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APPENDIX B

AIR QUALITY ANALYSIS METHODOLOGIES

This appendix provides the methodologies that were used to analyze potential air quality impacts associated with the Chevron El Segundo Refinery CARB Phase 3 Clean Fuels Project. This appendix begins with a discussion of the methodologies used to estimate construction and operational emissions, followed by emissions summaries. The appendix continues with discussions of mitigation measures and emissions remaining after mitigation. The health risk assessment and evaluations prepared for the refinery and the terminals are then presented. Following is a discussion of emissions from the project alternatives. Spreadsheets that provide details of the emissions calculations are attached as well as detailed inputs and outputs from the TANKS version 4.09 runs, the health risk assessment, the PM_{10} ambient air modeling and the CO "hot spots" analysis.

B.1 CONSTRUCTION EMISSIONS

Construction emissions can be distinguished as either onsite or offsite. Onsite emissions generated during construction principally consist of exhaust emissions (CO, VOC, NO_X, SO_X, and PM_{10}) from construction equipment, fugitive dust (PM_{10}) from grading and excavation, and VOC from asphaltic paving and painting. Offsite emissions during the construction phase normally consist of exhaust emissions and entrained paved road dust from worker commute trips and material delivery trips and fugitive dust lost from haul trucks removing excavated soil.

Chapter 2 describes the modifications and new equipment that will require construction at the refinery and at each of the terminals (see Tables 2.5-1 and 2.5-2). To estimate the peak daily emissions associated with the construction activities, the anticipated construction schedule, the types of construction equipment, the number of construction equipment, and the peak daily operating time for each piece of equipment were estimated. Additionally, estimates were made of the number and length of daily onsite and offsite motor vehicle trips.

Table B.1-1 lists the anticipated schedule, peak daily construction equipment requirements, and peak daily motor vehicle trips for the construction. Several pieces of construction equipment will be used for construction associated with several of the of the process units at the refinery, and this equipment is listed under "Common Construction Activities" in the table. Equipment that is anticipated to be used only for construction associated with individual process units is listed separately. Motor vehicles and trips listed under "Refinery Construction Motor Vehicles" represent the peak daily anticipated motor vehicle usage during construction. The information in the table was developed from previous experience with similar refinery and terminal construction projects.

Construction is anticipated to occur five days per week, from 6:30 a.m. to 5:00 p.m. at the refinery and from 7:00 a.m. to 6:00 p.m. at the terminals.

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

Equipment/Vehicle Type	Number	Hours per Day Operation/Miles per Day per Vehicle
Common Refinery Construction Activities (1/1/02 - 9/30/03)		
300 Ton Crawler Crane	1	10
Forklift	5	6
Air Compressor, 230 hp	1	10
Concrete Pump	1	6
Scraper	2	10
Bulldozer	3	10
Grader	2	10
Vibratory Roller	2	10
Backhoe	3	10
Front End Loader	4	10
Hoe Ram	2	10
Wacker Packer Plate Compactor	5	6
Refinery Construction Motor Vehicles (1/1/02 - 9/30/03)		
Onsite pickup truck	12	20
Onsite flatbed truck	12	24
Onsite watering truck	2	30
Onsite dump truck	12	30
Onsite bus	8	20
Offsite construction commuter	262	50
Offsite heavy-duty delivery vehicle	40	20
Offsite haul truck	16	30
Offsite haul truck	4	400
Alkylate Depentanizer Construction (1/1/02 - 10/31/02)		
200 Ton Crawler Crane	1	10
28 Ton Rough Terrain Crane	2	10
Welding Machine, 20 hp	6	10
Air Compressor, 230 hp	1	10
Isomax Depentanizer Construction (1/1/02 - 10/31/02)		
200 Ton Crawler Crane	1	10
28 Ton Rough Terrain Crane	1	10
Welding Machine, 20 hp	5	10
Air Compressor, 230 hp	1	10

Table B.1-1(Continued)
Construction Schedule, Equipment Requirements and Motor Vehicle Trips

Equipment/Vehicle Type	Number	Hours per Day Operation/Miles per Day per Vehicle
Pentane Storage Sphere Construction (1/1/02 - 10/31/02)		
28 Ton Rough Terrain Crane	1	10
Air Compressor, 230 hp	2	10
Generator, 550 hp	2	10
Pentane Railcar Loading Facility Construction (1/1/02 - 10/31/02)		
100 Ton Rough Terrain Crane	1	10
28 Ton Rough Terrain Crane	1	10
Welding Machine, 20 hp	1	10
Air Compressor, 230 hp	1	10
Generator, 550 hp	1	10
NHT-1 Construction (1/1/02 - 9/30/02)		
230 Ton Crawler Crane	1	10
28 Ton Rough Terrain Crane	1	10
Welding Machine, 20 hp	2	10
Air Compressor, 230 hp	1	10
Additional Gasoline Storage Tank Construction (1/1/02 - 9/30/02)		
55 Ton Rough Terrain Crane	1	10
28 Ton Rough Terrain Crane	4	10
8.5 Ton Carry Deck	1	8
Welding Machine, 20 hp	6	10
Air Compressor, 230 hp	1	10
Generator, 550 hp	4	10
FCC Emissions Reduction System Installation (10/1/02 - 9/30/03)		
140 Ton Crawler Crane	1	10
28 Ton Rough Terrain Crane	1	10
Welding Machine, 20 hp	5	10
Air Compressor, 230 hp	1	10
Alkylation Plant Modifications (10/1/02 - 9/30/03)		
8.5 Ton Carry Deck	1	8
Air Compressor, 230 hp	1	10

Table B.1-1 (Concluded)
Construction Schedule, Equipment Requirements and Motor Vehicle Trips

Equipment/Vehicle Type	Number	Hours per Day Operation/Miles per Day per Vehicle
Huntington Beach Terminal Construction (1/1/02 - 6/30/02)		
28 Ton Rough Terrain Crane	1	10
Forklift	2	10
Welding Machine, 40 hp	4	10
Air Compressor, 25 hp	1	10
Generator, 22 hp	1	10
Backhoe	1	10
Offsite construction commuter	20	60
Offsite heavy-duty delivery vehicle	7	60
Offsite medium-duty delivery vehicle	5	60
Offsite pickup truck	5	60
Montebello Terminal Construction (3/1/02 - 8/31/02)		
28 Ton Rough Terrain Crane	1	10
Forklift	3	10
Welding Machine, 40 hp	4	10
Air Compressor, 25 hp	3	10
Generator, 22 hp	1	10
Backhoe	2	10
Offsite construction commuter	28	60
Offsite heavy-duty delivery vehicle	7	60
Offsite medium-duty delivery vehicle	5	60
Offsite pickup truck	5	60
Van Nuys Terminal Construction (5/1/02 - 10/31/02)		
28 Ton Rough Terrain Crane	1	10
Forklift	2	10
Welding Machine, 40 hp	4	10
Air Compressor, 25 hp	1	10
Generator, 22 hp	1	10
Backhoe	1	10
Offsite construction commuter	20	60
Offsite heavy-duty delivery vehicle	7	60
Offsite medium-duty delivery vehicle	5	60
Offsite pickup truck	5	60

B.1.1 Exhaust Emissions from Construction Equipment.

The combustion of fuel to provide power for the operation of various construction activities and equipment results in the generation of NO_X, SO_X, CO, VOC, and PM_{10} emissions. The following predictive emission equation was used to estimate exhaust emissions from each construction activity:

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

where:

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

BHP = Equipment bhp

LF = Equipment load factor

T_H = Equipment operating hours/day

N = Number of pieces of equipment

Table B.1-2 provides the emission factors, horsepower and load factors used to estimate peak daily exhaust emissions from construction equipment. Equipment horsepower ratings and load factors are typical values for the various types of construction equipment, based on contractor experience. The emission factors were taken from the South Coast Air Quality Management District (SCAQMD) CEQA Air Quality Handbook (SCAQMD, 1993). These emission factors were applied to the construction equipment operating data in Table B.1-1 to calculate peak daily construction equipment exhaust emissions during construction for each process unit at the refinery and at each terminal.

Table B.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	PM_{10} lb/bhp-hr
300 Ton Crawler Crane	Diesel	450	43	0.009	0.003	0.023	0.002	0.002
230 Ton Crawler Crane	Diesel	334	43	0.009	0.003	0.023	0.002	0.002
200 Ton Crawler Crane	Diesel	237	43	0.009	0.003	0.023	0.002	0.002
140 Ton Crawler Crane	Diesel	287	43	0.009	0.003	0.023	0.002	0.002

Table B.1-2 (Concluded)
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	PM_{10} lb/bhp-hr
100 Ton Rough Terrain Crane	Diesel	250	43	0.009	0.003	0.023	0.002	0.002
65 Ton Rough Terrain Crane	Diesel	250	43	0.009	0.003	0.023	0.002	0.002
55 Ton Rough Terrain Crane	Diesel	250	43	0.009	0.003	0.023	0.002	0.002
28 Ton Rough Terrain Crane	Diesel	145	43	0.009	0.003	0.023	0.002	0.002
8.5 Ton Carry Deck	Diesel	75	43	0.009	0.003	0.023	0.002	0.002
Forklift	Diesel	93	47.5	0.022	0.003	0.018	0.002	0.002
Welding Machine, 20 hp	Diesel	20	45	0.011	0.002	0.018	0.002	0.001
Welding Machine, 40 hp	Diesel	40	45	0.011	0.002	0.018	0.002	0.001
Air Compressor, 25 hp	Diesel	230	48	0.011	0.002	0.018	0.002	0.001
Air Compressor, 230 hp	Diesel	230	48	0.011	0.002	0.018	0.002	0.001
Generator, 550 hp	Diesel	550	74	0.011	0.002	0.018	0.002	0.001
Generator, 22 hp	Diesel	22	74	0.011	0.002	0.018	0.002	0.001
Concrete Pump	Diesel	177	62	0.020	0.003	0.024	0.002	0.002
Scraper	Diesel	350	66	0.011	0.001	0.019	0.002	0.002
Bulldozer	Diesel	300	59	0.011	0.002	0.023	0.002	0.001
Grader	Diesel	200	57.5	0.008	0.003	0.021	0.002	0.001
Vibratory Roller	Diesel	150	57.5	0.007	0.002	0.020	0.002	0.001
Backhoe	Diesel	95	46.5	0.015	0.003	0.022	0.002	0.001
Front End Loader	Diesel	200	46.5	0.011	0.002	0.023	0.002	0.002
Hoe Ram	Diesel	225	62	0.020	0.003	0.024	0.002	0.002
Wacker Packer Plate Compactor	Gasoline	5	43	0.830	0.043	0.004	0.001	0.000

B.1.2 Fugitive Dust (PM_{10}) Emissions

Fugitive dust emissions are generated during the construction phase from the following operations:

- Material handling (i.e., dropping soil onto the ground or into trucks during excavation)
- Bulldozing and scraping
- Grading
- Storage pile wind erosion
- Vehicle travel on unpaved surfaces

- Loss of material from haul trucks
- Vehicle travel on paved roads

The only major excavation that will take place at single locations will be for the construction of the pentane railcar loading facilities, the pentane storage tank and the new gasoline storage tanks. Minor excavation will occur during construction at other process units to install new foundations.

Although fugitive dust emissions from construction activities are temporary, they may have an impact on local air quality. Fugitive dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions. The following methodologies provide the predictive emission equations, emission factors, and default values used to calculate fugitive dust emissions for the project.

The following equations were used to calculate uncontrolled fugitive dust PM_{10} emissions. Construction contractors will comply with SCAQMD Rule 403 – Fugitive Dust, by watering the site two times per day, reducing the uncontrolled onsite fugitive dust emissions by 50 percent. Additionally, haul trucks will comply with the vehicle freeboard requirements of Section 23114 of the California Vehicle Code for both public and private roads, which is estimated to reduce uncontrolled fugitive PM_{10} emissions from soil loss by 50 percent.

<u>Emissions from Material Handling</u>

Fugitive PM_{10} emissions are generated during excavation when excavated material is dropped onto the ground at the side of the excavation location or dropped into trucks for removal from the site. The following equation was used to estimate these emissions:

$$\text{Emissions (lb/day)} = 0.0011 \times (U/5)^{1.3} / (M/2)^{1.4} \times V \times D \times N_D \qquad \text{(EQ. B.1-2)}$$

where:

U = Mean wind speed (mph)
M = Soil moisture content (percent)
V = Volume of soil handled (yd^3/day)
D = Soil density (tons/yd^3)
N_D = Number of times soil is dropped

Source: Equation 1, Section 13.2.4, US EPA Compilation of Air Pollutant Emission Factors (AP-42), January 1995.

The values that were used for the variables in this equation are listed in Table B.1-3.

Table B.1-3
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Material Handling

Parameter	Value	Basis
Mean wind speed	12 mph	SCAQMD 1993 CEQA Air Quality Handbook, Default

Soil moisture content	5.9 percent	"Open Fugitive Dust PM10 Control Strategies Study," Midwest Research Institute, October 12, 1990.
Volume of soil handled	82,500 yd^3 total over 30 days = 2,750 yd^3/day	Foundation design areas and depths and anticipated excavation schedule
Soil density	1.215 ton/yd^3	Table 2.46, Handbook of Solid Waste Management
Number of soil drops	2	Once onto ground and once into haul truck

<u>Emissions from Bulldozing and Scraping:</u>

Bulldozer and scraper operations to clear and rough-grade soil for foundations will generate fugitive PM_{10} emissions. The following equation for fugitive PM_{10} emissions from bulldozing was used to estimate emissions from both bulldozing and scraping activities:

$$\text{Emissions (lb/day)} = 0.75 \times s^{1.5} / M^{1.4} \times T_H \times N \qquad \text{(EQ. B.1-3)}$$

where:

- s = Soil silt content (percent)
- M = Soil moisture content (percent)
- T_H = Equipment operating hours/day
- N = Number of pieces of equipment

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

Values of the variables used in this equation to calculate fugitive dust PM_{10} emissions are listed in Table B.1-4.

Table B.1-4
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Bulldozing and Scraping

Parameter	Value	Basis
Soil silt content	7.5 percent	SCAQMD 1993 CEQA Air Quality Handbook, Overburden
Soil moisture content	5.9 percent	"Open Fugitive Dust PM10 Control Strategies Study," Midwest Research Institute, October 12, 1990.
Hours of operation	See Table B.1-1 for peak daily bulldozer and scraper operation	Anticipated construction schedule
Number of pieces of equipment	See Table B.1-1	Anticipated construction equipment requirements

Emissions from Grading

Fine grading by graders prior to pouring foundations will also generate fugitive PM_{10} emissions. These emissions were estimated using the following equation:

Emissions (lb/day) = 0.0306 x $S^{2.0}$ x VMT x N (EQ. B.1-4)

where:

S = Grader speed (mph)

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.

Values of the variables used in this equation to calculate fugitive dust PM_{10} emissions are listed in Table B.1-5.

Table B.1-5
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Grading

Parameter	Value	Basis
Grader speed	5 mph	Assumption
VMT	5 mph x peak daily hours of operation	Assumed average vehicle speed
Hours of operation	See Table B.1-1 for Peak Daily Grader	Anticipated construction schedule
Number of pieces of equipment	See Table B.1-1	Anticipated construction equipment requirements

<u>Emissions from Storage Pile Wind Erosion:</u>

Wind erosion of temporary soil storage piles during excavation generates fugitive PM_{10} emissions. The following equation was used to estimate these emissions:

Emissions (lb/day) = 0.85 x (s/1.5) x (365-p/235) x (U_{12}/15) x A (EQ. B.1-5)

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

Table B.1-6 lists the values used in this equation to estimate emissions.

Table B.1-6
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Storage Pile Wind Erosion

Parameter	Value	Basis
Soil silt content	7.5 percent	SCAQMD 1993 CEQA Air Quality Handbook, Overburden
Number of days per year with precipitation of 0.01 inches or more	0	Conservative assumption based on construction not occurring during rain
Percentage of time unobstructed wind speed exceeds 12 miles per hour	100 percent	Conservative estimate
Storage pile area	202,200 ft^2 over 30 days = 6,740 ft^2/day = 0.154 acres/day	Foundation areas and anticipated excavation schedule

<u>Emissions from Vehicle Travel on Unpaved Surfaces</u>

Travel on unpaved surfaces by onsite dump trucks and watering trucks will generate fugitive PM_{10} emissions. These emissions were estimated using the following equation:

$$\text{Emissions (lb/day)} = 2.6 \times (S/15) \times (s/12)^{0.8} \times (W/3)^{0.4} / (M/0.2)^{0.3} \times VMT \times N \qquad \text{(EQ. B.1-6)}$$

where:

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

s = Soil silt content (percent)

W = 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 bulldozer and grader travel on unpaved surfaces are included in the bulldozing and grading emissions equations above.

Table B.1-7 lists the values used in this equation to estimate emissions.

Table B.1-7
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Vehicle Travel on Unpaved Surfaces

Parameter	Value	Basis

Vehicle speed	5 mph	Assumption
Soil silt content	7.5 percent	SCAQMD 1993 CEQA Air Quality Handbook, Overburden
Vehicle weight	40 tons	Assumption
Soil moisture content	5.9 percent	"Open Fugitive Dust PM10 Control Strategies Study," Midwest Research Institute, October 12, 1990.
VMT	5 mph x peak daily hours of operation	Assumed average vehicle speed
Hours of operation	See Table B.1-1 for Peak Daily Dump Trucks and Water Trucks	Anticipated construction schedule
Number of pieces of equipment	See Table B.1-1	Anticipated construction equipment requirements

<u>Emissions from Loss of Material from Haul Trucks</u>

Loss of material from haul trucks hauling cut away from the construction site can generate fugitive PM_{10} emissions. These emissions were estimated using the following equation:

$$\text{Emissions (lb/day)} = [0.029\ (U^{*} - U_t)^2 + 0.0125\ (U^{*} - U_t)]\ (M / 2)^{-1.4} \times PM \times A_T \times N_T \qquad \text{(EQ. B.1-7)}$$

where:

U^{*} = Friction velocity (mi/hr)

= $0.4 \times U_T / \ln(H_T / H_R)$

U_T = Truck speed (mi/hr)

H_T = Height above exposed surface (cm)

H_R = Roughness height (cm)

U_t = Threshold friction velocity (mi/hr)

M = Soil moisture content (%)

PM = PM_{10} factor (dimensionless)

A_T = Exposed surface area (sq. ft.)

N_T = Number of haul truck trips per day

Source: Adapted from AP-42 industrial wind erosion equations

Table B.1-8 lists the values used in this equation to estimate emissions.

Table B.1-8
Parameters Used to Calculate Fugitive Dust PM_{10} Emissions from Loss of Material from Haul Trucks

Parameter	Value	Basis

Parameter	Value	Basis
Soil moisture content	5.9 percent	"Open Fugitive Dust PM10 Control Strategies Study," Midwest Research Institute, October 12, 1990.
Haul truck speed	60	Conservative upper limit
Height above exposed soil surface in haul truck	30.48	Assumption
Roughness height	0.3	Default value
Threshold friction velocity for haul trucks	1.61	Environ study
PM_{10} factor for haul truck soil losses	0.5	Assumption
Exposed haul truck soil surface area	258	Typical value for open top sets
Number of haul truck trips per day	See Table B.1-1 for peak daily haul truck trips	Anticipated construction schedule

Emissions from Paved Road Dust Entrainment:

Vehicles travelling on paved roads entrain dust that has deposited on the roads, which produces PM_{10} emissions. These emissions were estimated using the following equation:

$$\text{Emissions (lb/day)} = 7.26\ (sL/2)^{0.65} \times (WF/3)^{1.5} \times VMT \qquad \text{(EQ. B.1-8)}$$

where:

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

WF = mileage-weighted average of vehicles on the roadway (tons)

VMT = vehicle-miles-traveled

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

Table B.1-9 lists the values used in this equation to estimate entrained paved road dust PM_{10} emissions. Although the vehicle weight used in the calculation should be the mileage-weighted average of all vehicles on the road, weights for the various types of vehicles, estimated from the weight-ranges for the vehicle classes in which they belong, have been conservatively used. The silt loading values are the default values assigned to the various road types in the California Air Resources Board Emission Inventory Methodology 7.9, Entrained Paved Road Dust (1997). The number of vehicles of each type and the mileage for each vehicle per day are listed in Table B.1-1.

Table B.1-9

Parameters Used to Calculate Entrained Paved Road Dust PM_{10} Emissions

Vehicle Type	Vehicle Weight (tons)	Road Type	Silt Loading (g/m^2)
Onsite pickup truck	5	Local	0.320
Onsite flatbed truck	15	Local	0.320
Onsite bus	40	Local	0.320
Offsite construction commuter	3	Collector	0.037
Offsite heavy-duty delivery vehicle	40	Collector	0.037
Offsite medium-duty delivery vehicle	15	Collector	0.037
Offsite pickup truck	3	Collector	0.037
Offsite haul truck	40	Collector	0.037

B.1.3 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. B.1-9)

where:

A = Area paved (acres/day)

Source: URBEMIS7G User's Guide, 1998

The maximum daily area anticipated to be paved during construction at the refinery is 30,000 ft^2 (0.69 acres).

B.1.4 Architectural Coating (Painting) Emissions

Architectural coating generates VOC emissions from the evaporation of solvents contained in the surface coatings applied to buildings. The following equation was used to estimate VOC emissions from architectural coatings:

Emissions (lb/day) = C x V (EQ. B.1-10)

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 at the refinery and at each of the three distribution terminals is estimated to be 10 gallons for touch-up purposes. The equipment to be installed at each site will be pre-painted to manufacturer specifications.

B.1.5 Motor Vehicle Emissions During Construction

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. B.1-11)

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

<u>VOC</u>

Emissions (lb/vehicle-day) = $[(EF_{Run} \times VMT) + (EF_{Start} \times Start) + (EF_{Soak} \times Trip)$
$+ (EF_{Rest} \times Rest) + EF_{Runevap} \times VMT) + (EF_{Diurnal} \times Diurnal)] / 453.6$
(EQ. B.1-12)

where:

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

<u>PM_{10}</u>

Emissions (lb/vehicle-day) = $[(EF_{Run} + EF_{Tire} + EF_{Brake}) \times VMT) +$
$(EF_{Start} \times Start)] / 453.6$ (EQ. B.1-13)

where:

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 B.1-10 lists the vehicle class for each type of vehicle and the assumed vehicle speed.

Table B.1-10
Motor Vehicle Classes and Speeds During Construction

Vehicle Type	Vehicle Class	Speed (mph)
Onsite pickup truck	Medium duty truck, cat	15
Onsite flatbed truck	Medium heavy-duty truck, diesel	15
Onsite watering truck	Medium heavy-duty truck, diesel	15
Onsite dump truck	Heavy heavy-duty truck, diesel	15
Onsite bus	Urban bus, diesel	15
Offsite construction commuter	Light duty truck, cat	35
Offsite heavy-duty delivery vehicle	Heavy heavy-duty truck, diesel	25
Offsite medium-duty delivery vehicle	Medium heavy-duty truck, diesel	25
Offsite pickup truck	Light duty truck, cat	25
Offsite haul truck	Heavy heavy-duty truck, diesel	25

Tables B.1-11 through B.1-13 list the emission factors. Note, start-up and evaporative VOC emission factors (Table B.1-12) are currently only available for gasoline-fueled vehicles and are not available for diesel-fueled vehicles.

Table B.1-11
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	15.33	33.94	1.85	1.46
Onsite flatbed truck	4.04	N/A	14.02	N/A
Onsite watering truck	4.04	N/A	14.02	N/A
Onsite dump truck	8.13	N/A	20.94	N/A
Onsite bus	8.51	N/A	29.90	N/A
Offsite construction commuter	13.02	35.49	1.24	1.09
Offsite heavy-duty delivery vehicle	4.85	N/A	17.21	N/A
Offsite medium-duty delivery vehicle	2.41	N/A	11.53	N/A
Offsite pickup truck	15.57	35.49	1.37	1.09
Offsite haul truck	4.85	N/A	17.21	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 2001, summertime.

Table B.1-12
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	0.98	3.42	0.33	0.13	2.41	0.33
Onsite flatbed truck	0.60	N/A	N/A	N/A	N/A	N/A
Onsite watering truck	0.60	N/A	N/A	N/A	N/A	N/A
Onsite dump truck	1.67	N/A	N/A	N/A	N/A	N/A
Onsite bus	1.80	N/A	N/A	N/A	N/A	N/A
Offsite construction commuter	0.40	2.93	0.46	0.17	1.32	0.45
Offsite heavy-duty delivery vehicle	1.15	N/A	N/A	N/A	N/A	N/A
Offsite medium-duty delivery vehicle	0.41	N/A	N/A	N/A	N/A	N/A
Offsite pickup truck	0.57	2.93	0.46	0.17	1.85	0.45
Offsite haul truck	1.15	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 2001, summertime.

Table B.1-13
Motor Vehicle PM_{10} Emission Factors During Construction

Vehicle Type	Running Exhaust (g/mi)	Start-Up (g/start)[a]	Tire Wear (g/mi)	Brake Wear (g/mi)
Onsite pickup truck	0.04	0.03	0.02	0.03
Onsite flatbed truck	0.67	N/A	0.01	0.01
Onsite watering truck	0.67	N/A	0.01	0.01
Onsite dump truck	0.96	N/A	0.04	0.01
Onsite bus	0.79	N/A	0.01	0.01
Offsite construction commuter	0.01	0.02	0.01	0.01
Offsite heavy-duty delivery vehicle	0.66	N/A	0.04	0.01
Offsite medium-duty delivery vehicle	0.46	N/A	0.01	0.31
Offsite pickup truck	0.02	0.02	0.01	0.01
Offsite haul truck	0.66	N/A	0.04	0.01

[a] Assumed to be after 720 minutes with engine off.
Source: ARB EMFAC2000 motor vehicle emission factor model, version 2.02, for calendar year 2001, summertime.

To calculate start-up emissions it was assumed that each gasoline-fueled vehicle (i.e., onsite pickup truck, offsite 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).

B.2 OPERATIONAL EMISSIONS

After construction is completed, direct operational emissions will be generated at the refinery and the terminals by the new and modified processes, by changes in storage tank service, by new tanks, by additional load on the sulfur plant, and by tanker truck loading at the Port of Los Angeles. Additionally, indirect operational emissions will be generated by locomotives, tanker truck trips to deliver ethanol to terminals, and by marine tanker ethanol delivery operations at the Port of Los Angeles.

B.2.1 Direct Operational Emissions

The sources of potential emissions resulting from new equipment and modifications to existing units proposed for the project are discussed below.

El Segundo Refinery

At the refinery, the following equipment changes result in sources of fugitive VOC emissions from components:

- Alkylate Depentanizer
- Isomax Light Gasoline Depentanizer
- FCC Light Gasoline Depentanizer
- FCC Light Gasoline Splitter
- Pentane Storage Sphere
- Pentane Export Railcar Load Rack
- NHT-1
- Additional Gasoline Storage
- FCC Deethanizer
- FCC Debutanizer
- FCC Depropanizer
- FCC C3 Treating
- Refinery Deisobutanizer Reactivation

In addition to these new and modified units, a new tank will be constructed at the refinery for additional gasoline storage. Modifications will also be made to the FCC, NHT-1 and cogen trains A and B.

Huntington Beach Terminal

Ethanol will be brought to the Huntington Beach Terminal by tanker truck and unloaded into one existing diesel fuel storage tank converted to ethanol service. A new two-lane unloading station will be constructed to unload the ethanol from the tanker trucks to the storage tank.

The converted storage tank, as well as modifications associated with ethanol unloading and blending, will result in fugitive emissions from various components.

Montebello Terminal

Ethanol will be brought to the Montebello Terminal by tanker truck and by railcar and unloaded into a new 50,000 bbl internal floating roof storage tank. A new two-lane unloading station will be constructed to unload the ethanol from the tanker trucks to the storage tank. A rail spur and rail car unloading facility, capable of unloading 12~~eight~~ rail cars simultaneously, will also be constructed. The existing loading rack will be modified to allow for ethanol blending. Ethanol will be loaded into tanker trucks for transport to the Van Nuys and Huntington Beach Terminals.

The new ethanol storage tank, as well as modifications associated with ethanol unloading and blending, will result in fugitive emissions from various components.

Van Nuys Terminal

Ethanol would be brought to the Van Nuys Terminal by tanker truck and unloaded into two existing gasoline tanks converted to ethanol service. For purposes of estimating emissions, it was assumed that tanks 1 and 2 will be converted. The associated tank and piping modifications are sources of fugitive emissions from these components.

The converted storage tanks, as well as modifications associated with ethanol unloading and blending will result in fugitive emissions from various components.

The change in service of a tank to ethanol is anticipated to lead to a reduction in emissions because of differences in the vapor pressures between ethanol and the materials currently stored. This potential reduction has been estimated, but is not included in the evaluation of the project's significance.

The following methodologies were used to estimate emissions from these sources.

<u>Emissions from Process Components</u>

The following equation was used to calculate fugitive VOC emissions from process components:

Emissions (lb/day) = (EF / 365) x N (EQ. B.2-1)

where:

EF = VOC emission factor for type of component and type of service (lb/year-component)

N = Number of components

The emission factors that were used are listed in Table B.2-1.

Table B.2-1
Fugitive VOC Emission Factors for Process Components

Type of Component – Service	VOC Emission Factor (lb/year-component)
Refinery	
Bellows valves – All	0
Non-Bellows valves - HC gas/vapor	23
Non-Bellows valves - Light liquid	19
Pumps, sealless – All	0
Pumps, non-sealless – Light liquid	104
Compressors – Vapor	514
Flanges/Connectors – All	1.5
Pressure relief valves (no rupture disc) - All	1135
Process drains – All	80
Terminals	
Valves - Light liquid	47
Pumps - Light liquid	432
Flanges – All	4.9
Light liquid streams are liquid streams with a vapor pressure greater than that of kerosene (>0.1 psia @ 100 ^{o}F or 689 Pa @ 38 ^{o}C), based on the most volatile class of liquid at >20% by volume. Source: Guidelines for Fugitive Emissions Calculations, Petroleum Industry, SCAQMD, June 1999, Attachment 6	

Emissions of toxic air contaminants (TACs) from process components were also estimated using the following equation:

Emissions (lb/day) = VOC x Wt / 100 (EQ. B.2-2)

where:

VOC = VOC emissions from the process component (lb/day)

Wt = Weight percent of toxic compound in stream passing through the component

The emission factors in Table B.2-1 were used to calculate increases in emissions from new process components as well as reductions in emissions from process components that are anticipated to be removed during process modifications. Chevron estimated the numbers and types of service for components to be added and removed for each refinery process unit and at the terminals. It was assumed that all of the new valves less than 8" in size would be bellows valves and that 50 percent of the removed valves less than 8" in size are bellows valves. The estimated total number of new and removed components at the refinery and the terminals are listed in Table B.2-2. The compositions of the streams for the new and removed process components are listed in the attached spreadsheets.

Table B.2-2
Project Net Components

		Number			
Component Type	**Service**	**El Segundo Refinery**	**Huntington Beach Terminal**	**Montebello Terminal**	**Van Nuys Terminal**
Valves, sealed bellows	Vapor	184	0	0	0
Valves, sealed bellows	Light Liquid	443	0	0	0
Valves, non-sealed bellows	Vapor	-26	0	0	0
Valves, non-sealed bellows	Light Liquid	-950	165	191	236
Pumps, sealless	Light Liquid	29	0	0	0
Pumps, non-sealless	Light Liquid	-17	4	6	4
Compressors	Vapor	2	0	0	0
Flanges/Connectors	All	1,552	472	631	862
Control, check, relief valves	All	90	0	0	0
Process drains	All	0	0	0	0

Chevron has in place an SCAQMD-approved inspection and maintenance program to detect and remedy leaks from process components. This program has allowed Chevron to estimate emissions from process components with emission factors that are more relevant than the SCAQMD default factors.

<u>Emissions from Loading Operations</u>

VOC emissions will be generated by ethanol loading of tanker trucks at a third-party terminal at the Port of Los Angeles. Because the specific terminal has not yet been identified, the vapor recovery unit (VRU) control efficiency is not yet known. Therefore, it was assumed that the emissions would be at the 0.08 lb/1000 gal-limit specified in SCAQMD Rule 462.

The ethanol that will be loaded into tanker trucks at Port of Los Angeles contains five percent gasoline as a denaturant. Emissions of TACs during tanker truck loading were estimated by applying Equation B.2-2 to the estimated total VOC emissions.

Pentanes will be loaded into railcars for transport out of the refinery. The quantities of butanes and propane loaded into railcars will also increase. However, these loading operations will be conducted under pressure, with vapors from the railcar vapor space returned to the storage vessels. Therefore, these loading operations will not additional generate emissions.

<u>Emissions from Sulfur Recovery</u>

Additional sulfur will be removed in order to meet the CARB Phase 3 specifications for gasoline sulfur content. Most of this sulfur will be recovered by the refinery sulfur plant, but a small fraction will be emitted as sulfur oxides. These emissions were estimated using the following equation:

Emissions (lb/day) = S x 2 x (1 - CE / 100) (EQ. B.2-4)

where:

S = Weight of additional sulfur removed (lb/day)

CE = Sulfur plant recovery efficiency (percent)

The additional sulfur to be removed is estimated to be 131 lb/day, based on expected production rates and feed sulfur content. Based on the 1999 emission report, the recovery efficiency was 99.94 percent.

Emissions from Storage Tanks

New emissions from the new gasoline storage tank at the refinery and the emissions from the new ethanol storage tanks, one each at the Huntington Beach and Montebello terminals were estimated using version 4.09 of the US EPA TANKS program. The changes in VOC emissions that are anticipated to occur from changes in service of the two existing tanks at the Van Nuys terminal were also estimated using version 4.09 of the TANKS program. Additionally, emissions of TACs from new tanks and tanks changing service were estimated by applying Equation B.2-2 to the VOC emissions from each storage tank. Outputs from the TANKS program are included as Attachment B.3 to this Appendix.

Emission from Combustion Units

Proposed emissions for the combustion units, the FCC/No. 39 boiler, the NHT-1 furnace F4531, and the cogen trains A and B were evaluated. Proposed emissions for the FCC/No. 39 boiler were calculated by assigning 90% of the current emissions to the FCC and 10% of the current emissions to the boiler. Proposed emissions of the FCC were calculated by increasing the current FCC emissions by a factor of 1.19 based on the anticipated increased usage and applying control factors to the FCC due to SCR and a CO catalyst. It was assumed that PM_{10} emissions are created by the conversion of SO_2 to SO_3 in the SCR and subsequent reaction with water vapor and ammonia slip to form ammonia sulfate at a rate of 5%. CO, VOC, and NO_x emissions will be maintained at or below current levels to comply with current permit limits.

The NHT-1 will have an increased firing rate capacity, as well as modifications that will result in lower emissions. The changes to the NHT-1 will result in an increase in CO, VOC, SO_x, and PM_{10} emissions and a decrease in NO_x emissions.

The cogen trains A and B are not anticipated to have any changes in emissions caused by the use of pentanes for fuel.

B.2.2 Indirect Operational Emissions

In addition to the process related changes in emissions that will result from the modifications at the refinery and terminals, emissions from indirect sources will increase. The indirect sources that were evaluated include:

- Tanker truck trips to deliver ethanol to distribution terminals
- Additional locomotive activity moving the additional rail cars transporting pentane and delivering ethanol to the Montebello distribution terminal
- Additional marine tanker calls for importing ethanol

<u>Emissions from On-Road Motor Vehicles</u>

Equations B.1-11 through B.1-13 were used to calculate exhaust emissions from tanker truck ethanol delivery trips. Equation B.1-8 was used to calculate entrained road dust PM_{10} emissions from these vehicles. Table B.2-3 lists the assignment of these vehicles to vehicle classes and speeds, and Tables B.2-4 through B.2-6 list the emission factors. Note, the ethanol tanker trucks are assumed to be diesel-fueled; only VOC exhaust emission factors (Table B.2-5) are available for diesel trucks. Table B.2-7 lists the parameters used to calculate entrained paved road dust PM_{10} emissions.

Table B.2-3
Motor Vehicle Classes and Speeds During Operations

Vehicle Type	Vehicle Class	Speed (mph)
Ethanol tanker, full, freeway	Heavy heavy-duty truck, diesel	40
Ethanol tanker, full, surface street	Heavy heavy-duty truck, diesel	25
Ethanol tanker, empty, freeway	Heavy heavy-duty truck, diesel	40
Ethanol tanker, empty, surface street	Heavy heavy-duty truck, diesel	25

Table B.2-4
Motor Vehicle CO and NO_X Emission Factors During Operation

Vehicle Type	CO	NO_x
	Running Exhaust (g/mi)	Running Exhaust (g/mi)
Ethanol tanker, full, freeway	3.15	16.74
Ethanol tanker, full, surface street	4.85	17.21
Ethanol tanker, empty, freeway	3.15	16.74
Ethanol tanker, empty, surface street	4.85	17.21
Source: ARB EMFAC2000 motor vehicle emission factor model, Version 2.02, for calendar year 2001, summertime.		

Table B.2-5
Diesel Motor Vehicle VOC Emission Factors During Operation

Vehicle Type	Running Exhaust (g/mi)
Ethanol tanker, full, freeway	0.77
Ethanol tanker, full, surface street	1.15
Ethanol tanker, empty, freeway	0.77
Ethanol tanker, empty, surface street	1.15
Source: ARB EMFAC2000 motor vehicle emission factor model, Version 2.02, for calendar year 2001, summertime.	

Table B.2-6
Motor Vehicle PM_{10} Emission Factors During Operation

Vehicle Type	Running Exhaust (g/mi)	Tire Wear (g/mi)	Brake Wear (g/mi)
Ethanol tanker, full, freeway	0.45	0.04	0.01
Ethanol tanker, full, surface street	0.66	0.04	0.01
Ethanol tanker, empty, freeway	0.45	0.04	0.01
Ethanol tanker, empty, surface street	0.66	0.04	0.01
Source: ARB EMFAC2000 motor vehicle emission factor model, Version 2.02, for calendar year 2001, summertime.			

Table B.2-7
Parameters Used to Calculate Entrained Paved Road Dust PM_{10} Emissions

Vehicle Type	Vehicle Weight (tons)	Road Type	Silt Loading (g/m^2)
Ethanol tanker, full, freeway	40	Freeway	0.020
Ethanol tanker, full, surface street	40	Collector	0.037
Ethanol tanker, empty, freeway	11	Freeway	0.020
Ethanol tanker, empty, surface street	11	Collector	0.037

Ethanol may be transported to the Huntington Beach, Montebello and Van Nuys distribution terminals from a third party terminal(s) at the Port of Los Angeles, or to the Huntington Beach and Van Nuys distribution terminals from the Montebello distribution terminal. Since ethanol transport trips would not originate from both locations on the same day, the peak daily emissions would be associated with transport from the Port of Los Angeles, because trips would be made from there to all three distribution terminals instead of to two distribution terminals when coming from Montebello. The estimated daily travel distance, based on anticipated routing patterns, for ethanol delivery tanker trucks are listed in Table B.2-8.

Table B.2-8
Daily Mileage for Ethanol Tanker Trucks from Port of Los Angeles

Destination	Number/Day	Surface Street (One-Way Miles/Truck per Day)	Freeway (One-Way Miles/Truck per Day)
Huntington Beach	12	21	0
Montebello	18	12	13
Van Nuys	15	3	35

Emissions from Locomotives

Pentane will be transported out of the refinery by rail car. Based on the construction of ten new rail loading spots, the maximum daily number of rail car shipments would increase by ten. This increase in railcar movement will require additional switch engine operating time at the refinery. Additionally, ethanol will be received by railcar at the Montebello terminal.

The following equation was used to estimate the increased locomotive engine exhaust emissions:

Exhaust Emissions (lb/day) = EF x FU (EQ. B.2-5)

where:

EF = Emission factor for specific air contaminant (lb/gal)

FU = Daily fuel use associated with increased switch engine operations (gal/day)

Table B.2-9 provides the emission factors. The emission factors for CO, VOC, NO_x and PM_{10} were taken from "Technical Highlights: Emission Factors for Locomotives" (USEPA, 1997). The emission factor for SO_X was calculated from a 0.05 weight percent limit for sulfur in diesel fuel and a diesel fuel density of 7.1 lb/gal:

EF for SO_X (lb/gal) = 0.0005 lb sulfur/gal x 7.1 lb fuel/gal x 2 lb SO_2/lb sulfur / 453.6 g/lb

= 3.2 g SO_X/gal (EQ. B.2-6)

Table B.2-9
Locomotive Engine Emission Factors

CO (g/gal)	VOC (g/gal)	NO_X (g/gal)	SO_X (g/gal)	PM_{10} (g/gal)
38.1	21	362	3.2	9.2
Source: "Technical Highlights: Emission Factors for Locomotives," EPA420-F-97-051, except SO_X. SO_X estimated from 0.05 wt. percent sulfur in diesel fuel and fuel density of 7.1 lb/gal.				

Based on current operating times and number of railcar movements, it is anticipated that 3.75 hours will be required to handle the ten additional railcars at the refinery. Additionally, the switch engine fuel use averages 7.11 gal/hr. It is anticipated that delivery of ethanol by railcars to the Montebello distribution terminal will require 2820 minutes of locomotive operations. The fuel use during this period was estimated from the anticipated 1,200 horsepower engine rating, a fuel efficiency of 20.8 bhp-hr/gal from USEPA (1997) and a conservative assumption of a 100 percent load factor.

<u>Emissions from Marine Tankers</u>

Chevron currently imports MTBE, FCC feed and toluene by marine tanker to Chevron's El Segundo marine terminal. MTBE will no longer be imported when the project becomes operational, but imports of FCC feed and toluene will increase. Chevron will also import isooctane and isooctene by marine tanker to the El Segundo terminal. Although the imported quantities of FCC feed, toluene, isooctane and isooctene are anticipated to increase, the elimination of MTBE imports is anticipated to lead to a net annual decrease in the number ship calls to the El Segundo terminal. Chevron will import ethanol by marine tanker to a third-party terminal in the Port of Los Angeles. The increase in annual ship calls for ethanol import to the Port of Los Angeles will exceed the decrease in ship calls at the El Segundo terminal by an estimated 12 ship calls per year. Peak daily emissions from marine tankers may increase as a result of the project, since it is possible that a marine tanker would be visiting the Port of Los Angeles to deliver ethanol on the same day that another marine tanker is visiting the El Segundo terminal.

Marine vessel emissions depend on the type of propulsion system (primarily motorships with diesel engines and steamships with diesel-fueled boilers), engine size and engine load. Engine load varies with ship speed during the various modes that occur during a ship call. Ships enter and exit South Coast waters, which extend approximately 100 miles from the coastline, in cruise mode at a speed of about 15 to 23 knots. In the precautionary area, which extends approximately five miles from the San Pedro Bay breakwater, speeds are limited to 12 knots. Between the pier and about one mile outside the breakwater, ships operate in maneuvering mode, usually with tug boat assistance, at an average speed of about five knots.

Motorships operate auxiliary engines and boilers while in port to provide power for lights, ventilation, etc., and steam for hot water and to keep fuel from solidifying. Motorship tankers also use auxiliary engines to power cargo offloading pumps. Steamships use their main boilers while in port, rather than auxiliary engines. These activities that occur while in port are called "hotelling."

In 1996, ARCADIS Geraghty & Miller (formerly Acurex Environmental) prepared a 1993 and projected future year inventories of emissions from marine vessels in the South Coast Air Basin for the SCAQMD) (Acurex Environmental, 1996). ARCADIS Geraghty & Miller (1999) updated the data in the earlier report during 1999 to include a 1997 base year and emissions projected to occur in 2000, 2010 and 2020. The future-year emissions were based on projected future-year emission factors and 1997 vessel activity. Both the original and the updated report evaluated typical vessel and associated engine sizes by type of propulsion system, vessel type (tanker, bulk carrier, etc.), times and engine and engine loads in the various operating modes, emission factors associated with each operating mode, and the resulting emissions. The results from the 1999 update were used to evaluate the potential change in peak daily emissions associated with marine tankers for the project.

The peak daily number of marine tanker calls at the El Segundo terminal is not anticipated to increase from the project, because modifications are not being made to increase the number of tankers that can be accommodated at the same time. Additionally, the peak daily emissions per ship call are not anticipated to increase for the following reasons:

1. There is no reason to anticipate that the sizes of the marine tankers calling on the El Segundo terminal will change significantly, so the engine sizes and resulting emission rates in the various operating modes are not anticipated to change significantly.
2. The times spent in the cruising and maneuvering modes (an estimated total of about eight hours per ship call) are not anticipated to change significantly, so emissions during these operating modes are not anticipated to change.
3. Hourly emissions are higher during the cruising mode than during hotelling, because the engines operate at a higher load. Therefore, peak daily emissions are highest when the entire ship call, including cruising both into and out of port, is completed within a 24-hour period. This will occur if the hotelling time is about 16 hours, since the cruising and maneuvering time is about eight hours. There were occasions during 1999 and 2000 when the hotelling time during ship calls for MTBE and FCC feed import at the El Segundo terminal were about 16 hours.

Import of ethanol to the Port of Los Angeles is anticipated to lead to an increase in emissions from marine tankers. It is anticipated that only one ship call will occur at a time. The specific sizes and types of marine tankers that will be used for ethanol import cannot be identified at this time. Therefore, emissions were estimated for both motorship and steamship marine tankers in the size ranges that ARCADIS Geraghty & Miller (1999) reported as calling on San Pedro Bay ports most frequently during 1997 (473 of 548 total calls by marine tanker motorships between 69,900 and 107,700 deadweight tons and 130 of 231 total calls by marine tanker steamships between 56,200 and 86,600 deadweight tons).

The average times per ship call reported by ARCADIS Geraghty & Miller (1999) for marine tankers in these size ranges during the various operating modes are listed in Table B.2-10. It was assumed that the times for cruising and maneuvering listed in the table will be the same for marine tankers delivering ethanol. However, the hotelling time is estimated to be 16.4 hours, instead of the 62.1-hour average time during 1997, based on offloading 100,000 bbl of ethanol at an estimated offloading rate of 6,700 bbl/hr plus an additional 1.5 hours of hotelling for connecting and disconnecting from the offloading line and other activities. The resulting total time per ship call was estimated to be 25.0 hours for motorships and 24.5 hours for steamships. It was conservatively assumed that all of the emissions associated with these ship calls would occur during a single day, since the total estimated times per ship call exceed 24-hours by only a small amount.

Table B.2-10
Average Times in Operating Modes for Marine Tankers Calling on San Pedro Bay Ports During 1997

Operating Mode	Time in Mode (hours/ship call)	
	Motorships[a]	Steamships[b]
Cruise	3.1	5.6
Precautionary Area Cruise	1.0	1.0
Maneuvering	1.5	1.5
Hotelling	62.1	62.1

[a] Between 69,900 and 107,700 deadweight tons
[b] Between 56,200 and 86,600 deadweight tons
Source: Adapted from ARCADIS Geraghty & Miller (1999)

Marine tanker emissions per ship call estimated by ARCADIS Geraghty & Miller (1999) are listed in Table B.2-11 by emission source and operating mode. Emissions during cruising and maneuvering in the table were assumed to apply to marine tankers delivering ethanol, while emissions during hotelling in the table were multiplied by a factor of 0.264 to account for the shorter hotelling time (16.4 hours for ethanol delivery / 62.1 hours average from Table B.2-10).

Neither of the marine vessel emissions inventory reports includes detailed information on emissions from tugboats. Therefore, data from the Mobil Torrance Refinery Reformulated Fuels Project Volume VII – Revised Draft EIR (SCAQMD, 1998) was used to estimate tug boat emissions during marine tanker ship calls. This Revised Draft EIR provided estimates of the annual emissions from tug boats associated with marine tankers delivering MTBE, as well as the number of ship calls, number of tug boats, and the tug boat operating time. These data were used to estimate the hourly emissions from each tug boat, as shown in Table B.2-12. Tug boat emissions during each ship call for ethanol import were then estimated by multiplying these hourly emissions by the maneuvering time and by the number of tug boats used during each ship call, which was assumed to be two.

Table B.2-11
Estimated Emissions from Marine Tankers Calling on San Pedro Bay Ports During 2000

Source	Mode	CO (lb/call)	VOC (lb/call)	NO_X (lb/call)	SO_X (lb/call)	PM_{10} (lb/call)
Motorships[a]						
Main Engine/Boiler	Cruise	172.98	54.05	1,838.54	1,271.31	148.09
	Precautionary Area Cruise	20.86	6.51	230.02	153.32	17.86
	Maneuvering	14.78	4.63	180.26	102.40	11.95

	Hotelling	0.00	0.00	0.00	0.00	0.00
Auxiliary Engine	All Cruise	16.49	29.55	156.15	84.97	6.12
	Maneuvering	5.82	10.45	55.12	29.98	2.18
	Hotelling	193.10	345.87	1,827.11	994.09	71.78
Auxiliary Boiler	Maneuvering	1.67	0.13	3.98	10.28	0.43
	Hotelling	69.64	5.22	165.82	425.14	17.39
Total		**495.33**	**456.40**	**4,457.00**	**3,071.48**	**275.80**
Steamships[b]						
Main Engine/Boiler	Cruise	27.33	6.50	429.50	1,673.33	385.00
	Precautionary Area Cruise	2.83	0.67	44.17	171.83	39.50
	Maneuvering	1.17	0.17	37.50	146.00	11.83
	Hotelling	62.17	50.83	1,219.33	1,296.33	169.67
Auxiliary Engine	All Cruise	0.00	0.00	0.00	0.00	0.00
	Maneuvering	0.00	0.00	0.00	0.00	0.00
	Hotelling	0.00	0.00	0.00	0.00	0.00
Auxiliary Boiler	Maneuvering	0.00	0.00	0.00	0.00	0.00
	Hotelling	0.00	0.00	0.00	0.00	0.00
Total		**93.50**	**58.17**	**1,730.50**	**3,287.50**	**606.00**

[a] Between 69,900 and 107,700 deadweight tons
[b] Between 56,200 and 86,600 deadweight tons
Source: Adapted from ARCADIS Geraghty & Miller (1999)

Table B.2-12
Calculation of Hourly Tug Boat Emissions

Time Period	**Number of Ship Calls**	**Tug Boat Operating Time (hrs)**	**Emissions**				
			CO (lb)	**VOC (lb)**	**NO_X (lb)**	**SO_X (lb)**	**PM_{10} (lb)**
Annual[a]	23	46	817	18	146	37	110
Hourly			17.76	0.39	3.17	0.80	2.39

[a] From Mobil Torrance Refinery Reformulated Fuels Project Volume VII – Revised Draft EIR (SCAQMD, 1998)

B.3 EMISSIONS SUMMARIES (PRE-MITIGATION)

B.3.1 Construction Emissions Summary

Tables B.3-1 through B.3-13 list estimated peak daily emissions during construction at each process unit and terminal.

Table B.3-1
Common Refinery Construction Activities Emissions Summary
(Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	381.7	62.1	578.7	53.7	34.4	NA	34.4
Onsite Fugitive PM_{10}	NA	NA	NA	NA	NA	202.7	202.7
Asphaltic Paving	NA	1.8	NA	NA	NA	NA	NA
Architectural Coating	NA	35.0	NA	NA	NA	NA	NA
Total Onsite	**381.7**	**98.9**	**578.7**	**53.7**	**34.4**	**202.7**	**237.0**
Offsite Haul Truck Soil Loss	NA	NA	NA	NA	NA	32.1	32.1
Total Offsite	**0.0**	**0.0**	**0.0**	**0.0**	**0.0**	**32.1**	**32.1**
TOTAL	**381.7**	**98.9**	**578.7**	**53.7**	**34.4**	**234.7**	**269.1**

Note: Sums of individual values may not equal totals because of rounding.
NA: Not Applicable

Table B.3-2
Refinery Construction Motor Vehicle Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Onsite Motor Vehicles	27.8	5.2	39.2	0.0	1.6	56.1	57.7
Offsite Motor Vehicles	447.8	65.2	146.4	0.0	4.6	184.3	188.9
TOTAL	**475.6**	**70.3**	**185.6**	**0.0**	**6.2**	**240.4**	**246.6**

Note: Sums of individual values may not equal totals because of rounding.

Table B.3-3
Alkylate Depentanizer Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	38.5	10.1	81.7	7.8	5.0	NA	5.0

Table B.3-4
Isomax Depentanizer Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	31.9	8.0	65.8	6.4	4.0	NA	4.0

Table B.3-5
Pentane Storage Sphere Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	119.4	22.6	200.6	21.9	11.3	NA	11.3

Table B.3-6
Pentane Railcar Facility Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	73.2	15.6	133.8	13.9	7.8	NA	7.8

Table B.3-7
NHT-1 Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	32.7	8.7	70.5	6.7	4.4	NA	4.4

Table B.3-8
Additional Gasoline Storage Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	231.6	47.3	410.7	43.5	23.7	NA	23.7

Table B.3-9
FCC Stack Emission Reduction System Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	33.8	8.7	70.7	6.8	4.3	NA	4.3

Table B.3-10
Alkylation Plant Modifications Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	14.5	3.0	25.8	2.7	1.5	NA	1.5

Table B.3-11
Huntington Beach Terminal Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	41.4	7.6	55.9	5.7	3.6	NA	3.6
Architectural Coating	NA	35.0	NA	NA	NA	NA	NA
Total Onsite	**41.4**	**42.6**	**55.9**	**5.7**	**3.6**	**NA**	**3.6**
Offsite Motor Vehicles	**54.7**	**8.3**	**27.9**	**0.0**	**1.0**	**30.6**	**31.6**
TOTAL	**96.1**	**50.9**	**83.7**	**5.7**	**4.5**	**30.6**	**35.1**
Note: Sums of individual values may not equal totals because of rounding. NA: Not Applicable							

Table B.3-12
Montebello Terminal Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	57.7	10.3	73.5	7.4	4.7		4.7
Architectural Coating	NA	35.0	NA	NA	NA	NA	NA
Total Onsite	**57.7**	**45.3**	**73.5**	**7.4**	**4.7**	**NA**	**4.7**
Offsite Motor Vehicles	**69.8**	**10.3**	**29.2**	**0.0**	**1.0**	**31.2**	**32.2**
TOTAL	**127.5**	**55.6**	**102.7**	**7.4**	**5.7**	**31.2**	**36.9**
Note: Sums of individual values may not equal totals because of rounding. NA: Not Applicable							

Table B.3-13
Van Nuys Terminal Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	41.4	7.6	55.9	5.7	3.6	NA	3.6
Architectural Coating	NA	35.0	NA	NA	NA	NA	NA
Total Onsite	**41.4**	**42.6**	**55.9**	**5.7**	**3.6**	**NA**	**3.6**
Offsite Motor Vehicles	**54.7**	**8.3**	**27.9**	**0.0**	**1.0**	**30.6**	**31.6**
TOTAL	**96.1**	**50.9**	**83.7**	**5.7**	**4.5**	**30.6**	**35.1**

Note: Sums of individual values may not equal totals because of rounding.
NA: Not Applicable

Because construction is not anticipated to occur at every process unit and terminal simultaneously, the overall peak daily construction emissions will not be equal to the sum of the peak daily emissions listed in the preceding tables. Therefore, the anticipated overlap of construction at the various locations was evaluated to determine overall peak daily emissions. First, it was conservatively assumed that the peak daily emissions during construction at each overlapping location would occur at the same time. Next, the locations where construction is anticipated be taking place were identified for each month of the entire construction period. The peak daily emissions from the construction activities taking place each month were then added together to estimate the total peak daily emissions during each month. Finally, the months with the highest peak daily emissions were identified.

The resulting peak daily emissions are anticipated to occur during a two-month period that includes all of the construction activities except installation of the FCC stack emissions reduction facilities and modifications to the alkylation plant. The estimated emissions during this period are summarized in Table B.3-14 along with the CEQA significance level for each pollutant. As shown in the table, significance thresholds are exceeded for all pollutants during construction. Most of the emissions are associated with construction activities at the refinery. In fact, emissions associated with construction at each of the terminals are below the significance levels. The emissions estimates represent a “worst-case,” because they incorporate the assumption that construction activities at each location occur at the peak daily levels throughout the construction period. It is unlikely that the peak daily levels would actually occur at all locations where construction is taking place at the same time.

Table B.3-14
Overall Peak Daily Construction Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	1,049.5	200.0	1,726.9	172.7	102.4	NA	102.4
Onsite Motor Vehicles	27.8	5.2	39.2	0.0	1.6	56.1	57.7
Onsite Fugitive PM_{10}	NA	NA	NA	NA	NA	202.7	202.7
Asphaltic Paving	NA	1.8	NA	NA	NA	NA	0.0
Architectural Coating	NA	140.0	NA	NA	NA	NA	0.0
Total Onsite	**1,077.3**	**346.9**	**1,766.1**	**172.7**	**104.0**	**258.8**	**362.8**
Offsite Haul Truck Soil Losses	NA	NA	NA	NA	NA	32.1	32.1
Offsite Motor Vehicles	627.0	92.1	231.4	0.0	7.5	276.7	284.2
Total Offsite	**627.0**	**92.1**	**231.4**	**0.0**	**7.5**	**308.8**	**316.2**
TOTAL	**1,704.4**	**439.0**	**1,997.5**	**172.7**	**111.5**	**567.6**	**679.1**
CEQA Significance Level	*550*	*75*	*100*	*150*	---	---	*150*
Significant? (Yes/No)	**Yes**	**Yes**	**Yes**	**Yes**	---	---	**Yes**

Note: Sums of individual values may not equal totals because of rounding.
NA: Not Applicable

B-3-2 Operational Emissions Summary

Table B.3-15 lists the estimated peak daily direct operational emissions at the refinery and at each of the terminals, as well as the indirect emissions from the refinery switch engine, ethanol tanker truck deliveries, and ethanol marine tanker deliveries. Tables B.3-16 and B.3-17 compare the operational emissions with the CEQA significance levels for sources subject to RECLAIM and for non-RECLAIM sources, respectively. As seen in Table B.3-17, the significance level is exceeded for VOC, NO_x, SO_2, and PM_{10} emissions.

Table B.3-15
Peak Daily Project ~~Direct~~ Operational Emissions Summary (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	PM_{10} (lb/day)
Direct Emissions					
El Segundo Refinery					
Fugitive VOC from process components	0.0	-46.7	0.0	0.0	0.0
Modified equipment (FCC)	0.0	0.0	0.0	153.4	268.8
Modified equipment (NHT-1)	12.2	6.6	-29.4	7.3	13.7
Cogen Trains A and B	0.0	0.0	0.0	0.0	0.0
New tank 1016	0.0	34.3	0.0	0.0	0.0
Sulfur recovery plant	0.0	0.0	0.0	0.2	0.0
Total	**12.2**	**-5.9**	**-29.4**	**160.9**	**282.5**
Montebello Terminal					
Fugitive VOC from components	0.0	40.2	0.0	0.0	0.0
New ethanol storage tank	0.0	5.0	0.0	0.0	0.0
Total	**0.0**	**45.2**	**0.0**	**0.0**	**0.0**
Van Nuys Terminal					
Fugitive VOC from components	0.0	46.7	0.0	0.0	0.0
Converted ethanol storage tanks	0.0	-9.1	0.0	0.0	0.0
Total	**0.0**	**37.6**	**0.0**	**0.0**	**0.0**
Huntington Beach Terminal					
Fugitive VOC from components	0.0	32.3	0.0	0.0	0.0
Converted ethanol storage tank	0.0	-0.1	0.0	0.0	0.0
Total	**0.0**	**32.2**	**0.0**	**0.0**	**0.0**
Port of Los Angeles					
Ethanol tanker truck loading	0.0	31.7	0.0	0.0	0.0
Total	**0.0**	**31.7**	**0.0**	**0.0**	**0.0**
Total Direct Emissions	**12.2**	**140.7**	**-29.4**	**160.9**	**282.5**
Indirect Emissions					
Refinery switch engine	2.2	1.2	21.3	0.2	0.5
Montebello Locomotive	2.3~~1.6~~	1.2~~0.9~~	21.5~~15.3~~	0.2~~0.1~~	0.5~~0.4~~
Ethanol tanker truck deliveries	21.5	5.2	95.0	0.0	71.4
Ethanol marine tanker deliveries	355.4	199.3	3,000.7	2,336.2	488.4
Total Indirect Emissions	**381.4~~380.7~~**	**207.0~~206.7~~**	**3,138.4~~3,123.3~~**	**2,336.6**	**560.8~~560.6~~**
Note: Sums of individual values may not equal totals because of rounding.					

Table B.3-16
Project Operational Criteria Pollutant Emissions Summary for RECLAIM Sources

Pollutant	Direct Emissions (lb/day)	RECLAIM Allocations[a] (lb/day)	Total (lb/day)	SCAQMD CEQA Threshold (lb/day)	Significant?
NO_X	-29	5,668	5,639	15,533	No
SO_2	161	2,602	2,763	5,181	No

[a] The 2003 facility Allocation for NO_x and SO_x includes purchased RTCs and is converted to pounds per day by dividing 365 days per year.

Table B.3-17
Project Operational Criteria Pollutant Emissions Summary for Non-RECLAIM Sources

Pollutant	Direct Emissions (lb/day)	Indirect Emissions (lb/day)	Total (lb/day)	SCAQMD CEQA Threshold (lb/day)	Significant?
CO	12	381	393	550	No
VOC [a]	141	207	347	55	**Yes**
NO_X	NA	3,138~~3,132~~	3,138~~3,132~~	55	**Yes**
SO_X	NA	2,337	2,337	150	**Yes**
PM_{10}	283	561	843	150	**Yes**

[a] Does not include emission changes from changes in tank service.

Anticipated changes in direct operational emissions of TACs at the refinery and the terminals are listed in Table B.3-18. All of the toxic compounds listed are SCAQMD Rule 1402 carcinogenic contaminants.

Table B.3-18
Changes in Direct Operational Toxic Air Contaminant Emissions

Species	Emissions (lbs/year)			
	El Segundo Refinery	Huntington Beach Terminal	Montebello Terminal	Van Nuys Terminal
Toxic Air Contaminants for Which Health Risk Factors Exist				
Acetaldehyde	12.9	0.0	0.0	0.0
Acrolein	0.0	0.0	0.0	0.0
Ammonia	1,550.0	0.0	0.0	0.0
Benzene	6.8	7.3	9.2	-6.9
1,3-Butadiene	-18.6	0.0	0.0	0.0
Hexavalent Chromium	0.0	0.0	0.0	0.0
Copper	0.0	0.0	0.0	0.0
Formaldehyde	35.1	0.0	0.0	0.0
Hydrogen Cyanide	0.0	0.0	0.0	0.0
Hydrogen Sulfide	3.3	0.0	0.0	0.0
Manganese	0.4	0.0	0.0	0.0
Mercury	0.1	0.0	0.0	0.0
Methanol	-5,523.4	0.0	0.0	0.0
Naphthalene	7.7	0.0	0.0	0.0
Nickel	0.0	0.0	0.0	0.0
Phenol	3.6	0.0	0.0	0.0
PAH	0.0	0.0	0.0	0.0
Toluene	58.5	22.2	29.3	-43.9
Xylenes (Mixed)	25.8	29.0	39.5	-22.9
Zinc	0.6	0.0	0.0	0.0
Benzo(A)anthracene	0.0	0.0	0.0	0.0
Benzo(B)Fluoranthene	0.0	0.0	0.0	0.0
Benzo(K)Fluoranthene	0.0	0.0	0.0	0.0
Indeno(123cd)Pyrene	0.0	0.0	0.0	0.0
Sulfuric Acid	20.3	0.0	0.0	0.0
Other Toxic Air Contaminants				
Ethyl Benzene	4.6	1.0	1.4	-11.2
Hexane	-14.8	49.6	64.4	-41.8
MTBE	-65.7	0.0	0.0	0.0

B.4 EMISSIONS SUMMARIES (MITIGATED)

B.4.1 Construction Emissions

As indicated in the previous summary tables, construction activities may have significant unmitigated air quality impacts for CO, VOC, NO_X, SO_X, and PM_{10}. Construction emissions are primarily from: 1) onsite fugitive dust from grading and excavation; 2) onsite exhaust emissions (CO, VOC, NO_X, SO_X, and PM_{10}) from construction equipment; 3) onsite VOC emissions from asphaltic paving and painting; 4) offsite exhaust emissions from truck traffic and worker commute trips; 5) offsite road dust associated with traffic to and from the construction site; 6) and offsite fugitive dust (PM_{10}) from trucks hauling materials, construction debris, or excavated soils from the site.

Table B.4-1 lists mitigation measures for each construction emission source and identifies the estimated control efficiency of each measure. As shown in the table, no feasible mitigation has been identified for the emissions from architectural coating or from on-road vehicle trips. Additionally, no other feasible mitigation measures have been identified to further reduce emissions. 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 B.4-2 presents a summary of overall peak daily mitigated construction emissions. The table includes the emissions associated with each source and an estimate of the reductions associated with mitigation. The implementation of mitigation measures, while reducing emissions, does not reduce the construction-related CO, VOC, NO_X, SO_X or PM_{10} impacts below significance.

B.4.2 Operational Emissions

The project operational CO emission increase is below the emissions significance criteria threshold applied to this project. However, operational VOC, NO_x, SO_x and PM_{10} emissions from sources that are not subject to RECLAIM are anticipated to exceed the significance criterion. These increased VOC, NO_x, SO_x and PM_{10} emissions are primarily due to ethanol deliveries by marine vessel at the Port of Los Angeles.

Project operational VOC emissions at the Refinery will be substantially reduced through the application of BACT, which, by definition, is the lowest achievable emission rate. For example, except for valves larger than eight inches, the new valves to be installed will be of the bellow-seals (leakless) variety.

The VOC exceedance does not include the actual emission reductions that will result from the storage of lower vapor pressure CARB Phase 3 reformulated gasoline at the Refinery and terminals. Although the actual VOC emission reductions will occur, the current maximum potential to emit permit conditions will no be changed. This means that the Refinery will not be required to

Table B.4-1
Construction-Related Mitigation Measures and Control Efficiency

Mitigation Measure Number	Mitigation	Source	Pollutant	Control Efficiency (%)
AQ-1	Increase watering of active site by one time per	Onsite Fugitive	PM_{10}	16

	day[a]	Dust PM_{10}		
AQ-2	Wash wheels of all vehicles leaving unimproved areas	Onsite Fugitive Dust PM_{10}	PM_{10}	Not Quantified
AQ-3	Remove all visible roadway dust tracked out onto paved surfaces from unimproved areas at the end of the workday	Onsite Fugitive Dust PM_{10}	PM_{10}	Not Quantified
AQ-4	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 PM_{10}	Unknown Unknown Unknown Unknown Unknown
AQ-5	Use low sulfur diesel (as defined in SCAQMD Rule 431.2) where feasible.	Construction Equipment	SO_X PM_{10}	Unknown
AQ-6	Proper equipment maintenance	Construction Equipment Exhaust	CO VOC NO_X SO_X PM_{10}	5 5 5 5 0
AQ-7	Cover haul trucks with full tarp	Haul Truck Soil Loss	PM_{10}	90
	No feasible measures identified	Architectural Coating	VOC	N/A
	No feasible measures identified[b]	On-Road Motor Vehicles	CO VOC NO_X PM_{10}	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 the site two times per day, reducing fugitive dust by 50 percent. This mitigation measure assumes an incremental increase in the number of times per day the site is 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.

Table B.4-2
Overall Peak Daily Construction Emissions (Mitigated)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Onsite Construction Equipment Exhaust	1,049.5	200.0	1,726.9	172.7	102.4	NA	102.4
Mitigation Reduction (%)	0%	5%	5%	5%	5%	---	
Mitigation Reduction (lb/day)	0.0	-10.0	-86.3	-8.6	-5.1	---	-5.1

Remaining Emissions	**1,049.5**	**190.0**	**1,640.6**	**164.1**	**97.3**	---	**97.3**
Onsite Motor Vehicles	27.8	5.2	39.2	0.0	1.6	56.1	57.7
Mitigation Reduction (%)	0%	0%	0%	0%	0%	0%	
Mitigation Reduction (lb/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Remaining Emissions	**27.8**	**5.2**	**39.2**	**0.0**	**1.6**	**56.1**	**57.7**
Onsite Fugitive PM10	NA	NA	NA	NA	NA	202.7	202.7
Mitigation Reduction (%)	---	---	---	---	---	16%	
Mitigation Reduction (lb/day)	---	---	---	---	---	-32.4	-32.4
Remaining Emissions	---	---	---	---	---	170.3	170.3
Asphaltic Paving	NA	1.8	NA	NA	NA	NA	NA
Mitigation Reduction (%)	---	0%	---	---	---	---	---
Mitigation Reduction (lb/day)	---	0.0	---	---	---	---	---
Remaining Emissions	---	**1.8**	---	---	---	---	---
Architectural Coating	NA	140.0	NA	NA	NA	NA	NA
Mitigation Reduction (%)	---	0%	---	---	---	---	---
Mitigation Reduction (lb/day)	---	0.0	---	---	---	---	---
Remaining Emissions	---	**140.0**	---	---	---	---	---
Total Onsite	**1,077.3**	**336.9**	**1,679.8**	**164.1**	**98.9**	**226.4**	**325.3**
Offsite Haul Truck Soil Loss[a]	NA	NA	NA	NA	NA	64.1	64.1
Mitigation Reduction (%)	---	---	---	---	---	90%	
Mitigation Reduction (lb/day)	---	---	---	---	---	-57.7	-57.7
Remaining Emissions	---	---	---	---	---	6.4	6.4
Offsite Motor Vehicles	627.0	92.1	231.4	0.0	7.5	276.7	284.2
Mitigation Reduction (%)	0%	0%	0%	0%	0%	0%	
Mitigation Reduction (lb/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Remaining Emissions	**627.0**	**92.1**	**231.4**	**0.0**	**7.5**	**276.7**	**284.2**
Total Offsite	**627.0**	**92.1**	**231.4**	**0.0**	**7.5**	**283.1**	**290.6**
TOTAL	**1,704.4**	**429.0**	**1,911.2**	**164.1**	**106.4**	**509.5**	**615.9**
Significance Threshold	*550*	*75*	*100*	*150*	---	---	*150*
Significant? (Yes/No)	**Yes**	**Yes**	**Yes**	**Yes**	---	---	**Yes**

Note: Sums of individual values may not equal totals because of rounding.

[a] Does not include 50% control from freeboard, since tarp is being used instead to achieve 90% control

limit emissions to the new lower levels, but could, theoretically, continue to emit up to the maximum potential to emit. Therefore, no credit for reducing emissions due to the lower vapor pressure of CARB Phase 3 reformulated gasoline will be allowed for the proposed project. It also should be noted that the specific VOCs that increase as a result of the project were evaluated as part of a HRA (Section B.5) and, based on their composition, are not anticipated to create localized human health risks.

NO_X, SO_X, and PM_{10} are of local, as well as regional concern. As seen from the summary in Table B.3-15, anticipated peak daily emissions of these pollutants are primarily associated with a marine tanker ship calls to deliver ethanol at the Port of Los Angeles. Additionally, locomotive operations contribute to NO_X emissions, and tanker trucks delivering ethanol to the terminals contribute to both NO_X and PM_{10} emissions.

No feasible mitigation measures have been identified to reduce emissions from marine tankers, the locomotives, or the tanker trucks. No feasible technologies to reduce emissions to levels that would reduce operational emissions below the significance thresholds were identified. Additionally, the U.S. EPA has the authority to regulate emissions from locomotives and ocean-going vessels, and the U.S. EPA and CARB have the authority to regulate emissions from motor vehicles. The SCAQMD has limited authority to regulate emissions from on-road mobile sources. The SCAQMD, however, has no authority to regulate off-road mobile sources. In particular, the SCAQMD evaluated potential measures to mitigate marine vessel emissions for another project and concluded that the SCAQMD has no jurisdictional authority to impose conditions that affect marine vessel emissions. Further, the SCAQMD is prohibited from imposing mitigation measures that may hinder or impair safety at the Port of Los Angeles. For a complete discussion demonstrating the SCAQMD has no jurisdictional authority to regulate emissions from marine vessels, the reader is referred to the Mobil Torrance Refinery Fuels Project Volume VII – Revised Draft EIR (SCAQMD, 1998).

A potential alternative for importing ethanol would be by tanker truck, but this mode could lead to emissions similar to those from marine tankers. Importing ethanol by pipeline is not feasible because of the risk of contamination with water.

Similarly, potentially feasible alternatives to exporting pentanes by railcar, such as by marine tanker, would lead to emissions similar to those from import of ethanol by marine tanker. Exporting pentanes by pipeline is not feasible without construction of new pipelines, which is not economically feasible.

The only potentially technically feasible alternative to ethanol delivery to the terminals by tanker truck or by railcar would be delivery by pipeline. However, pipeline delivery would require dedicated pipelines to avoid contamination by water, and pipelines that could be dedicated to ethanol distribution do not exist.

Therefore, operational NO_X, SO_X, and PM_{10} emissions cannot be mitigated to levels below the significance thresholds. However, it should be noted that marine tanker calls to deliver ethanol are intermittent, so the peak daily emissions will not occur every day. Furthermore, in Table B.3-15, SO_X and PM_{10} emissions from other sources that are not subject to RECLAIM are anticipated to be 0.2 and 121 pounds per day, respectively, which are below the significance thresholds. Additionally, total NO_X emissions from sources at the Refinery, including sources subject to RECLAIM, are anticipated to decrease by about 8 pounds per day, which is below the significance criterion.

B.5 RISK ASSESSMENTS

Risk assessments procedures for SCAQMD Rule 1401 were followed for the Refinery, the three distribution terminals, and the third-party Port of Los Angeles marine terminal. SCAQMD Rule 1401 risk assessment procedures consist of four tiers, or levels of effort to assess impacts, from a quick look-up table (Tier 1) to a detailed risk assessment involving air quality modeling analysis (Tier 4). For the Refinery, a health risk assessment (Tier 4) was prepared and is described in detail below. The emissions of TACs at the terminals exceed Tier 1 thresholds. Therefore, a Tier 2 analysis was performed for the Huntington Beach, Montebello, and Van Nuys terminals. Results of the Tier 2 analysis are presented below.

The Tier 2 screening risk assessment consists of calculating the MICR, as well as the acute and chronic hazard index (HIA and HIC), due to all TACs at each terminal. Table B.5-1 summarizes the calculated values for the MIC and compares them to the thresholds for each terminal.

Table B.5-1
Tier 2 Analysis Results and Comparison to Significance Threshold for MICR

Terminal	MICR	Significance Threshold	Exceeds Threshold
Huntington Beach	0.11	1.0	No
Montebello	0.21	1.0	No
Van Nuys	0.19	1.0	No

Table B.5-2 presents the HIA by target organ and compares this result to the threshold for each terminal.

Table B.5-2
Tier 2 Analysis Results and Comparison to Threshold for HIA

Target Organ	Huntington Beach	Montebello Terminal	Van Nuys Terminal	Significance Threshold	Exceeds Threshold
Cardiovascular	3.11E-05	7.54E-05	NA	1.0	No
Central nervous system	3.84E-06	9.60E-06	NA	1.0	No
Endocrine	0.00E+00	0.00E+00	NA	1.0	No
Eye	1.22E-05	3.14E-05	NA	1.0	No
Immune	3.11E-05	7.54E-05	NA	1.0	No
Kidney	0.00E+00	0.00E+00	NA	1.0	No
Gastrointestinal system/liver	0.00E+00	0.00E+00	NA	1.0	No
Reproductive	3.50E-05	8.50E-05	NA	1.0	No
Respiratory	1.22E-05	3.14E-05	NA	1.0	No
Skin	0.00E+00	0.00E+00	NA	1.0	No

Table B.5-3 presents the HIC by target organ and compares this result to the threshold for each terminal.

Table B.5-3
Tier 2 Analysis Results and Comparison to Threshold for HIC

Target Organ	Huntington Beach	Montebello Terminal	Van Nuys Terminal	Significance Threshold	Exceeds Threshold
Cardiovascular	6.14E-05	1.22E-04	0.00E+00	1.0	No
Central nervous system	1.25E-04	2.51E-04	0.00E+00	1.0	No
Endocrine	2.55E-07	5.42E-07	0.00E+00	1.0	No
Eye	0.00E+00	0.00E+00	0.00E+00	1.0	No
Immune	0.00E+00	0.00E+00	0.00E+00	1.0	No
Kidney	2.55E-07	5.42E-07	0.00E+00	1.0	No
Gastrointestinal system/liver	2.55E-07	5.42E-07	0.00E+00	1.0	No
Reproductive	9.96E-05	2.00E-04	0.00E+00	1.0	No
Respiratory	6.13E-05	1.24E-04	9.35E-06	1.0	No
Skin	0.00E+00	0.00E+00	0.00E+00	1.0	No

An estimate of the cancer burden is only required when the MICR exceeds one in one million. As shown in Table B.5-1, the Rule 1401 threshold value for the MICR is not exceeded at any of the terminals. Thus, the cancer burden has not been estimated. Additionally, the Rule 1401 threshold values of the HIA and the HIC have not been exceeded at any of the terminals. Therefore, further analysis was not required for the terminals.

The TAC emissions at the as-yet undetermined marine terminal in the Port of Los Angeles are due to the loading of ethanol at a third-party marine terminal into tanker trucks. Since the vapor recovery unit efficiency at the as-yet unidentified third-party marine terminal is not known, a conservative “worse-case” assumption was made, and the SCAQMD maximum emission factor per Rule 462 was used to estimate emissions. Estimated daily benzene emissions due to loading of 45 tanker trucks with ethanol at the marine terminal are less than the total project benzene emissions at either the Montebello or Huntington Beach Terminals. Since the third-party marine terminal has not yet been selected and information, such as distance to receptors and the property line, are not known, a site-specific detailed analysis has not been performed.

While the third-party marine terminal will be responsible for reporting the emissions from the ethanol tanker truck loading and performing any associated risk assessments that may be required, the TAC emissions can be compared to those from the Chevron distribution terminals to obtain a better understanding of the potential risks. Greater benzene emissions from the Montebello and Huntington Beach Terminals result in a maximum individual cancer risk (MICR) that is approximately one order of magnitude less than the threshold for this project, as shown in Table B.5-1. Therefore, it is assumed that the lower emissions from ethanol loading at the third-party marine terminal will not result in a risk that is significant.

Atmospheric dispersion modeling was conducted to determine the localized ambient air quality impacts from the proposed project at the refinery. The health risk assessment modeling was prepared based on the most recent Health Risk Assessment (HRA) for the El Segundo Refinery. The atmospheric dispersion modeling methodology used for the project follows generally accepted modeling practice and the modeling guidelines of both the EPA and the SCAQMD. All dispersion modeling was performed using the Industrial Source Complex Short-Term 3 (ISCST3) dispersion model (Version 00101) (EPA, 2000). The outputs of the dispersion model were used as input to a risk assessment using the ACE2588 (Assessment of Chemical Exposure for AB2588) risk assessment model (Version 93288) (CAPCOA, 1993). The updates to the ACE2588 model are consistent with those used in the most recent HRA for the refinery. Input and output listings of model runs are provided in Attachment B.4 to this Appendix.

<u>Model Selection</u>

The dispersion modeling methodology used follows EPA and SCAQMD guidelines. The ISCST3 model (Version 00101) is an EPA model used for simulating the transport and dispersion of emission sources in areas of both simple, complex, and intermediate terrain. Simple terrain, for air quality modeling purposes, is defined as a region where the heights of release of all emission sources are above the elevation of surrounding terrain. Complex terrain is defined as those areas where nearby terrain elevations exceed the release height of emissions from one or more sources. Intermediate terrain is that which falls between simple and complex terrain. Simple terrain exists in the vicinity of the refinery.

Modeling Options

The options used in the ISCST3 dispersion modeling are summarized in Table B.5-5. EPA regulatory default modeling options were selected except for the calm processing option. Since the meteorological data set developed by the SCAQMD is based on hourly average wind measurements, rather than airport observations that represent averages of just a few minutes, the SCAQMD's modeling guidance requires that this modeling option not be used.

Meteorological Data

The SCAQMD has established a standard set of meteorological data files for use in air quality modeling in the Basin. For the vicinity of the refinery, the SCAQMD requires the use of its Lennox 1981 meteorological data file. This is the meteorological data file used for recent air quality and Health Risk Assessment (HRA) modeling studies at the refinery. To maintain consistency with this prior modeling, and following SCAQMD modeling guidance, the 1981 Lennox meteorological data set was used for this modeling study.

In the Lennox data set, the surface wind speeds and directions were collected at the SCAQMD's Lennox monitoring station, while the upper air sounding data used to estimate hourly mixing heights were gathered at Los Angeles International Airport. Temperatures and sky observation (used for stability classification) were taken from Los Angeles Airport data.

Receptors

Appropriate model receptors must be selected to determine the "worst-case" modeling impacts. For this modeling, a coarse grid of receptors was used. In addition, residential receptors were located on the north and south sides of the property. No receptors were placed within the refinery property line. Terrain heights for all receptors were obtained from the Refinery HRA.

Table B.5-5
Dispersion Modeling Options for ISCST3

Feature	Option Selected
Terrain processing selected	Yes
Meteorological data input method	Card Image
Rural-urban option	Urban
Wind profile exponents values	Defaults
Vertical potential temperature gradient values	Defaults
Program calculates final plume rise only	Yes
Program adjusts all stack heights for downwash	Yes
Concentrations during calm period set = 0	No
Aboveground (flagpole) receptors used	No
Buoyancy-induced dispersion used	Yes
Surface station number	52118
Year of surface data	1981
Upper air station number	91919
Year of upper air data	1981

Source Parameters

Tables B.5-6 and B.5-7 summarize the source parameter inputs to the dispersion model. The source parameters presented are based upon the parameters of the existing and proposed equipment at the facility. Fifteen sources comprised of eleven sources of components with fugitive emissions, one new storage tank and three combustion source stacks were modeled. The eleven sources comprised of components with fugitive emissions were modeled as rectangular area sources. The tank was modeled as an area source. The emission rate used in the ISCST3 model run for the area sources is in units of g/s-m^2. A unit emission rate of 1 g/s was used, so that the emission rate is the inverse of the area in units of g/s-m^2. Table B.5-6 details modeling parameters for the area sources, and Table B.5-7 details modeling parameters for the point sources.

The coordinates listed in Table B.5-7 are the first vertex of the rectangle, the center of the tank, or the location of the point source. The new NHT-1 Furnace 4531 stack will be located approximately 50 feet east of the existing stack. This location change is reflected in the coordinates listed for Model ID 90052 below. The emission rate used in the ISCST3 model run for the area sources is in units of g/s-m^2. A unit emission rate of 1 g/s was used, so that the emission rate is the inverse of the area in units of g/s-m^2. The emission rate used in the ISCST3 model run for the point sources is in units of g/s.

Table B.5-6
Area Source Locations and Parameters Used in Modeling the Proposed Project

Model ID/Equipment	UTM X [m]	UTM Y [m]	Elevation Z [m]	Area [m^2]	Q [$g/s\text{-}m^2$]
100/Fugitives for Additional Gasoline Storage	368585	3753275	46.8	455,000	2.20E-06
254/Fugitives for Alky Modifications	369671	3753040	33.3	11,751	8.51E-05
257/Fugitives for Iso-Octene Plant	370201	3752340	35.1	1,208	8.28E-04
258/Fugitives for FCC Modifications consisting of Light Gasoline Depentanizer, Light Gasoline Splitter, Debutanizer, Depropanizer, C3 Caustic/MEA Treating	369723	3752628	31.2	12,210	8.19E-05
323/Fugitives for FCC C4 Treating	369457	3753122	32.6	800	1.25E-03
330/Fugitives for Deisobutanizer Reactivity	369671	3753040	33.3	6,300	1.59-04
346/Fugitives for FCC Modifications consisting of WGC Interstage System, Deetathanizer, MAB Upgrade, Stack Emission Reduction, Relief/Vapor Recovery System	369740	3752588	32.4	10,000	1.00E-04
834/Fugitives for Isomax Depentanizer	370312	3752388	33.6	11,990	8.34E-05
837/Fugitives for NHT-1	370114	3752212	33.9	7,200	1.39E-04
1001/Fugitives for Pentane Storage Sphere	370592	3752666	32.0	600	1.67E-03
1002/Fugitives for Pentane Export Railcar Load Rack Facility	370875	3753230	32.0	153,000	6.54E-06
1016/Fugitives for Tank 1016	369730	3752221	32.0	4,933	2.03E-04

Table B.5-7
Point Source Locations and Parameters Used in Modeling

Model ID/Equipment	UTM X [m]	UTM Y [m]	Stack Base Elevations Above MSL Z [m]	Release Height Above Ground Level [m]	Q [g/s]
90026/No. 39 Boiler Main Stack	369746	3752659	31.3	46.9	1.00E+00
90027/No. 39 Boiler Auxiliary Stack	369746	3752654	31.4	42.6	1.00E+00
90052/NHT#1 Furnace 4531 Stack (current)	370149	3752437	32.9	31.1	1.00E+00
90052/NHT#1 Furnace 4531 Stack (proposed)	370164	3752437	32.9	31.1	1.00E+00
Note: MSL = mean sea level					

Emissions

The modeling was performed using only direct operational emissions associated with the proposed project. These emissions consist of toxic emissions resulting from the removal and addition of components with fugitive emissions in various process streams at the refinery, as well as the proposed new storage tank, increased usage of the No. 39 boiler and modifications to the NHT-1 Furnace 4531.

With respect to the components with fugitive emissions, since the components are associated with a variety of streams, the emissions for some toxic pollutants increased at a specific location, whereas other toxics decreased. Thus, two model runs were created, one for the increase in toxic emissions and one for the decrease. For the components, the annual emission rate was based on the calculated annual emissions, and the peak hourly emission rate was derived from the annual emission rate assuming continuous operations at 8,760 hours per year. The emission rates used in the ACE2588 model run were in units of g/s.

Current emissions for the FCC/No. 39 boiler and NHT-1 Furnace 4531 were taken from the most recent HRA. Proposed emissions for the FCC/No. 39 boiler were allocated by assigning 90% of the proposed emissions to the FCC and 10% of the proposed emissions to the boiler. The proposed FCC emissions were assigned to the existing auxiliary stack and the proposed boiler emissions were assigned to the existing main stack.

The NHT-1 Furnace 4531 proposed emissions were calculated by increasing the current emissions by a factor of 2.33. The factor of 2.33 is the ratio of the proposed (78 MMBtu/hr) to the current (33.48 MMBtu/hr) firing rate of the furnace. Two model runs were created, one for the current emission rates and stack parameters, and one for the proposed emission rates and stack parameters.

Model Runs

Four modeling files were created to assess the potential health risks from this project. The details of the runs are summarized in Table B.5-8.

Table B.5-8
Details of Model Runs

Model Run	Area Sources	Point Sources	Receptors
1	Positive emission values	Proposed emissions and proposed stack parameters	Residential receptors
2	Negative emission values	Current emissions and current stack parameters	Residential receptors
3	Positive emission values	Proposed emissions and proposed stack parameters	Coarse grid receptors
4	Negative emission values	Current emissions and current stack parameters	Coarse grid receptors

Health Risks

The potential health risks impacts that are addressed are carcinogenic, chronic noncarcinogenic, and acute noncarcinogenic.

The ACE2588 Risk Assessment Model (Version 93288) was used to evaluate the potential health risks from TACs. The ACE2588 model, which is accepted by the California Air Pollution Control Officers Association (CAPCOA), has been widely used for required health risk assessments under the CARB AB2588 toxic hotspots reporting program. The model provides conservative algorithms to predict relative health risks from exposure to carcinogenic, chronic noncarcinogenic, and acute noncarcinogenic pollutants. This multipathway model was used to evaluate the following routes of exposure: inhalation, soil ingestion, dermal absorption, mother's milk ingestion, and plant product ingestion. Exposure routes from animal product ingestion and water ingestion were not assumed for this analysis.

The 93288 version of ACE2588 incorporates revised toxicity and pathway data recommended in the October 1993 CAPCOA HRA guidance. The pathway data in ACE2588 were modified to include site-specific fractions of homegrown root, leafy, and vine plants. These site-specific fractions were used to maintain consistency with assumptions previously accepted for this particular site location by SCAQMD.

The results obtained based on the CAPCOA HRA guidance are considered to be consistent with those which would be obtained following SCAQMD's Risk Assessment Procedures for Rules 1401 (SCAQMD, 2000) and 212 (SCAQMD, 1997).

Only TACs identified in the CAPCOA HRA guidance with potency values or reference exposure levels have been included in the HRA. The 25 TACs emitted from the proposed project consist of acetaldehyde, acrolein, ammonia, benzene, benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, 1,3-butadiene, copper, formaldehyde, hexavalent chromium, hydrogen cyanide, hydrogen sulfide, indeno(123cd)pyrene, manganese, mercury, methanol, naphthalene, nickel, phenol, polyaromatic hydrocarbons, sulfuric acid, toluene, xylenes, and zinc.

The dose-response data used in the HRA were extracted from the October 1993 CAPCOA HRA Guidelines. The pertinent data are located in Tables III-5 through III-10 of the CAPCOA guidance.

Following CAPCOA guidance, the inhalation, dermal absorption, soil ingestion, and mother's milk pathways were included in a multipathway analysis. Pathways not included in the analysis are water ingestion, fish, crops, and animal and dairy products that were not identified as a potential concern for the project setting. Inhalation pathway exposure conditions were characterized by the use of the ISCST3 dispersion model as previously discussed.

Significance criteria for this EIR is an increased cancer risk of 10 in one million or greater. The established SCAQMD Rule 1401 limits are 1.0 in one million cancer risk for sources without best available control technology for toxics (T-BACT) and ten in one million for those with T-BACT. The significance criteria for noncarcinogenic acute and chronic hazard are indices of 1.0 for any endpoint.

The net predicted cancer risks at each of the modeled receptors were reviewed by combining runs 1 and 2, as well as runs 3 and 4 as detailed in Table B.5-8 above. The maximum increased cancer risk at any receptor is 0.005 per million. The peak receptor is a routine grid receptor and is located on the southeastern side of the property. The peak risk at a residential receptor is a negative value. Therefore, the modeling indicates that the proposed project is not anticipated to impact any residential receptors. The results of the HRA indicate that the potential impact of the project is well below the significance level of 10 per one million.

The maximum noncarcinogenic acute and chronic hazard indices from the model runs 1 and 3 as detailed in Table B.5-8 above were 0.03 and 0.03, respectively. These values are well below the significance level of 1.0. Thus, the HRA results indicate that impacts are not only below the SCAQMD significance criteria, but they indicate that there are minimal impacts as a result of the project.

B.6 PM_{10} AMBIENT AIR MODELING

Atmospheric dispersion modeling was conducted to determine the localized ambient air quality impacts from PM_{10} emissions due to the proposed project at the Refinery. PM_{10} emissions are the only criteria pollutant emissions that exceed the project significance threshold as shown in Table 4.1-1 (150 lbs/day) and require modeling per SCAQMD Rule 1303 to determine impacts on ambient air. The atmospheric dispersion modeling methodology used for the project follows generally accepted modeling practice and the modeling guidelines of both the U.S. EPA and the SCAQMD. All dispersion modeling was performed using the Industrial Source Complex Short-Term 3 (ISCST3) dispersion model (Version 00101) (EPA, 2000).

Model Selection

The dispersion modeling methodology used follows U.S. EPA and SCAQMD guidelines. The ISCST3 model (Version 00101) is an U.S. EPA model used for simulating the transport and dispersion of emissions in areas of both simple, complex, and intermediate terrain. Simple terrain, for air quality modeling purposes, is defined as a region where the heights of release of all emission sources are above the elevation of surrounding terrain. Complex terrain is defined as those areas where nearby terrain elevations exceed the release height of emissions from one or more sources. Intermediate terrain is that which falls between simple and complex terrain. Simple terrain exists in the vicinity of the Refinery.

Modeling Options

The options used in the ISCST3 dispersion modeling are summarized in Table B.5-5. U.S. EPA regulatory default modeling options were selected except for the calm processing option. Since the meteorological data set developed by the SCAQMD is based on hourly average wind measurements, rather than airport observations that represent averages of just a few minutes, the SCAQMD's modeling guidance requires that this modeling option not be used.

Meteorological Data

The SCAQMD has established a standard set of meteorological data files for use in Basin air quality modeling. For the area in which the Refinery is located, the SCAQMD requires the use of its Lennox 1981 meteorological data file, which is consistent with the data used for previous air quality and health risk assessment modeling studies at the Refinery. To ensure consistency with this prior modeling methodology, and SCAQMD guidance, the 1981 Lennox meteorological data set was used for this modeling study at the Refinery.

In the Lennox data set, the surface wind speeds and directions were collected at the SCAQMD's Lennox monitoring station, while the upper air sounding data used to estimate hourly mixing heights were gathered at Los Angeles International Airport. Temperatures and sky observation (used for stability classification) were taken from Los Angeles International Airport data.

Receptors

Appropriate model receptors must be selected to determine the "worse-case" modeling impacts. For this modeling, a routine grid of receptors was used. In addition, residential receptors were located on the north and south sides of the property. No receptors were placed within the Refinery property line. Terrain heights for all receptors were obtained from the existing Refinery HRA.

Source Parameters

Table B.6-1 summarizes the source parameter inputs to the dispersion model. The source parameters presented are based upon the parameters of the existing and proposed equipment at the facility. Three combustion source stacks were modeled using actual emission rates. The new NHT #1 Furnace 4531 stack will be located approximately 50 feet east of the existing stack. This location change is reflected in the coordinates listed for Model ID 90052 below. The emission rate used in the ISCST3 model run for the point sources is in units of g/s.

Table B.6-1
Point Source Locations and Parameters Used in Modeling

Model ID/Equipment	UTM X [m]	UTM Y [m]	Stack Base Elevations Above MSL Z [m]	Release Height Above Ground Level [m]
90026/No. 39 Boiler Main Stack	369746	3752659	31.3	46.9
90027/No. 39 Boiler Auxiliary Stack	369746	3752654	31.4	42.6
90052/NHT#1 Furnace 4531 Stack (current)	370149	3752437	32.9	31.1
90052/NHT#1 Furnace 4531 Stack (proposed)	370164	3752437	32.9	31.1

Emissions

Modeling was performed using direct operational PM_{10} emissions from the FCC/No. 39 boiler and the NHT-1 Furnace 4531 associated with the proposed project. As in the most recent HRA for the Refinery, 94.3% of the current emissions from the FCC/No. 39 boiler were assigned to the main stack and 5.7% of the emissions were assigned to the auxiliary stack.

Proposed PM_{10} emissions for the FCC/No. 39 boiler were calculated by assigning 90% of the current emissions to the FCC and 10% of the current emissions to the boiler. Proposed emissions of the FCC were calculated by increasing the current FCC emissions by a factor of 1.19 based on the anticipated increased usage and applying control factors to the FCC due to SCR and a CO catalyst. It was assumed that PM_{10} emissions are also created by the conversion of SO_2 to SO_3 in the SCR and subsequent reaction with water vapor and ammonia slip to form ammonia sulfate at a rate of 5%. The proposed FCC PM_{10} emissions were assigned to the existing auxiliary stack and the proposed boiler emissions were assigned to the existing main stack.

The NHT-1 Furnace 4531 proposed PM_{10} emissions were calculated at the proposed firing rate of 78 MMBtu/hr and assigning the manufacturer guaranteed emission rate.

Two model runs were created, one for the current emission rates and stack parameters, and one for the proposed emission rates and stack parameters. The input and output modeling files are included as Attachment B.5 to this Appendix.

Results

The ambient air significant thresholds for PM_{10} project impacts are 2.5 µg/m^3 and 1.0 µg/m^3 for the 24-hour and annual impacts, respectively, as indicated in Table 4.1-1. The modeling indicates that the 24-hour impact at the property boundary is 1.98 µg/m^3 and the annual impact is 0.43 µg/m^3 as shown in Table B.6-2. Therefore, this project does not have significant impacts on PM_{10} ambient air concentrations.

Table B.6-2
PM_{10} Ambient Air Modeling Results and Significance Thresholds

Time Period	Model Result (µg/m^3)	Significance Threshold (µg/m^3)	Significant?
24-hour	2.0	2.5	NO
Annual	0.4	1.0	NO

B.7 CARBON MONOXIDE IMPACTS ANALYSIS

As discussed in Section 4.1-5 in the Draft EIR, a CO hot spot analysis was conducted to determine if increased construction traffic would lead to localized exceedances of the CO ambient air quality standards at major intersections near the Refinery. The CALINE4 model was used for this analysis. The outputs from the CALINE4 model are contained in Attachment B.6.

B.8 PROJECT ALTERNATIVES

Three project alternatives have been identified for the proposed project, including: (1) construction of a new alkylate depentanizer; (2) the use of pentanes as a refinery fuel; and (3) constructing a refrigerated pentane storage tank instead of a pentane-reformate storage tanks. Project alternatives were developed by modifying one or more components of the proposed project. Unless otherwise stated, all other components of each project alternative are identical to the proposed project.

B.8.1 Alternative 1 – New Alkylate Depentanizer

As an alternative to reusing an existing column (C-5740) in the TAME Plant, a new depentanizer in the Alkylation Plant would be constructed. An additional 75 construction workers would be required to build the new depentanizer, and these workers would be onsite during the peak construction period. At an average vehicle ridership of 1.3 workers per commuting vehicle, this would lead to an additional 58 commuting round trips per day. Construction of the new depentanizer would occur at the same time as the construction of the other new columns planned as part of the proposed project. It is anticipated that the peak daily construction equipment requirements would be twice the requirements for modifying the existing column.

Tables B.8-1 and B.8-2 summarize the estimated emissions associated with construction activities for this alternative before and after mitigation, respectively. The operational impacts of this alternative are expected to be similar to the proposed project.

Table B.8-1
Overall Peak Daily Construction Emissions Summary - Alternative 1 (Pre-mitigation)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Construction Equipment Exhaust	1,088.0	210.1	1,808.6	180.5	107.5	NA	107.5
Onsite Motor Vehicles	27.8	5.2	39.2	0.0	1.6	56.1	57.7
Onsite Fugitive PM_{10}	NA	NA	NA	NA	NA	202.7	202.7
Asphaltic Paving	NA	1.8	NA	NA	NA	NA	0.0
Architectural Coating	NA	140.0	NA	NA	NA	NA	0.0
Total Onsite	**1,115.8**	**357.0**	**1,847.9**	**180.5**	**109.0**	**258.8**	**367.9**
Offsite Haul Truck Soil Losses	NA	NA	NA	NA	NA	32.1	32.1
Offsite Motor Vehicles	719.4	104.9	239.6	0.0	7.6	280.3	287.9
Total Offsite	**719.4**	**104.9**	**239.6**	**0.0**	**7.6**	**312.4**	**319.9**
TOTAL	**1,835.2**	**461.9**	**2,087.4**	**180.5**	**116.6**	**571.2**	**687.8**
CEQA Significance Level	*550*	*75*	*100*	*150*	---	---	*150*
Significant? (Yes/No)	**Yes**	**Yes**	**Yes**	**Yes**	---	---	**Yes**

Note: Sums of individual values may not equal totals because of rounding.
NA: Not Applicable

Table B.8-2
Overall Peak Daily Construction Emissions - Alternative 1 (Mitigated)

Source	CO (lb/day)	VOC (lb/day)	NO_X (lb/day)	SO_X (lb/day)	Exhaust PM_{10} (lb/day)	Fugitive PM_{10} (lb/day)	Total PM_{10} (lb/day)
Onsite Construction Equipment Exhaust	1,088.0	210.1	1,808.6	180.5	107.5	NA	107.5
Mitigation Reduction (%)	0%	5%	5%	5%	5%	---	
Mitigation Reduction (lb/day)	0.0	-10.5	-90.4	-9.0	-5.4	---	-5.4
Remaining Emissions	**1,088.0**	**199.6**	**1,718.2**	**171.5**	**102.1**	---	**102.1**
Onsite Motor Vehicles	27.8	5.2	39.2	0.0	1.6	56.1	57.7
Mitigation Reduction (%)	0%	0%	0%	0%	0%	0%	
Mitigation Reduction (lb/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Remaining Emissions	**27.8**	**5.2**	**39.2**	**0.0**	**1.6**	**56.1**	**57.7**
Onsite Fugitive PM10	NA	NA	NA	NA	NA	202.7	202.7
Mitigation Reduction (%)	---	---	---	---	---	16%	
Mitigation Reduction (lb/day)	---	---	---	---	---	-32.4	-32.4
Remaining Emissions	---	---	---	---	---	**170.3**	**170.3**
Asphaltic Paving	NA	1.8	NA	NA	NA	NA	NA
Mitigation Reduction (%)	---	0%	---	---	---	---	
Mitigation Reduction (lb/day)	---	0.0	---	---	---	---	---
Remaining Emissions	---	**1.8**	---	---	---	---	---
Architectural Coating	NA	140.0	NA	NA	NA	NA	NA
Mitigation Reduction (%)	---	0%	---	---	---	---	
Mitigation Reduction (lb/day)	---	0.0	---	---	---	---	---
Remaining Emissions	---	**140.0**	---	---	---	---	---
Total Onsite	**1,115.8**	**346.5**	**1,757.4**	**171.5**	**103.7**	**226.4**	**330.1**
Offsite Haul Truck Soil Loss[a]	NA	NA	NA	NA	NA	64.1	64.1
Mitigation Reduction (%)	---	---	---	---	---	90%	
Mitigation Reduction (lb/day)	---	---	---	---	---	-57.7	-57.7
Remaining Emissions	---	---	---	---	---	**6.4**	**6.4**
Offsite Motor Vehicles	719.4	104.9	239.6	0.0	7.6	280.3	287.9
Mitigation Reduction (%)	0%	0%	0%	0%	0%	0%	
Mitigation Reduction (lb/day)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Remaining Emissions	**719.4**	**104.9**	**239.6**	**0.0**	**7.6**	**280.3**	**287.9**
Total Offsite	**719.4**	**104.9**	**239.6**	**0.0**	**7.6**	**286.7**	**294.3**
TOTAL	**1,835.2**	**451.4**	**1,997.0**	**171.5**	**111.2**	**513.1**	**624.3**
Significance Threshold	*550*	*75*	*100*	*150*	---	---	*150*
Significant? (Yes/No)	**Yes**	**Yes**	**Yes**	**Yes**	---	---	**Yes**

Note: Sums of individual values may not equal totals because of rounding.
[a] Does not include 50% control from freeboard, since tarp is being used instead to achieve 90% control

B.8.2 Alternative 2 – Construction of a Refrigerated Pentane Storage Tank Instead of a Pentane-Gasoline Mix Tank

Under this alternative, a refrigerated pentane storage tank would be constructed as an alternative to the new pentane-reformate storage tank. The refrigerated storage tank would have a 200,000 barrel capacity, which is smaller than the proposed 493,000 barrel capacity of the pentane-reformate storage tank. With this alternative, it would still be necessary to construct the proposed pentane storage sphere and associated railcar loading facilities to export pentanes out of the Refinery during the summer months. Because of its smaller size, overall emissions from construction of this storage tank would be about 80 percent of the emissions from construction of the pentane-reformate storage tank. However, peak daily emissions associated with construction activities are anticipated to be the same as for the proposed project.

Operational emissions from a new refrigerated pentane storage tank are expected to increase by two percent as compared to a new pentane-gasoline mix storage tank. Table B.8-3 summarizes the estimated operational emissions associated with this alternative for non-RECLAIM sources. As shown in Table B.8-3 below, VOC emissions for Alternative 2 are anticipated to be slightly less than for the project. However, Alternative 2 would not significantly change the impact of the project.

Table B.8-3
Alternative 2~~3~~ Operational Criteria Pollutant Emissions Summary for Non-RECLAIM Sources

Pollutant	Direct Emissions (lb/day)	Indirect Emissions (lb/day)	Alternative 2 Total (lb/day)	Project Total (lb/day)	SCAQMD CEQA Threshold (lb/day)	Significant?
CO	12.2	381.4~~380.7~~	393.6~~393.0~~	393.6~~393.0~~	550	NO
VOC	141.5	207.0~~206.7~~	348.6~~348.2~~	347.8~~347.4~~	55	**YES**
NO_X	0	3,138.4~~3123.3~~	3,138.4~~3,132.3~~	3,138.4~~3,132.3~~	55	**YES**
SO_X	0	2336.6	2,336.6	2,336.6	150	**YES**
PM_{10}	282.5	560.8~~560.6~~	843.3~~843.2~~	843.3~~843.2~~	150	**YES**

B.8.3 Alternative 3 – Feeding All of the Incremental Butanes Produced at the FCC to the Alkylation Unit

With this alternative, construction activities and resulting emissions are anticipated to be the same as for the proposed project. Direct VOC emissions would increase by 1.9 pounds per day due to the additional components in fugitive service associated with the two new contactors and new acid settling drum. Indirect operational emissions associated with this alternative would be the same as for the proposed project.