	Total annual VMT is calculated based on assumption of .4 miles/one way,360 1-way trips/day at 22days/month

Road Surface	VMT	E	Base Emissions	Corrected[1]	Ext	Mitigated Emissions	Corrected[1]
	mile/yr	lb/VMT	ton/yr	ton/yr	lb/VMT	ton/yr	ton/yr
Arterial	1,425,600	-0.000266	-0.19	0	-0.000256	-0.18	0
Collector	42,768	-0.000266	-0.01	0	-0.0002556	-0.01	0
Totals				**0.000E+00**			**0.000E+00**

Note: 1 AP 42, Fifth Edition, Volume I Chapter 13.2.1, page 13.2.1-5. "There may be situations where low silt loading and/or low average weight will yield calculated negative from equation 1. If this occurs, the emissions calculated from equation 1 should be set to zero." = 0

Combustion emissions from diesel trains. Trains will be delivering large equipment onsite during constructio
4 rail deliveries for the entire projec

Fleet average emission factors for all locomotives

Year	HC	CO	NOx	PM
		(g/bhp-hr)		
2010	0.44	1.32	7.84	0.28

Reference: EPA Technical Highlights, Emission Factors for Locomotives, December 1997.

4 trains
3600 bhp per train assume 20% load of total load 18,000 bhp for 5mph
0.45 mile onsite
5 miles/hr, assumed speed onsite

Peak hour onsite
Etr-h (lb/hr)=Ntrh (train/hr)*P(bhp/train)*(L (mile)/Vt (mile/hr))*C1(lb/g)*Eftr(g/bhp-hr)

assume max # of trains that would ever come in one hour is 1

CO 1,8hr (lbs/hr)	NOx 1hr (lbs/hr)	SO2 1,3 hr (lbs/hr)
0.94	5.60	3.69

Daily onsite
Etr-d(lb/day)=NTr-d (train/day)*P(bhp/train)*(L(mile)/Vt(mile/hr))*C1(lb/g)*Eftr(g/bhp-hr)

assume max # of trains that would ever come in one day is 1
and that it would be onsite 1 hour

PM10 24hr (lbs/day)	PM2.5 24hr (lbs/day)	SO2 24 hr (lbs/day)	ROCs (use HCs) (lbs/day)
0.20	0.18	3.69	0.31

0.92 PM2.5 fraction of total PM. Reference: Ceidars Table A for trains

Annual onsite
Etr-a(tons/year)=Etr-d(lb/day)*365(days/year)*C2(ton/lb)

max # of trains that come in one year is **4**
and that they would run 1 hour onsite each

PM10 annual (tons/yr)	PM2.5 annual (tons/yr)	NOx annual (tons/yr)	CO annual (tons/yr)	SO2 annual (tons/yr)	ROCs (use HCs) (tons/yr)
0.15	0.13	4.09	0.69	2.69	0.23

Etr-h=Peak hour locomotive emissions (lb/hr)
Etr-d=Daily locomotive emissions (lb/day)
Etr-a=Annual locomotive emissions (tons/year)
Ntr-h=Number of trains during the peak hour (trains/hr)
Ntr-d=Number of daily trains
P=Power rating of locomotives for individual trains (18,000 bhp/train)
L: Length of one-way rail line across project site
Vt: Train speed
C1: Conversion factor 0.002205 lb/g
C2: Conversion factor 0.0005 tons/lb

SO2 **ONSITE**

20.8	bhp-hr/gal	EPA estimated conversion factor
18000	bhp	assumed typical brake horsepower of one locomotive full load
20		assumed percent load when train is traveling 5mph
7.1		lbs/gallon
15		sulfur fuel by weight (15 parts per million, multiplied by 100 for percentage)
3.69	lbs/hr SO2	

SO2 **OFFSITE**

20.8	bhp-hr/gal	EPA estimated conversion factor
18000	bhp	assumed typical brake horsepower of one locomotive full load
60		assumed percent load when train is traveling 30 mph
7.1		lbs/gallon
15		sulfur fuel by weight (15 parts per million, multiplied by 100 for percentage)
11.06	lbs/hr SO2	

Offsite Combustion emissions--trains

4	trains	
10800	bhp per train	assume 60% load of total load 18,000 bhp for 30mph
30.00	miles offsite round trip	
30	miles/hr, assumed speed onsite	

Daily offsite
Etr-d(lb/day)=NTr-d (train/day)*P(bhp/train)*(L(mile)/Vt(mile/hr))*C1(lb/g)*Eftr(g/bhp-hr)

assume max # of trains that would ever run in one day is 1
and that it would run 1 hour offsite

PM10 24hr (lbs/day)	PM2.5 24hr (lbs/day)	SO2 24 hr (lbs/day)	CO (lbs/day)	NOx (lbs/day)	ROCs(use HCs) (lbs/day)
6.67	6.13	11.06	31.43	186.70	10.48

0.92 PM2.5 fraction of total PM. Reference: Ceidars Table A for trains

Annual offsite
Etr-a(tons/year)=Etr-d(lb/day)*365(days/year)*C2(ton/lb)

max # of trains that come in one year is **4**
and that they would run 1 hour offsite each

PM10 annual (tons/yr)	PM2.5 annual (tons/yr)	SO2 annual (tons/yr)	CO (tons/yr)	NOx annual (tons/yr)	ROCs(use HCs) (tons/yr)
4.87	4.48	8.07	22.95	136.29	7.65

APPENDIX J4
OPERATING EMISSIONS

Willow Pass Generating Station
Siemens Flex Plant 10s - Combined Cycle
Potential Emission Estimates

Turbine Operating Parameters

Ambient Temperature	UNITS	Winter Minimum (20°F / 90% RH)			Yearly Average (59°)			Summer Maximum (94°F)					
CTG Load Level	%	100%	85%	60%	100%	85%	60%	100%	100%	100%	100%	85%	60%
Case No From Siemens Data		1	2	39	4	8	60	19	18	17	16		43
Evap Cooling Status	off / on	Off	Off	Off	Off	Off	Off	On	On	Off	Off	Off	Off
Power Augmentation Status	off / on	Off	Off	Off	Off	Off	Off	On	Off	On	Off	Off	Off
Stack Outlet Temperature	(°F)	350	346	343.7	340	337	328.7	338	348	333	341	346	323.3

Average Emission Rates from each Gas Turbine (lbs/hr/turbine) - Normal Operation

	UNITS	Winter Minimum (20°F / 90% RH)			Yearly Average (59°)			Summer Maximum (94°F)					
Net Power	kw	286,700	244,200	172,900	259,400	221,400	149,600	268,700	250,100	255,900	233,300	N/A	140,100.0
Heat Rate,	Btu/kWh (LHV)	7,135	7,330	8,250	7,160	7,410	8,455	7,115	7,130	7,020	7,185	N/A	8,580.0
Fuel Flow	MMBtu/hr (LHV)	2,046	1,790	1,426	1,857	1,641	1,265	1,912	1,783	1,796	1,676	1,509	1,202
Fuel Flow	MMBtu/hr (HHV)	2,271	1,987	1,583	2,062	1,821	1,404	2,122	1,979	1,994	1,861	1,674.6	1,334
Fuel Heating Value	Btu/scf	908	908	908	908	908	908	908	908	908	908	908.0	908.0
Oxygen	VOL%	12.3	12.4	12.8	12.3	12.5	12.7	10.9	12.0	11.1	12.3		12.8
CO_2	VOL%	4.0	3.9	3.8	3.9	3.8	3.7	4.0	3.9	3.9	3.8		3.6
H_2O	VOL%	8.0	7.9	7.6	8.5	8.4	8.6	14.9	9.9	14.1	9.1		8.7
N_2	VOL%	74.9	74.9	75.0	74.4	74.4	74.1	69.4	73.3	70.0	73.9		74.1
Ar	VOL%	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.8	0.9		0.9
Oxygen	lbm/hr	604,147.8	534,359.7	448,054.1	557,810.4	502,428.7	409,093.5	501,141.7	525,617.5	487,406.3	510,555.9	459,500.3	530,349.7
CO_2	lbm/hr	267,228.7	232,086.9	182,164.7	242,994.2	213,078.2	161,725.3	250,167.8	233,504.7	170,789.3	159,522.8	143,570.5	150,639.2
H_2O	lbm/hr	220,485.3	191,262.8	149,961.9	217,605.1	191,070.1	155,590.9	386,375.4	242,824.1	617,906.9	378,451.1	340,606.0	359,376.2
N_2	lbm/hr	3,215,827.9	2,822,939.8	2,307,879.6	2,950,136.9	2,629,121.3	2,085,751.8	2,799,994.9	2,801,704.9	3,066,324.5	3,069,151.4	2,762,236.2	3,073,372.2
Ar	lbm/hr	54,528.1	48,378.2	38,605.4	50,345.8	44,837.4	34,902.7	47,726.0	47,959.1	36,785.4	36,557.3	32,901.6	36,103.6
MW of exhaust gas	lb/lbmol	28.5	28.5	28.5	28.4	28.4	28.4	27.7	28.2	27.8	28.3	28.3	28.3
NO_x (@ 2.0 ppm)	lbm/hr	17.4	15.1	12.0	15.8	13.9	10.0	16.3	15.2	15.3	14.3	12.9	10.0
CO (@ 2.0 ppm)	lbm/hr	10.6	9.2	7.1	9.7	8.5	6.3	10.0	9.3	9.4	8.7	7.8	6.0
CO (@ 3 ppm)	lbm/hr	15.9	13.8	10.7	14.6	12.8	9.5	15.0	14.0	14.1	13.1	11.7	9.0
VOC (@ 2.0 ppm)	lbm/hr	6.2	5.4	4.1	5.6	5.0	3.6	5.8	5.4	5.4	5.0	4.5	3.5
SO_2 (based on 0.4 gr total S / 100 scf)	lbm/hr	2.6	2.3	1.8	2.3	2.1	1.6	2.4	2.2	2.3	2.1	1.9	1.5
SO_2 (based on 1.0 gr total S / 100 scf) worst-case	lbm/hr	6.4	5.6	4.5	5.8	5.2	4.0	6.0	5.6	5.6	5.3	4.7	3.8
PM_{10}	lbm/hr	10.0	8.9	8.0	9.3	8.3	8.0	8.9	8.8	8.5	8.5	7.7	8.0
NH_3 (@ 5 ppm slip)	lbm/hr	16.1	14.0	11.0	14.7	12.8	10.0	15.1	14.1	14.2	13.2	11.9	9.0
% of HC as VOC (using CO @ 3ppm)	%	28.1	28.1	27.8	27.8	28.2	27.6	27.9	27.9	27.7	27.7	27.7	28.0
Total Inerts	lbm/hr	4,363,324	3,828,197	3,129,789	4,018,750	3,580,309	2,847,064	3,985,700	3,851,272	3,800,335	3,675,203	3,307,683	2,731,651
Total	lbm/hr	4,363,392	3,828,256	3,129,837	4,018,812	3,580,364	2,847,107	3,985,764	3,851,332	3,800,395	3,675,259	3,307,733	2,731,692
Total Inerts	lbmol/hr	153,368	134,559	109,817	141,605	126,112	100,426	143,940	136,425	136,850	129,820	116,838	96,389
Total Inerts	ft^3/min	1,511,297	1,319,398	1,073,724	1,378,149	1,222,758	963,566	1,397,371	1,341,016	1,320,217	1,265,033	1,145,639	918,497
Exit Velocity	fps	70.5	61.5	50.1	64.3	57.0	44.9	65.2	62.5	61.6	59.0	53.4	42.8

notes:

All turbine operating parameters and emissions data provided by Siemens based on expected operating parameters at the WPGS Site

Assumed average sulfur content in gas (for annual emission):	0.4	gr total S / 100 scf
Assumed average sulfur content in gas (for short term emissions):	1	gr total S / 100 scf
Assumed fuel heating value:	908	Btu/scf
HHV/LHV	1.11	ratio
Stack Diameter	21.33	ft

Willow Pass Generating Station
Siemens Flex Plant 10s - Combined Cycle
Potential Emission Estimates

Startup / Shutdown Emissions from Turbine (1CT)

Startup (41° F)			Shutdown (41° F)		
12 (min. in startup)	1-hr. (w/1 SU) (lb/hr)	SU emissions (lb/12min)	7 (min. in shutdown)	1-hr. (w/1 SD) (lb/hr)	SD emissions (lb/7min)
NO_X	38.7	24.8	NOx	25.9	10.5
CO	279.8	267.1	CO	149.5	135.4
VOC	17.7	12.7	VOC	10.7	5.2
SO_2 (based on 0.4 gr total S / 100 scf)	2.7	0.6	SO_2	2.4	0.2
SO_2 (based on 1.0 gr total S / 100 scf) worst-case	6.7	1.6	SO_2 worst - case	6.1	0.4
PM_{10}	11.1	3.1	PM_{10}	9.9	1.1

notes:

Startup and shutdown emissions data provided by Siemens based on expected operating parameters at the WPGS Site

Startup and shutdown SO_2 emissions are calculated based on the total amount of fuel used for each and the emission rate of SO_2 at winter minimum - 20°F; 100% load

Fuel use for startup on natural gas @ 41 °F	24,173	lb/start
Fuel use for shutdown on natural gas @ 41 °F	6,525	lb/shutdown

1-hr emission comparisons

	1-hr. (w/1 SU) (lb/hr)	1-hr. (w/1 SD) (lb/hr)	1-hr (lb/hr)
NO_X	38.7	25.9	17.4
CO	279.8	149.5	15.9
VOC	17.7	10.7	6.2
SO_2 (based on 0.4 gr total S / 100 scf)	2.7	2.4	2.6
SO_2 (based on 1.0 gr total S / 100 scf) worst-case	6.7	6.1	6.4
PM_{10}	11.1	9.9	10.0

Average Annual Emissions

		Pollutant	Emissions (lb/yr/CT)	Both Turbines (ton/yr/2CT)
Total Hours of Operation	4,383			
Total Number of Starts	193	NO_X	77,103	77.1
Start Duration (hr)	0.2	CO	142,371	142.4
Total Number of Shutdowns	193	CO_2	1,093,738,123	1,093,738
Shutdown Duration (hr)	0.1	VOC	28,459	28.5
Yearly Average w/Power Augmentation Operation (hr)	4000	SO_2	10,521	10.5
Normal Operation (hr)	322	PM_{10}	39,400	39.4

notes:

Average annual emissions are calculated using yearly average- 59°F, at 100 % load for Normal Operation

Power augmentation emissions are calculated using summer maximum - 94°F, at 100 % load with power augmentation and evaporative cooling ON.

SO_2 emissions are based on 0.4 gr total S / 100 scf.

Modeling Worst-Case 1 hr Emissions per Turbine

Pollutant	lb/hr/CT	g/sec/CT
NOx	38.7	4.9
CO	279.8	35.3
SO_2	6.7	0.8
PM_{10}	11.1	1.4

notes:

Startup emissions represent worst case hr for NOx, CO, and SO_2 and were used for the worst-case scenario

SO_2 emissions are based on 1 gr/100 scf

Willow Pass Generating Station
Siemens Flex Plant 10s - Combined Cycle
Potential Emission Estimates

Modeling Worst-Case 3 hr Emissions per Turbine

	(hr)	emission rate (lb/hr)	Emissions (lb/CT)	
Total Hours of Operation	3.0			
Startup Duration	0.6		4.7	contribution over 3 hr from start up
Shutdown Duration	0.0		0.0	contribution over 3 hr from shut down
Hours of Operation	2.4	6.4	15.4	contribution over 3 hr from operation
SO_2 worst-case 3 hr emissions per turbine	20.1	lb/3 hr		
SO_2 worst-case 1 hr emissions per turbine	6.7	lb/hr		
SO_2 modeling worst-case emissions per turbine	0.8	g/sec		

notes:

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard.

Operational emissions using "worst-case" (winter minimum - 20°F; 100% load)

SO2 emissions are based on 1 gr/100 scf

Worst-case 3 hr emissions assumes a start up of : 3

Worst-case 3 hr emissions assumes a shut down of : 0

Conservatively assumes 3 startups in a 3 hr period, no shut downs

Willow Pass Generating Station
Siemens Flex Plant 10s - Combined Cycle
Potential Emission Estimates

Modeling Worst-Case 8 hr Emissions per Turbine

	(hr)	max emission rate (lb/hr)	Emissions (lb/8 hr/CT)	
Total Hours of Operation	8.0			
Startup Duration	0.4		534.2	contribution over 8 hr from start up
Shutdown Duration	0.1		135.4	contribution over 8 hr from shut down
Hours of Operation	7.5	15.9	119.0	contribution over 8 hr from operation
CO worst-case 8 hr emissions per turbine	788.6	lb/8 hr		
	98.6	lb/hr		
	12.4	g/sec		

notes:

Only CO is considered for an average 8-hour Ambient Air Quality Standard.

Operational emissions using "worst-case" (winter minimum - 20°F; 100% load)

Worst-case 8 hr emissions assumes a total start up of : 2

Worst-case 8 hr emissions assumes a total shut down of : 1

Modeling Worst-Case 24 Hour Emission Rate

SO_2 (lb/day/CT)	154.3	based on 1.0 gr/100 scf
SO_2 (g/s/CT)	0.8	based on 1.0 gr/100 scf
PM_{10} (lb/day/CT)	243.0	
PM_{10} (g/s/CT)	1.3	

Assumptions:

Only SO2 and PM10 are considered for an average 24-hour Ambient Air Quality Standard.

SO2 Conservative estimate: all 24 hrs of baseline operation are in winter minimum - 20°F; 100% load

PM10 Conservative estimate: 24 hrs taken from worst-case daily below.

Worst-Case Daily Emissions per Turbine

Pollutant	Time in Start Up (hr)	Startup Emission Rate (lb/start)	Time in Shut Down (hr)	Shutdown Emission Rate (lb/start)	Time in Operation (hr)	Operational Emission Rate (lb/start)	Worst-Case Daily Emissions (lb/day/CT)	Modeling Worst-Case 24 Hr Emission (g/s/CT)	
NOx	0.6	24.8	0.4	10.5	23.1	17.4	507.0		
CO	0.6	267.1	0.4	135.4	23.1	15.9	1,574.1		
VOC	0.6	12.7	0.4	5.2	23.1	6.2	196.6		
SO_2	0.6	1.6	0.4	0.4	23.1	6.4	154.2	0.8	based on 1.0 gr/100 scf
PM_{10}	0.6	3.1	0.4	1.1	23.1	10.0	243.0	1.3	based on 1.0 gr/100 scf

Assumptions:

For NOx, CO, VOC, SO_2 and PM_{10} -- emissions are calcuted assuming:

Worst-case daily emissions assumes a total start up of : 3

Worst-case daily emissions assumes a total shut down of : 3

Remainder of time is spent in operation at "worst-case" (winter minimum - 20°F; 100% load)

Willow Pass Generating Station
Siemens Flex Plant 10s - Combined Cycle
Potential Emission Estimates

Pollutant	Emission Factors		Emission Rate
	lbs/MCF/unit	lbs/MMBTU/unit	lbs/hr/unit
CO	35	**0.034**	0.17
NO_x	30.6	**0.03**	0.15
PM_{10}	3	**0.0029**	0.015
SO_2 (0.4 gr S/100 SCF)	1.14	**0.0011**	0.006
SO_2 (1gr S/100 SCF)	2.85	**0.0028**	0.014
VOC	2.8	**0.0027**	0.014

note: these emission factors are from FIRE ver 6.25. Using "process heaters from natural gas" (SCC 3-10-004-04). The SCC# was obtained from http://www.epa.gov/ttnchie1/eiip/techreport/volume02/ii10.pdf.
Except for Sox, which was calculated.

1020	BTU/SCF	conversion factor
5	MMBTU/hr	max heat input capacity

For Willow Pass

1	unit	number of Fuel Gas Heater, one for FP10
4,383	hours	number of hours FP10 is running

Modeling Worst-Case 1 hr Emissions per heater

pollutant	lbs/hr/unit	g/sec/unit
CO	0.172	0.0216
NO_x	0.150	0.0189
PM_{10}	0.015	0.0019
SO_2 (1gr S/100 SCF)	0.014	0.0018
VOC	0.014	0.0017

Annual Emissions for the Fuel Gas Heater for FP10.

pollutant	lbs/yr/unit	tons/yr/unit	g/sec/unit
CO	752	0.376	0.01082
NO_x	657	0.329	0.00946
PM_{10}	64.5	0.032	0.00093
SO_2 (based on 0.4 gr total S / 100 scf)	24.5	0.012	0.00035
VOC	60.2	0.030	0.00087

APPENDIX J5
GREENHOUSE GAS EMISSIONS

Willow Pass Genergating Station
Greenhouse Gas Point Source Emissions Estimate

The calculation below is referred to the "*Power/Utility Reporting Protocol Version 1.0 April 2005* ", California Climate Action Registry

Step 1. Identify the annual consumption of each fossil and non-fossil fuel

Natural Gas for all turbines and fuel gas heater

Step 2. Determine annual consumption of the fuel

	Max Fuel Flow HHV (MMBtu/hr)	Hours of Operation (hr/yr)	Fuel Consumed (MMBtu)	number of unit	Total Annual Fuel Consumed (MMBtu)
Two Turbines (Siemens Flex 10)	2,122	4,383	9,300,726.00	2	18,601,452
Fuel Gas Heater	5	4,383	21,915.00	1	21,915
Total					18,623,367

note:
1. Max Fuel Flow HHV: used 2,122 MMBtu/hr for each turbine (100% load operation at 338ºF stack outlet temperature);
1. Max Fuel Flow HHV: used 5 MMBtu/hr for the fuel gas heater max heat input capacity

Step 3. Apply or Derive an Appropriate CO_2 Emission Factors for Each Fuel

Find the emission factors for natural gas

Natural gas	Unit
53.05	(kg CO_2/MMBtu)
0.003901	(kg CH_4/MMBtu)
0.001361	(kg N_2O/MMBtu)

Step 4. Calculate fuel's carbon dioxide (CO_2) emissions

(1) Two Turbines
Total Emissions (metric tons) = Adjusted Emission Factor (kg CO_2/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 986,807.03 metric tons

(2) Fuel Gas Heater
Total Emissions (metric tons) = Adjusted Emission Factor (kg CO_2/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 1162.59075 metric tons

Step 5a . Calculate each fuel's methane (CH_4) emissions .

(1) Two Turbines
Total Emissions (metric tons) = Adjusted Emission Factor (kg CH_4/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 72.56426425 metric tons

(2) Fuel Gas Heater
Total Emissions (metric tons) = Adjusted Emission Factor (kg CH_4/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 0.085490415 metric tons

Step 5b. Calculate each fuel's N_2O emissions

(1) Two Turbines
Total Emissions (metric tons) = Adjusted Emission Factor (kg N_2O/MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 25.31657617 metric tons

(2) Fuel Gas Heater
Total Emissions (metric tons) = Adjusted Emission Factor (kg N_2O /MMBtu) x Fuel Consumed (MMBtu) x 0.001 metric tons/kg
= 0.029826315 metric tons

Willow Pass Genergating Station
Greenhouse Gas Point Source Emissions Estimate

Step 6. Convert CH_4 and N_2O emissions to CO_2 equivalents and sum all subtotals

Greenhouse Gas GWP (SAR, 1996)
Source: Intergovernmental Panel on Climate Change, Second Assessment Report (1996)

Greenhouse Gas	GWP (SAR, 1996)
CO_2	1
CH_4	21
N_2O	310

RESULTS

Total Metric Tons of CO_2e = Total Metric Tons of CO_2 + CH_4 Tons of CO_2e + N_2O Tons of CO_2e

Cases \ Equipment	Turbines	Process Heater	Total Metric Tons of CO_2e
2 turbines and 1 fuel gas heater	996,179	1,174	997,353

Willow Pass Generating Station
SF6 Emissions Estimate

WPGS

Estimated SF_6 emissions from any equipment on the proposed project site

Breaker	Qty	SF6 Lbs/Bkr	Leakage Rate	Leakage Lbs/Yr (per Bkr)	Leakage Lbs/Yr (All Bkrs)	CO_2e emissions (metric tons/Yr)
230kV Circuit Breaker	3	161	1%	1.61	4.83	52.36
138kV Circuit Breaker	4	75	1%	0.75	3	32.52
					CO_2e emissions (metric tons/Yr)	84.88

Note:

Greenhouse Gas Global Warming Potentials (GWPs) - Intergovernmental Panel on Climate Change, Second Assessment Report (1996)

Greenhouse Gas	GWP (SAR, 1996)
SF_6	23,900