Appendix C

Construction-and Operational-Related Air Quality Impacts (e.g., emissions) Estimation Methodologies

Emissions that can adversely affect air quality originate from various activities. A project generates emissions both during the period of its construction and through ongoing daily operations. During construction of the CTs, steam turbine generator, HRSGs with associated SCRs, cooling towers and ammonia storage tanks, emissions will be generated by onsite construction equipment and by offsite vehicles used to deliver supplies, and for worker commuting. After construction activities are completed, emissions will be generated by operation of the equipment, along with offsite vehicles used for aqueous ammonia delivery.

The following discussion provides the methodologies used to estimate the construction and operational air quality impacts from the project. The discussion first presents the methodologies for estimating unmitigated construction emissions and unmitigated operational emissions. The unmitigated emissions are compared with the SCAQMD's CEQA air quality significance thresholds to determine if significant air quality impacts are created during the various phases of the proposed project. Feasible mitigation measures are then identified for emissions that exceed the SCAQMD's CEQA air quality significance thresholds, and the remaining mitigated emissions are presented. Details (e.g., formulae, input variables, assumptions, and references) of the methodologies used to estimate air quality impacts are presented in the attached spreadsheets.

C.1 Construction Emissions (Unmitigated)

Construction-related emissions can be distinguished as either onsite or offsite. Onsite emissions generated during construction principally consist of exhaust emissions (NO_X, SO_X, CO, VOC, and PM10) from heavy-duty construction equipment operation, fugitive dust (PM10) from disturbed soil, and VOC emissions from asphaltic paving and painting. Offsite emissions during the construction phase normally consist of exhaust emissions and entrained paved road dust (PM10) from worker commute trips, material delivery trips, and haul truck material removal trips to and from the construction site.

Construction-related activities at the project sites are anticipated to include the following major components:

- Grading,
- Construction of equipment pads and foundations and paving of access roads and equipment maintenance areas, and

- Equipment installation of combined cycle combustion turbines (CTGs), heat recovery steam generators (HRSGs) with associated selective catalytic reduction (SCR) systems, a steam turbine generator, a cooling tower, ammonia storage tanks, and associated auxiliary equipment.

C.1.1 Numbers, Sizes, Schedules, and Assumptions Associated with Construction Equipment, Vehicles, and Workers

To estimate the "worst-case" peak daily emissions associated with the construction activities, the anticipated schedule, and the types and number of construction equipment were estimated. Additionally, estimates were made of the number of peak daily worker commuting trips and material delivery and removal trips for each of the construction activities. Estimates that were made previously of the construction equipment and manpower requirements for installing five 47-MW CTs and associated SCRs at LADWP's Harbor Generating Station (HGS) and one 47-MW peaking CT and associated SCR at VGS (Los Angeles Department of Water and Power's Electrical Generation Stations Modifications Project, January 2001) were extrapolated to the increased amount of equipment to be installed for the proposed project. The specific assumptions for each phase of construction are as follows:

- <u>Grading</u>: Based on the size of the area to be graded, it was estimated that peak construction equipment and manpower required for the grading phase of construction would be the same as for grading for installation of the five CTs at HGS.
- <u>Foundations and Paving</u>: Based on the requirements for equipment pads and foundations, it was estimated that peak construction equipment and manpower required for construction of foundations and pads would be the same as for construction of foundations and pads for installation of the five CTs at HGS. Based on the area to be paved, it was estimated that the requirements for paving would be the same as for installation of the peaking CT at VGS.
- <u>Equipment Installation</u>: Based on the amount of equipment to be installed, it was estimated that peak construction equipment and manpower requirements for equipment installation would be 50 percent greater than for installation of the equipment at HGS.

Table C.1-1 lists the anticipated schedule, peak daily construction equipment requirements, peak daily construction worker trips, peak daily material delivery truck trips, and peak daily haul truck trips for construction. Construction-related activities are anticipated to occur six days per week, Monday through Saturday, in two shifts between from 6:00 am to 5:00 pm. Allowing time for shift changes and work breaks, all construction equipment is assumed to operate 10 hours per day except light plants, which are assumed to operate two hours per day.

Table C.1-1
Construction Schedule, Equipment Requirements and Motor Vehicle Trips

Start and End Construction Month	Type of Equipment (Onsite)	Number of Equipment	Number of Construction Workers (Offsite)	Daily Material Delivery Trips (Offsite)	Daily Haul Truck Trips (Offsite)
Grading					
1-1	Grader	1	3	0	0
	Light Plant	20			
Construction of Foundations and Asphalt Paving					
2-12	Concrete Vibrator	10	253	33	0
	Concrete Pump	10			
	Light Plant	25			
	Paver	1			
Equipment Installation					
11-26	Forklift	9	600	15	3
	Backhoe	3			
	Compressor	2			
	Light Plant	30			
	Welder	15			
	Trencher	2			
	Plate Compactor	2			
	Crane	6			

C.1.2 Exhaust Emissions from Construction Equipment

The combustion of fuel to provide power for the operation of construction equipment results in the generation of NO_X, SO_X, CO, VOC, and PM10 emissions. The following predictive emission equation was used to estimate exhaust emissions from each type of construction equipment:

Exhaust Emissions (lb/day) = EF x BHP x LF x T_H x N (EQ. C-1)

where:

EF = Emission factor for specific air contaminant (lb/bhp-hr)

BHP = Equipment brake horse power (bhp)

LF = Equipment load factor

T_H = Equipment operating hours/day (anticipated to be 10 for all equipment)

N = Number of pieces of equipment

Table C.1-2 provides the emission factors, horsepower, and load factors used to estimate peak daily exhaust emissions from construction equipment. With the exception of the concrete vibrators, the concrete pumps, and the light plants, equipment horsepower ratings, load factors, and emission factors were taken from the SCAQMD's CEQA Air Quality Handbook (SCAQMD, 1993)[1]. Horsepower ratings for the concrete vibrators, the concrete pumps, and the light plants were obtained from the Allen Engineering Web site (www.alleneng.com, concrete vibrator backpack power unit), the Schwing Web site (www.schwing.com, Model P-88), and the Ingersoll-Rand Web site (www.irco.com, Model L8), respectively. The emission factors and load factors for these equipment were taken from the SCAQMD's CEQA Handbook[2].

Table C.1-2
Construction Equipment Horsepower, Load Factors and Emission Factors

Equipment Type	Fuel	Horse-power	Load Factor Percent	CO lb/bhp-hr	VOC lb/bhp-hr	NO_X lb/bhp-hr	SO_X lb/bhp-hr	PM10 lb/bhp-hr
Grader	Diesel	156.6	57.5	0.008	0.003	0.021	0.002	0.001
Barber-Green Paver	Diesel	91	59	0.007	0.001	0.023	0.002	0.001
Forklift	Diesel	83	47.5	0.013	0.003	0.031	0.002	0.002
Backhoe	Diesel	79	46.5	0.015	0.003	0.022	0.002	0.001
Concrete Vibrator	Gasoline	2.5	62	0.570	0.025	0.011	0.001	0.000
Concrete Pump	Diesel	33	62	0.020	0.003	0.024	0.002	0.002
Light Plant	Diesel	13.6	62	0.020	0.003	0.024	0.002	0.002
Compressor	Diesel	37	48	0.011	0.002	0.018	0.002	0.001
Welder	Diesel	35	45	0.011	0.002	0.018	0.002	0.001
Trencher	Diesel	60	69.5	0.020	0.003	0.022	0.002	0.002
Plate Compactor	Diesel	8	55	0.007	0.002	0.020	0.002	0.001
Crane	Diesel	194	43	0.009	0.003	0.023	0.002	0.002

C.1.3 Fugitive Dust (PM10) Emissions

Fugitive dust emissions can be generated during one of three construction phases, which can generally be classified into the following major categories: demolition; site preparation (e.g., backfill and grading); and general construction. Demolition and site preparation include the use of heavy-duty construction equipment (e.g., backhoe) for excavation, concrete removal, backfill and grading, and slab pouring/paving. General construction activities entail the handling and transport of construction materials in conjunction with the actual physical installation of the equipment.

[1] These variables were obtained from an EPA report entitled Nonroad Engine and Vehicle Study Report, (EPA 460/3-91-02, November 1991).
[2] Id.

Fugitive dust emissions during the construction phase for the proposed project are anticipated to be generated by the following operations:

- Grading;
- Construction equipment and motor vehicle travel on unpaved surfaces;
- Storage pile wind erosion; and
- Vehicle travel on paved roads.

Although fugitive dust emissions from construction activities are temporary, they may have a significant impact on local air quality. Fugitive dust emissions often vary substantially from day to day, depending on the level of activity at the construction site, the specific operations, and the prevailing meteorological conditions. The following methodologies provide the predictive emission equations used to estimate fugitive dust emissions associated with the proposed project. The emission factors and default values used to calculate fugitive dust emissions for the proposed project can be found in Table C.1-3.

The following equations were used to calculate uncontrolled fugitive dust PM10 emissions. Construction contractors will comply with SCAQMD Rule 403 – Fugitive Dust, by watering the site two times per day, reducing the uncontrolled fugitive dust emissions by 50 percent. This control efficiency was factored into the unmitigated fugitive dust emission estimates for the proposed project.

C.1.3.1 Emissions from Grading

Emissions (lb/day) = $0.0306 \times S^{2.0} \times VMT \times N$ (EQ. C-2)

where:

S = Grader speed (miles/hr)

VMT = Vehicle distance traveled (miles/vehicle-day)

N = Number of graders

Source: Table 11.9-1, US EPA Compilation of Air Pollutant Emission Factors (AP-42), July 1998.

C.1.3.2 Emissions from Construction Equipment and Motor Vehicle Travel on Unpaved Surfaces

Emissions (lb/day) = $2.6 \times (S/15) \times (s/12)^{0.8} \times (W/3)^{0.4} / (M/0.2)^{0.3} \times VMT \times N$ (EQ. C-3)

where:

S = Equipment/motor vehicle speed (miles/hour) (set to 15 mph for speeds above 15 mph)

s = Soil silt content (percent)

W = Equipment/motor vehicle weight (tons)

M = Soil moisture (percent)

VMT = Vehicle distance traveled (miles/vehicle-day)

N = Number of vehicles

Source: Equation 1, Section 13.2.3, U.S. EPA Compilation of Air Pollutant Emission Factors (AP-42), September 1998.

Note that emissions from grader travel on unpaved surfaces are included in the grading emissions equations above.

C.1.3.3 Emissions from Storage Pile Wind Erosion

Emissions (lb/day) = $0.85 \times (s/1.5) \times (365\text{-}p/235) \times (U_{12}/15) \times A$ (EQ. C-4)

where:

s = Soil silt content (percent)

p = Number of days per year with precipitation of 0.01 inches or more

U_{12} = Percentage of time unobstructed wind speed exceeds 12 miles/hour

A = Storage pile area (acres)

Source: US EPA Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures, 1992

C.1.3.4 Emissions from Paved Road Dust Entrainment

Emissions (lb/day) = $7.26\ (sL/2)^{0.65} / (W/3)^{1.5} \times VMT$ (EQ. C-5)

where:

sL = Road surface silt loading (g/m^2)

W = Vehicles weight (tons)

VMT = Vehicle distance traveled (miles/vehicle-day)

Source: California Air Resources Board Emission Inventory Methodology 7.9, Entrained Paved Road Dust (1997)

Table C-5 lists the values for the various parameters and variables in these equations that were used to estimate onsite and offsite fugitive PM10 emissions.

Table C.1-3
Parameters Used to Calculate Onsite and Offsite Fugitive Dust PM10 Emissions

Parameter	Value	Basis
Soil silt content (s)	7.5 percent	SCAQMD 1993 CEQA Air Quality Handbook, Overburden
Soil moisture content (M)	5.9 percent	"Open Fugitive Dust PM10 Control Strategies Study," Midwest Research Institute, October 12, 1990.
Grader speed (S)	5 mph	Assumption
Grader distance traveled (VMT)	1 mile/day	Assumption
Construction equipment speed on unpaved surfaces (S)	5 mph	Assumption
Material haul and delivery truck speeds on unpaved surfaces (S)	5 mph	Assumption
Onsite pickup truck speed on unpaved surfaces (S)	15 mph	Assumption
Construction equipment weight (W)	40 tons	Estimated weight for heavy equipment
Material haul and delivery truck weight (W)	40 tons	Estimated weight for loaded haul truck

Table C.1-3 (Concluded)
Parameters Used to Calculate Onsite and Offsite Fugitive Dust PM10 Emissions

Parameter	Value	Basis
Onsite pickup truck weight (W)	5 tons	Estimated weight for 1 ton truck
Construction equipment distance traveled on unpaved surfaces (VMT)	1 mile/day	Assumption
Haul and delivery truck distance traveled on unpaved surfaces (VMT)	1 mile/day	Estimated from site configurations
Onsite pickup truck distance traveled on unpaved surfaces (VMT)	Varies by activity	Typical values for types of activities
Number of days per year with precipitation of 0.01 inches or more (p)	0	Conservative assumption based on construction not occurring during wet season
Percentage of time unobstructed wind speed exceeds 12 miles per hour (U_{12})	100 percent	Conservative estimate
Storage pile surface area (A)	0.069	Estimated from grading and excavation requirements
Construction worker commuting vehicle weight (W)	3 tons	Typical for light-duty truck
Offsite roadway silt loading (sL)	0.037 g/m^2	Default for collector road, ARB Emission Inventory Methodology 7.9, Entrained Paved Road Dust (1997)

C.1.4 Asphaltic Paving Emissions

In addition to the combustion emissions associated with the operation of paving equipment used to apply asphaltic materials, VOC emissions are generated from the evaporation of hydrocarbons contained in the asphaltic materials. The following equation was used to estimate daily VOC emissions from asphaltic paving:

Emissions (lb/day) = 2.62 x A (EQ. C-6)

where:

A = Area paved (acres/day)

Source: URBEMIS7G User's Guide, 1998

The maximum areas anticipated to be paved during one day is estimated to be 0.6 acres (25,920 ft^2) at VGS.

C.1.5 Architectural Coating Emissions

Architectural coatings generate VOC emissions from the evaporation of solvents contained in the coating to form a durable film that acts as the protective barrier for the substrate coated. The following equation was used to estimate VOC emissions from architectural coatings associated with the proposed project:

Emissions (lb/day) = C x V (EQ. C-7)

where:

C = VOC content of coating (lb/gal)

V = Amount of coating applied (gal/day)

A VOC content of 3.5 lb/gal (420 g/l) was assumed, based on the VOC limit specified in SCAQMD Rule 1113 for an industrial maintenance coating. The maximum daily volume of coating anticipated to be applied for is estimated to be 30 gallons for touch-up purposes. The equipment to be installed at each site will be pre-painted to manufacturer specifications.

C.1.6 Motor Vehicle Emissions During Construction

Onsite daily motor vehicle construction emissions include emissions from material delivery and haul trucks, watering trucks, and pickup trucks while onsite. Offsite daily construction motor vehicle emissions entail all emissions generated outside the project sites' boundaries from worker and material transport trips. The methods of estimating emissions from these sources are discussed in the following sections.

The following equations were used to calculate emissions from motor vehicles:

<u>CO and NO_X</u>

Emissions (lb/vehicle-day) = $[(EF_{Run} \times VMT) + (EF_{Start} \times Start)] / 453.6$ (EQ. C-8)

<u>VOC</u>

$$\text{Emissions (lb/vehicle-day)} = [(EF_{Run} \times VMT) + (EF_{Start} \times Start) + (EF_{Soak} \times Trip) + (EF_{Rest} \times Rest) + EF_{Runevap} \times VMT) + (EF_{Diurnal} \times Diurnal)] / 453.6 \quad \text{(EQ. C-9)}$$

<u>PM10</u>

$$\text{Emissions (lb/vehicle-day)} = [(EF_{Run} + EF_{Tire} + EF_{Brake}) \times VMT + (EF_{Start} \times Start)] / 453.6 \quad \text{(EQ. C-10)}$$

where:

EF_{Run} = Running exhaust emission factor (g/mi)

EF_{Start} = Start-up emission factor (g/start)

VMT = Distance traveled (mi/vehicle-day)

Start = Number of starts/vehicle-day

EF_{Soak} = Hot-soak emission factor (g/trip)

Trip = One-way trips/vehicle-day

EF_{Rest} = Resting loss evaporative emission factor (g/hr)

Rest = Resting time with constant or decreasing ambient temperature (hours/vehicle-day)

$EF_{Runevap}$ = Running evaporative emission factor (g/mi)

$EF_{Diurnal}$ = Diurnal evaporative emission factor

Diurnal = Time with increasing ambient temperature (hours/vehicle-day)

EF_{Tire} = Tire wear emission factor (g/mi)

EF_{Brake} = Break wear emission factor (g/mi)

The motor vehicle emission factors generally depend on the vehicle class, and the running exhaust emission factors depend on vehicle speed. Table C.1-4 lists the vehicle class for each type of vehicle, the assumed vehicle speed, and the daily VMT for each vehicle type. Tables C.1-5 through C.1-7 list the emission factors.

Table C.1-4
Motor Vehicle Classes, Speeds and Daily VMT During Construction

Vehicle Type	Vehicle Class	Speed (mph)	VMT (mi/vehicle-day)
Onsite pickup truck	Medium duty truck, catalyst	15	2-10
Watering truck	Medium heavy-duty truck, diesel	15	1
Material removal haul truck, onsite	Heavy heavy-duty truck, diesel	5	1
Delivery vehicle, onsite	Heavy heavy-duty truck, diesel	5	1
Construction commuter	Light-duty truck, catalyst	35	40
Material removal haul truck, offsite	Heavy heavy-duty truck, diesel	25	40
Delivery vehicle, offsite	Heavy heavy-duty truck, diesel	25	40

Table C.1-5
Motor Vehicle CO and NO_X Emission Factors During Construction

Vehicle Type	CO		NO_X	
	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Running Exhaust (g/mi)	Start-Up (g/start)[a]
Onsite pickup truck	15.91	40.33	2.82	2.12
Watering truck	7.39	N/A	19.14	N/A
Material removal haul truck, onsite	20.30	N/A	28.92	N/A
Delivery vehicle, onsite	20.30	N/A	28.92	N/A
Construction commuter	15.10	40.92	0.94	0.97
Material removal haul truck, offsite	6.03	N/A	16.96	N/A
Delivery vehicle, offsite	6.03	N/A	16.96	N/A

[a] Assumed to be after 720 minutes with engine off.

Source: ARB EMFAC2000 motor vehicle emission factor model, version 2.02, for calendar year 2002, summertime

Table C.1-6
Motor Vehicle VOC Emission Factors During Construction

Vehicle Type	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Hot-Soak (g/trip)	Resting Loss (g/hr)	Running Evaporative (g/mi)	Diurnal Evaporative (g/hr)
Onsite pickup truck	1.32	4.46	0.90	0.23	1.03	0.67
Watering truck	1.02	N/A	N/A	N/A	N/A	N/A
Material removal haul truck, onsite	2.59	N/A	N/A	N/A	N/A	N/A
Delivery vehicle, onsite	2.59	N/A	N/A	N/A	N/A	N/A
Construction commuter	0.39	3.46	0.50	0.20	0.28	0.59
Material removal haul truck, offsite	1.12	N/A	N/A	N/A	N/A	N/A
Delivery vehicle, offsite	1.12	N/A	N/A	N/A	N/A	N/A

[a] Assumed to be after 720 minutes with engine off.

Source: ARB EMFAC2000 motor vehicle emission factor model, version 2.02, for calendar year 2002, summertime

Table C.1-7
Motor Vehicle PM10 Emission Factors During Construction

Vehicle Type	Running Exhaust (g/mi)	Tire Wear (g/mi)	Brake Wear (g/mi)	Start-Up (g/start)[a]
Onsite pickup truck	0.07	0.02	0.03	0.05
Watering truck	0.99	0.01	0.01	N/A
Material removal haul truck, onsite	1.64	0.04	0.01	N/A
Delivery vehicle, onsite	1.64	0.04	0.01	N/A
Construction commuter	0.01	0.01	0.01	0.02
Material removal haul truck, offsite	0.71	0.04	0.01	N/A
Delivery vehicle, offsite	0.71	0.04	0.01	N/A

[a] Assumed to be after 720 minutes with engine off.

Source: ARB EMFAC2000 motor vehicle emission factor model, version 2.02, for calendar year 2002, summertime

To calculate start-up emissions, it was assumed that each gasoline-fueled vehicle (i.e., onsite pickup truck and worker commuter vehicle) would be started twice each day, once at the beginning of the day and once at the end of the day. Start-up emissions are not applicable to diesel-fueled vehicles. Additionally, to calculate VOC resting loss and diurnal evaporative emissions, it was assumed that each vehicle would experience 12 hours of constant or decreasing ambient temperature (for resting losses) and 12 hours of increasing ambient temperature (for diurnal emissions).

C.2 Operational Emissions (Unmitigated)

C.2.1 Direct Operational Emissions (Onsite)

Operational emissions consist primarily of emissions generated from the operation of the new combined cycle combustion turbines at VGS. Specific emission sources at the VGS will be two new combustion turbines (GE PG7241 FA), two duct burners, and one new cooling tower. Air emissions will consist of criteria pollutants (NO_X, SO_X, CO, VOC and PM10) and toxic air contaminants (TACs).

C.2.1.1 Combustion Turbine Emissions

As indicated above, the new combustion turbines are GE PG7241 FA units. These turbines will have the capability to fire both natural gas and distillate fuel. The primary fuel will be natural gas. Distillate fuel will be used in the event of an emergency. Each combustion turbine will have a dry low NOx combustor for natural gas use, water injection for distillate firing, SCR for NO_X control, and a CO catalyst system for CO reduction. Each combustion turbine will have a capacity of 171.7 megawatt (MW) at ISO conditions. The maximum-fired duty of each combustion turbine can be calculated using the following equation:

Maximum Firing Rate, MFR (MMBtu/hr) = P x H (EQ. C-11)

where:

P = Combustion Turbine Power Output (kW)

H = Heat Rate = Btu/kW-hr (LHV)[3]

The maximum quantity of gaseous fuel fired in an hour is then determined as follows:

Maximum Fuel (MMSCFH) = MFR/(LHV x 1,000,000) (EQ. C-12)

[3] The conversion factor is in terms of the Lower Heating Value and was supplied by GE Power for various ambient air temperatures.

where:

MFR = Maximum Firing Rate Calculated from Equation C-11

LHV = Lower heating value (Btu/scf)

In addition to the combustion turbine fuel, each unit will have a duct burner. Each duct burner will have a maximum fired duty of 226.5 MMBtu/hr (LHV). The fuel used by the duct burner is determined using Equation EQ. C-12. For the duct burner the MFR value in Equation EQ.; C-12 is replaced by 226.5 MMBtu/hr.

Emissions During Normal Operations

Emissions from the normal operation of the combustion turbines and duct burners were determined using the SCAQMD's BACT permitting limits, which are 2.5 ppmvd @ 15% O_2 for NO_X, 6.0 ppmvd @ 15% O_2 for CO, 5.0 ppmvd @ 15% O_2 for NH_3 slippage and 2.0 ppmvd @ 15% O_2 for VOC. These emission limits were then converted to emission rates per unit of heat and fuel input as follows:

Emission Rate (lbs/MMBtu) = EV x Concentration x MW/(1,000,000 x 379) (EQ. C-13)

EV = V (dry SCF/MMBtu) x 20.9/(20.9-%O_2) (EQ. C-14)

where:

V = Exhaust Gas Volume (dry SCF/MMBtu)

%O_2 = Percent Oxygen in the Exhaust Gas

EV = Corrected Stack Gas Exhaust Volume (dry SCF/MMBtu)

Concentration = Concentration of Pollutant (ppmv)

MW = Molecular Weight of Pollutant (lbs/lb-mole)

Source: SCAQMD Title V Technical Guidance Manual, page A-20, 1998. EPA Method 19, 40 CFR Part 60, provides the F factor for various fuels.

PM10 emission factors for the normal operation of the combustion turbine were obtained from the latest edition of USEPA's AP-42, Table 3.1-2a. In addition, PM10 emissions associated with the ammonia slippage and the conversion of SO_2 to SO_3 and then to ammonium sulfate were also estimated. The AP-42 SO_X emission factor in Table 3.1-2a of AP-42, was used to estimate the

SO_X emissions. The SO_X emission factor requires the sulfur content of the fuel. For natural gas 6 ppmv was used. For diesel and distillate fuel, a sulfur value of 0.05 percent by weight was assumed. For mitigated emissions, a sulfur content for low sulfur diesel fuel of 15 ppmw was used.

To convert the emission rate in lbs/MMBtu to lbs/unit of fuel the following equation was used:

For natural gas:

Emission Factor (lbs/MMSCF) = ER (lbs/MMBtu) x HHV (EQ. C-15)

where:

ER = Emission Rate (lbs/MMBtu)

HHV = Higher Heating Value (Btu/scf)

For diesel/distillate fuel:

Emission Factor (lbs/Mgal) = ER (lbs/MMBtu) x HHV/1,000 (EQ. C-16)

where:

ER = Emissions Rate (lbs/MMBtu)

HHV = Higher Heating Value (Btu/gal)

To calculate the conversion of SO_2 to SO_3, and then to PM10, the following equations were used:

$SO_3 = CR \times SO_2$ (EQ. C-17)

where:

SO_3 = lb-mole of SO_3

SO_2 = lb-mole of SO_2

CR = Conversion rate (fraction) = 0.6 without duct firing and 0.65 with duct firing

Source: SCAQMD Energy Team Application and Processing Calculations, 10-14-93.

Conversion rate provided by SCR/CO catalyst supplier.

$PM10 = SO_3 \times$ MW of ammonium sulfate (EQ. C-18)

where:

PM10 = lbs of PM10

SO_3 = lb-moles of SO_3

MW of ammonium sulfate = 132.2 lbs/lb-mole

Emissions During Start Up

During start-up, the combustion turbines will operate for a period of time without any NO_X or CO control. Once stable operating conditions are reached, dry Low NO_X combustor operations begin. Finally, when the SCR/CO Catalyst system reaches the appropriate temperature for the catalyst to be effective, ammonia injection will commence and the SCR/CO Catalyst system will become operational. Several emission factors were used to properly represent the different levels of control and load during this startup period. During the entire natural gas start-up phase, emissions of PM10 and SO_X were estimated using the emission factors described above. For NO_X, CO and VOC, start-up emission rates generated for the Mountainview Power Plant Project during the initial start-up phase were used to estimate emissions (Application for Certification, Mountainview Power Plant Project; CEC, 2000). Mountainview has the same GE turbines as the LADWP proposes to install at VGS. SCAQMD has accepted these emission rates for start-up. PM10 and SO_x emissions were based on AP-42 emission factors and fuel consumption during the start-up period provided by the combustion turbine manufacturer. Once stable operations are achieved, emission rates were based on BACT values for NO_X, CO and VOC and AP-42 emissions factors for PM10 and SO_x.

Emissions During Dual Fuel Readiness Testing

As indicated above, each combustion turbine will have the capability to fire distillate fuel in the event of an emergency condition. In order to ensure that distillate fuel can be fired, each turbine will undergo a one-hour alternate fuel readiness test once per month. During the readiness testing, primary NO_X control will be achieved by water injection. Readiness testing will be done when the unit is hot and operating under normal conditions. During the test the unit will be switched from natural gas operation to distillate fuel operation. For readiness testing, NO_X, CO and VOC emission rates were provided directly by the manufacturer. For PM10 and SO_x, AP-42 emission factors were used for all levels of operation.

Fuel use levels during distillate fuel readiness testing were determined as follows:

MFR = P x H (EQ. C-19)

where:

P = Power Output (kW)

H = Heat Rate (Btu/kW-h)

Fuel (Mgal) = MFR/(LHV x 1,000) (EQ. C-20)

Table C.2-1 presents the maximum emissions for each of the above modes of operation.

Table C.2-1
Combustion Turbine Emissions One Turbine

Pollutant	Modes of Operation		
	Start-Up Emissions (lbs/Start-up) [a]	Dual Fuel Readiness Testing (lbs/hr) [b]	Normal Operation (lbs/hr) [c]
NO_X as NO_2	77.96	313.0	19.32
CO	323.23	26.3	28.16
VOC as CH_4	14.62	6.20	5.34
PM10	25.8	23.22	16.32
SO_X as SO_2	4.84	98.57	2.13
Ammonia	13.25	NA	14.19

a Start-up lasts four hours. The emissions shown are for the entire four-hour period.
b Readiness testing lasts one hour only.
c Maximum firing rate with duct burner at an ambient temperature of 22°F

Toxic Air Contaminants

The combustion turbines will emit toxic air contaminants (TACs). For TACs, excluding ammonia, the most recent emission factors (2001) from the California Air Resources Board (CARB) were used to estimate emissions. These emission factors are the same for uncontrolled operation, operation with water injection, and with SCR/CO catalyst operation. Emissions of ammonia will occur only when the SCR is operational. Therefore, the five-ppmv emission limit was used to develop the emission factor. The TAC emission factors for natural gas firing are presented in

Table C-.2-2 and TAC emission factors for distillate (No. 2 diesel) fuel firing are presented in Table C.2-3. Only those TACs that are listed in SCAQMD Rule 1401 are listed in these tables.

For TAC emission estimation it was assumed that the combustion turbines would operate at maximum capacity for 24 hours a day, 365 days per year. The emissions during normal operation were determined as follows:

Emissions (lbs/hr) = EF (lbs/MMscf) x Fuel (MMscf/hr) (EQ. C-21)

Table C.2-2
Natural Gas Fired Combustion Turbine TAC Emission Factors

HAP	CAS Number	Emission Factor (lbs/MMscf)
1,3-Butadiene	106990	1.27E-04
Acetaldehyde	75070	1.37E-01
Acrolein	107028	1.89E-02
Ammonia	7664417	7.25E+00
Benz(a)anthracene (PAH)	56553	2.26E-05
Benzene	71432	1.33E-02
Benzo(a)pyrene (PAH)	50328	1.39E-05
Benzo(b)fluoranthene (PAH)	205992	1.13E-05
Benzo(k)fluoranthene (PAH)	207089	1.10E-05
Chrysene (PAH)	218019	2.52E-05
Dibenz(a,h)anthracene (PAH)	53703	2.35E-05
Ethylbenzene	100414	1.79E-02
Formaldehyde	50000	9.17E-01
Hexane	110543	2.59E-01
Indeno(1,2,3-cd)pyrene (PAH)	193395	2.35E-05
Naphthalene (PAH)	91203	1.66E-03
Propylene	115071	7.71E-01
Propylene Oxide	75569	4.78E-02
Toluene	108883	7.10E-02
Xylene(Total)	1330207	2.61E-02
CAS = Chemical Abstract Service		

Table C.2-3
Distillate Fuel-Fired Combustion Turbine TAC Emission Factors

TAC	CAS Number	Emission Factor (lbs/Mgal)
Arsenic	7440382	2.02E-04
Benz(a)anthracene (PAH)	56553	8.53E-05
Benzene	71432	1.13E-02
Benzo(a)pyrene (PAH)	50328	8.33E-05
Benzo(b)fluoranthene (PAH)	205992	1.32E-04
Benzo(k)fluoranthene (PAH)	207089	1.30E-04
Beryllium	7440417	5.43E-05
Cadmium	7440439	3.25E-04
Chrysene (PAH)	218019	1.03E-04
Chromium (Hex)	18540299	1.08E-05
Chromium (total)	7440473	4.24E-04
Copper	7440508	9.98E-04
Dibenz(a,h)anthracene (PAH)	53703	8.25E-05
Dioxin: 4D Total	41903575	3.74E-09
Dioxin: 5D Total	36088229	7.15E-09
Dioxin: 6D Total	34465468	9.00E-09
Dioxin: 7D Total	37871004	1.68E-08
Dioxin: 8D	3268879	1.07E-07
Formaldehyde	50000	7.05E-02
Furan: 4F Total	55722275	3.34E-08
Furan: 5F Total	30402154	4.67E-08
Furan: 6F Total	55684941	2.41E-08
Furan: 7F Total	38998753	1.67E-08
Furan: 8F	39001020	8.61E-09
HCL	7647010	8.09E-02
Indeno(1,2,3-cd)pyrene (PAH)	193395	8.26E-05
Lead	7439921	6.08E-04
Manganese	7439965	1.03E-02
Mercury	7439976	2.71E-06
Naphthalene (PAH)	91203	1.08E-02
Nickel	7440020	4.88E-02
Selenium	7782492	8.39E-06
Zinc	7440666	5.38E-02

C.2.1.2 Cooling Tower Emissions

There will be one new cooling tower constructed for the two new combined cycle turbines. The cooling tower will have ten cells with a maximum water circulation rate of 105,600 gpm. The operation of the cooling tower will cause PM10 emissions. PM10 emissions would result from the cooling tower drift (water droplets) that contains dissolved solids.

PM10 emissions from the cooling tower were estimated as follows:

Drift (lbs/day) = Circulation Rate (gpm) x (drift factor (%)/100) x 1440 (min/day) x 8.334 (lbs/gal) (EQ. C-22)

PM10 Emissions (lbs/day) = Drift (lbs/day) x Total Dissolved Solids (ppm) /1,000,000 (EQ. C-23)

Source: AP-42, Chapter 13.4, Wet Cooling Towers

C.2.1.3 Indirect (Offsite) Mobil Source Operational Emissions

Indirect offsite operational emissions will be generated by additional trips by tanker trucks delivering aqueous ammonia to the project site. However, operation of the new equipment will not require any additional employees, so there will not be any increase in indirect operational emissions due to additional employee commuting trips.

Based on operational requirements for aqueous ammonia, it was estimated that two to three additional aqueous ammonia delivery trips will be made to the VGS each month. However, the 47-MW peaking CT that is currently being installed at VGS is anticipated to require one aqueous ammonia delivery trip each month. Since it is unlikely that these additional delivery trips will occur on the same days as the delivery trips that will be required for operation of the 47-MW peaking CT, the peak daily number of delivery trips and the associated emissions are not anticipated to increase.

C.2.2 Operational-Related Emissions Summary (Pre-Mitigation)

Operational-related emissions were calculated for comparison with the various significance thresholds and criteria that are listed in Table 4.2-1 of Subsection 4.2 of this Final EIR. Peak daily emissions from both direct operations and indirect emissions were calculated for comparison with the peak daily mass emissions thresholds. Additionally, peak hourly, daily and annual emissions of various pollutants were estimated for use in air quality dispersion modeling to evaluate potential localized air quality impacts, as described in Subsection 4.2.3.2 for criteria pollutants and in

Subsection 4.2.3.3 for toxic air contaminants. The reader is referred to those Subsections of this Final EIR for a presentation of the results of those potential impact evaluations. The following subsections summarize the emissions that were estimated for these various analyses.

C.2.2.1 Peak Daily Operational Emissions

Because all of the new equipment operating modes are not anticipated to take place at the same time, the overall maximum daily operational emissions will not be equal to the sum of the maximum daily emissions from all of the operating modes. For CO and VOC it was assumed that each combustion turbine would be under start-up conditions for 48 hours per year. Each turbine would go through 12 alternate fuel readiness tests annually for a total of 12 hours. Normal operations would occur for 8700 hours annually. Daily emissions would then equal the total annual emissions divided by 365.

A summary of the resulting "worst-case" operational-related non-RECLAIM daily mass emissions associated with each project site is shown in Table C.2-4. A summary of operational RECLAIM pollutant (NO_X) emissions is shown in Table C.2-5.

Table C.2-4
Overall Peak Daily Operational Non-RECLAIM Daily Mass Emissions

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	PM10 (lb/day)
CTG	1,370	256	0.00	108.3	781.2
Cooling Tower	0.00	0.00	0.00	0.00	71
Total Emissions	**1,370**	**256.0**	**0.00**	**108.3**	**852.2**
Indirect Emissions (Aqueous Ammonia Delivery Trucks)	0.0	0.0	0.0	0.0	0.0
Total Project	**1,370**	**256.0**	**0.00**	**108.3**	**852.2**
Note: Based on Normal Operations for 8,700 hours; 48 hours of start-up and 12 hours for alternate fuel readiness testing of each CGT.					

Table C.2-5
Overall Peak Daily Operational RECLAIM Daily Mass Emissions

Criteria	Emissions
CTG NO_X Emissions (lb/day)	1,221
Average Daily Historical Emissions	(526)
Net Emissions Increase	695
2002 RECLAIM NO_X allocation (lb/day)[a]	271
Total (lb/day)	**966**
Significance Threshold	1,542
Significant? (Yes/No)	**No**

[a] The 2002 facility allocation for NO_X includes purchased RTCs and is converted to pounds per day. This value was taken from the Facility Permit to Operate for the facility. The value from the column headed NO_X RTC Holding was selected.

C.2.2.2 Emissions for Analysis of SO_2 Ambient Air Quality Impacts

For the one-hour, three-hour SO_2, and 24-hour ambient air quality analyses, the evaluation assumed the following:

- One CTG would be operating at maximum capacity on natural gas
- One CTG would be tested for distillate readiness

Table C.2-6 provides the resulting estimated SO_2 emission rates for the project.

Table C.2-6
Emissions for One-Hour, Three-Hour, and 24-Hour Ambient SO_2 Impacts Analysis

Pollutant	One CTG Normal Operation (lbs/hr)	One CTG Readiness Test (lbs/hr)	Total Emissions (lbs/hr)
SO_2	2.13	98.57	100.7

The following operating scenario was selected for the annual SO_2 ambient air quality analysis:

- Two CTGs would be operating at maximum operation on natural gas.
- Two CTGs would be tested for distillate fuel readiness, 12 tests each per year.

Table C.2-7 provides the SO_2 emission rates for the project.

Table C.2-7
Emissions for Annual Ambient SO_2 Impacts Analysis

Pollutant	Two CTGs Normal Operation (lbs/hr)	CT Readiness Test (lbs/test)	Total Emissions (lbs/hr)
SO_2	4.26	98.57	102.83

C.2.2.3 Emissions for Analysis of One-Hour NO_2 Ambient Air Quality Impacts

For the one-hour NO_2, the worst case for NOx is the distillate fuel readiness testing of one combustion turbine with the other turbine is operating at full load. Table C.2-8 lists the NO_2 emissions modeled for the project.

Table C.2-8
Emissions for One-Hour NO_2 Ambient Air Quality Analysis One Combustion Turbine

Equipment	NO_2 (lbs/hr)
CTG	332.9

C.2.2.4 Emissions for Analysis One-Hour and Eight-Hour CO Ambient Air Quality Impacts

For the one-hour and eight-hour CO ambient air quality impacts analyses, the worst case is one turbine starting and one at normal operation. Table C.2-9 lists the CO emissions modeled for the project.

Table C.2-9
Emissions for One-Hour and Eight-Hour CO Ambient Analysis One Combustion Turbine

Equipment	CO (lbs/hr)
CTG	351.39

C.2.2.5 Emissions for Analysis of Annual NO_2 Ambient Air Quality Impacts

The annual NO_2 impact analysis was conducted using the following scenario:

- Two CTGs at normal full-load operation on natural gas, 8760 hours
- Distillate fuel readiness test of each CTG, twelve times per year

Table C.2-10 provides the NO_2 emissions modeled for the annual NO_2 analysis.

Table C.2-10
Emissions for Annual NO_2 Ambient Impacts Analysis
Two Combined Cycle Combustion Turbines

Site	Normal Operations (lbs/hr)	CT Readiness Test (lbs/test)	Total (lbs/yr)
VGS	38.64	626	347,882

C.2.2.6 Emissions for Analysis of PM10 Ambient Air Quality Impacts

Two averaging times were modeled for PM10: 24-hours and annual. For the 24-hour average PM10 case, the following conditions were assessed:

- Two CTGs under normal operation on natural gas for 23 hours each.
- Two CTGs conducting a readiness
- Cooling Tower in operation

The 24-hour PM10 emissions are provided in Table C.2-11.

Table C.2-11
Emissions for 24-Hour PM10 Ambient Impacts Analysis

Site	2 CTGs Normal Operation (lbs/hr)	2 CTGs Readiness Test (lbs/test)	Cooling Tower (lbs/hr)	24-Hour Analysis Total (lbs/day)
VGS	32.64	46.44	2.96	860.3

For the annual average PM10 case, the following conditions were analyzed:

- Two CTGs under normal operation on natural gas.
- Two CTGs conducting readiness tests, 12 tests each per year.
- Cooling Tower in operation.

The annual average PM10 emissions are provided in Table C.2-12.

Table C.2-12
Emissions for Annual PM10 Ambient Impacts Analysis

Site	2 CTGs Normal Operation (lbs/hr)	2 CTGs Readiness Test (lbs/test)	Cooling Tower (lbs/hr)	Annual Average Analysis Total (lbs/yr)
VGS	32.64	46.44	2.96	312,413

C.2.2.7 Toxic Air Contaminants

Both acute and chronic risks were evaluated for TACs. For acute risks, the worst-case evaluation resulted from the full-load normal operation of the combustion turbines. For chronic risks (long term), the following operating scenario was considered:

- Two CTGs normal full-load operation for 8,760 hours per year
- Two CTGs undergoing readiness tests, 12 tests per year for each turbine

Table C.2-13 provides the TAC emissions of one CTGs for normal operations at full load combusting natural gas. Table C.2-14 provides the TAC emissions for distillate fuel readiness testing of one CTG.

Table C.2-13
Toxic Air Contaminants [a] Emissions for One CTG
Normal Operations

Toxic Air Contaminant	Maximum Hourly (lb/hr)	Total Annual [b] (lb/yr)
1,3-Butadiene	2.49E-04	2.18E+00
Acetaldehyde	2.68E-01	2.35E+03
Acrolein	3.70E-02	3.24E+02
Ammonia	1.42E+01	1.24E+05
Arsenic	1.05E-04	9.17E+01
Benz(a)anthracene	4.42E-05	3.87E-01
Benzene	2.60E-02	2.28E+02
Benzo(a)pyrene	2.72E-05	2.38E-01
Benzo(b)fluoranthene	2.21E-05	1.94E-01
Benzo(k)fluoranthene	2.15E-05	1.89E-01
Chloroform	2.44E-02	2.13E+02
Chrysene	4.93E-05	4.32E-01
Dibenz(a,h)anthracene	4.60E-05	4.03E-01
Ethylbenzene	3.50E-02	3.07E+02
Formaldehyde	1.79E+00	1.57E+04
Hexane	5.07E-01	4.44E+03
Indeno(1,2,3-cd)pyrene	4.60E-05	4.03E-01
Naphthalene	3.25E-03	2.85E+01
Propylene	1.51E+00	1.32E+04
Propylene Oxide	9.35E-02	8.19E+02
Toluene	1.40E-01	1.23E+03
Xylene (Total)	5.11E-02	4.47E+02

[a] SCAQMD Rule 1401 (Amended June 15, 2001) Toxic Air Contaminants
[b] Based on operation of 8760 hours per year.

Table C.2-14
Toxic Air Contaminant [a] Emissions Estimates for One CTG
Diesel Fuel Readiness Testing

Toxic Air Contaminant	Maximum Hourly (lb/hr)	Total Annual [b] (lb/yr)
Arsenic	2.81E-03	3.37E-02
Benz(a)anthracene (PAH)	1.19E-03	1.42E-02
Benzene	1.57E-01	1.89E+00
Benzo(a)pyrene (PAH)	1.16E-03	1.39E-02
Benzo(b)fluoranthene (PAH)	1.84E-03	2.20E-02
Benzo(k)fluoranthene (PAH)	1.81E-03	2.17E-02
Beryllium	7.55E-04	9.06E-03
Cadmium	4.52E-03	5.42E-02
Chrysene (PAH)	1.43E-03	1.72E-02
Chromium (Hex)	1.50E-04	1.80E-03
Chromium (total)	5.89E-03	7.07E-02
Copper	1.39E-02	1.66E-01
Dibenz(a,h)anthracene (PAH)	1.15E-03	1.38E-02
Dioxin: 4D Total	5.20E-08	6.24E-07
Dioxin: 5D Total	9.94E-08	1.19E-06
Dioxin: 6D Total	1.25E-07	1.50E-06
Dioxin: 7D Total	2.34E-07	2.80E-06
Dioxin: 8D	1.49E-06	1.78E-05
Formaldehyde	9.80E-01	1.18E+01
Furan: 4F Total	4.64E-07	5.57E-06
Furan: 5F Total	6.49E-07	7.79E-06
Furan: 6F Total	3.35E-07	4.02E-06
Furan: 7F Total	2.32E-07	2.79E-06
Furan: 8F	1.20E-07	1.44E-06
HCL	1.12E+00	1.35E+01
Indeno(1,2,3-cd)pyrene (PAH)	1.15E-03	1.38E-02
Lead	8.45E-03	1.01E-01
Manganese	1.43E-01	1.72E+00
Mercury	3.77E-05	4.52E-04
Naphthalene (PAH)	1.50E-01	1.80E+00
Nickel	6.78E-01	8.14E+00
Selenium	1.17E-04	1.40E-03
Zinc	7.48E-01	8.97E+00

[a] SCAQMD Rule 1401 (Amended June 15, 2001) Toxic Air Contaminants
[b] Based on 12 distillate readiness tests per year for one CTG

C.2.3 Emissions for Analysis of Impacts During Gas Turbine Commissioning

There are three situations during combustion turbine commissioning that have the potential to result in higher NO_2 and CO impacts than operating conditions already addressed. The first condition is the period of time prior to the installation of the SCR when the combustor is being tuned. NO_X emissions would be high because the NO_X emissions control system would not be functioning and the combustor would not be tuned for optimum performance. CO emissions would also be high because combustor performance would not be optimized and CO catalyst would not be installed. The second high emission condition would occur when the combustor has been tuned but the SCR and CO catalyst installation are not complete. This situation is likely to occur under transient conditions characterized by 50 to 60% load. The third condition relates to distillate fuel commissioning. In this case the distillate fuel combustor will be checked and tuned at various loads with and without water injection. Each condition is discussed in more detail below.

Condition 1: Under this condition the NO_x emissions are estimated at twice the gas turbine outlet level of 9 ppmvd or 18 ppmvd (CEC, 2000). If operations at this level continued for one hour the maximum hourly emission rate would be estimated as follows:

NO_x (lbs/hr) = (18 ppm/2.5 ppm) x Normal Emissions at 2.5 ppmvd (lbs/hr) (EQ. C-24)

NO_x (lbs/hr) = (18/2.5) x 16.97 (lbs/hr) = 122.2 lbs/hr.

CO emissions would also be high since gas turbine combustor performance would not be optimized. CO emissions should be equivalent to the estimated emissions during a non-catalyst equipped combustion turbine during start-up. Reported values (CEC, 2000) are in the range of 900 lbs/hr.

Condition 2. During the lower load conditions, NO_X emissions could be as high as 100 ppmvd (CEC, 2000). During the transient conditions, the average operating load is expected to be about 50 to 60% of the baseload. The worst-case hourly emissions would then be determined as follows:

NO_X (lbs/hr) = (100 ppm/2.5 ppm) x (0.6 x Baseload Emissions) (EQ. C-25)

NO_X (lbs/hr) = (100/2.5) x 10.2 (lbs/hr) = 408 lbs/hr

In this condition the combustors would be tuned but the CO catalyst installation is not complete. CO emissions should meet the gas turbine outlet guarantee for CO of approximately 9 ppmv. If operation at this condition continued for one hour the hourly emission rate would be as follows:

CO (lbs/hr) = (9 ppm/6 ppm) x (0.6 x baseload CO in lbs/hr) (EQ. C-26)

CO (lbs/hr) = 1.5 x (0.6 x 28.16) = 25.3 lbs/hr

<u>*Condition 3.*</u> Distillate fuel commissioning will result in higher emissions because the initial fire will be without water injection. This will be followed by operation with water injection. There would be no SCR or CO catalyst during distillate fuel commissioning. US EPA AP-42 all load emission factors were used to estimate the emissions along with fuel use information obtained from similar installations. Only NO_X and CO emissions are addressed here as the distillate fuel readiness testing results in the largest SO_x, VOC and PM10 emissions associated with distillate fuel operation. The large NO_X emission rate occurs when the unit operates without water injection. The emission factor is 88.54 lbs/Mgal. The combustion turbine would burn 3.28 Mgal/hour without water injection. The resulting NOx emission rate is:

NO_x = EF x Fuel (EQ. C-27)

where:

EF = AP-42 Emission Factor (lbs/Mgal)

Fuel = Fuel Burned (Mgal/hr)

The resultant maximum hourly emission rate is 290 lbs/hr.

For CO the maximum hourly emission rate would occur during water injection. Equation EQ. C-30 would be used to estimate these emissions. The AP-42 emission factor for CO with water injection is 14.32 lbs/Mgal and the fuel usage during the water injection period of distillate fuel commissioning is estimated at 6.94 Mgal/hr. The resultant CO emission rate would be 99.4 lbs/hr.

CEC, 2000; Application for Certification Mountainview Power Plant, Mountainview Power Company, LLC

C.3 Mitigation Measures

C.3.1 Mitigation Measures for Construction-Related Activities

The emissions from construction-related activities are primarily from three main sources: 1) onsite fugitive dust, 2) onsite construction equipment operation, and 3) offsite motor vehicles (e.g., worker commuting and material delivery trips). The mitigation measures listed below are intended to minimize the emissions associated with these sources.

Table C.3-1 lists mitigation measures for each emission source and identifies the estimated control efficiency of each mitigation measure. As shown in the table, no feasible mitigation have been identified for the emissions from on-road (offsite) vehicle trips. Additionally, no other feasible mitigation measures have been identified to further reduce emissions from this source or the sources for which mitigation measures have been identified[4].

Table C.3-1
Construction-Related Mitigation Measures and Control Efficiency

Mitigation Measure	Mitigation	Source	Pollutant	Control Efficiency (%)
AQ-1	Increase watering of active sites by one additional time per day[a]	Onsite Fugitive Dust PM10	PM10	16[a]
AQ-2	Proper equipment maintenance	Construction Equipment Exhaust	VOC NOx SOx PM10 CO	5 5 5 5 0
AQ-3	Prior to use in construction, the project proponent will evaluate the feasibility of retrofitting the large off-road construction equipment that will be operating for significant periods. Retrofit technologies such as selective catalytic reduction, oxidation catalysts, air enhancement technologies, etc. will be evaluated. These technologies will be required if they are commercially available and can feasibly be retrofitted onto construction equipment.	Construction Equipment Exhaust	CO VOC NO_X SO_X PM10	Unknown Unknown Unknown Unknown Unknown

[4] CEQA Guidelines §15364 defines feasible as ". . . capable of being accomplished in a successful manner within a reasonable period if time, taking into account economic, environmental, legal, social, and technological factors."

Table C.3-1 (Concluded)
Construction-Related Mitigation Measures and Control Efficiency

Mitigation Measure	Mitigation	Source	Pollutant	Control Efficiency (%)
AQ-4	Use low sulfur diesel (as defined in SCAQMD Rule 431.2) where feasible.	Construction Equipment	SO_X PM10	Unknown
	No feasible measures identified[b]	On-Road Motor Vehicles	VOC NO_x PM10 CO	N/A N/A N/A N/A

[a] It is assumed that construction activities will comply with SCAQMD Rule 403 – Fugitive Dust, by watering active sites two times per day, reducing fugitive dust by 50 percent. This mitigation measure assumes an incremental increase in the number of times per day active sites are watered (i.e., from two to three times per day).

[b] Health and Safety Code §40929 prohibits the air districts and other public agencies from requiring an employee trip reduction program making such mitigation infeasible. No feasible measures have been identified to reduce emissions from this source.

C.3.2 Mitigation Measures for Operational-Related Activities

Operation-related activities associated with the proposed project may have significant unmitigated air quality impacts for CO, SO_x, VOC, and PM10.

VOC is an ozone precursor and is considered to be a regional pollutant. Therefore, offsets can be used to mitigate significant VOC impacts. However, pursuant to Rule 1304(a)(2), LADWP is not required to provide emission offsets when replacing electric utility steam boilers with CTGs unless there is an increase in generating capacity. If there is a net increase in capacity, LADWP would be required to provide offsets only for the increase in capacity. LADWP is decommissioning 4 electric utility steam boilers with a net capacity of 526 MW as part of the proposed project, and replacing them with CTGs with a net capacity of 532 MW. LADWP will be required to provide offsets for VOC, PM10, CO, and SO_x for only 6 MW of generating capacity to satisfy the requirements for Regulation XIII.

Unmitigated SO_x emissions exceed the significance criteria. The emissions associated with the one-hour diesel fuel readiness testing contribute almost 50-percent of the total for peak daily SO_x emissions. The use of low sulfur diesel fuel during readiness testing will reduce the significant impact of SO_x emissions to insignificance. Due to the use of natural gas as the primary fuel, SO_x emissions during normal operation of the CTGs would not be significant.

For CO and PM10 emissions associated with the proposed project, no feasible mitigation measures have been identified to reduce significant impacts to insignificance. However, the proposed project utilizes state-of-the-art emission controls for these pollutants.

The feasible mitigation measures for operating emissions are presented in Table C.3-1.

Table C.3-2
Operational-Related Mitigation Measures and Control Efficiency

Mitigation Measure	Mitigation	Source	Pollutant	Control Efficiency (%)
AQ-5	Use low sulfur diesel (as defined in SCAQMD Rule 431.2) where feasible.[a]	Diesel readiness testing	SO_x	97%
	No feasible measures identified	Fuel combustion in CTGs	VOC PM10 CO	N/A N/A N/A

[a.] Pursuant to Rule 431.2, low sulfur diesel will be required for use in stationary sources by June 2004. The project is expected to be operational prior to that date. The use of low sulfur diesel is therefore an appropriate mitigation measure for the project.

C.4 Project Alternatives

C.4.1 Alternative A - No Project

Alternative A (No Project) would not generate any of the secondary adverse air quality impacts from construction-related activities needed to implement the proposed project. Furthermore, since the CTGs and SCR systems would not be installed, no additional operational-related emissions from equipment operation or the delivery of aqueous ammonia would be generated.

C.4.2 Alternative B – Install a Dry Cooling System

An alternative to wet cooling towers is dry air cooling. Air is substituted for water to provide the necessary cooling to condense the exhaust steam from the steam turbine. Dry cooling would require approximately twice as much space as the proposed plant facility.

The construction schedule for this alternative would be approximately 50 percent longer than the schedule for the proposed project. However, the construction equipment and workforce would be anticipated to be the same as for the proposed project, so peak daily construction related emissions would be the same. Both the proposed project and Alternative B generate significant CO, VOC, NO_x, and PM10 emissions from construction activities.

The use of dry cooling would avoid the generation of PM10 emissions associated with the wet cooling towers. However, the reduction in PM10 emissions would not reduce the impact of PM10 emissions to levels of insignificance. Further, dry cooling requires more energy for operation than wet cooling, and would lower the net power output from the facility by an estimated 10%.

C.5 Construction Fuel Consumption

Fuel consumption associated with construction-related activities was also estimated for use in evaluating the significance of impacts on energy resources. Fuel usage by onsite construction equipment was calculated using a diesel fuel use rate of 0.05 gallons per brake-horsepower-hour and a gasoline fuel use rate of 0.12 gallons per brake-horsepower-hour from Table A9-3-E of the SCAQMD's CEQA Air Quality Handbook (1993). Motor vehicle fuel usage was estimated by assuming an average fuel efficiency for all vehicles of 20 miles per gallon. The resulting estimated fuel consumption associated with construction activities for the proposed project is summarized in Table C.5-1. Because construction of Alternative B is anticipated to require the same equipment and workforce as the proposed project and to last approximately 50 percent longer, fuel consumption during construction of Alternative B is anticipated to be approximately 50 percent more than for the proposed project.

Table C.5-1
Construction Related Fuel Usage for Proposed Project

Activity	Working Days[a]	Construction Equipment				Motor Vehicles				Total	
		Daily Gasoline Use (gal)	Daily Diesel Use (gal)	Total Gasoline Use (gal)	Total Diesel Use (gal)	Daily Gasoline VMT	Daily Diesel VMT	Gasoline Use (gal)[b]	Diesel Use (gal)[b]	Gasoline Use (gal)	Diesel Use (gal)
Grading	26	0.0	61.9	0	1,613	120	1	156	1	**156**	**1,615**
Foundations and Paving	287	18.6	150.2	5,334	43,082	10,230	1,681	146,691	24,104	**152,025**	**67,187**
Equipment Installation	417	0.0	690.1	0	287,852	24,030	618	501,197	12,890	**501,197**	**300,742**
TOTAL				**5,334**	**332,548**			**648,044**	**36,995**	**653,379**	**369,543**

[a] Based on 6 working days per week

[b] Based on 20 miles per gallon