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APPENDIX G1
MODELING PROTOCOL

FINAL REPORT

MODELING PROTOCOL FOR THE COLUSA GENERATING STATION

COLUSA COUNTY, CALIFORNIA

PREPARED FOR:

COLUSA COUNTY AIR POLLUTION CONTROL DISTRICT,

U.S. ENVIRONMENTAL PROTECTION AGENCY REGION IX

AND

CALIFORNIA ENERGY COMMISSION

URS PROJECT NO. 28067004.00100

JULY 12, 2006

F I N A L R E P O R T

MODELING PROTOCOL FOR THE COLUSA GENERATING STATION COLUSA COUNTY, CALIFORNIA

Prepared for

Colusa County Air Pollution Control District, USEPA

and California Energy Commission

URS Project No. 28067004.00100

July 12, 2006

URS

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$\mu g/m^3$	Micrograms per cubic meter
AAQS	Ambient Air Quality Standards
AERMOD	American Meteorological Society/Environmental Protection Agency regulatory model
AFC	Application for certification
AQRV	Air Quality Related Values
ATC	Authority to Construct
BACT	Best available control technology
BPIP	Building profile input program
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CARB	California Air Resources Board
CEC	Colusa County Air Pollution Control District
CEC	California Energy Commission
CGS	Colusa Generating Station
CO	Carbon monoxide
CTG	Combustion turbine generator
DLN	Dry low NOx
DOC	Determination of compliance
FLAG	Federal land managers air quality related values workgroup
g/s	Gram per second
GE	General Electric
GEP	Good engineering practice
HRSG	Heat recovery steam generator
H1H	High first high
H2H	High second high
H6H	Highest sixth high
HARP	Hotspots analysis and reporting program
HRA	Health risk assessment
ISCST3	Industrial source complex short term model 3rd version
Km	Kilometers
LAER	Lowest achievable emission rate
LORS	Laws, ordinances, regulations, and standards
MEI	Maximally exposed individual
mm	millimeter
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NCDC	National Climactic Data Center
NNSR	Nonattainment new source review
NO_x	Nitrogen oxides
NO_2	Nitrogen dioxide
NSR	New source review
O_3	Ozone
OEHHA	Office of Environmental Health Hazard Assessment
OLM	Ozone limiting method

Pb	Lead
$PM_{2.5}$	Particulate matter less than 2.5 microns in diameter
PM_{10}	Particulate matter less than 10 microns in diameter
Ppm	Parts per million
PSD	Prevention of significant deterioration
ROC	Reactive organic compounds
SCR	Selective catalytic reduction
SIL	Significant impact level
SO_2	Sulfur dioxide
STG	Steam turbine generator
TAC	Toxic air contaminants
T-BACT	Best available control technology for toxics
TPY	Tons per year
USEPA	U. S. Environmental Protection Agency
USGS	U.S. Geological Society
UTM	Universal Transverse Mercator
ZOI	Zone of impact

1.1 BACKGROUND

E&L Westcoast is proposing to develop and construct a new power plant in Colusa County California to be called the Colusa Generating Station (CGS). The power plant will include two General Electric (GE) Frame 7EA Dry Low NO_x (DLN) combustion turbine generators (CTG) each with a heat recovery steam generator (HRSG) and duct burners to supply steam to one steam turbine generator (STG). A natural-gas fired auxiliary boiler will be installed to facilitate plant starts. This new power plant will be an approximately 640 megawatt (MW) (with duct firing) natural gas-fired combined cycle unit at a Greenfield site located near the town of Delevan in Colusa County, California (Figures 1 and 2). The project is subject to the site licensing requirements of the California Energy Commission (CEC) and is applying for licensing under the CEC Application for Certification (AFC) program. The CEC will coordinate its independent air quality evaluations with the Colusa County Air Pollution Control District (CCAPCD) through the Determination of Compliance (DOC) process. The project is also subject to the Federal Prevention of Significant Deterioration of Air Quality (PSD) preconstruction permitting program under the United States Environmental Protection Agency (USEPA).

The annual emissions increases of several criteria pollutants will be above the significant emission thresholds specified by the USEPA's Prevention of Significant Deterioration (PSD) regulations for Major Sources. Specifically, the increases in emissions will be greater than: 100 tons per year (tpy) each of nitrogen oxides (NO_x), carbon monoxide (CO), particulate matter less than 10 micrometers in diameter (PM_{10}), and less than 100 tpy of reactive organic compounds (ROC) and sulfur oxides (SO_x), and less than 0.6 tons per year of lead (Pb) and less than 7 tons per year of sulfuric acid mist. Colusa County is designated a federal unclassified or attainment area for all pollutants and state non-attainment area for ozone (O_3) and $PM_{10.}$

Because Federal PSD regulations will apply to this project, the air dispersion modeling for this project will be conducted in conformance with PSD requirements. For example, worst-case predicted impacts due to the project alone 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 regulations potentially apply to all criteria pollutants, depending on the quantity of pollutants emitted. The area around the CGS is designated as attainment or unclassified for the federal nitrogen dioxide (NO_2), $O_{3,}$ CO, $PM_{10,}$ particulate matter less than 2.5 micrometers in diameter ($PM_{2.5}$) and SO_2 standards. With respect to the California Ambient Air Quality Standards (CAAQS), the area around the CGS is classified as attainment for NO_2, CO, sulfates, Pb, hydrogen sulfide, and SO_2, and non-attainment for O_3 and PM_{10}, and unclassified for $PM_{2.5}$. NO_x and SO_2 are regulated as PM_{10} precursors, and NO_x and ROC as O_3 precursors. Project emissions of non-attainment pollutants and their precursors will be offset to satisfy state and local NSR regulations.

1.2 PURPOSE

The CEC, CCAPCD and EPA require the use of atmospheric dispersion modeling to demonstrate compliance with applicable air quality standards, EPA requires evaluation of PSD increments and impacts

on visibility in nearby (within 100 kilometers [km]) federal Class I wilderness areas, and both CEC and CCAPCD require modeling to determine the potential impacts on human health from emissions of toxic air contaminants. Finally, CEC siting regulations also require that the cumulative impacts of the proposed project and other new and reasonably foreseeable projects within 6 miles of the project site be assessed via modeling.

This document summarizes the procedures that will be used for the air dispersion modeling in support of project certification and permitting. Modeling of both construction and operations emissions will be performed in accordance with CEC guidance (CEC, 1997). This protocol is being submitted to the CEC, CCAPCD and USEPA for their review and comment prior to completion of the AFC and the PSD application for the Colusa Generating Station. The proposed model selection and modeling approach is based on review of applicable regulations and agency guidance documents, as well as discussions with agency staff.

Source: Berndtson & Berndtson, California North Road Map

0 15 30
Scale in Miles
1:1,200,000

REGIONAL LOCATION MAP

Colusa Generating Station
28067004 E&L Westcoast, LLC
July 2006 Colusa County, California

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FIGURE 1

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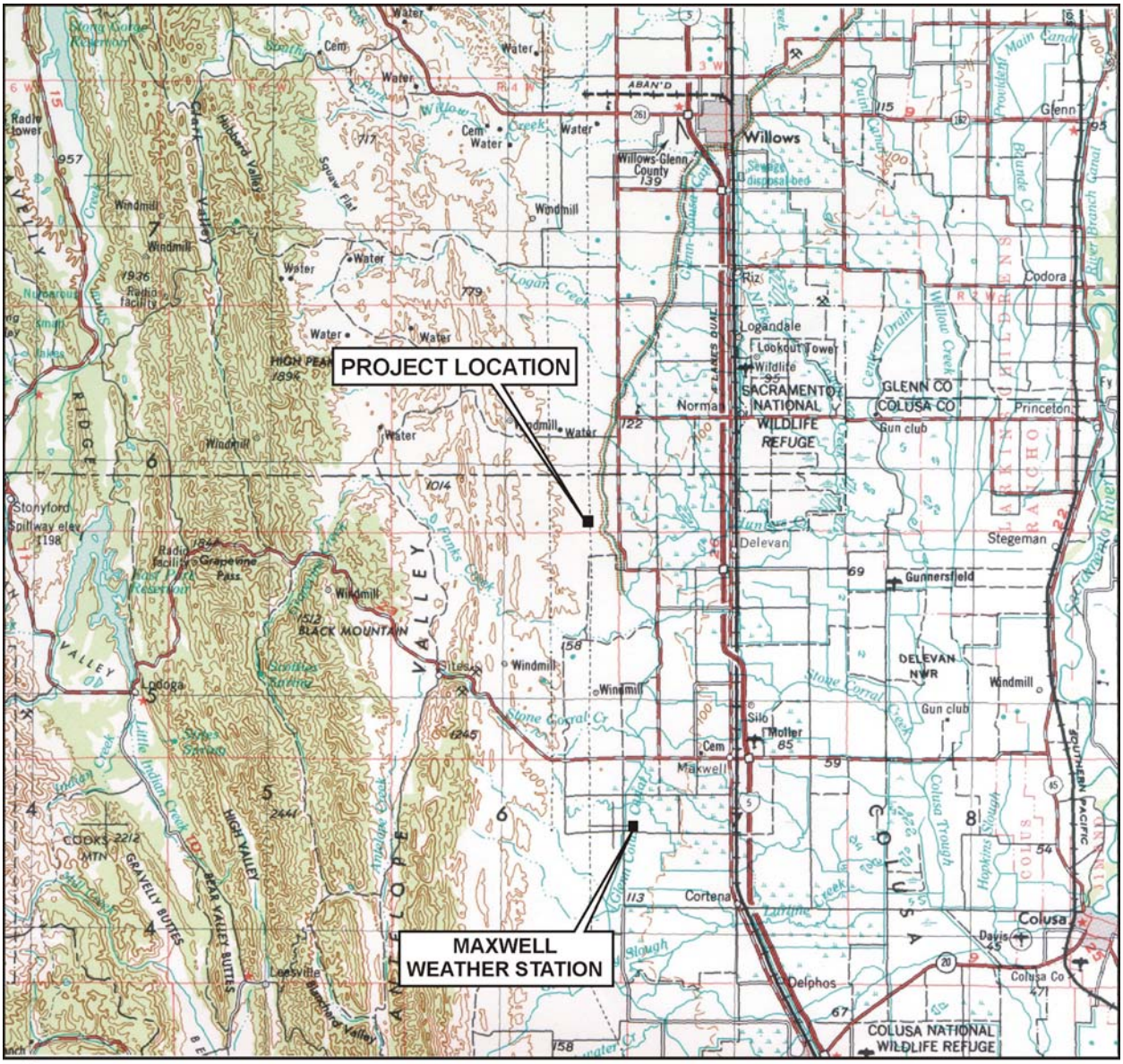

Source:
USGS Topographic-Bathymetric Series
Ukiah, California, 1979

N

0 5 10

Scale in Miles
1:250,000

SITE VICINITY MAP

28067004
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Colusa Generating Station
E&L Westcoast, LLC
Colusa County, California

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FIGURE 2

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2.1 PROJECT LOCATION

The Colusa Generating Station Project will be implemented at a previously undeveloped or greenfield site near the town of Delevan, California (see Figure 1). The Colusa Generating Station site will be located approximately 15 miles north of Colusa, California (see Figure 2). The project site is located within approximately 1 mile of complex terrain (i.e., with elevation exceeding proposed stack heights) and is surrounded by rural land use.

2.2 DESCRIPTION OF THE PROPOSED SOURCES

The Colusa Generating Station will include two trains with wet cooling, transformers, control and administrative buildings, aqueous ammonia storage tanks, and other ancillary facilities. Each train will consist of a natural gas-fired "7F" technology combustion turbine – generator (CTG) set and a supplementary fired heat recovery steam generator (HRSG) equipped with selective catalytic reduction (SCR) for the control of nitrogen oxides (NO_x) and an oxidation catalyst for control of carbon monoxide (CO) emissions. Natural gas will be the only fuel used by the CTGs. The trains will be combined cycle configurations and will include a single steam turbine with other ancillary components typical of a combined cycle power plant. Each CTG will be nominally rated at 170 MW and the steam turbine will be nominally rated at 330 MW. A natural gas-fired auxiliary boiler rated at 44 million BTU/hr will be included to provide steam to shorten the time required for plant starts. An emergency diesel engine-generator set rated at 1000 kw will also be included. The project will also include two emergency firewater pumps. One pump will be driven with an electric motor and one pump will be driven with a diesel engine. In the event of an emergency that requires firewater, the diesel driven firewater pump will start automatically only in the event that the electric motor driven firewater pump fails to start. The gas turbines will be fired exclusively on natural gas, and each will be equipped with dry low NO_x combustors and selective catalytic reduction (SCR) for the control of NO_x emissions and an oxidation catalyst for control of CO emissions. The new CTGs will operate in combined cycle mode and each gas turbine/HRSG train will have an exhaust stack with a height of 150 feet. An evaporative cooling tower will be used for plant cooling and will be outfitted with a high efficiency drift elimination system. Ammonia reagent for the CGS SCR systems will be provided by a single aqueous ammonia storage tank.

3.1 CALIFORNIA ENERGY COMMISSION REQUIREMENTS

For projects with electrical power generation capacity of 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 application must include the following air quality information (CEC, 1997):

- A description of the project, including project emissions, 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 CCAPCD Rules;
- Existing baseline air quality data for all regulated pollutants;
- A description of the regional climate, using existing meteorological data, including temperature, wind speed and direction;
- A listing of applicable laws, ordinances, regulations and standards (LORS) and a determination of compliance with all applicable LORS;
- An emissions offsets strategy;
- An air quality impact assessment (i.e., national and state ambient air quality standards [AAQS] and PSD review) and protocol for the assessment of cumulative impacts of the proposed project along with permitted and under construction projects within a 10 km radius; and
- An analysis of human exposure to air toxics (i.e., health risk assessment [HRA]).

The proposed modeling approaches for evaluating the CGS Project's incremental and cumulative air quality impacts, and the health risk assessment for the project's emissions of toxic air contaminants will comply with the requirements for an AFC air quality assessment.

3.2 COLUSA COUNTY AIR POLLUTION CONTROL DISTRICT REQUIREMENTS

The CCAPCD has promulgated NSR requirements under Rule 3.6. In general, all equipment with the potential to emit air pollutants is subject to NSR requirements. NSR has four major requirements that potentially apply to new sources:

- Installation of BACT;
- Ambient air quality impact modeling to demonstrate compliance with NAAQS and CAAQS;
- Emission offsets; and
- Certification of statewide compliance with air quality requirements.

Assembly Bill 2588, California Air Toxics Hot Spots Program allows a predicted incremental cancer risk from toxic air contaminants (TAC) at any receptor up to ten in one million, prior to public notification, if best available control technology for toxics (T-BACT) is implemented. A TAC analysis should include TAC emission estimates and a modeling analysis to identify the Zone of Impact (ZOI) and the Maximally Exposed Individual (MEI). The ZOI encompasses the area within which the incremental carcinogenic risk (due to the inhalation pathway only) equals or exceeds one in one million.

3.3 U.S. ENVIRONMENTAL PROTECTION AGENCY REQUIREMENTS

USEPA has promulgated PSD regulations applicable to criteria pollutant emissions from major sources in Colusa County. The CGS Project will be a major source under the PSD rules, because NOx, CO and PM_{10} are criteria pollutants for which a net emissions increase may exceed a PSD significant source threshold (greater than 100 tons per year). The project area is designated attainment or unclassified with respect to all the federal ambient standards. Many of the PSD requirements are the same as the AFC and NSR requirements described above (e.g., project description, BACT, ambient air quality standards analysis); however, PSD requires the following additional analyses:

- A PSD increment (consumption) analysis;
- An analysis of air quality related values (AQRV) to ensure the protection of visibility of federal Class I 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.

This section describes the dispersion models and modeling techniques that will be used in performing the air quality analysis for the CGS. The objectives of the modeling are to demonstrate that air emissions from the CGS will not cause or contribute to an exceedance of an ambient air quality standard violation, and will not cause a significant health risk.

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. USEPA allowed a one-year "grace period" commencing November 9, 2005 during which the use of either model is acceptable, depending on the preference of the local air quality jurisdiction. For this analysis, we have selected AERMOD, since this is consistent with the most recent USEPA policy and the data needed to support its application are available in Colusa County.

4.1 SCREENING MODELING

An initial screening analysis will be conducted to identify which operating mode for the turbine results in worst-case ambient air impacts. The most recent version of the USEPA AERMOD model will be used to model worst-case conditions for each of three operating modes across the load range (100, 75, and 50 percent loads) and each of three ambient temperature conditions (18, 59 and 114 degrees Fahrenheit). A unit emission rate of 1.0 gram per second (g/s) will be modeled using stack parameters corresponding to the different combinations of turbine load and ambient temperature. Building downwash effects will be addressed, as described in Section 4.4. Concentrations for each pollutant, expressed in units of micrograms per cubic meter ($\mu g/m^3$), will be obtained by multiplying the unit concentrations obtained from the AERMOD screening results (expressed in $\mu g/m^3$ per g/s) by the emission rate calculated for each pollutant (expressed in g/s) for each operating mode. This is a streamlined process, because it allows AERMOD to be executed only once for all pollutants for each operating mode, instead of having to execute the model iteratively for each pollutant. The operating mode that yields the highest concentrations for each averaging time pertaining to the National and California AAQS will be considered the worst-case CGS gas turbine/HRSG operating mode for that averaging time. The worst-case operating mode will be used as the basis for selecting CGS stack parameters in all subsequent AERMOD modeling analyses. Refined modeling (discussed in the following section) will be used to determine the worst case annual and short-term impacts of the turbine/HRSG unit in combination with other project sources. Screening modeling will not be used to eliminate pollutants from the refined modeling analysis.

4.2 REFINED MODELING

The purpose of the refined modeling analysis is to demonstrate that air pollutant emissions from the CGS will not cause or contribute to an AAQS violation; and will not cause a significant health risk impact. The most recent version (04300) of the AERMOD model will be used for the refined modeling. The regulatory default option will be selected. AERMOD will be used for modeling concentrations of pollutants having short-term (e.g., one to 24 hour) ambient standards with the appropriate averaging time selected. Modeling for pollutants having annual standards (i.e., $PM_{10,}$ SO_2 and NO_2), will be conducted using AERMOD with the PERIOD option to predict impacts for comparison with the annual standards. Specific modeling techniques for conducting the AAQS and HRA analyses are discussed below.

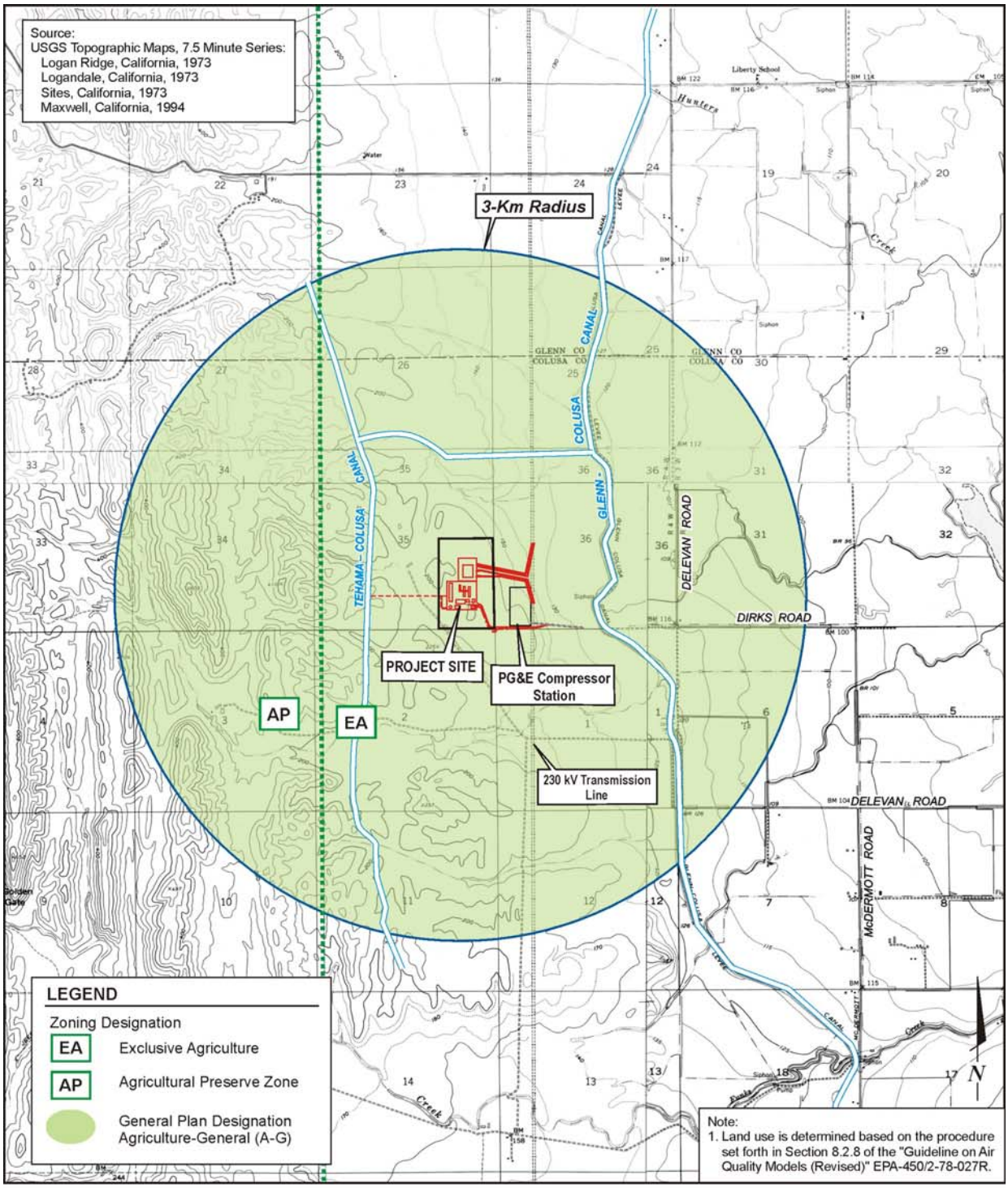
An analysis of the land use adjacent to the project was conducted and will be included in the AFC application. This analysis was conducted in accordance with Section 7.2.3 of the Guideline on Air Quality Models (USEPA 2005 and Auer [1978]). The land use analysis within 3 kilometers of the site was conducted using the Auer (1978) land use classification system to determine whether the area around the CGS site is predominately rural or urban. Figure 3 depicts land use classifications within 3 kilometers of the GCS site. Based on the Auer land use analysis, all land within a 3 km radius of the CGS is designated general agricultural. Since the Auer classification scheme requires more than the 50 percent of the area within the 3 km radius around a source to be non-rural for an urban classification, the rural mode will be used in the AERMOD modeling analyses.

All AERMOD regulatory default settings will be used.

4.2.1 Area of Impact Analysis

Ground level concentrations caused by the project will be compared to ambient air quality impact significance levels defined by U.S. EPA (Table 4-1). If maximum off-property pollutant concentrations for each pollutant are below these levels, then the project will not cause significant air quality impacts, and the radius of the Area of Impact for this pollutant will be assigned the value of zero.

If the predicted ambient concentrations for the project are above ambient air quality impact significance levels, an area of significant impact will be defined for each pollutant and averaging period for which significance levels are exceeded. The receptor locations and time periods where the project has a significant impact constitute *significant events*. The AOI is the area having a radius equal to the distance to the significant event located farthest from the project. The largest radius for each pollutant, regardless of averaging period, will be used to define the AOI for the remainder of the analysis. For example, CO has both 1-hour and 8-hour averaging periods; therefore, the short-term AOI would be defined as the area having a radius equal to the distance from the project to either the 1-hour or 8-hour significant event, whichever is longer.



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Scale in Feet
1:48,000

LAND USE WITHIN THREE KILOMETERS OF THE EMISSION POINTS

Colusa Generating Station
E&L Westcoast, LLC
Colusa County, California

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FIGURE 3

7/10/06 vsa ..\28067004 CPV Colusa\July 2006 figs\F3_lu_airQ.cdr

4.2.2 PSD Increment Analysis

The purpose of the PSD increment analysis is to determine whether the Colusa Power Plant project will cause or contribute to a predicted PSD increment exceedance. The PSD increments are shown in Table 4-1. United States EPA guidance states that increment consumption should generally be based on changes in *actual* emissions reflected by the normal source operation for a period of two years (U.S. EPA, 1990a). The following approach is proposed for performing the PSD increment analysis:

1. A PSD increment receptor grid will be developed for each pollutant and averaging period, for each of the five meteorological years, by analyzing the maximum concentration at each receptor from the AOI analysis. Only those receptors from the AOI analysis that have at least one predicted significant event will be included in the PSD increment analysis.

2. For short-term modeling, the MAXIFILE output option will be invoked to save any events that exceed 100% of the PSD increment. The PLOTFILE output will also be used to identify the receptors, if any, having high second-high events (H2H) that exceed 100% of the PSD increment. The PLOTFILE output will also be used to identify the receptors, if any, having concentrations greater than 100% of the applicable PSD increment. If concentrations do not exceed 100% of the applicable PSD increment, compliance with the applicable PSD increment is demonstrated and no further modeling is necessary.

3. The H2H events that exceed 100% of the PSD increment will be rerun to determine if the project has a significant event during a predicted PSD increment exceedance event. The AERMOD model will be used to analyze short-term events. AERMOD with the PERIOD option will be used to analyze annual events. If the project does not have a significant impact during these exceedance events, compliance with PSD increments is demonstrated and no further modeling is necessary.

4. If predicted exceedances are encountered for which the project has a significant impact, receptor locations will be analyzed to determine if they are located within another modeled facility’s boundaries. The corresponding facility's contribution to the maximum concentration at that receptor will be determined and subtracted (from the concentration modeled at that receptor). If the revised total predicted impact at these receptors is below the PSD increment, compliance with PSD increments is demonstrated for the project and no further analysis is necessary.

5. For any remaining events, a culpability analysis using AERMOD will be performed to identify the sources having the greatest impact, and determine if these are project sources or off-property sources. For any culpable project sources, the modeling inventory, including source locations and stack parameters used to estimate emissions,

will be reviewed to ensure they are reasonable. Adjustments will be made as appropriate.

6. An AERMOD run will be performed with the revised inventory in (5) above. If no PSD increment exceedance is predicted then compliance with PSD increments is demonstrated and no further modeling is necessary.

4.2.3 PSD Monitoring Exemption Analysis

The monitoring exemption thresholds from the PSD regulations will be included in the analysis as justification for using agency-collected local ambient air quality monitoring data as background levels for the AAQS analysis discussed in the following section. Also, criteria pollutant impacts from the CGS Project will be compared to the PSD significant impact levels (SIL), because these often serve as significance criteria for new source impacts from new sources in California.

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

Pollutant	Averaging Time	CAAQS (a,c)	NAAQS (b,c)	Ambient Impact Significance Levels ($\mu g/m^3$)	PSD/NNSR Significant Emissions Increase Thresholds (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[d]	Annual		0.053 ppm (100 $\mu g/m^3$)	1	100	2.5	25
	1-hour	0.25 ppm (470 $\mu g/m^3$)					
SO_2	Annual		0.03 ppm (80 $\mu g/m^3$)	1	100	2	20
	24-hour	0.04 ppm[e] (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 $\mu g/m^3$	50 $\mu g/m^3$	1	100	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		65 $\mu g/m^3$				
O_3	8-hour	0.07 ppm (137 $\mu g/m^3$)	0.08 ppm (157 $\mu g/m^3$)	See footnote[f]	100 (of VOCs)		
	1-hour	0.09 ppm (180 $\mu g/m^3$)	See footnote[g]				

a. California standards for ozone (as volatile organic compounds, 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. 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 average concentrations above the standard is equal to or less than one.
c. 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 millibar).
d. Nitrogen dioxide (NO_2) is the compound regulated as a criteria pollutant; however, emissions are usually based on the sum of all oxides of nitrogen (NO_x).
e. At locations where the state standards for ozone and/or PM_{10} are violated. National standards apply elsewhere.
f. Modeling is required for any net increase of 100 tons per year or more of VOCs subject to PSD.
g. New federal 8-hour ozone and fine particulate matter ($PM_{2.5}$) standards were promulgated by USEPA on July 18, 1997. The federal 1-hour ozone standard was revoked by USEPA on June 15, 2005.

Blanks = Not applicable
CAAQS = California Ambient Air Quality Standard
mm = millimeters
NAAQS = National Ambient Air Quality Standard
ppm = parts per million by volume, or micromoles of pollutant per mole of gas
TPY = ton per year
$\mu g/m^3$ = micrograms per cubic meter

4.2.4 Ambient Air Quality Standard Analysis

The purpose of the ambient air quality standard analysis is to determine whether the CGS Project will cause or contribute to an federal or state AAQS violation. The project will not be considered to cause or contribute to an AAQS violation unless impacts from the project itself combined with the background concentration exceed the AAQS, or the project has a significant impact at the same location and time as a predicted AAQS violation. The following approach is proposed for performing the AAQS analysis:

1. The receptor grid deployment spacing described in Section 4.5 will be used for the AAQS analysis.
2. Short-term and annual AAQS modeling will be performed using AERMOD. Annual AAQS modeling will be performed using AERMOD with the PERIOD option. Both short-term and annual analyses will be run using sequential hourly meteorological data for five years. Maximum impact equals highest predicted modeled impact plus background.
3. For NO_2 modeling, the modeling will initially assume full conversion of NO_x to NO_2. Should it be required, NO_2 estimates will be reduced using the USEPA ozone limiting method (OLM) or the Plume Volume Molar Ratio Method (PVMRM) (for either hourly and/or annual impacts). If 1-hour and annual concentrations do not exceed the applicable AAQS, then compliance is demonstrated and no further modeling is necessary for NO_2.

Comparison of model-predicted impacts with ambient air quality standards will require assumptions regarding background pollutant concentrations, i.e., the contributions of sources other than those of the sources being modeled. For purposes of the CGS modeling analyses, background values for each pollutant and averaging time will be represented using the highest measured levels at the nearest air quality monitoring station in Colusa County or adjacent county if necessary over the last three years. Section 4.6.2 discusses the representativeness of the air quality monitoring data that are available for this purpose.

4.2.5 Health Risk Assessment Analysis

The CEC and CCAPCD require a health risk assessment (HRA) of TAC emissions from the operation of the project. Contaminants potentially emitted by the CGS Project with potential carcinogenic, chronic or acute non-carcinogenic health 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). As recommended by this guideline, the California Air Resources Board (CARB) Hotspots Analysis and Reporting Program (HARP) (CARB, 2005) will be used to perform a refined 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.

First, ground-level impacts from the CGS sources alone will be estimated using the ISCST3 atmospheric dispersion modeling. The HARP modeling analysis will be consistent with, and use similar appropriate parameters as the modeling approach discussed above for the AAQS analyses using AERMOD. Based on the impacts modeled using ISCST3 (the dispersion model incorporated by HARP), the HARP model will

be used to estimate health risk. The meteorological data use in the AERMOD modeling and discussed in Section4.6 will be used to predict the highest 1-hour and annual impacts. Model receptors will be placed at 25 meter spacing around the CGS facility fence line and 100 meter spacing out to 10 km. All receptors that HARP creates that are inside the fence will be excluded. HARP will also include the census receptors out to 10 km. Receptors will also be placed at all sensitive locations (e.g., child care facilities, schools, hospitals, libraries or churches) out to 1 mile if any are identified. However, previous analyses identified no sensitive receptors within a 3-mile radius of the site (URS, 2001). The HRA will be performed using HARP and will follow the following steps:

1. Define the Point of Maximum Impact (PMI) and the location of the Maximally Exposed Individual (MEI) (i.e., the location where an individual may experience the highest carcinogenic risk);

2. Define the Point of Maximum Impact (PMI) of the maximum chronic non-carcinogenic adverse health effects and the maximum acute adverse health effects; and
3. Calculate concentrations and adverse health effects at locations of maximum impact for each pollutant.

The HARP model will be performed for the inhalation pathway for diesel particulate and for all applicable uptake pathways for all other TACs. Diesel particulate will not be speciated, it will only be modeled as diesel particulate. A discussion of the surrounding land use, sensitive receptors and local meteorology will be provided in the AFC application.

Due to the short-term nature of the construction activities, a HRA will not be conducted.

4.2.6 Air Quality Related Values and Visibility Analysis

A PSD analysis of AQRV will be required because the CGS Project will be a major source. The PSD regulations require an analysis of the proposed project to impact air quality (including visibility) of any federal Class 1 area. A screening level modeling analysis will be conducted to evaluate these impacts at the only Class I area within 100 km from the proposed project site, i.e., Yolla Bolly Middle Eel Wilderness, the closest part of which is about 88 kilometers northwest from the CGS. This analysis will be conducted using the screening version of the CALPUFF model and the same meteorological input data used for the AAQS modeling analysis. Applicable recommendations from the CALPUFF Reviewer's Guide (Draft) of September 2005 prepared for the USDA Park Service and the National Forest Service will be implemented in the screening version of CALPUFF AQRV modeling.

4.2.7 Visible Plume Analysis

Moisture contained in the exhaust of the CTGs and the cooling systems may condense after it leaves the stack forming a visible plume. Visible plumes must be evaluated as potential impacts to visibility under the CEC AFC rules. The Combustion Source Visible Plume (CSVP) model will be used for the analysis of the CTG plumes. The Seasonal/Annual Cooling Tower Impact (SACTI) model to will be used to predict cooling tower visible plume dimensions. The same meteorological data used for the AAQS analysis will be used for CSVP and SACTI, although it will need to be formatted appropriately for each model.

4.3 EMISSIONS SOURCES REPRESENTED IN MODELING ANALYSES

4.3.1 Project Sources

The proposed CGS Project will entail two new GE 7EA gas turbine and HRSG with duct firing, an auxiliary boiler, a cooling tower, an emergency diesel generator and an emergency diesel firewater pump. Table 4-2 presents preliminary annual emission estimates for the CGG Project. Conceptual plant design includes SCR for NO_x and oxidation catalysts for CO that will match recent BACT determinations for similar projects. Emissions of SO_2 and PM_{10} will be low, owing to the exclusive use of interstate pipeline quality natural gas as fuel for the gas turbines, HRSG duct burners and the auxiliary boiler.

Worst-case emissions scenarios will be determined and modeled for each pollutant and averaging time using realistic combinations of normal operations, turbine/HRSG startups/shutdowns and maintenance conditions. Initial commissioning activities will also be evaluated. The modeling to address all of these operating conditions is discussed below.

Normal operating combustion turbine generator emissions will vary with ambient temperature and turbine load, as well as use or non-use of duct burners. The screening modeling analysis described in Section 4.1 will be used to determine the turbine/HRSG operating mode and ambient conditions that will produce the highest incremental air quality impacts for each averaging time addressed by the ambient standards, and the corresponding emission parameters will be used to represent the turbine/HRSG contributions for all refined modeling of normal operations.

Table 4-2. Preliminary Estimated Emissions for Colusa Generating Station Combustion Turbine-Generators, Duct Burners, Auxiliary Boiler and Emergency Diesels (tons per year)

NO_x	CO	SO_2	VOC	PM_{10}	Pb
>100	>100	<100	<100	>100	<0.6

Startup and shutdown conditions will also be considered. The emissions from these events will be quantified conservatively, using data provided by the turbine vendors and a reasonable maximum number of startups/shutdowns will be assumed in developing the worst-case emissions scenarios for each relevant averaging time.

Emissions resulting from turbine/HRSG commissioning immediately following equipment installation will also be represented, based on the sequence of commissioning activities recommended by the equipment manufacturers and the expected durations and pollutant emissions profiles for each step in the commissioning process. Care will be taken to ensure that conservative assumptions are used for all parameters in order to avoid underestimating these one-time emissions.

Equipment emissions and stack parameters for all of the operating modes described above will be examined and modeled to determine which activity will produce the highest ground-level concentrations for all pollutants and averaging times, and the maximum impacts will be reported in the AFC and PSD applications as evidence of the project's compliance with applicable air quality standards. Where applicable, emissions estimates of all pollutants and all modes of operation will be provided in both ppm and pounds per hour values.

Toxic air contaminants (TACs) will also be emitted from the operational CGS project due to turbine/HRSG combustion of natural gas. These emissions have not been estimated at this time; however, because only natural gas will be used as fuel for the CTG, only small quantities of TAC including benzene, formaldehyde, and polycyclic aromatic hydrocarbons may potentially be emitted. In addition, TACs potentially contained in the cooling tower circulating water will be quantified and included in the health risk assessment described in Section 4.2.4. Emissions estimates for TAC will be based on published emission factors (the CARB's CATEF database or AP-42) and/or vendor data, if available.

The CGS equipment will use a wet cooling tower. The tower will be equipped with efficient drift eliminators to reduce the associated particulate emission rates. The PM_{10} emission data for the cooling tower will incorporate this control measure. Any TAC emitted from the cooling tower will be examined in the HRA.

One new diesel-fired emergency generator will be installed for the CGS Project. This new generator will comply with CARB emission limits for the class and model year of the diesel engine. A limit on the annual hours of non-emergency usage will be proposed by the applicant and included in the conditions of certification for the CGS. The modeling of the generator emissions will be consistent with this limit. Diesel particulate matter will be the only TAC included in the HRA from the emergency generator and the emergency diesel fire pump.

Temporary construction emissions will result from equipment exhaust (primarily NO_x and diesel particulate emissions) and fugitive dust (PM_{10}) from earthmoving activities and vehicle and equipment traffic on unpaved surfaces. A construction schedule and equipment list provided by the project engineering design firm will be consulted to determine the scenarios that will produce the highest emissions for the different averaging times addressed in the ambient air quality standards. For the CGS, the fugitive PM_{10} emissions from construction will be initially estimated using data on the area to be disturbed and the extent of equipment operations, and will take into account the effects of implementing control measures for controlling fugitive dust during construction. The air quality impacts of the heavy equipment exhaust and fugitive dust emissions will then be modeled using AERMOD. The construction site, parking area, and lay-down area will be modeled as volume sources. Low sulfur diesel fuel (15 ppm by weight) will be utilized in any emission calculations for construction equipment used at the CGS site.

4.3.2 Cumulative Impact Analysis Including Sources outside CGS

A cumulative impact analysis will evaluate the combined air quality impacts of all routinely operating sources within the CGS together with the emission from other projects within 6 miles from the ECGS that are currently either under construction, currently in an air quality permitting or CEQA review process, or reasonably expected to enter these processes in the near future. A request will be made to CCAPCD asking for a list of all newly permitted sources or other sources that are reasonably anticipated to be

permitted within six miles of the CGS. This list, when compiled will be forwarded onto CEC for review. Based on this information, additional sources may be included in the cumulative source modeling analysis. There is one existing major source adjacent to the CGS site. The Delevan Compression Station, owed and operated by PG&E, contains three gas turbine-driven compressors licensed for full year operation. Historical usage records for these gas turbines will be obtained from PG&E and used to estimate past actual emissions. The difference between estimated past actual emissions and the maximum potential emissions allowed by permit for these sources will be modeled when evaluating the cumulative impact of the CGS.

4.4 BUILDING WAKE EFFECTS

The effect of building wakes (i.e., downwash) upon the stack plumes of emission sources at the CGS plant 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 PSD application applications that describe the input assumptions and output results from the BPIP-Prime model. The AERMOD model considers direction-specific downwash using both the Huber Snyder and Schulman-Scire algorithms as evaluated in the BPIP-Prime program.

4.5 RECEPTOR GRID

This section presents the receptor grids that will be used in the AAQS modeling analyses. The receptor grid to be used for determining the AOI is as follows:

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

If a maximum concentration value is located in the 100-m or 250-m grid, a dense receptor grid will be placed around the maximum concentration point and the model will be rerun. The dense grid will use 25-m spacing and will extend at least 500 meters in all directions from the original point of maximum concentration.

For the HRA modeling, receptors will be placed at 25 meter spacing around the fence line and 100 meter spacing outside of the fence out to 10 km. All receptors that HARP creates that are inside the ECGS fenceline will be excluded. HARP will also include all census receptors out to 10 km. These census receptors will include the population locations in and around the CGS. Receptors will also be placed at all sensitive locations if applicable (e.g., schools, hospitals, etc.) out to 1 mile.

A detailed project map and a 7 ½-minute U.S Geological Survey (USGS) map will be provided in the AFC application showing the receptors used in the modeling. Actual Universal Transverse Mercator (UTM) coordinates will be used. The CAAQS and NAAQS apply to all locations offsite of the applicant's facility, i.e. where public access is not under the control of the applicant. The CAAQS and NAAQS are not evaluated for receptors on the property controlled by the applicant.

4.6 METEOROLOGICAL AND AIR QUALITY DATA

4.6.1 Meteorological Data

Meteorological data suitable for input to AERMOD were obtained from Western Weather Group of Chico, California from their Maxwell meteorological station, outside the town of Maxwell (population about 1,300), located approximately 8 miles south of the CGS Project site. The five years of meteorological data to be used in this modeling analysis include data from 2001 through 2005. Data were missing from each year's dataset, although none of the years had 10 percent or more missing data, which are not recommended for use in permit modeling applications. Missing data were replaced by following the USEPA approved techniques for filling in missing data.

The meteorological data recorded at Maxwell are acceptable for use at CGS for two reasons, proximity and terrain similarity including the very important parameter of surface roughness. As mentioned above, the Maxell meteorological station is located approximately 8 miles south of the CGS site. The station and the CGS site are located in the west side of the Sacramento Valley with the closest elevated terrain approximately 1-2 miles to the west (See Figure 2). The terrain in the Sacramento Valley area is relatively flat and only slightly above sea level. The Coast Range provides the terrain boundary of the Valley to the west. The highest points in the Coast Range in the area are just above 2,000 feet and lie about 15 miles west. The Sacramento Valley is over 25 miles across at this point. The Sacramento River lies about 12 miles east of the site.

The Maxell meteorological station is the closest meteorological recording station to the CGS site, and there are no intervening terrain features between the two locations; thus meteorological conditions at the CGS site will be very similar to those at the Maxwell meteorological station. The terrain and land use at both the proposed project site and the meteorological station are identical having mostly level ground and are designated agricultural, which encompasses operations including open space, cattle grazing, or irrigated crops.

The closest NWS stations are at Red Bluff (60 miles), Sacramento (70 miles) and Redding (90 miles). None of these stations have land use or terrain as similar to the conditions at the CGS site as the Maxwell Station. Therefore, these sites are not as representative of the meteorological conditions of the project site and were not used as the primary source of meteorological data in the permit modeling for the CGS project. However, it is proposed that the cloud cover data collected at Red Bluff be used to supplement the Maxwell data because cloud cover data is not recorded at Maxwell. Upper air data from Oakland Airport will also be used in AERMOD.

Annual and seasonal wind roses produced from the five years of data from the Maxwell meteorological station are provided in Appendix A.

4.6.2 Background Air Pollutant Monitoring Data

Available CARB air quality data from 2003 through 2005 will be used to represent background air pollutant concentrations. The ambient air quality in Colusa County is currently monitored at one permanent air monitoring station. The monitoring station within the county is the Colusa-Sunrise Boulevard Station about 20 miles from the proposed project site. The monitoring station at Colusa-Fairgrounds Station ceased reporting data after 1996. The Colusa-Sunrise station measures only ozone, PM_{10} and $PM_{2.5}$. Data from other stations are necessary to fill in the background concentrations of the remaining criteria pollutants. The monitoring station at Yuba City (Sutter County – 38 miles) will be used as the source of CO and NO_2 data and the monitoring station at Del Paso Manor (Sacramento County – 60 to 70 miles) will be used as the source of SO_2 data.

For both the construction and operational phase modeling, the highest reported concentration that has occurred within the last 3 years will be used as the background values for each pollutant and averaging time and will be added to the maximum modeled contributions of project sources to obtain totals suitable for comparison with the ambient air quality standards. This is a conservative approach because it assumes that the highest recorded value and the modeled maximum impact both occur at the same time and at the same location.

5.1 NAAQS AND CAAQS ANALYSIS

The AAQS analyses for the new CGS sources alone and the cumulative analysis will be presented in a summary table. A figure indicating the location of the maximum pollutant concentrations will be provided. For CO, NO_2, and SO_2, the maximum short-term and annual concentrations will be reported. For PM_{10}, the maximum 24-hour concentration (of the individual five years) over the five years modeled will be presented. Background concentrations will be added to yield the total concentration, which will be compared with the NAAQS and CAAQS.

5.2 PSD INCREMENT ANALYSIS

Results of the PSD increment analyses will be presented in a summary table.

5.3 HEALTH RISK ASSESSMENT ANALYSIS

Maps at a scale of 1:24,000 will depict the following data:

- Elevated terrain within a 10-km radius of the project;
- Distribution of population via census data with 10-km radius of the project and sensitive receptors, including schools, pre-schools, etc., within a 1-mile radius of the project;
- Current and future residential land uses;
- Location of proposed new or modified transmission lines;
- Isopleths of 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 1.0; and
- Isopleths of any areas where exposures to air toxics lead to an estimated carcinogenic risk equal to or exceeding one in one million.

Health risk assessment modeling results will be summarized to include maximum annual (chronic both carcinogenic and non-carcinogenic) and hourly (acute) adverse health effects from 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.

5.4 DATA SUBMITTAL

Electronic copies of the modeling input and output files will be provided to CCAPCD, USEPA and the CEC.

ARB 2003. *HARP User Guide – Software for Emission Inventory Database Management, Air Dispersion Modeling Analyses, and Health Risk Assessment version 1.3*, Air Resources, Board, California Environmental Protection Agency. December 2003.

Auer, August H. Jr, 1978. American Meteorological Society. *Journal of Applied Meteorology*, 17(5): 636-643. "*Correlation of Land Use and Cover with Meteorological Anomalies*", May 1978.

California Air Resources Board (CARB), 2005. HARP (Hotspots Analysis and Reporting Program), Version 1.1 (Build 23.02.21), April 2005.

CEC, 1997. "Regulations Pertaining to the Rules of Practice and Procedure and Plant Site Certification". Title 20, California Code of Regulations. Chapter 1, 2, 5.

Office of Environmental Health Hazard Assessment (OEHHA), 2003. *Air Toxics Hot Spots Program Risk Assessment Guidelines*, August 2003.

URS, 2001. Application for Certification for Colusa Power Plant Project Colusa County, California. June 2001

United States Environmental Protection Agency, 1990. *New Source Review Workshop Manual Prevention of Significant Deterioration and Nonattainment Area Permitting (Draft)*, Office of Air Quality Planning and Standards, U.S. Environmental Protection Agency, Research Triangle Park, NC 27711. October 1990.

United States Environmental Protection Agency, 2004. *User's Guide for the AMS/EPA Regulatory Model - AERMOD*. EPA-454/B-03-001. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Emissions Monitoring and Analysis Division, Research Triangle Park, NC. September 2004.

United State Environmental Protection Agency, 2005. "*Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule"*, 40 CFR Part 51, AH-FRL07990-9, November 9, 2005.

United States Forest Service et al. 2000. *Federal Land Managers Air Quality Related Values Workgroup (FLAG) Phase 1 Report.* Prepared by U.S. Forest Service Air Quality Program, National Park Service Air Resources Division, U.S. Fish and Wildlife Service Air Quality Branch. December 2000.

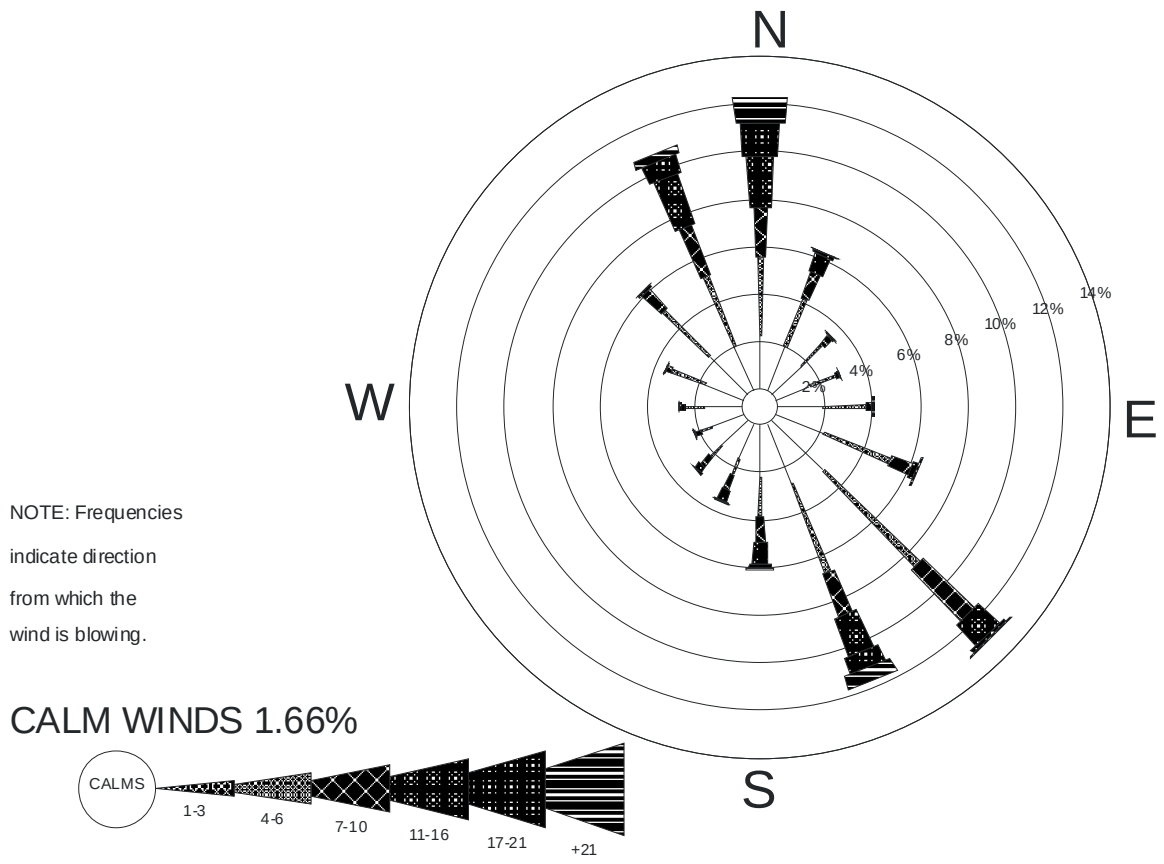

Figure A-1 Windrose for All Months 2001-2005 Maxwell Weather Station

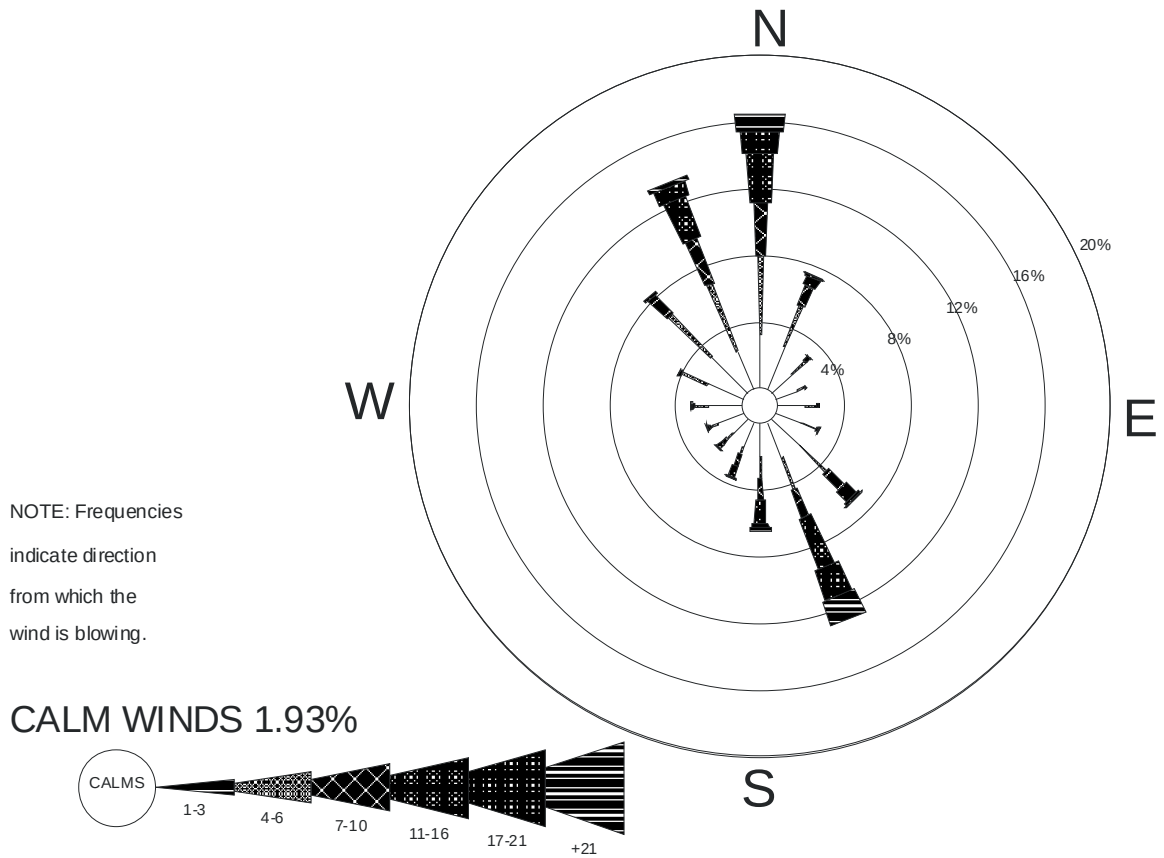

Figure A-2 Windrose for Winter Months (Dec – Feb) 2001-2005 Maxwell Weather Station

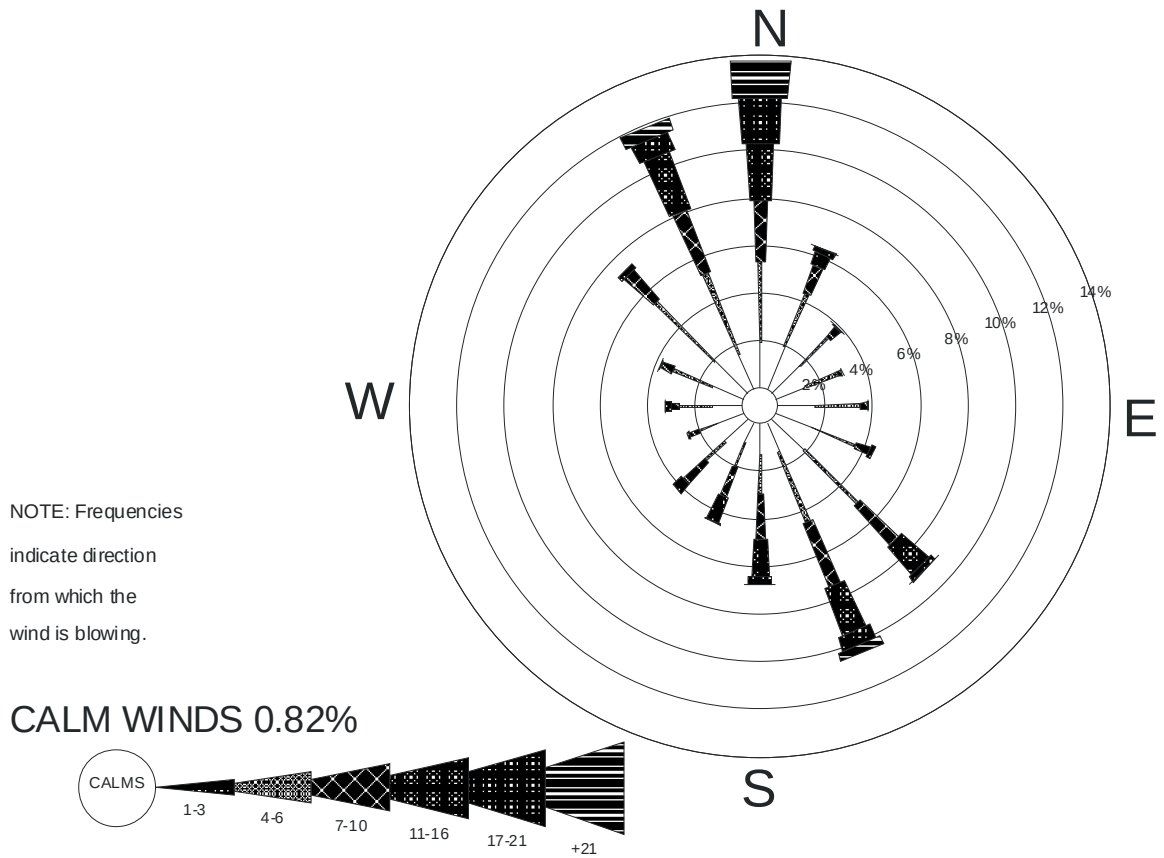

Figure A-3 Windrose for Spring Months (Mar – May) 2001-2005 Maxwell Weather Station

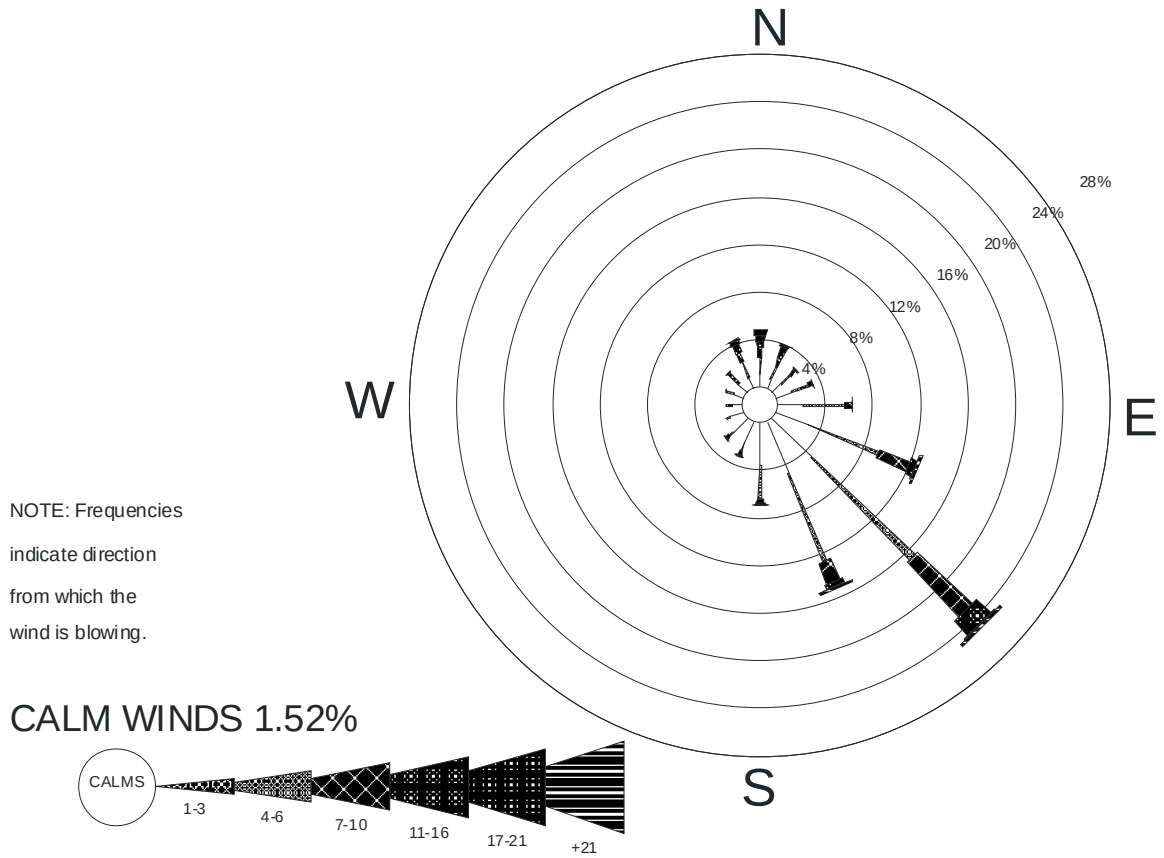

Figure A-4 Windrose for Summer Months (Jun – Aug) 2001-2005 Maxwell Weather Station

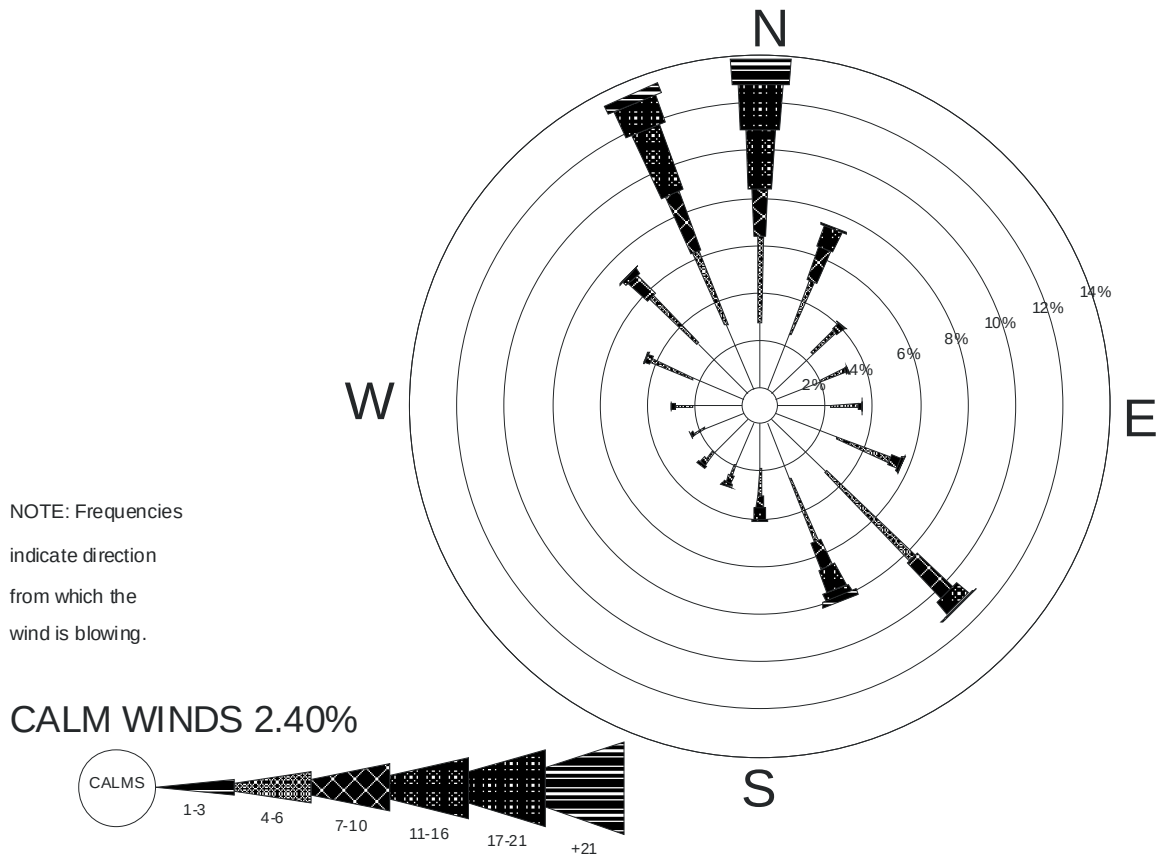

Figure A-5 Windrose for Autumn Months (Sep – Nov) 2001-2005 Maxwell Weather Station

USDA United States Department of Agriculture | Forest Service | Pacific Southwest Region

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File Code: 2580
Date: 29 SEP 2006

Mr. Mark Strechlow
Sr. Project Manager
URS Corporation
1333 Broadway, Suite 800
Oakland, CA 94612

Dear Mr. Strechlow,

Thanks for the opportunity to review and comment on the modeling protocols for the proposed Colusa Generating Station. The following comments reflect the Forest Service review of the modeling protocols dated July 12, 2006.

The Colusa Generating Station is a proposed 640 megawatt (MW) natural gas-fired electric generating station planned near Delevan in Colusa County, California (about 70 miles northwest of Sacramento). The project will consist of two General Electric (GE) Frame 7EA combustion turbine generators. The applicant is E&L Westcoast. The modeling protocol was prepared by URS Corporation (Oakland, CA office).

Emission controls for the project include dry low-NOx burners along with selective catalytic reduction (SCR) for controlling nitrogen oxide (NOx) emissions and oxidation catalyst for controlling carbon monoxide (CO) emissions. Specific project emissions were not listed in the protocol, but based on Table 4-2, are believed to exceed 100 tons per year (tpy) for NOx and particulate matter (PM-10), but will be less than 100 tpy for sulfur dioxide (SO_2).

The proposed Class I modeling analysis will be conducted with the CALPUFF model in the screening mode. The analysis will be done for the Yolla Bolly Middle Eel Wilderness, located about 88 km northwest of the project site. The Class I analysis discussion is very brief (1 paragraph on Page 4-9) and very few details regarding the proposed modeling have been provided by the protocol.

Due to the lack of specific details regarding the CALPUFF modeling, a complete and comprehensive review of the proposed Class I modeling analysis is not currently possible. The protocol cited the September 2005 "CALPUFF Reviewers Guide" prepared by ARS on behalf of the Forest Service and National Park Service as the principal guidance document to be followed.

We have the following questions and/or additional guidance concerning the proposed Class I modeling:

1. The protocol lacks any discussion of particulate matter (PM) speciation from the proposed combustion turbines. PM speciation is important as some of the PM-10

emissions released from combustion sources may be organic in nature and these organic emissions have a larger impact on visibility compared to other PM emissions. It is recommended that the applicant should follow the guidance presented on the National Park Service internet site (www2.nature.nps.gov/air/permits/ect/index.cfm) in developing the PM emissions profile for the Class I modeling analysis.

2. The protocol discusses the Maxwell monitoring station as the source of the meteorological inputs for the modeling and it is presumed that this station will also be used for the CALPUFF screening modeling. However, the CALPUFF wet/dry deposition calculations also require hourly precipitation information and it is not clear whether or not precipitation data are also present in the Maxwell monitoring station data. If precipitation data are not available for the Maxwell monitoring site, what alternative is proposed for the CALPUFF wet/dry deposition calculations?

3. Another important input for CALPUFF is the background ozone and ammonia concentrations. These data are not specifically discussed in the protocol. Background ozone data are apparently available for the Colusa-Sunrise Boulevard Station (about 20 miles from the project site). Background ozone for the CALPUFF modeling should be based on the monthly average ozone from this station, unless a more representative ozone monitoring station can be identified. The background ammonia levels should be based on the recommended values from the Phase II IWAQM report, and calculated based on the weighted mean based on land use patterns for the trajectory from the proposed source to the Class I area of interest.

4. The sulfur dioxide (SO_2) emissions should be included in the visibility and acid deposition modeling analyses, even if the project SO_2 emissions are less than the 40 tpy PSD "significant" emission rate in the PSD regulations.

Thanks again for the opportunity to be involved in an early review process. If you have any questions please contact me at 559-784-1500, x1114 / tprocter@fs.fed.us or Dr. Suraj Ahuja at 530-521-7394 / sahuja@fs.fed.us.

Sincerely,

/S/ TRENT PROCTER
Trent Procter
Air Quality Program Manager

Colusa County APCD Comments dated July 19, 2006 from Les Fife

1) Page iii - List of Acronyms and Abbreviations
The abbreviation for the Colusa County Air Pollution Control District is not CEC

Response:

This is a typographical error and we apologize for any confusion it may have caused.

2) Page 4-1 - Screening Modeling
Initial screening only covers the turbine stacks yet refined modeling includes other project sources. Is there no scenario for screening that includes other sources?

Response:

The performance of the gas turbines is significantly influenced by ambient conditions, as are the emissions. The performance of the other sources such as the auxiliary boiler and the diesel engines are not influenced as much by ambient conditions. Also the emission rates for the turbines are significantly higher than the emission rates for the others sources. That is why only the gas turbines are subjected to screening modeling.

3) Page 4-9 - Health Risk Assessment Analysis
No HRA done on construction activities due to short term nature. What is the expected time frame? Seems like the HRA would be highest for the diesel powered construction equipment. On page 4-11 it says that the air quality impacts of the temporary construction emissions will be modeled.

Response:

The heath risk assessment typically performed for diesel particulate mater addresses the cancer risk associated with exposure duration of a lifetime of 70 years. It is not particularly meaningful to extrapolate a 20-month construction period exposure to lifetime cancer risk. The impacts to air quality from emissions of NOx and PM10, which have 1-hour, and 24 hour ambient air quality standards, respectively, are reasonable to evaluate with respect to temporary construction exposures.

4) Page 4-11 - Project Sources
Says the heavy equipment exhaust will be modeled using 15 ppm sulfur diesel. Why not worst case 500 ppm diesel or we need a guarantee that low sulfur diesel will be used. Will this sulfur content also apply to the backup generator and fire pump?

Response:

It is anticipated that the Conditions of Certification drafted by the CEC for this project will stipulate the use of 15 ppm ultra-low sulfur fuel in the construction equipment. The same fuel will be used in the stationary diesel engines.

5) Page 4-12 - Cumulative Impact Analysis
Considering the PG&E Delevan Compressor Station emissions the statement about the difference between actual emissions and permitted maximum being modeled is confusing. Also need more specifics on how maximum potential emission is determined.

Response:

The portion of the cumulative impact analysis under question uses computer modeling to quantify the effect of the unused capacity of existing sources on local air quality data used as background air quality (background air quality data is discussed more in section 4.6.2.). The air quality impact on local air monitoring station(s) is influenced by the emissions from existing sources. If those sources were operating at less than full capacity during the period of measurement, the monitoring station(s) would not have measured the maximum potential impact from them. Therefore, the difference in emissions between actual operation during the monitoring period and maximum allowed by permit is modeled.

In the case of the Delevan Compressor station, source test information is available for two of the three gas turbines. Emission factors could be used for the third. PG&E will be contacted to determine average operation for the monitoring periods. The site's operating permit will be reviewed to determine the sources potential to emit.

Staff comments on the URS modeling protocol
for the Colusa Generation Station
July 2006

CEC Staff has reviewed the URS modeling protocol for the Colusa Generation Station Power Plant Project and has the following minor concerns.

Background:

Based on the brief description of the local topography near the project site, it is clear that AERMOD would produce a more accurate result than ISCST3. ISCST3 will most likely over predict the air quality impacts under these circumstances. However, the met-data requirements for AERMOD are significant. There are three things that would eliminate AERMOD from consideration prior to analyzing the met-data.

- Downward sloping elevations from the point of emission.
- Calms hours exceeding 25%.
- Complex terrains raise more than a 15% slope from the emission source.

For the first condition, it is unclear from the description of the local terrain that the project site does not contain these downward sloping elevations. For the second condition, the applicant has stated that the met-data will contain 10% missing data (replaced via EPA procedures) and has identified the number of calm hours 1.66% over all. For the third condition, the applicant has not provided sufficient description of the local terrain to make this determination.

Please respond to the following comments prior to filing the AFC:

Comment 1. Please confirm that there are no downward sloping elevations from the point of emission.

Response:

There is no downward sloping terrain from the point of emissions that will cause concern relative to the use of AERMOD. The Sacramento Valley, which lies to the east of the proposed project site, has flat terrain for more than 20 miles. The terrain difference at the Sacramento River (the lowest point in the valley) is about 135 feet less than the stack base elevation. The river is over 13 miles away from the emission point. Therefore that terrain is essentially flat.

Comment 2. Please confirm that the nearby complex terrains raise no more than a 15% slope from the height of the emission source.

Response:

The complex terrain rises no more than 5 percent on average from the site to the highest elevation nearby (within ten miles) and rises much less than 5 percent on

average to points further away. Therefore, this site complies with the "no greater than 15 percent" criterion.

Background:

To run AERMOD in accordance with the USEPA guidelines, the modeler is required to compare, in specific numeric terms, the physical location around the meteorological data collection site and the proposed project site. Specifically, the sites must be divided into sectors sweeping from 0 degrees to 360 degrees (the advice being that no sector should be less than 30 degrees). Each sector is described by three variables, the albedo number, the Bowen ratio and the surface roughness length. These three variables are based, among other things, on the land use patterns in each sector. So it is incumbent on the modeler to choose the sectors such that these variables are simple to determine and consistent between the met-data collection site(s) and the project site. To date, staff is unaware of any analysis on AERMOD to determine its sensitivity to these variables.

This comment can be addressed in the AFC:

Comment 3. Please provide the following information for the both project and the meteorological collection station sites:

A. For both the project site and meteorological station site:
   1. A map showing at least 3-5 kilometers diameter (please be consistent from one site to the next) around the site and legibly detailed to sufficiently show land use patterns as defined in the most recent version of the *User's Guide For The AERMOD Meteorological Preprocessor (AERMET)*, tables 4-1, 4-2a, 4-2b, 4-2c, and 4-3.
   2. For each sector as defined by the modeler.
      a. The sector boundaries.
      b. The albedo number for the sector.
      c. The Bowen ratio for the sector (including a rationale for the Bowen ratio table to be used…wet, normal or dry).
      d. The surface roughness length for the sector.
      e. The identification of each land use pattern within the sector.

B. A sector by sector comparison of the project site and meteorological station site for the following variables:
   1. The sector boundaries.
   2. The albedo number for the sector.
   3. The Bowen ratio for the sector.
   4. The surface roughness length for the sector.

Response:

The land use characteristics surrounding both the Colusa Generating Station and the Maxwell meteorological station are presented in Figure 1. The land use classifications were obtained from the USGS National Land Cover Data (NLCD), 1992. These data show that there are 4 dominant land use classifications surrounding the facility and the meteorological station. The definitions of these land use classifications are:

- *Grasslands/Herbaceous - Areas dominated by upland grasses and forbs. In rare cases, herbaceous cover is less than 25 percent, but exceeds the combined cover of the woody species present. These areas are not subject to intensive management, but they are often utilized for grazing.*
- *Pasture/Hay - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops.*
- *Row Crops - Areas used for the production of crops, such as corn, soybeans, vegetables, tobacco, and cotton.*
- *Small Grains - Areas used for the production of graminoid crops such as wheat, barley, oats, and rice.*

All 4 classifications encompass rural agricultural or grazing lands. The examination of each 30 degree sector surrounding both the facility and meteorological station determined that all sectors are comprised of rural agricultural or grazing lands. Two data sources were used to determine the appropriate surface characteristics, albedo, Bowen ratio and surface roughness, for use in the AERMET meteorological processing, Boundary Layer Climates by T.R. Oke and tables 4-1, 4-2a, 4-2b, 4-2c, and 4-3 in the AERMET manual.

The albedo, the fraction of total incident solar radiation reflected by the surface back to space without absorption, for all 4 land use classifications is between 0.16-0.26 per Oke and 0.14-0.20 per AERMET (excluding winter). Because very little snow falls, and even less accumulates, the winter surface characteristics described in the AERMET manual are not applicable to these sites. The albedo is dependant upon the amount of vegetation, from the land use definitions above for all 4 classifications and analysis of aerial photos of the area, very little variation in the albedo is expected around either the facility or meteorological station. Hence we propose for all sectors surrounding the facility and meteorological station to use an albedo of 0.18 for spring through autumn and an albedo of 0.4 for winter.

The Bowen ratio, is a measure of atmospheric moisture, Oke states that for grasslands the value is between 0.4-0.8. At the nearest NWS meteorological station, Red Bluff, the average annual precipitation is 23.5 inches. Becasue this is neither an arid or excessively moist area the Bowen ratio for average moisture conditions from the AERMET manual were examined. It ranged from 0.3-1.0 (excluding winter). Thus it was determined that the appropriate Bowen ratio for areas surrounding the facility and meteorological station is 0.4 for spring, 0.6 for summer, 0.8 for autumn and 1.0 for winter.

The surface roughness length is related to the height of the obstacles the wind must flow over. The surface roughness rule-of-thumb as described by Oke, is z_o=1/10 h, where h is the canopy height. The canopy height is the height of the vegetation, and the height of the vegetation is dependant upon the season and the type of crop. Oke describes the surface roughness for crops and grasslands to be between 0.04-0.20m.

The AERMET characterizes surface roughness to be between 0.01-0.20m (excluding winter). Hence it was determined that the appropriate surface roughness length to describe the lands surrounding both the facility and meteorological station is 0.04m for spring, 0.15m for summer, 0.07m for autumn and 0.01m for winter.

Background:

To run AERMOD, the modeler must first run AERMAP to create a terrain input file. AERMAP relies on USGS DEM data files (7½ minutes is recommended) and the grid of receptors input by the modeler. What AERMAP must do is find the "Local Terrain Max", which is the highest point that exceeds a 10% slope starting at the receptor. So a local terrain max is determined for each receptor in the grid. A grid-density of 100 meters (that is 100 meters between receptors) would have approximately 40,000 receptors in a 10 kilometer square around the project site. That would mean that AERMAP needs to find 40,000 local terrain maxes. While the computer can perform this task, it will also extend out the "domain boundary" to include the local terrain maxes. That means that the modeled area must also increase to the ends of the domain boundary. If the computer is allowed to simply pick a local terrain max with no intelligence, it can increase the domain boundary to 50,000 meters in California. However, it is not evident what problems this might cause. Therefore, staff simply wants to remain informed.

This comment can be addressed in the AFC:

Comment 4. Please provide the output file of AERMAP and a description of the ultimate domain boundary.

Response:

An analysis has been conducted to determine if there are any significant terrain features surrounding the Colusa Generating Station. The mountains of the Mendocino National Forest to the west of the Colusa Generating Station contain the only significant terrain features. It was determined that only a handful of the receptors within the 10 kilometer modeling grid will have terrain features that rise more than 10%. All of these features will be incorporated in the AERMAP analysis where the terrain domain will be set to cover 25 kilometers to the west of the facility and 15 kilometers to the north, east and south.

A recent test was conducted to determine the amount of computing power needed to conduct the AERMAP and AERMOD analyses for the Colusa Generating Station. The test was conducted on a new PC, a Pentium 4 duel processor with 1 GB RAM and 3 GHz processing speed.

It was determined that for 5 years of meteorological data and 28,000 receptors it would take AERMOD approximately 10 days to model all pollutants. Fortunately the AERMAP run only needs to occur once, but it is expected to take approximately 48 hours for 28,000 receptors with the domain described above. If additional nested grid receptors are required, more time will be needed to run AERMAP.

URS proposes that the AERMOD receptor spacing be modified to the following:

- *25-meter spacing along the property line and extending from the property line out to 100 meters;*

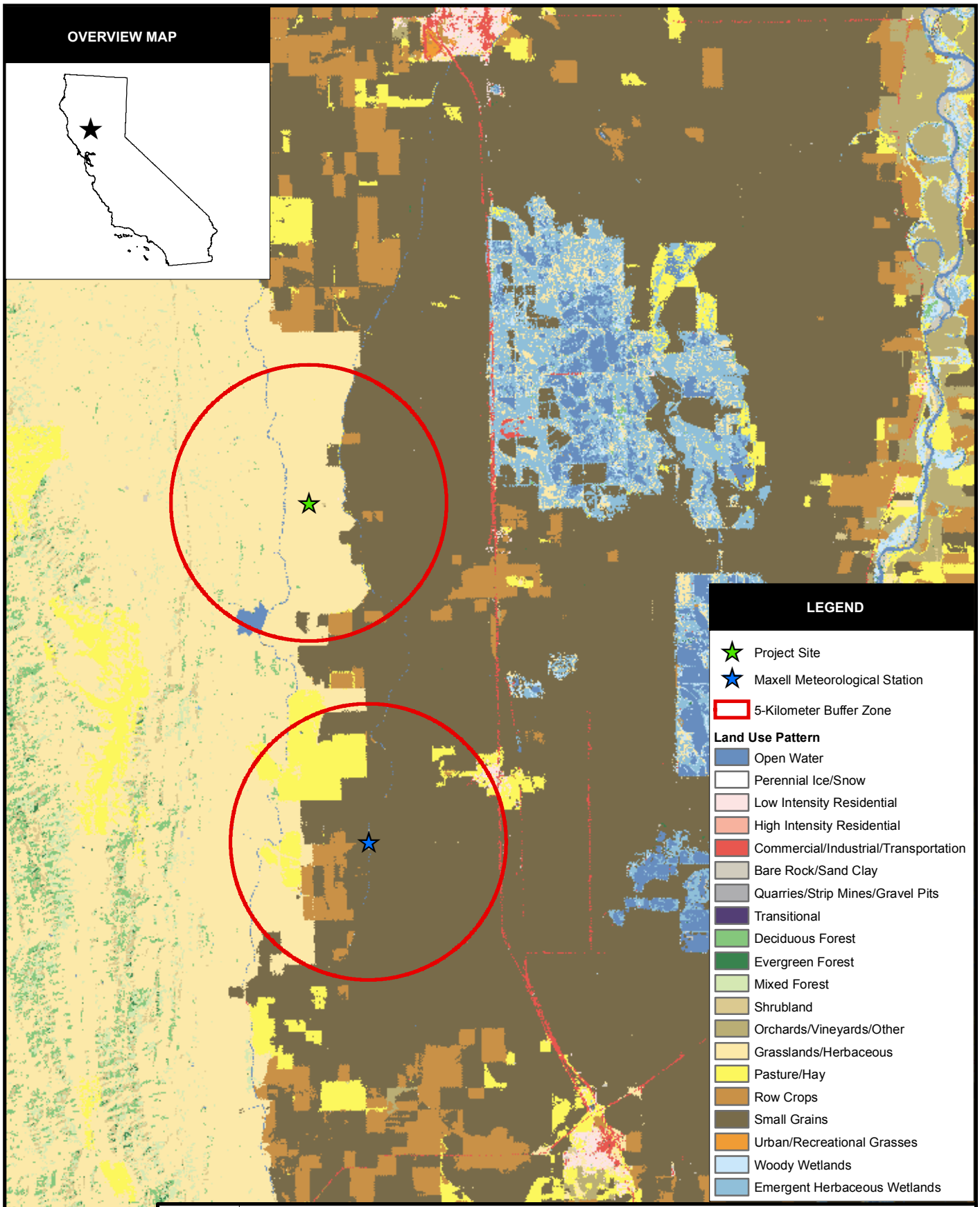
- *100-meter spacing within 1 km of project sources for any locations not covered by the 25-meter grid;*

- *500-meter spacing within 1 to 5 km of project sources;*

- *1,000-meter spacing within 5 to 10 km of project sources.*

- *If maximum concentrations are predicted where the grid spacing is less dense than 25 meter, a 25 meter spaced nested grid of receptors will be placed surrounding the receptor where the maximum was predicted. This nested grid will extend out 500 meters in all directions or until the next regular grid receptors is encountered.*

Use of this receptor spacing should reduce the necessary computing time to run AERMOD to approximately 40 hours.



SOURCES:
USGS (Land cover dataset geotiff 1992);
ESRI.

LAND USE PATTERNS AROUND THE COLUSA GENERATING STATION AND MAXWELL METEOROLOGICAL STATION

URS

1.5 0 1.5 3 Miles

SCALE: 1" = 3 Miles (1:190,080)

CREATED BY: LG	DATE: 08-10-06	FIG. NO: 1
PM: JM	PROJ. NO: 28067004.20100	

G:\gis\projects\1577\28067004\mxd\landuse.mxd

Bohning.Scott@epamail.epa.gov
10/23/2006 05:04 PM

To Mark_Strehlow@URSCorp.com
cc Bohnenkamp.Carol@epamail.epa.gov, Hogan.Sean@epamail.epa.gov
bcc
Subject Colusa Modeling Protocol - EPA Comments

History: This message has been replied to and forwarded.

Mark - Here's comments you requested.

Comments on Colusa Generating Station (CGS) modeling protocol (URS 7/12/06)

Generally, I'm pretty happy with the protocol for CGS. I have few disagreements; mainly requests for more detail, expansion of scope for some items, plus questions on the proposed plume visibility models. Thanks for your patience in waiting for EPA comments.

4.1 Screening modeling
Given the additional parameters in AERMOD as compared to ISC/SCREEN, it's not clear to me what "worst-case conditions" would be for comparing operating modes. What you have in mind should be spelled out with some justification, or alternatively SCREEN3 (or ISCST3 with screening meteorology) could be used.

4.2.2 PSD Increment Analysis (see also below under 4.3.2)
The source of inventory data for nearby pollution sources should be mentioned, for both the PSD and the NAAQS analyses. Ideally, the specific sources with their emissions and stack parameters should also be listed. Also, there should be a list of nearby §107 areas, and the status of minor source baseline date triggering in each for the relevant pollutants (to help determine what nearby sources need to be included in any cumulative analysis).

4.2.7 Visible Plume Analysis
I am not familiar with the Combustion Source Visible Plume (CSVP) and the Seasonal/Annual Cooling Tower Impact (SACTI) models, except by name. Please provide some references to the formulation and testing of these models, and if possible a comparison to VISCREEN or PLUVUE which are mentioned for visibility in EPA's Guideline on Air Quality Models.

4.3.2 Cumulative Impact Analysis Including Sources outside CGS
It is not clear with the cumulative analysis mentioned in this section is solely to meet the CEC's requirements, or is also intended to meet PSD requirements. Typically PSD analyses include sources within 50 km of the Significant Impact Area, and the protocol should make provision for this should a full cumulative analysis be needed under PSD (required for pollutants for which CGS impact exceeds Significant Impact Level).

4.5 Receptor Grid
While the impact area for a gas-fired facility will likely be small, receptors out to 10 km may not be far enough. At least for initial model runs, additional grids further out should be included, e.g. 1000 m spacing out to 25+ km, sparser out to 50 km. To cut down on the number of receptors, this could also be a polar grid, with e.g. rings every 1000 m from 10 km to 20 km, and rings every 5000 m out to 50 km.

4.6.1 Meteorological Data

I concur with the use of meteorological data from the Maxwell site as representative for the CGS facility. However, additional details on the parameters needed for AERMOD should be provided for the two locations, along with how they were determined (measurements vs. tables, what land use assumed, any sector averaging done): surface roughness, albedo, Bowen ratio.

4.6.2 Background Air Pollutant Monitoring Data
The choice of monitors seems OK, but given the distances involved, there should be some documentation on whether concentrations at these sites are likely to be conservatively high.

5.1, 5.2 NAAQS and PSD analyses
In addition to the impact tables, the protocol should also provide for isopleth maps of pollutants with significant concentrations due to the CGS facility.

Sincerely,
Scott Bohning

=+=+=+=+=+=+=+=+=+=+=+=+=+=+=
Scott Bohning
U.S. EPA Region 9, AIR-7
bohning.scott@epa.gov
415/947-4127 fax-3579

P.S. Note that I will be out of the office 10/25 - 10/29.

APPENDIX G2
CONSTRUCTION EMISSION CALCULATIONS

There are going to be 337,000 cubic yards (cy) of earth moved at the site during the first three months of construction. The analysis below addresses this activity, considering that the earth is going to be first removed and pushed by backhoes and bulldozers, then loaded into dump trucks by excavator loaders, transported, and finally unloaded.

The fugitive dust sources considered for this activity are the following: dirt pushing and bulldozing, loading of trucks, transportation of earth on unpaved roads, and unloading of trucks. Because the contractor has not been hired yet, there is not a detailed construction schedule for heavy equipment available and several assumptions had to be made. Table 8.1-8 includes three dozer tractor crawlers in each of the first three months and six dump trucks in month 1 and three dump trucks in months 2 and 3 to accomplish the earthmoving.

The AP-42 calculation methods were used to estimate the PM10 fugitive dust emissions. Table G.2-2 presents the controlled PM10 emissions per month of construction and fugitive dust source for this activity. Earth moving is considered to take place in the first three months of construction, the 337,000 cy of earth are going to be moved in two main but different ways: by the use of dump trucks (loading, transporting, and unloading) and by the use of bull dozer tractor crawlers. The detailed calculations are presented below:

Earthmoving Activities:

The equipment available for moving the 337,000 cy (455,000 tons) of earth is 12 truck-month and 9 dozer-month. We consider a capacity of 14 cy (18.9 tons) for a dump truck (based on John Deere models) and of 38.5 cy (52 tons) for a bulldozer tractor crawler (Caterpillar D10R).

If we consider that half of the earth is moved by bulldozers and the other half by trucks, we have:

Trucks:
-Number of truck trips needed:
227,500 tons/18.9 tons per truck = 12,037 truck trips needed
-Number of trips per hour and truck (frequency of trips):
12,037 trips/[12 truck-month*20 (days/month)* 7 (hours/day)] = 7.16 trips/hour
-Vehicle mile traveled per day:
7.16 trips/hour * 7 hours/day * 0.1515 miles/trip = 7.60 VMT/day

Bulldozers:
-Number of bulldozer trips or moves needed:
227,500 tons/52 tons per bulldozer = 4,375 bulldozer trips needed
-Number of trips per hour and bulldozer (frequency of trips):
4,375 trips/[9 dozer-month*20 (days/month)* 7 (hours/day)] = 3.47 trips/hour
-Vehicle mile traveled per day:
3.47 trips/hour * 7 hours/day * 0.1515 miles/trip =3.68 VMT/day

Emission factor calculations:

Loading of trucks: AP-42, Table 11.9-4, shows an emission factor for "truck loading of excavated materials by power shovel" of 0.037 lb/ton.

Unloading of trucks: AP-42, Table 11.9-4, the emission factor in this case is for "bottom dump truck unloading", 0.002 lb/ton.

Dump truck transportation of earth on unpaved road: AP-42, section 13.2.2 "Unpaved Roads":

$$E = \frac{k\left(\frac{s}{12}\right)^a \left(\frac{W}{3}\right)^b}{\left(\frac{M}{0.2}\right)^c}$$

Where: E = size-specific emission factor (lb/VMT)
s = surface material silt content (%) = 55%
W = mean vehicle weight (tons) = 39.07 tons
M = surface material moisture content (%) = 18%
k= 1.5 lb/VMT
a = 0.9
b = 0.45
c = 0.3

W, the mean vehicle weight, was calculated for a round trip, adding the weights of an unloaded and a loaded truck and dividing the result by two.
M and s are field data, and k, a, b, and c are the constants to use in the calculation of fugitive dust as PM10 (AP-42).

The result of this calculation was E = 4.21 lb/VMT

General Land Clearing/Bulldozing: AP-42, section 13.2.3 "Heavy Construction Operations" recommends the emission factor on table 11.9-1 of the AP-42 for this activity:

$$E = k\frac{1.0(s)^{1.5}}{(M)^{1.4}}$$

Where: E = size-specific emission factor (lb/hr)
k = scaling factor for PM10 = 0.75
M and s as defined above.
And this equation results in an emission factor of 5.35 lb/hr.

Emissions calculations:

<u>*Loading and unloading of trucks*</u>:

$$PM_{10}(lb/month) = E(lb/ton) \times \frac{trips}{hour} \times \frac{hours}{day} \times \frac{days}{month} \times \frac{tons}{trip} \times \#\,oftrucks$$

These emissions can be controlled by watering and chemical treatments with 90% efficiency (AP-42, material handling operations)

<u>*Transportation of earth on unpaved roads*</u>:

$$PM_{10}(lb/month) = E(lb/VMT) \times \frac{VMT}{truck \times day} \times \#\,oftrucks \times \frac{days}{month}$$

These emissions can be controlled by chemical dust suppressants with 80% efficiency (AP-42, unpaved roads)

<u>*Land Clearing/Bulldozing*</u>:

$$PM_{10}(lb/month) = E(lb/hr) \times \frac{hr}{day \times dozer} \times \#\,ofdozers \times \frac{days}{month}$$

These emissions can be controlled by watering and chemical treatments with 90% efficiency (AP-42, material handling operations)

Table G.2-2 applies the equations above for each fugitive dust source and according to the schedule (Table G.2-1). The PM10 emissions in Table G.2-2 correspond to controlled emissions, with the efficiencies described before for each source.

Table G.2-1
Estimated Number of Pieces of Construction Equipment and Schedule for Earth Moving

Construction Equipment	Average Hours per Day	Average Units On Site Per Month																						Total Months
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	…	24	
Dozer Tractor Crawler	7	3	3	3																				9
Dump Truck	7	6	3	3																				12

Table G.2-2
Controlled Fugitive Dust as PM10 Emissions from Earth Moving

Fugitive Dust Source	PM10 Emissions Pounds Per Month		
	1	2	3
Loading of Dump Trucks with Excavated Material	420.9	210.4	210.4
Unloading of Dump Trucks	22.8	11.4	11.4
Transportation of Earth on Unpaved Roads	766.9	383.5	383.5
Dirt Pushing and Bulldozing	224.6	224.6	224.6
Total	1,435.2	829.9	829.9

Notes: worst 1-hour would be 7.2 lb/hr

The total monthly emissions on Table G.2-3 are added to the original emissions calculated with the emission factor of 0.11 tons/acre/month of activity. This emission factor is very conservative because it considers all TSP and not PM10 in particular, and it also considers that the activity occurs 30 days per month. Other fugitive dust emissions sources related to the earth moving such as wind erosion are therefore included in this emission factor.

.

PM10 emissions from construction at Colusa

Activity	Emission Factor (as PM10)	Units
General land clearing/Bulldozing	5.35	lb/hr
Loading of excavated material into trucks	0.037	lb/ton
Truck transport of excavated material	4.21	lb/VMT
Truck dumping of excavated material	0.002	lb/ton

s (silt content)	M (moisture content)	u (mean wind speed in mph)	Tons of earth moved	density (tons/cy)	Vol. Moved cy
55	18	5.1	455000	1.35	337000

Truck capacity (cy)*	Truck weight (tons)*	Loaded truck weight
14	18.9	37.8

18.9

truck trips needed	dozers trips needed	Round trip distance (miles)	dozer crawler capacity (tons)	# of trucks	# of dozers
12035.71	4375	0.1515	52	12	9

TRUCKS: 227500 tons
12037 trips
7.16 trips per hour
7.60 truck VMT/day

DOZERS 227500 tons
4375 trips/moves
3.47 moves per hour
3.68 dozer VMT/day

*Data based on John Deere models

Table G.2-3

Uncontrolled Emission Factor[a]	0.11	tons PM10/acre-month
Controlled Emission Factor	0.011	tons PM10/acre-month
Control Efficiency[b]	90%	

Month	Construction Trailer and Parking Areas (acres)	Construction Laydown Area (acres)	Power Block Area (acres)	Switchyard (acres)	Plant Access Road (acres)	Proposed Transmission Line Interconnection (acres)	Water Supply Pipeline (acres)	Teresa Creek Bridge (acres)	Disturbed Area (acres)	Uncontrolled Emissions (tons/month)	Controlled Emissions (tons/month)	Earth Moving (tons/month)	Fugitive Dust TOTAL (tons/mo)	Equip. Exhaust PM10 (tons/mo)	Total PM10 (tons/mo)
-1								2.0	2	0.22	0.02	0	**0.02**	**0.17**	**0.20**
1	5.0	20.0	15.00	20.0	7.4	4.3	0	2.0	73.7	8.11	0.81	0.718	**1.53**	**0.17**	**1.70**
2	5.0	20.0	15.00	20.0	7.4	4.3	0	2.0	73.7	8.11	0.81	0.415	**1.23**	**0.19**	**1.42**
3	2.5	10.0	7.50	10.0	3.7	2.2	0	0	35.85	3.94	0.39	0.415	**0.81**	**0.20**	**1.00**
4	2.5	10.0	7.38	10.0	3.7	2.2	0	0	35.73	3.93	0.39	0.00	**0.39**	**0.16**	**0.55**
5	2.5	10.0	7.37	10.0	3.7	2.2	0	0	35.72	3.93	0.39	0.00	**0.39**	**0.17**	**0.56**
6	2.5	10.0	7.32	10.0	3.7	2.2	2.4	0	38.02	4.18	0.42	0.00	**0.42**	**0.19**	**0.61**
7	2.5	10.0	7.30	10.0	3.7	2.2	2.4	0	38	4.18	0.42	0.00	**0.42**	**0.22**	**0.64**
8	2.5	10.0	7.21	10.0	3.7	2.2	2.4	0	37.91	4.17	0.42	0.00	**0.42**	**0.22**	**0.64**
9	2.5	10.0	7.18	10.0	3.7	2.2	2.4	0	37.88	4.17	0.42	0.00	**0.42**	**0.23**	**0.65**
10	2.5	10.0	7.10	10.0	3.7	2.2	2.4	0	37.8	4.16	0.42	0.00	**0.42**	**0.22**	**0.64**
11	2.5	10.0	7.09	10.0	3.7	2.2	2.4	0	37.785	4.16	0.42	0.00	**0.42**	**0.22**	**0.63**
12	2.5	10.0	7.07	10.0	3.7	2.2	2.4	0	37.77	4.15	0.42	0.00	**0.42**	**0.20**	**0.62**
13	2.5	10.0	7.06	10.0	3.7	2.2	2.4	0	37.755	4.15	0.42	0.00	**0.42**	**0.16**	**0.57**
14	2.5	10.0	7.04	10.0	3.7	2.2	2.4	0	37.74	4.15	0.42	0.00	**0.42**	**0.15**	**0.56**
15	2.5	10.0	7.03	10.0	3.7	2.2	2.4	0	37.725	4.15	0.41	0.00	**0.41**	**0.15**	**0.56**
16	2.5	10.0	7.02	10.0	3.7	2.2	2.4	0	37.715	4.15	0.41	0.00	**0.41**	**0.13**	**0.54**
17	2.5	10.0	7.01	10.0	3.7	2.2	2.4	0	37.705	4.15	0.41	0.00	**0.41**	**0.11**	**0.52**
18	2.5	10.0	7.00	10.0	3.7	2.2	2.4	0	37.7	4.15	0.41	0.00	**0.41**	**0.07**	**0.48**
19	2.5	10.0	7.00	10.0	3.7	2.2	2.4	0	37.7	4.15	0.41	0.00	**0.41**	**0.06**	**0.47**
20	2.5	10.0	7.00	10.0	3.7	2.2	2.4	0	37.7	4.15	0.41	0.00	**0.41**	**0.04**	**0.46**
21	2.5	0	0	0	0	0	0	0	2.5	0.28	0.03	0.00	**0.03**	**0.03**	**0.06**
22	2.5	0	0	0	0	0	0	0	2.5	0.28	0.03	0.00	**0.03**	**0.03**	**0.06**
23	2.5	0	0	0	0	0	0	0	2.5	0.28	0.03	0.00	**0.03**	**0.03**	**0.06**
24	2.5	0	0	0	0	0	0	0	2.5	0.28	0.03	0.00	**0.03**	**0.03**	**0.06**

Worst-Case Onsite Controlled Emissions

Months	Total Annual Emissions (tons/year)
-1-11	9.25
1-12	9.67
2-13	8.54
3-14	7.69
4-15	7.24
5-16	7.24
6-17	7.19
7-18	7.06
8-19	6.90
9-20	6.71
10-21	6.12
11-22	5.67

		lb/unit time
Annual Worst-case Emission Rate (ton/year)	9.7	**19338.9**
Annual Worst-case Emission Rate (g/s)[c]	0.28	
Monthly Worst-case Emission Rate (ton/month)	1.7	**3405.9**
24-hour Worst-Case Emissions (lb/day)	170.3	
24-hour Worst-Case Emissions (lb/hr)	17.03	
1-hour Worst-case Emission Rate (lb/hr)[d]	15.5	
1-hour Worst-case Emission Rate (g/s)	1.95	

[a]Uncontrolled emission factor from Midwest Research Institute (MRI, 1996)

[b]A 90% control efficiency was assumed due to fugitive dust compliance program.

[c] Based on 8760 hours per year.

[d] Based on 22 days/month and 10 hrs/day.

TABLE G.2-4 CONSTRUCTION MONTHLY NOx EMISSIONS SUMMARY

Construction Equipment	NOx Emissions Per Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Excavator Loader	181.1	543.3	543.3	543.3	362.2	362.2	181.1	181.1	181.1	181.1	181.1	181.1	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Backhoe	181.1	543.3	543.3	543.3	362.2	362.2	181.1	181.1	181.1	181.1	181.1	181.1	-	-	-	-	-	-	-	-	-	-	-	-
Dozer Tractor Crawler	429.8	429.8	429.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fron End Loader	-	-	-	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	123.3	-	-	-	-	-	-	-	-
Trenching Machine	28.2	56.3	56.3	28.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Motor Grader	83.3	83.3	83.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Plate Compactor	6.1	12.2	12.2	12.2	12.2	18.3	18.3	18.3	18.3	18.3	18.3	12.2	6.1	6.1	6.1	6.1	6.1	-	-	-	-	-	-	-
Roller Vibrator	85.4	85.4	85.4	85.4	85.4	170.8	170.8	170.8	170.8	85.4	85.4	85.4	85.4	-	-	-	-	-	-	-	-	-	-	-
Water Truck	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	216.4	-	-	-	-	-	-	-
Concrete Mixer	-	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	-	-	-	-	-	-	-
Concrete Pump, trailer mount	-	-	-	23.6	23.6	23.6	23.6	23.6	23.6	23.6	23.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Mortar Mixer	-	-	1.0	1.0	2.0	2.0	2.0	2.0	2.0	2.0	1.0	1.0	1.0	-	1.0	-	-	-	-	-	-	-	-	-
Paving Machine	83.3	83.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	83.3	83.3	83.3	-	-	-	-	-
Dump Truck	1,514.6	757.3	757.3	252.4	504.9	504.9	504.9	504.9	504.9	504.9	504.9	504.9	504.9	504.9	504.9	504.9	252.4	252.4	252.4	252.4	252.4	252.4	252.4	252.4
Crane (6-ton)	-	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	22.9	-	-	-	-	-	-
Crane (20-ton)	68.8	137.6	137.6	137.6	137.6	137.6	206.4	206.4	206.4	206.4	206.4	206.4	137.6	137.6	137.6	68.8	-	-	-	-	-	-	-	-
Crane (50-ton)	141.9	283.7	283.7	283.7	425.6	425.6	425.6	425.6	567.4	567.4	567.4	425.6	425.6	283.7	283.7	141.9	141.9	-	-	-	-	-	-	-
Crane (100-ton)	-	-	-	-	220.3	220.3	220.3	220.3	220.3	220.3	220.3	220.3	220.3	220.3	220.3	-	-	-	-	-	-	-	-	-
Crane (300-ton)	-	-	-	-	-	-	316.0	316.0	316.0	316.0	316.0	316.0	-	-	-	-	-	-	-	-	-	-	-	-
Crane (360-ton)	-	-	-	-	-	-	316.0	316.0	316.0	316.0	316.0	316.0	-	-	-	-	-	-	-	-	-	-	-	-
Crane (500-ton)	-	-	-	-	-	-	517.9	517.9	517.9	517.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manlift, telescoping	-	-	-	26.4	26.4	52.9	52.9	52.9	52.9	52.9	52.9	52.9	52.9	26.4	52.9	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4	26.4
Welder (250 amp)	-	27.8	27.8	55.6	55.6	55.6	83.4	111.2	111.2	111.2	83.4	83.4	55.6	55.6	55.6	55.6	55.6	27.8	27.8	-	-	-	-	-
Air Compressor (185 cfm)	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	8.9	-	-	-	-
Air Compressor (750 cfm)	-	-	-	-	26.8	53.7	53.7	53.7	53.7	53.7	53.7	26.8	26.8	26.8	26.8	26.8	26.8	26.8	-	-	-	-	-	-
Generator (6 kW)	28.4	28.4	28.4	28.4	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	56.7	-	-	-	-	-	-	-
Forklift (2-ton)	34.9	34.9	34.9	34.9	34.9	34.9	69.8	69.8	69.8	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9	34.9
Forklift (4-ton)	-	-	48.7	48.7	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	97.4	-	-	-	-	-	-	-	-
Fuel/Lube Truck	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7	156.7
Pickup Truck (1/2-ton)	540.9	540.9	540.9	540.9	540.9	901.6	901.6	901.6	901.6	901.6	901.6	901.6	901.6	901.6	901.6	901.6	901.6	721.2	721.2	540.9	360.6	360.6	360.6	360.6
Stakebed Truck	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	326.6	-	-	-	-	-	-
Hydrolic Boom Truck	-	197.3	197.3	197.3	197.3	197.3	197.3	197.3	197.3	-	197.3	197.3	197.3	197.3	197.3	197.3	197.3	197.3	197.3	-	-	-	-	-
Concrete Trowel	7.7	7.7	15.4	15.4	15.4	15.4	15.4	15.4	7.7	7.7	7.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Floor Saw	-	-	-	-	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	-	-	-	-	-	-	-	-
Bobcat Skip Loader	75.3	75.3	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	150.6	-	-	-	-	-	-	-
Hydrotest Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10.1	10.1	10.1	10.1	-	-	-	-	-	-
Total	4,199.3	4,669.8	4,719.2	3,874.2	4,210.7	4,716.1	5,635.3	5,663.1	5,797.2	5,479.6	5,130.2	4,924.1	3,827.2	3,572.5	3,610.1	3,151.7	2,685.7	1,895.5	1,509.0	1,020.4	831.1	831.1	831.1	831.1

Note: Above estimates are for a single shift execution and 5/10 work week.

Yearly Emissions (lbs/yr)	
Month 1-12	59,018.7
Month 2-13	58,646.6
Month 3-14	57,549.4
Month 4-15	56,440.3
Month 5-16	55,717.7
Month 6-17	54,192.7
Month 7-18	51,372.2
Month 8-19	47,245.9
Month 9-20	42,603.2
Month 10-21	37,637.1
Month 11-22	32,988.6
Month 12-23	28,689.5
Month 13-24	24,596.5

Worst-Case Emissions	
Worst Month	5797.2 lb/month
Worst 1-hr	29.0 lb/hr
Worst Year	59018.7 lb/year

TABLE G.2-5 CONSTRUCTION MONTHLY CO EMISSIONS SUMMARY

Construction Equipment	CO Emissions Per Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Excavator Loader	99.3	297.9	297.9	297.9	198.6	198.6	99.3	99.3	99.3	99.3	99.3	99.3	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Backhoe	99.3	297.9	297.9	297.9	198.6	198.6	99.3	99.3	99.3	99.3	99.3	99.3	-	-	-	-	-	-	-	-	-	-	-	-
Dozer Tractor Crawler	247.3	247.3	247.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fron End Loader	-	-	-	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	76.9	-	-	-	-	-	-	-	-
Trenching Machine	14.7	29.5	29.5	14.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Motor Grader	25.9	25.9	25.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Plate Compactor	4.1	8.1	8.1	8.1	8.1	12.2	12.2	12.2	12.2	12.2	12.2	8.1	4.1	4.1	4.1	4.1	4.1	-	-	-	-	-	-	-
Roller Vibrator	52.5	52.5	52.5	52.5	52.5	105.0	105.0	105.0	105.0	52.5	52.5	52.5	52.5	-	-	-	-	-	-	-	-	-	-	-
Water Truck	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	133.8	-	-	-	-	-	-	-
Concrete Mixer	-	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	6.0	-	-	-	-	-	-	-
Concrete Pump, trailer mount	-	-	-	26.0	26.0	26.0	26.0	26.0	26.0	26.0	26.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Mortar Mixer	-	-	1.1	1.1	2.2	2.2	2.2	2.2	2.2	2.2	1.1	1.1	1.1	-	1.1	-	-	-	-	-	-	-	-	-
Paving Machine	51.2	51.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51.2	51.2	51.2	-	-	-	-	-
Dump Truck	936.6	468.3	468.3	156.1	312.2	312.2	312.2	312.2	312.2	312.2	312.2	312.2	312.2	312.2	312.2	312.2	156.1	156.1	156.1	156.1	156.1	156.1	156.1	156.1
Crane (6-ton)	-	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	47.6	-	-	-	-	-	-
Crane (20-ton)	55.9	111.9	111.9	111.9	111.9	111.9	167.8	167.8	167.8	167.8	167.8	167.8	111.9	111.9	111.9	55.9	-	-	-	-	-	-	-	-
Crane (50-ton)	147.3	294.6	294.6	294.6	441.9	441.9	441.9	441.9	589.2	589.2	589.2	441.9	441.9	294.6	294.6	147.3	147.3	-	-	-	-	-	-	-
Crane (100-ton)	-	-	-	-	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	45.7	-	-	-	-	-	-	-	-	-
Crane (300-ton)	-	-	-	-	-	-	71.4	71.4	71.4	71.4	71.4	71.4	-	-	-	-	-	-	-	-	-	-	-	-
Crane (360-ton)	-	-	-	-	-	-	372.4	372.4	372.4	372.4	372.4	372.4	-	-	-	-	-	-	-	-	-	-	-	-
Crane (500-ton)	-	-	-	-	-	-	114.8	114.8	114.8	114.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manlift, telescoping	-	-	-	26.6	26.6	53.2	53.2	53.2	53.2	53.2	53.2	53.2	53.2	26.6	53.2	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6	26.6
Welder (250 amp)	-	26.1	26.1	52.2	52.2	52.2	78.2	104.3	104.3	104.3	78.2	78.2	52.2	52.2	52.2	52.2	52.2	26.1	26.1	-	-	-	-	-
Air Compressor (185 cfm)	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	13.5	-	-	-	-
Air Compressor (750 cfm)	-	-	-	-	11.9	23.7	23.7	23.7	23.7	23.7	23.7	11.9	11.9	11.9	11.9	11.9	11.9	11.9	-	-	-	-	-	-
Generator (6 kW)	20.9	20.9	20.9	20.9	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	41.8	-	-	-	-	-	-	-
Forklift (2-ton)	39.3	39.3	39.3	39.3	39.3	39.3	78.5	78.5	78.5	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3	39.3
Forklift (4-ton)	-	-	39.2	39.2	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	78.3	-	-	-	-	-	-	-	-
Fuel/Lube Truck	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
Pickup Truck (1/2-ton)	334.5	334.5	334.5	334.5	334.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	557.5	446.0	446.0	334.5	223.0	223.0	223.0	223.0
Stakebed Truck	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	70.8	-	-	-	-	-	-
Hydrolic Boom Truck	-	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	-	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	41.2	-	-	-	-	-
Concrete Trowel	4.7	4.7	9.3	9.3	9.3	9.3	9.3	9.3	4.7	4.7	4.7	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Floor Saw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bobcat Skip Loader	70.6	70.6	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	141.1	-	-	-	-	-	-	-
Hydrotest Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4.4	4.4	4.4	4.4	-	-	-	-	-	-
Total	2,498.9	2,770.8	2,835.1	2,390.6	2,599.3	2,917.3	3,398.6	3,424.7	3,567.3	3,434.4	3,333.6	3,139.8	2,411.3	2,183.8	2,215.9	1,939.3	1,623.1	1,011.5	876.8	646.9	521.9	521.9	521.9	521.9

Note: Above estimates are for a single shift execution and 5/10 work week.

Yearly Emissions (lbs/yr)	
Month 1-12	36,310.2
Month 2-13	36,222.6
Month 3-14	35,635.6
Month 4-15	35,016.5
Month 5-16	34,565.2
Month 6-17	33,589.0
Month 7-18	31,683.2
Month 8-19	29,161.5
Month 9-20	26,383.7
Month 10-21	23,338.3
Month 11-22	20,425.9
Month 12-23	17,614.2
Month 13-24	14,996.3

Worst-Case Emissions	
Worst Month	3567.3 lb/month
Worst 1-hr	17.8 lb/hr
Worst Year	36310.2 lb/year

TABLE G.2-6 CONSTRUCTION MONTHLY VOC EMISSIONS SUMMARY

Construction Equipment	VOC Emissions Per Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Excavator Loader	19.1	57.2	57.2	57.2	38.1	38.1	19.1	19.1	19.1	19.1	19.1	19.1	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Backhoe	19.1	57.2	57.2	57.2	38.1	38.1	19.1	19.1	19.1	19.1	19.1	19.1	-	-	-	-	-	-	-	-	-	-	-	-
Dozer Tractor Crawler	80.0	80.0	80.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fron End Loader	-	-	-	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	24.9	-	-	-	-	-	-	-	-
Trenching Machine	2.9	5.8	5.8	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Motor Grader	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Plate Compactor	1.4	2.8	2.8	2.8	2.8	4.2	4.2	4.2	4.2	4.2	4.2	2.8	1.4	1.4	1.4	1.4	1.4	-	-	-	-	-	-	-
Roller Vibrator	12.5	12.5	12.5	12.5	12.5	25.0	25.0	25.0	25.0	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-	-	-	-
Water Truck	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	27.8	-	-	-	-	-	-	-
Concrete Mixer	-	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-	-	-	-
Concrete Pump, trailer mount	-	-	-	10.5	10.5	10.5	10.5	10.5	10.5	10.5	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Mortar Mixer	-	-	1.6	1.6	3.2	3.2	3.2	3.2	3.2	3.2	1.6	1.6	1.6	-	1.6	-	-	-	-	-	-	-	-	-
Paving Machine	12.3	12.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	12.3	12.3	12.3	-	-	-	-	-
Dump Truck	194.4	97.2	97.2	32.4	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	64.8	32.4	32.4	32.4	32.4	32.4	32.4	32.4	32.4
Crane (6-ton)	-	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	19.1	-	-	-	-	-	-
Crane (20-ton)	17.5	35.1	35.1	35.1	35.1	35.1	52.6	52.6	52.6	52.6	52.6	52.6	35.1	35.1	35.1	17.5	-	-	-	-	-	-	-	-
Crane (50-ton)	29.7	59.3	59.3	59.3	89.0	89.0	89.0	89.0	118.7	118.7	118.7	89.0	89.0	59.3	59.3	29.7	29.7	-	-	-	-	-	-	-
Crane (100-ton)	-	-	-	-	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	13.7	-	-	-	-	-	-	-	-	-
Crane (300-ton)	-	-	-	-	-	-	20.0	20.0	20.0	20.0	20.0	20.0	-	-	-	-	-	-	-	-	-	-	-	-
Crane (360-ton)	-	-	-	-	-	-	78.0	78.0	78.0	78.0	78.0	78.0	-	-	-	-	-	-	-	-	-	-	-	-
Crane (500-ton)	-	-	-	-	-	-	31.5	31.5	31.5	31.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manlift, telescoping	-	-	-	10.1	10.1	20.2	20.2	20.2	20.2	20.2	20.2	20.2	20.2	10.1	20.2	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1	10.1
Welder (250 amp)	-	10.6	10.6	21.2	21.2	21.2	31.7	42.3	42.3	42.3	31.7	31.7	21.2	21.2	21.2	21.2	21.2	10.6	10.6	-	-	-	-	-
Air Compressor (185 cfm)	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	-	-	-	-
Air Compressor (750 cfm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator (6 kW)	10.0	10.0	10.0	10.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	20.0	-	-	-	-	-	-	-
Forklift (2-ton)	14.4	14.4	14.4	14.4	14.4	14.4	28.8	28.8	28.8	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4	14.4
Forklift (4-ton)	-	-	13.4	13.4	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	26.7	-	-	-	-	-	-	-	-
Fuel/Lube Truck	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1	17.1
Pickup Truck (1/2-ton)	69.4	69.4	69.4	69.4	69.4	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	92.6	92.6	69.4	46.3	46.3	46.3	46.3
Stakebed Truck	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	21.7	-	-	-	-	-	-
Hydrolic Boom Truck	-	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	-	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	12.9	-	-	-	-	-
Concrete Trowel	0.5	0.5	1.0	1.0	1.0	1.0	1.0	1.0	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Floor Saw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bobcat Skip Loader	25.3	25.3	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	50.6	-	-	-	-	-	-	-
Hydrotest Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	578.6	652.2	680.7	589.0	648.7	719.1	852.9	863.5	892.7	852.9	822.1	780.0	614.4	560.5	572.2	499.6	410.3	246.7	206.0	147.1	120.2	120.2	120.2	120.2

Note: Above estimates are for a single shift execution and 5/10 work week.

Yearly Emissions (lbs/yr)	
Month 1-12	8,932.4
Month 2-13	8,968.1
Month 3-14	8,876.4
Month 4-15	8,767.9
Month 5-16	8,678.4
Month 6-17	8,440.0
Month 7-18	7,967.6
Month 8-19	7,320.7
Month 9-20	6,604.3
Month 10-21	5,831.8
Month 11-22	5,099.2
Month 12-23	4,397.3
Month 13-24	3,737.6

Worst-Case Emissions	
Worst Month	892.7 lb/month
Worst 1-hr	4.5 lb/hr
Worst Year	8968.1 lb/year

TABLE G.2-7 CONSTRUCTION MONTHLY SOx EMISSIONS SUMMARY

Construction Equipment	SOx Emissions Per Month of Constructior																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Excavator Loader	0.3	0.8	0.8	0.8	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Backhoe	0.3	0.8	0.8	0.8	0.5	0.5	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	-	-	-	-	-	-	-
Dozer Tractor Crawler	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fron End Loader	-	-	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-
Trenching Machine	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Motor Grader	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Plate Compactor	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Roller Vibrator	0.1	0.1	0.1	0.1	0.1	0.3	0.3	0.3	0.3	0.1	0.1	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-
Water Truck	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	-	-
Concrete Mixer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Pump, trailer mount	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Mortar Mixer	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Paving Machine	0.1	0.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.1	0.1	0.1	-	-	-	-	-
Dump Truck	1.9	0.9	0.9	0.3	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Crane (6-ton)	-	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	-	-	-	-	-	-
Crane (20-ton)	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.2	0.2	0.1	-	-	-	-	-	-	-	-
Crane (50-ton)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-
Crane (100-ton)	-	-	-	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	-	-	-	-
Crane (300-ton)	-	-	-	-	-	-	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	-	-	-	-	-	-	-
Crane (360-ton)	-	-	-	-	-	-	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-
Crane (500-ton)	-	-	-	-	-	-	0.8	0.8	0.8	0.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manlift, telescoping	-	-	-	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Welder (250 amp)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Air Compressor (185 cfm)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-
Air Compressor (750 cfm)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Generator (6 kW)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forklift (2-ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Forklift (4-ton)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fuel/Lube Truck	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Pickup Truck (1/2-ton)	0.7	0.7	0.7	0.7	0.7	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	0.9	0.9	0.7	0.4	0.4	0.4	0.4
Stakebed Truck	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	-	-	-	-	-	-
Hydrolic Boom Truck	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-
Concrete Trowel	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Floor Saw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bobcat Skip Loader	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	-	-	-	-	-	-	-
Hydrotest Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	5.0	5.6	5.6	4.6	4.7	5.3	6.1	6.1	6.1	5.7	5.2	5.2	4.1	3.9	3.9	3.5	3.0	2.4	1.8	1.2	1.0	1.0	1.0	1.0

Note: Above estimates are for a single shift execution and 5/10 work week.

Yearly Emissions (lbs/yr)	
Month 1-12	65.4
Month 2-13	64.5
Month 3-14	62.7
Month 4-15	61.1
Month 5-16	60.0
Month 6-17	58.3
Month 7-18	55.3
Month 8-19	51.0
Month 9-20	46.1
Month 10-21	41.0
Month 11-22	36.3
Month 12-23	32.0
Month 13-24	27.8

Worst-Case Emissions	
Worst Month	6.1 lb/month
Worst 1-hr	0.03 lb/hr
Worst Year	65.4 lb/year

TABLE G.2-8 CONSTRUCTION MONTHLY PM10 EMISSIONS SUMMARY

Construction Equipment	PM10 Emissions Per Month of Construction																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Excavator Loader	13.1	39.2	39.2	39.2	26.1	26.1	13.1	13.1	13.1	13.1	13.1	13.1	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Backhoe	13.1	39.2	39.2	39.2	26.1	26.1	13.1	13.1	13.1	13.1	13.1	13.1	-	-	-	-	-	-	-	-	-	-	-	-
Dozer Tractor Crawler	46.3	46.3	46.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fron End Loader	-	-	-	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	13.8	-	-	-	-	-	-	-	-
Trenching Machine	2.0	4.1	4.1	2.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Excavator Motor Grader	8.7	8.7	8.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vibrating Plate Compactor	0.3	0.6	0.6	0.6	0.6	0.9	0.9	0.9	0.9	0.9	0.9	0.6	0.3	0.3	0.3	0.3	0.3	-	-	-	-	-	-	-
Roller Vibrator	8.0	8.0	8.0	8.0	8.0	16.0	16.0	16.0	16.0	8.0	8.0	8.0	8.0	-	-	-	-	-	-	-	-	-	-	-
Water Truck	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	17.5	-	-	-	-	-	-	-
Concrete Mixer	-	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	-	-	-	-	-	-	-
Concrete Pump, trailer mount	-	-	-	2.9	2.9	2.9	2.9	2.9	2.9	2.9	2.9	-	-	-	-	-	-	-	-	-	-	-	-	-
Mortar Mixer	-	-	0.2	0.2	0.4	0.4	0.4	0.4	0.4	0.4	0.2	0.2	0.2	-	0.2	-	-	-	-	-	-	-	-	-
Paving Machine	8.0	8.0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	8.0	8.0	8.0	-	-	-	-	-
Dump Truck	122.7	61.3	61.3	20.4	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	40.9	20.4	20.4	20.4	20.4	20.4	20.4	20.4	20.4
Crane (6-ton)	-	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	-	-	-	-	-	-
Crane (20-ton)	7.9	15.7	15.7	15.7	15.7	15.7	23.6	23.6	23.6	23.6	23.6	23.6	15.7	15.7	15.7	7.9	-	-	-	-	-	-	-	-
Crane (50-ton)	17.0	34.1	34.1	34.1	51.1	51.1	51.1	51.1	68.2	68.2	68.2	51.1	51.1	34.1	34.1	17.0	17.0	-	-	-	-	-	-	-
Crane (100-ton)	-	-	-	-	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	7.0	-	-	-	-	-	-	-	-	-
Crane (300-ton)	-	-	-	-	-	-	10.7	10.7	10.7	10.7	10.7	10.7	-	-	-	-	-	-	-	-	-	-	-	-
Crane (360-ton)	-	-	-	-	-	-	40.2	40.2	40.2	40.2	40.2	40.2	-	-	-	-	-	-	-	-	-	-	-	-
Crane (500-ton)	-	-	-	-	-	-	17.3	17.3	17.3	17.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manlift, telescoping	-	-	-	3.1	3.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	6.1	3.1	6.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
Welder (250 amp)	-	3.3	3.3	6.6	6.6	6.6	9.8	13.1	13.1	13.1	9.8	9.8	6.6	6.6	6.6	6.6	6.6	3.3	3.3	-	-	-	-	-
Air Compressor (185 cfm)	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	-	-	-	-
Air Compressor (750 cfm)	-	-	-	-	2.1	4.2	4.2	4.2	4.2	4.2	4.2	2.1	2.1	2.1	2.1	2.1	2.1	2.1	-	-	-	-	-	-
Generator (6 kW)	3.7	3.7	3.7	3.7	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	7.3	-	-	-	-	-	-	-
Forklift (2-ton)	5.0	5.0	5.0	5.0	5.0	5.0	9.9	9.9	9.9	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Forklift (4-ton)	-	-	6.3	6.3	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	12.5	-	-	-	-	-	-	-	-
Fuel/Lube Truck	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4	10.4
Pickup Truck (1/2-ton)	43.8	43.8	43.8	43.8	43.8	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	73.0	58.4	58.4	43.8	29.2	29.2	29.2	29.2
Stakebed Truck	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	11.3	-	-	-	-	-	-
Hydrolic Boom Truck	-	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	-	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	6.7	-	-	-	-	-
Concrete Trowel	0.6	0.6	1.1	1.1	1.1	1.1	1.1	1.1	0.6	0.6	0.6	-	-	-	-	-	-	-	-	-	-	-	-	-
Concrete Floor Saw	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bobcat Skip Loader	9.6	9.6	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	19.2	-	-	-	-	-	-	-
Hydrotest Pump	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.8	0.8	0.8	0.8	-	-	-	-	-	-
Total	349.3	381.6	390.3	315.3	343.8	386.5	444.6	447.9	464.4	444.7	430.7	407.8	319.4	291.1	295.1	259.9	213.3	133.4	115.6	83.1	68.1	68.1	68.1	68.1

Note: Above estimates are for a single shift execution and 5/10 work week.

Yearly Emissions (lbs/yr)	
Month 1-12	4,806.8
Month 2-13	4,776.9
Month 3-14	4,686.3
Month 4-15	4,591.2
Month 5-16	4,535.8
Month 6-17	4,405.3
Month 7-18	4,152.2
Month 8-19	3,823.2
Month 9-20	3,458.4
Month 10-21	3,062.1
Month 11-22	2,685.5
Month 12-23	2,322.9
Month 13-24	1,983.2

Worst-Case Emissions	
Worst Month	464.4 lb/month
Worst 1-hr	2.3 lb/hr
Worst Year	4806.8 lb/year

APPENDIX G2-A
TRAFFIC EMISSION CALCULATIONS

Table 1
Labor Transporation Impacts-Construction
Colusa Generating Station

Transportation Information			**Comment**
Construction Vehicles			
Average Daily Trips =	199	one-way trips	Information Provided By Applicant
Peak Daily Trips =	446	one-way trips	Information Provided By Applicant
Fleet Mix =	50%	LDA	Source is URBEMIS 2002 User's Guide, Appendix A.
	50%	LDT	LDA=light duty auto (passenger cars)
			LDT=light duty truck class 1 and 2 (0-5750 lb weight class)
Delivery Vehicles			
Average Daily Round Trips =	15	one-way trips	Information Provided By Applicant
Peak Daily Round Trips =	16	one-way trips	Information Provided By Applicant
Fleet Mix =	100%	HHDT	All delivery trucks were assumed to be HHDT.
			HHDT= heavy heavy duty truck (33001-60000 lb weight class).
One Way Trip Distance	10	miles	Information Provided By Applicant

EMFAC2002 Datum
Inputs
Construction Analysis year: 2007
EMFAC Geographical Region: Colusa, County
Season: Annual

Results

Vehicle Type:	Vehicle Miles Traveled Per Day	Tons Per Day				
		CO	NOx	PM10	SOx	VOC
Light Duty Automobile	239,000	1.46	0.13	0.01	0.00	0.16
Light Duty Truck	275,000	2.60	0.27	0.01	0.00	0.25
Heavy-Heavy Duty Truck	70,000	0.72	1.07	0.02	0.00	0.09

Note: For this calculation, VOC were assumed to be equivalent to ROG.

Calculation of Emission Factor

Vehicle Type:	Pounds per Mile				
	CO	NOx	PM10	SOx	VOC
Light Duty Automobile	0.01222	0.00109	0.00008	0.00000	0.00134
Light Duty Truck	0.01891	0.00196	0.00007	0.00000	0.00182
Heavy-Heavy Duty Truck	0.02057	0.03057	0.00057	0.00000	0.00257

Notes: Based on above tons/day and miles traveled.

Average Emissions Calculations

Source	Average Pounds Emitted Per Day				
	CO	NOx	PM10	SOx	VOC
Construction Employee Vehicles-LDA	12.2	1.1	0.1	0.0	1.3
Construction Employee Vehicles-LDT	18.8	2.0	0.1	0.0	1.8
Delivery Trucks-HHDT	3.1	4.6	0.1	0.0	0.4
Total	**34.1**	**7.6**	**0.2**	**0.0**	**3.5**

Peak Emissions Calculations

Source	Peak Pounds Emitted Per Day				
	CO	NOx	PM10	SOx	VOC
Construction Employee Vehicles-LDA	27.2	2.4	0.2	0.0	3.0
Construction Employee Vehicles-LDT	42.2	4.4	0.2	0.0	4.1
Delivery Trucks-HHDT	3.3	4.9	0.1	0.0	0.4
Total	**72.7**	**11.7**	**0.4**	**0.0**	**7.5**

Table 2
Labor Transporation Impacts-Operation
Colusa Generating Station

Transportation Information			**Comment**
Construction Vehicles			
Daily Trips =	31	one-way trips	Information Provided By Applicant
Peak Hour Trips =	18	one-way trips	Information Provided By Applicant
Fleet Mix =	50%	LDA	LDA=light duty auto (passenger cars)
	50%	LDT	LDT=light duty truck class 1 and 2 (0-5750 lb weight class)
Delivery Vehicles			
Daily Trips =	3	one-way trips	Information Provided By Applicant
Peak Hour Trips =	1	one-way trips	Information Provided By Applicant
Fleet Mix =	100%	HHDT	All delivery trucks were assumed to be HHDT. HHDT= heavy heavy duty truck (33001-60000 lb weight class).
One-way Trip Distance	10	miles	Information Provided By Applicant

EMFAC2002 Datum
Inputs
Operation Analysis year: 2009
EMFAC Geographical Region: Colusa, County
Season: Annual

Results

Vehicle Type:	Vehicle Miles Traveled Per Day	Tons Per Day				
		CO	NOx	PM10	SOx	VOC
Light Duty Automobile	257,000	1.21	0.11	0.01	0.00	0.13
Light Duty Truck	294,000	2.23	0.24	0.01	0.00	0.22
Heavy-Heavy Duty Truck	75,000	0.59	0.94	0.02	0.00	0.07

Note: For this calculation, VOC were assumed to be equivalent to ROG.

Calculation of Emission Factor

Vehicle Type:	Pounds per Mile				
	CO	NOx	PM10	SOx	VOC
Light Duty Automobile	0.00942	0.00086	0.00008	0.00000	0.00101
Light Duty Truck	0.01517	0.00163	0.00007	0.00000	0.00150
Heavy-Heavy Duty Truck	0.01573	0.02507	0.00053	0.00000	0.00187

Notes: Based on above tons/day and miles traveled.

Daily Emissions Calculations

Source	Peak Pounds Emitted Per Day				
	CO	NOx	PM10	SOx	VOC
Operational Employee Vehicles-LDA	1.5	0.1	0.0	0.0	0.2
Operational Employee Vehicles-LDT	2.4	0.3	0.0	0.0	0.2
Operational Delivery Trucks-HHDT	0.5	0.8	0.0	0.0	0.1
Total	**4.3**	**1.1**	**0.0**	**0.0**	**0.4**

Peak Hour Emissions Calculations

Source	Peak Pounds Emitted During Peak Hours				
	CO	NOx	PM10	SOx	VOC
Operational Employee Vehicles-LDA	0.8	0.1	0.0	0.0	0.1
Operational Employee Vehicles-LDT	1.4	0.1	0.0	0.0	0.1
Operational Delivery Trucks-HHDT	0.2	0.3	0.0	0.0	0.0
Total	**2.4**	**0.5**	**0.0**	**0.0**	**0.2**

APPENDIX G3
OPERATING EMISSIONS

Attachment 1
Colusa Generating Station
HRSG Stack and Aux Boiler Emission Calculations - Rev. 0

Ambient Temperature	Winter Minimum - 18°F				Yearly Average- 59°F				Summer Maximum - 114°F			
CTG Load Level	**100%**	**100%**	**75%**	**50%**	**100%**	**100%**	**75%**	**50%**	**100%**	**100%**	**75%**	**50%**
Evap Cooling Status	No	No	No	No	No	No	No	No	Yes	Yes	No	No
Duct Burner Status	Yes	No	No	No	Yes	No	No	No	Yes	No	No	No
Duct Burner Heat Input (MMBTU/hr)	674.3	0	0	0	674.3	0	0	0	688	0	0	0
Stack Outlet Temperature (°F)	162	193	181	175	161	193	181	175	186	202	188	167
Average Emission Rates from each Gas Turbine (lbs/hr/turbine) - Normal Operation												
(Reference: Bechtel/GE Turbine/Site Specific Information)												
Fuel Flow (MMBTU/hr)	2591.5	1917.2	1558.3	1239.1	2451.8	1777.5	1452.1	1161.4	2376.9	1688.9	1387.6	1096.4
NO_x (@ 2.0 ppm)	20.7	15.3	12.3	9.7	19.6	14.2	11.5	9.1	19	13.50	11	8.6
CO (@ 3.0 ppm)	18.9	14	11.3	8.9	17.9	13	10.5	8.3	17.4	12.3	10	7.8
VOC (@ 2.0 ppm)	7.2	3.4	2.7	2.2	6.8	3.1	2.5	2.1	6.6	3	2.5	2.1
SO_2	1.60	1.20	1.00	0.80	1.50	1.10	0.90	0.70	1.50	1.10	0.90	0.70
PM10	20	12.9	12.7	12.6	19.9	12.8	12.7	12.5	20.1	12.8	12.6	12.5
NH_3 (@ 5 ppm slip)	19.2	14.2	11.4	9	18.2	13.1	10.6	8.4	17.6	12.5	10.2	7.9
Stack Exit Velocity (fps)	68.6	71	55.1	44.3	63.7	66	52.3	42.8	63.1	63.7	51.5	42

Startup / Shutdown Emissions from Turbine (1CT)

Cold Startup			**Warm Startup**			**Hot Startup**			**Shutdown**		
270 minutes	Max 1-hr.	Total	180 min.	Max 1-hr.	Total	90 min.	Max 1-hr.	Total	30 min.	Max 1-hr.	Total
	lb/hr	lb/270 min		lb/hr	lb/180 min		lb/hr	lb/90 min		lb/hr	lb/30 min
NO_X	333.30	779.10	**NOx**	152.00	456.20	**NOx**	249.90	259.90	**NOx**	115.00	115.00
CO	373.60	1355.60	**CO**	370.30	790.50	**CO**	429.60	679.60	**CO**	483.50	483.50
VOC	27.70	106.70	**VOC**	27.70	47.40	**VOC**	27.70	38.00	**VOC**	23.90	23.90
SO_2	0.40	1.01	**SO2**	0.40	0.58	**SO2**	0.40	0.33	**SO2**	0.20	0.20
PM10	12.00	48.80	**PM**	12.00	30.80	**PM**	12.00	12.80	**PM**	6.00	6.00

Assumptions:
Startup and Shutdown Emissions from data provided by Client.
Spreadsheet "Colusa Startup Emissions Summary 07-13-06" and email 07/17/06 for shutdown (used higher, 30 min. assumed)
SO_2 emissions assume complete conversion of all sulfur to SO_2.

Average Annual Emissions

Duct Burner Emission Rates are based on the maximum duct burner capability scenario (59°F; 100% load; no evaporative cooling; duct burner duty = 598.3 MMBTU/hr)
Average Operation Emission Rates are based on the average operation scenario (59°F; 100% load; no overpressure; no power augmentation)

Total Hours of Operation		8760	Base Operation patterned after CCPP8	**Annual**		**Turbine Emissions**	**Emissions for Both Turbines**	**Sum of four individual quarters below**	**Higher**
Total Number of Cold Starts		14.0				**lb/yr/CT**	**ton/yr/2CT**	**ton/yr/2CT**	**ton/yr/2CT**
Cold Start Duration (hr)		4.50		**NO_X**		172932.40	172.9	183.0	183.0
Total Number of Warm Starts		0		**CO**		206859.60	206.9	264.5	264.5
Warm Start Duration (hr)		3.00		**VOC**		46498.80	46.5	47.4	47.4
Total Number of Hot Starts		42.0		**SO_2**		11169.86	11.2	10.2	11.2
Hot Start Duration (hr)		1.50		**PM**		141249.60	141.2	128.2	141.2
Total Number of Shutdowns		56.0							
Shutdown Duration (hr)		0.50							
Duct Burner Operation (hr)		4160	16 h/d for 5 d/wk						
Average Operation (hr)		4446							
Half Load Operation		0							

Attachment 1
Colusa Generating Station
HRSG Stack and Aux Boiler Emission Calculations - Rev. 0

First Quarter Emissions (Jan, Feb, Mar)

Duct Burner Emission Rates are based on the maximum duct burner capability scenario (18°F; 100% load; no evaporative cooler; duct burner duty = 598.3 MMBTU/hr)
Average Operation Emission Rates are based on the average operation scenario (18°F; 100% load; no evaporative cooler).
Actual average temperatures during this quarter are higher. Therefore, this produces a conservatively high emission estimate.

Total Hours of Operation		2160	Base Qtr, actual days, minimum temp.	**First Quarter**		**Turbine Emissions**	**Emissions for Both Turbines**	
Total Number of Cold Starts		3.5				**lb/qtr/CT**	**ton/qtr/2CT**	**g/s**
Cold Start Duration (hr)		4.50		**NO_X**		45140.75	45.1	**2.58**
Total Number of Warm Starts		0		**CO**		53446.40	53.4	
Warm Start Duration (hr)		3.00		**VOC**		12272.15	12.3	
Total Number of Hot Starts		10.5		**SO_2**		2971.61	3.0	
Hot Start Duration (hr)		1.50		**PM**		35140.55	35.1	
Total Number of Shutdowns		14.0						
Shutdown Duration (hr)		0.50						
Duct Burner Operation (hr)		1040						
Average Operation (hr)		1082						
Half Load Operation (hr)		0.00						

Second Quarter Emissions (Apr, May, Jun)

Duct Burner Emission Rates are based on the maximum duct burner capability scenario (59°F; 100% load; no evaporative cooler; duct burner duty = 598.3 MMBTU/hr)
Average Operation Emission Rates are based on the average operation scenario (59°F; 100% load; no evaporative cooler).
Actual average temperatures during this quarter are higher. Therefore, this produces a conservatively high emission estimate.

Total Hours of Operation		2184	Base Qtr, actual days, average temp.	**Second Quarter**		**Turbine Emissions**	**Emissions for Both Turbines**	
Total Number of Cold Starts		3.5				**lb/qtr/CT**	**ton/qtr/2CT**	**g/s**
Cold Start Duration (hr)		4.50		**NO_X**		43147.90	43.1	**2.46**
Total Number of Warm Starts		0		**CO**		51636.90	51.6	
Warm Start Duration (hr)		3.00		**VOC**		11606.10	11.6	
Total Number of Hot Starts		10.5		**SO_2**		2785.86	2.8	
Hot Start Duration (hr)		1.50		**PM**		35235.60	35.2	
Total Number of Shutdowns		14.0						
Shutdown Duration (hr)		0.50						
Duct Burner Operation (hr)		1040						
Average Operation (hr)		1106						
Half Load Operation (hr)		0.00						

Attachment 1
Colusa Generating Station
HRSG Stack and Aux Boiler Emission Calculations - Rev. 0

Third Quarter Emissions (Jul, Aug, Sep)

Duct Burner Emission Rates are based on the maximum duct burner capability scenario (59°F; 100% load; no evaporative cooler; duct burner duty = 598.3 MMBTU/hr)
Average Operation Emission Rates are based on the average operation scenario (59°F; 100% load; no evaporative cooler).
Actual average temperatures during this quarter are higher. Therefore, this produces a conservatively high emission estimate.

Total Hours of Operation		1208	PG&E 8/8/06 email worst quarter cycling case	**Third Quarter**		**Turbine Emissions**	**Emissions for Both Turbines**	
Total Number of Cold Starts		1.0	start of qtr			**lb/qtr/CT**	**ton/qtr/2CT**	**g/s**
Cold Start Duration (hr)		4.50		**NO_X**		50868.70	50.9	**2.91**
Total Number of Warm Starts		12	1 each week	**CO**		106290.31	106.3	
Warm Start Duration (hr)		3.00		**VOC**		11811.95	11.8	
Total Number of Hot Starts		60.7	4.67 each week	**SO_2**		1602.42	1.6	
Hot Start Duration (hr)		1.50		**PM**		22328.73	22.3	
Total Number of Shutdowns		73.7						
Shutdown Duration (hr)		0.50						
Duct Burner Operation (hr)		1040	16x5					
Average Operation (hr)		0						
Half Load Operation (hr)		0.00						

Fourth Quarter Emissions (Oct, Nov, Dec)

Duct Burner Emission Rates are based on the maximum duct burner capability scenario (59°F; 100% load; no evaporative cooler; duct burner duty = 598.3 MMBTU/hr)
Average Operation Emission Rates are based on the average operation scenario (59°F; 100% load; no evaporative cooler).
Actual average temperatures during this quarter are higher. Therefore, this produces a conservatively high emission estimate.

Total Hours of Operation		2208	Base Qtr, actual days, average temp.	**Fourth Quarter**		**Turbine Emissions**	**Emissions for Both Turbines**	
Total Number of Cold Starts		3.5				**lb/qtr/CT**	**ton/qtr/2CT**	**g/s**
Cold Start Duration (hr)		4.50		**NO_X**		43835.20	43.8	**2.50**
Total Number of Warm Starts		0		**CO**		53086.00	53.1	
Warm Start Duration (hr)		3.00		**VOC**		11736.20	11.7	
Total Number of Hot Starts		11.5		**SO_2**		2810.60	2.8	
Hot Start Duration (hr)		1.50		**PM**		35536.00	35.5	
Total Number of Shutdowns		15.0						
Shutdown Duration (hr)		0.50						
Duct Burner Operation (hr)		1040	16x5					
Average Operation (hr)		1128						
Half Load Operation (hr)		0.00						

Emissions from Auxiliary Boiler

			Hours per Qtr			
			Q1	Q2	Q3	Q4
Total Hours of Operation	2,400	hr/yr	600	600	600	600
Firing Rate	44	MMBtu/hr				
Stack Gas Temp.	329	F				
Flue Gas Flow	20,414	cfm				

		Emissions			
Pollutant	lb/MMBtu	lb/hr	lb/yr	ton/qtr	ton/yr
NOx (@ 7.0 ppm)	0.0108	0.48	1,140.48	0.14	0.57
CO (@50 ppm)	0.037	1.63	3,907.20	0.49	1.95
SO2	0.0006	0.03	63.36	0.01	0.03
VOC (@10 ppm)	0.004	0.18	422.40	0.05	0.21
PM10	0.005	0.22	528.00	0.07	0.26

ppm by volume, dry basis, corrected to 3% oxygen

Attachment 1
Colusa Generating Station
HRSG Stack and Aux Boiler Emission Calculations - Rev. 0

Emissions from Emergency Diesel Generator

Rated Horsepower	**1340**	**BHP**
Expected non-emergency usage	**50**	**hr/yr**

	Emission Fctr.	Emission Rate		
	g/HP/Hr	lb/hr	lb/yr	tpy
NO_X	4.700	13.88	693.9	0.347
CO	0.110	0.32	16.2	0.008
VOC (Total Hydrocarbons)	0.050	0.15	7.4	0.004
SO_2 (at 15 ppm fuel sulfur)	4.50E-03	0.01	0.7	0.000
PM_{10}	2.90E-02	0.09	4.3	0.002

Emissions from Emergency Diesel Firewater Pump

Rated Horsepower	**160**	**BHP**
Expected non-emergency usage	**50**	**hr/yr**

	Emission Fctr.	Emission Rate			
	g/HP/Hr	lb/hr	lb/yr	tpy	
NO_X	4.900	1.73	86.3	0.043	
CO	0.540	0.19	9.5	0.005	
VOC (Total Hydrocarbons)	0.000	0.00	0.0	0.000	Inc. with NOx
SO_2 (at 15 ppm fuel sulfur)	4.50E-03	0.00	0.1	0.000	
PM_{10}	1.30E-01	0.05	2.3	0.001	

Worst-Case 1-Hour Emissions per Turbine

Worst-Case 1-Hour Emissions for NO_2 and CO are equal to Cold Startup and Shutdown emission rates, respectively. Worst-Case 1-Hour Emissions for SO_2 are equal to 18°F; 100% load, duct firing emission rates

(lb/hr/turbine)	
NO_2	333.30
CO	483.50
SO_2	1.60
(g/sec/turbine)	
NO_2	41.99
CO	60.92
SO_2	0.20

Worst-Case 3 Hour Emission Rate per Turbine

Only SO_2 is considered for an average 3-hour Ambient Air Quality Standard. Emission rates are equal to 18°F; 100% load, duct firing emission rates.

(lb/hr/turbine)	
SO_2 (lb/hr/CT)	1.60
SO_2 (g/sec/CT)	0.20

Worst-Case 8-Hour Emission Rates

Only CO is considered for an average 8-hour Ambient Air Quality Standard.
Worst-case 8-Hour Scenario includes five hours at Startup and Shutdown rate. Remainder of 8 hours is at 18°F; 100% load, duct firing emission rates.

(lb/hr/turbine)			
Total Hours of Operation	8	lb/hr	lbs
Startup Duration (hours)	4.50		1355.60
Shutdown (hours)	0.50		483.50
Hours of Baseline Operation (hr)	3.00	18.90	56.70
	Total for 8 hrs		**1895.80**

CO (lb/hr/CT)	236.98
CO (g/s/CT)	29.86

Attachment 1
Colusa Generating Station
HRSG Stack and Aux Boiler Emission Calculations - Rev. 0

Worst-Case 24 Hour Emission Rate

Only SO_2 and PM_{10} are considered for an average 24-hour Ambient Air Quality Standard.
Extreme low temperature, 100% operating load is conservatively assumed for the entirety of the 24 hours.

SO_2 (lb/hr/CT)	1.60
SO_2 (g/s/CT)	0.20
PM_{10} (lb/hr/CT)	20.00
PM_{10} (g/s/CT)	2.52

Worst-Case Daily Emissions per Turbine

For NO_x, CO and VOC assume six hours at startup and shutdown emission rate (approx. three hot startups and three shutdowns), remainder of 18 hours per day at extreme low temperature, 100% full load.
For SO_2 and PM_{10} assume extreme low temperature, 100% operating load for 24 hours.

(Pounds)	start/stop amount	3 start/stop	full load hourly rate	18 or 24 hours of full load	Daily Total
NO_X	374.90	1124.70	20.70	372.60	1497.30
CO	1163.10	3489.30	18.90	340.20	3829.50
VOC	61.90	185.70	7.20	129.60	315.30
SO_2			1.60	38.40	38.40
PM_{10}			20.10	482.40	482.40

Worst-Case Emissions Turbine - Commissioning

(Pounds)	Plant Total	
NO_X	194,000	
CO	608,000	
VOC	27,000	
SO_2	2,225	scaled from pm10
PM_{10}	28,000	

bechtel 10/27

APPENDIX G4
CONSTRUCTION IMPACTS MODELING FILES

COLUSA CONSTRUCTION COMBUSTION MODELING RESULTS
modeling file: colusa1
modeling file: colusa1_OLM

	(all values in micrograms per cubic meter)					OLM			STANDARDS	
	2001	2002	2003	2004	2005	ADJUSTED	BACKGROUND	TOTAL	CAAQS	NAAQS
NO_X										
1 hour	1641	1782	1699	**1994**	1408	203.31	120.3	323.61	470	
annual	8	8.05	7.88	**8.33**	7.56		26.4	34.73		100
CO										
1 hour	1007	1093.5	1042.8	**1223.9**	864		6670	7893.9	23000	40000
8 hour	**317.2**	211.4	223.5	219	229.9		3767	4084.2	10000	10000
PM_{10}										
24 hour	5.66	5.15	4.69	4.97	**5.85**		***92***	97.85	50	150
annual	0.65	0.66	0.64	**0.68**	0.62		***25.5***	26.18	20	50
SO_2										
1 hour	1.7	1.84	1.76	**2.06**	1.46		15.72	17.78	655	
3 hour	**0.8**	0.78	0.64	0.69	0.61		15.72	16.52		1300
24 hour	0.07	0.064	0.061	0.065	**0.077**		7.88	7.96	105	356
annual	0.00886	0.00892	0.00873	**0.00923**	0.00838		2.67	2.68		80

Note: ***Bold Italic font*** indicates value above state standard.

COLUSA CONSTRUCTION FUGITIVE DUST MODELING RESULTS (Release Height = 3m)
modeling file: colusadust_stk: 24 hour-highest and annaul-highest
modeling file: colusedust_6th: 24 hour-high-sixth-high

							MONITORED		STANDARDS	
	2001	2002	2003	2004	2005	H6H for 5 yrs	BACKGROUND	TOTAL	CAAQS	NAAQS
PM_{10}										
24 hour-highest	266.3	206.6	**297.7**	245	212.07		***92***	389.7	50	150
24-hour-high-sixth-high (5 years)						200.5	***92***	292.5	50	150
annual-highest	9.26	9.13	**11.55**	9.21	11.21		***25.5***	37.05	20	50

APPENDIX G5
COMMISSIONING IMPACTS MODELING FILES

Colusa Generating Station
AERMOD results
Commissioning

Pollutant	Averaging Period	Maximum Modeled Concentration	PSD SIL	PSD Class II Increment	PSD Monitoring Significance	Measured Background Concentration	Measured Background Concentration	Maximum Total Concentration	NAAQS	CAAQS
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(ppm)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
NO_2	1-hour	209.80	-	-	-	0.064	120.3	330.1	-	470
CO	1-hour	1,630.24	2,000	-	-	5.8	6,444.4	8,074.7	40,000	23,000
	8-hour	495.72	500	-	575	3.39	3,766.7	4,262.4	10,000	10,000

Note that commissioning modeling is based on 1 turbine commissioning at a time with stack parameters from 50% load, 59F ambient temperature
Maximum emission rate for 1 turbine (lb/hr)

NO2	500
CO	950

APPENDIX G6
OPERATING IMPACTS MODELING FILES

Colusa Generating Station
AERMOD results
Normal Operations

Pollutant	Averaging Period	Maximum Modeled Concentration	2nd highest Modeled Concentration	PSD SIL	PSD Class II Increment	PSD Monitoring Significance	Measured Background Concentration	Measured Background Concentration	Maximum Total Concentration	NAAQS	CAAQS
		($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	(ppm)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)	($\mu g/m^3$)
NO_2	1-hour	336.45		-	-	-	0.064	120.3	456.8	-	470
	Annual	0.64		1	25	14	0.014	26.3	27.0	100	-
CO	1-hour	1,395.82		2,000	-	-	5.8	6,444.4	7,840.3	40,000	23,000
	8-hour	293.07		500	-	575	3.39	3,766.7	4,059.7	10,000	10,000
SO_2	1-hour[1]	4.38		-	-	-	0.006	15.6	20.0	-	655
	3-hour	1.85		25	512	-	0.006	15.6	17.4	1,300	-
	24-hour	0.35		5	91	13	0.003	7.8	8.1	365	105
	Annual	0.04		1	20	-	0.001	2.6	2.6	80	-
PM_{10}	24-hour[2]	6.11	3.76	5	30	10	-	92.0	98.1	150	50
	24-hour[3]	4.35		5	30	10	-	92.0	96.4	150	50
	Annual	0.51		1	17	-	-	25.5	26.0	50	20

Note that all cases are based on stack parameters in both turbines from 100% load, 59F ambient temperature except

[1]SO_2 1 hour is based on 2 turbines operating at 100% load, 18F ambient temerature

[2]PM_{10} 24 hour is based on 2 turbines operating at 50% load, 114F ambient temperature

[3]PM_{10} 24 hour is based on 2 turbines operating at 100% load, 59F ambient temperature

APPENDIX G7
CSVP RESULTS

Table 1: Plume Frequencies by Meteorological Conditions Predicted for the HRSG Stack from the CSVP Model for 2001-2005

Case	Total Hours	Hours with Plumes	Percent
All Hours	43,824	15,234	34.76%
Daylight Hours	22,254	4,746	21.33%
Daylight No Weather	19,815	3,017	15.23%
Seasonal Daylight Hours	9,801	4,179	42.64%
Seasonal Daylight No Weather	7,808	2,577	33.00%
Seasonal Daylight Clear	6,669	1911	28.65%

Notes:
Seasonal - includes November through April
No Weather - excludes all hours with weather (fog, mist, rain, ...)
Clear - includes clear skies and 50% of the scattered or broken skies (2-7/10), and excludes overcast skies (8/10 or greater)
Seasonal Daylight Clear - a combination of all of the above parameters

Table 2: 20th Percentile Predicted Plume Properties for the HRSG Stack from the CSVP Model, Per Stack for 2001-2005

Plume Parameter	HRSG Stack Predicted Visible Plume Properties, per stack	Note
Distance downwind from the stack where the plume stops being visible (m)	186.0	plume x dimension
Plume centerline height above the ground where the plume stops being visible (m)	173.6	
Greatest Visible Plume Width (m)	38.2	plume y dimension
Greatest Visible Plume Depth (m)	55.8	plume z dimension

Note: Parameters are based on the 20th percentile height for clear seasonal daylight hours, with the remaining parameters provided as the equivalent 20th percentile represented by the median of the 15th to 25th percentile hours sorted by height.